Global Supply-Chain Networks and Corporate Social Responsibility*

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Abstract

This paper examines the role of supply-chain relationships for the transmission of corporate Environmental and Social (E&S) policies, and the resulting impact on real E&S outcomes and firm performance. I show that E&S policies propagate from customers to suppliers, especially when customers have higher bargaining power and suppliers are in countries with lower ESG standards. This transmission mechanism matters: suppliers subsequently reduce their toxic emissions, litigation and reputation risk decreases, and financial performance improves. I use staggered E&S regulation changes around the world to establish causality. Global supply-chains act as a transmission mechanism for regulatory requirements and standards across borders.

Keywords: Corporate Social Responsibility; ESG; Sustainability; International Supply-Chains; Customers and Suppliers

JEL Codes: F30; F36; G38; Q50

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1 Introduction

Why do firms pursue costly Environmental and Social (E&S) activities, such as the reduction of environmental emissions and fair labor practices? Traditional economic theory suggests that corporations have no responsibility other than maximizing shareholder value (Friedman, 1970; Bénabou and Tirole, 2010). Nonetheless, the largest firms in the U.S. and Great Britain alone spend more than $15 billion per year on Corporate Social Responsibility (CSR) (Smith, 2014). Consequently, corporate E&S practices and policies have recently attracted considerable attention in the literature (Hart and Zingales, 2017).

This paper proposes a new economic mechanism to explain the adoption of corporate E&S policies, and examines the implications of E&S policy changes. Specifically, I focus on E&S policy transmission along global supply-chains. Firm networks, particularly customer-supplier relationships, are an important channel for the dissemination of corporate policies (see for example Banerjee, Dasgupta, and Kim, 2008; Cen, Maydew, Zhang, and Zuo, 2017; Chu, Tian, and Wang, 2018). Moreover, recent evidence shows that relationships with key stakeholders are an important motivation for E&S policy adoption (for example Lins, Servaes, and Tamayo, 2017). Hence, I study two main research questions. First, do corporate E&S policies and regulatory requirements propagate through firm-level networks from customers to suppliers, and why? Second, how does E&S propagation affect real E&S-related outcomes and firm financial performance?

Since customers often make significant relationship-specific investments in supply-chain networks, they are exposed to adverse shocks to their suppliers (Barrot and Sauvagnat, 2016). Given the nature of incomplete and implicit contracts in supply-chain relationships, customers therefore have a strong incentive to reduce potential sources of risk at their supplier firms, such as E&S related reputation and legal risk. For example, when over a hundred workers were poisoned by chemicals used in the production of iPhone screens at a Chinese electronics manufacturer in 2011, Apple tripled its own CSR staff, intervened directly in the supplier's production process, and started monitoring supplier facilities (Barboza and Duhigg, 2012; Bradsher and Duhigg, 2012).

I combine firm-level E&S data from Thomson Reuters ASSET4 and Sustainalytics, litigation and auditing data from AuditAnalytics, and toxic emissions data from the Environmental Protection Agency (EPA) with global supply-chain relationship data from FactSet Revere. My first set of tests

focuses on ESG scores widely used in previous research as a comprehensive measure of corporate E&S performance. In addition, I construct E&S indices as a measure of corporate E&S policy adoption. I estimate panel regressions and show that corporate customers are a key driver of firms' environmental (E) and social (S) policy choices and performance. I find a strong, positive effect of customer E&S policy adoption – such as initiatives to reduce environmental emissions and toxic waste or health and safety monitoring – on the subsequent E&S performance of upstream suppliers. These results hold after controlling for observable factors previously examined in the literature, including active (foreign) investors (Dimson, Karakaş, and Li, 2015; Dyck, Lins, Roth, and Wagner, 2018), country-level institutions (Ioannou and Serafeim, 2012; Liang and Renneboog, 2017), and industry trends (Flammer, 2015b), as well as unobservable time-invariant firm and relationship characteristics. The effect is statistically significant and economically meaningful. For an inter-quartile range increase in customer E&S indices, supplier E&S performance increases by 4% in the following year, relative to the sample mean.

Consistent with the notion that customers drive suppliers' E&S policies, the effect is significantly stronger when customers have higher bargaining power, and when customers adopt supply-chain specific policies, such as supplier E&S training and monitoring. Further, I show that E&S policy propagation is concentrated in supply-chain pairs where customer and supplier firms are located in different countries. In particular, I find that E&S propagation is more pronounced when ESG standards and enforcement are higher in the customer country than in the supplier country.

A key challenge when examining E&S transmission along the supply-chain is endogeneity. For example, supplier E&S performance might be persistent over time, and customers' E&S policy adoption might in turn be affected by supplier E&S performance. Similarly, common factors such as institutional cross-ownership could simultaneously drive E&S policies at the supplier and customer. While I control for common observable characteristics and unobservable time-invariant characteristics, residual endogeneity concerns might remain.

My second set of tests focuses on a quasi-natural experiment, exploiting country-level regulation changes around the world related to mandatory E&S reporting requirements and E&S standards, to establish a causal interpretation of the results. For example, in 2014 the European Union passed "Directive 2014/95/EU" on the disclosure of non-financial and diversity information, making E&S reporting mandatory for all public firms in the EU. Throughout the previous decade, several

European countries including France, Denmark, and Sweden passed E&S regulations as a precursor to "Directive 2014/95/EU". While the direct effect of such regulations on E&S policies of local customers might be endogenous, for example if large firms can influence regulators in their home country, the same is implausible for supplier firms abroad.

In a difference-in-difference setting, I use the staggered introduction of increasingly stringent E&S regulations in foreign customer countries as quasi-exogenous shocks to estimate the E&S policy propagation effect on supplier firms. I find that suppliers increase their E&S performance and policy adoption by 3% to 4%, relative to the sample mean, following the introduction of new E&S regulations affecting their foreign customers, compared to supplier-customer pairs without such regulation changes. This effect is more pronounced when the ESG standards in the customer country are higher than in the respective supplier country.

Both sets of tests show that suppliers improve their E&S scores due to E&S propagation along the supply-chain. But do such E&S spillovers matter? Several papers argue that corporate E&S activities do not have any real effects, but are primarily used for "green washing" (see e.g. Koehn and Ueng, 2010; Kitzmueller and Shimshack, 2012). Previous research has mainly relied on CSR ratings based on voluntary corporate disclosures to study corporate E&S performance. However, focusing on CSR ratings does not allow for a clear distinction between green washing and actual environmental and social outcomes. To assess if E&S spillovers matter, I examine two dimensions of real E&S outcomes: toxic environmental emissions, and legal and reputation risk. I provide the first evidence that ESG spillovers have real effects on E&S-related outcomes.

First, I use data for U.S. firms from the EPA's *Toxic Release Inventory* (TRI) program. Using detailed plant-level emissions, the EPA provides toxicity-risk weighted scores for each production facility. I hand-match the EPA emissions data to the U.S. suppliers in my sample, and use E&S regulation changes in foreign customer countries as shocks to E&S policy adoption for suppliers. I show that suppliers reduce toxic emissions by 20%, relative to the sample mean, when foreign customers are subject to stricter E&S requirements. The effect is concentrated in emissions with high risk for human health, and is stronger for suppliers with high legal risk, when customers have high bargaining power, and when customers are from countries with high ESG standards.

Second, I estimate the effect of E&S spillovers on supplier legal and reputation risk. Following a longstanding accounting literature, I use lawsuits related to E&S issues to measure legal risk

(Cen, Chen, Hou, and Richardson, 2018) and audit fees to measure corporate social capital (e.g. Bell, Landsman, and Shackelford, 2001). I show that the adoption of corporate E&S policies at customer firms is associated with a significantly reduced likelihood of E&S related lawsuits, lower E&S penalty payments, and lower audit fees for suppliers in the following years.

Finally, I examine how the propagation of corporate E&S policies impacts financial performance. Both the overall impact and economic channels through which E&S policies can affect firm value are widely debated in the literature. While traditional theory often views corporate E&S activities as managers prioritizing stakeholders at the expense of shareholders (e.g. Cheng, Hong, and Shue, 2013), others promote the view that firms can "do well by doing good". Empirical evidence has similarly been mixed. For example, while Di Giuli and Kostovetsky (2014) and Krüger (2015) find negative value effects of E&S activities, Fernando, Sharfman, and Uysal (2017) show that corporate E&S policies can create value for shareholders if they help reduce firms' environmental risk.

In this paper, I use E&S propagation along the supply-chain as a new approach to examine the value effects of corporate E&S policies. A key advantage of this setting is that it allows me to identify a causal effect of E&S policy adoption on firm performance in a large sample of firms. Previous research has primarily relied on narrower empirical settings and special events for identification. In my tests, I focus on U.S. suppliers and their foreign customers. This allows me to construct a sample of placebo suppliers using the Hoberg and Phillips (2010) industry-peer database.

To estimate the effect of E&S policies on firm performance, I first use the adoption of supply-chain specific customer E&S policies (e.g. ESG training and monitoring for suppliers). Second, I use ESG regulation changes in foreign customer countries as quasi-random shocks to E&S policy adoption. Using either of the two methods, I find a significant increase of 10% to 15% in ROA, and 4% to 6% in Tobin's Q, for treated U.S. supplier firms in the post-adoption period compared to placebo supplier firms.

Last, I explore the impact of supplier E&S performance and policy adoption on customer retention as a potential channel linking E&S policy adoption and firm performance. I find that the occurrence of an E&S scandal at a supplier firm significantly increases the likelihood that the supply-chain relationship is terminated in the following year, and further show that this effect is greatly mitigated when the supplier has high E&S policy adoption.

This paper makes several contributions. First, I motivate and document a new channel driving

corporate E&S policy choices and performance: E&S propagation along supply-chain networks. My results indicate that customers influence suppliers' E&S policy choices and performance to reduce supply-chain related risks. Cao, Liang, and Zhan (2019) also examine spillover effects of corporate E&S policies focusing on industry *rivals* within the United States. In contrast, this paper examines *cooperative* firm relationships with a strong economic link by studying customer-supplier relations. In a contemporaneous paper, Dai, Liang, and Ng (2018) also study supply-chain relationships and Corporate Social Responsibility, and document a spillover effect of ESG scores from customers to suppliers. My paper differs along several dimensions. First, I introduce a new quasi-natural experiment based on country-level ESG regulation changes to establish a causal link. Second, I look beyond ESG scores to distinguish between E&S policy adoption, performance, and real outcomes such as toxic emissions and legal risk, and to rule out green washing and potential reporting biases. Finally, I provide new, causal evidence on the impact of E&S propagation for firm performance.

Second, my results indicate that global supply-chains act as a channel for the transmission of regulatory requirements and institutional standards across borders. The effectiveness of ESG regulations has been questioned in the literature. For example, Dowell, Hart, and Yeung (2000) suggest that large companies can shift production to suppliers in countries with less stringent regulations and weaker enforcement. In contrast, my results indicate that ESG regulations and requirements have a positive effect on the E&S performance of upstream suppliers, especially when the discrepancy between the ESG standards in the supplier and customer country is high.

Third, I provide new causal evidence that corporate E&S policy adoption can improve firm financial performance, using a broad sample of firms over 13 years. Prior research has found positive value effects of E&S adoption focusing for example on close shareholder proposal votes (Flammer, 2015a), social capital during the financial crisis (Lins et al., 2017), and M&A transactions (Deng, Kang, and Low, 2013). Further, I suggest a new economic channel through which E&S policies can impact firm value. Previous literature has examined consumer awareness (Servaes and Tamayo, 2013), the cost of capital (Chava, 2014; Dhaliwal, Li, Tsang, and Yang, 2011), access to financing (Hong, Kubik, and Scheinkman, 2012), and employee retention (Edmans, 2011), among others.

The rest of this paper is organized as follows. Section 2 summarizes the data. Sections 3 and 4 outline the empirical approach and present results on the spillover of E&S policies and regulation changes along the supply-chain. Section 5 discusses the economic implications. Section 6 concludes.

2 Data and Descriptive Statistics

2.1 Firm-Level E&S Policies and Performance

In this paper, I focus on "E" and "S" as the two key components of ESG most closely related to 'Corporate Goodness', similar to Servaes and Tamayo (2013) and Flammer (2015a), among others. I obtain data on corporate E&S policies and performance ratings for firms around the world from Thomson Reuters' ASSET4 dataset and from Sustainalytics. Both data sources are widely used in the literature, for example Dyck et al. (2018), Hawn and Ioannou (2016), and Ioannou and Serafeim (2012). To construct the ASSET4 dataset, ESG analysts at Thomson Reuters collect information from annual reports, CSR reports, NGOs, and news releases for firms from over 50 countries. According to ASSET4, the reported data items are chosen to maximize coverage, timeliness of reporting, data quality, and materiality for investors. All data sources and key variables are explained in Tables A1 and A2.

In my main tests, I focus on E&S data from ASSET4 instead of Sustainalytics for two main reasons. First, the granularity of the ASSET4 dataset allows me to decompose E&S scores into components related to E&S policy adoption and performance. Prior research has largely used comprehensive scores, which confound E&S practices and policies, such as environmental commitments, with real outcomes, such as toxic waste production. This decomposition further allows me to account for E&S items related to a firm's supply-chain, which might otherwise introduce confounding effects. Sustainalytics data does not allow for a similar break-down of E&S data items. Second, ASSET4 provides the widest available coverage of international firms, with historical data going back to 2003. Sustainalytics data is available starting in 2009. Since most tests in this paper include firm-pair fixed effects, within-firm variation and a long panel are key for identification. I verify that the main results hold using the Sustainalytics dataset, as shown in Appendix Tables B1 and B2.[1]

ASSET4 evaluates firms' environmental policies, initiatives, and commitments in three main subcategories: Emission Reduction, Product Innovation, and Resource Reduction. Social performance is evaluated in seven subcategories: Community, Diversity & Opportunity, Employment Quality, Health & Safety, Human Rights, Product Responsibility, and Training & Development. Within each category, ASSET4 analysts consider specific items such as "does the company set specific

[1] Appendix B is intended to be an online appendix, and is not intended to be in the final version of the paper.

objectives to be achieved on emission reduction?". Based on the answers to these questions, ASSET4 constructs a proprietary score ranging from 0 to 100 for each major category (ENV and SOC) as well as each of the ten subcategories listed above for each covered firm in a given year.

Customer firms have strong incentives to influence supplier E&S performance due to potential legal and reputation risk exposure and possible supply-chain disruptions. In addition to the overall ENV and SOC Scores, I therefore collect the ASSET4 Scores for the Emissions Reduction (ER), Resource Reduction (RR), Health & Safety (HS), and Human Rights (HR) subcategories, since these are the areas most likely associated with supply-chain risks for customer firms. Considering these E&S subcategories further allows me to evaluate if E&S propagation along the supply-chain is concentrated in specific aspects of E&S policy adoption and performance. I also obtain data on E&S related outcomes, such as environmental controversies, human rights scandals, and work related injuries from ASSET4.

In addition to the ENV (SOC) Scores from ASSET4, I construct an equally-weighted policy index for each environmental and social category (i.e. "ENV Index" and "SOC Index") and the four subcategories (ER, RR, HS, HR), similar to Dyck et al. (2018). To construct the ENV (SOC) Index, I use the raw data items in the ASSET4 database related to the adoption of E&S policies, initiatives, and commitments, and sum across the score for each category and subcategory. Specifically, for questions where a "yes" answer is associated with better environmental or social performance (positive direction), I translate the Y/N items into 0 (N) and 1 (Y), and the answers to double Y/N questions into 0 (NN), 0.5 (YN or NY), and 1 (YY). For questions with a negative direction I use a reversed coding scheme. To make the E&S Indices comparable in magnitude to the ASSET4 Scores, I re-scale each index linearly to be distributed between 0 and 100. The ENV (SOC) Score and Index are highly positively correlated (between 0.83 to 0.90) across all (sub) categories.

The ENV (SOC) Score from ASSET4 has the advantage of providing a comprehensive measure of a firm's E&S policies and performance, and it is consistent with prior literature. The ENV (SOC) Index on the other hand excludes data items related to the E&S performance of the firm's supply-chain (e.g. "Is the company directly or indirectly through a supplier under the spotlight of the media because of a controversy linked to the spill of chemicals, oils and fuels, gases?") to avoid confounding effects on the dependent and independent variables in my tests. It further allows me to differentiate between corporate E&S policy choices and outcomes, by including only data items

related to the adoption of E&S policy, initiatives, and commitments, and excluding measures of E&S performance (e.g. CO2 emissions or work injuries).

Next, I construct measures of E&S outcomes related to litigation and legal risk, using penalty payments, audit fee payments, and E&S-related lawsuits from AuditAnalytics. AuditAnalytics assigns each legal case to a category representing the type of law it concerns. I count the number of lawsuits filed against the firm and the sum of penalty payments related to environmental issues (i.e. Energy Law, Environmental Law, or Natural Resources Law) as a measure of environmental legal risk. As a measure of social legal risk I collect the number of lawsuits and the sum of penalty payments related to social issues (i.e. Civil Rights, Disability Law, Health, Fair Labor Standards Act, Personal Injury) in a given year. AuditAnalystics data is only available for U.S. firms.

As a measure of environmental risk, I further obtain detailed environmental emissions data for U.S. firms from the Environmental Protection Agency's (EPA) *Toxic Release Inventory* (TRI) program. The EPA requires all facilities in the U.S. with more than 10 employees, which "manufactures, processes or otherwise uses" at least one of 600 chemicals listed in the TRI to provide detailed reports on chemicals and emissions released into air and water. Based on this data, the EPA provides a Risk-Screening Environmental Indicators (RSEI) Score[2], weighting factors such as the transport through the environment, relative toxicity, and potential human exposure for all released chemicals. I obtain the RSEI Score at the facility level and aggregate the measure at the parent firm level.[3] Since the TRI database does not provide standard firm identifiers, I hand-match firm names to the firms in my sample. TRI data is only available for U.S. firms.

2.2 Customers and Suppliers

In this paper, I use the 'supply-chain relationships' database from FactSet Revere as the primary source for customer-supplier links, since it covers both domestic and international supply-chain relationships and does not rely on SEC reporting requirements.[4] This data is hand-collected, verified,

[2] A detailed description of the methodology can be found at https://www.epa.gov/rsei/rsei-and-tri-emissions-data.

[3] I aggregate the facility level data by taking an equal weighted average across facilities for each firm per year. The results are robust to alternatively using the sum of emissions across facilities.

[4] Previous research relies mainly on the SEC's regulation S-K, which requires U.S. firms to disclose the existence and names of customer firms representing at least 10% of their total sales, to identify customer-supplier links (e.g. Hertzel, Li, Officer, and Rodgers, 2008, and Banerjee et al., 2008). This methodology has two important limitations. First, customers below the 10% threshold, which represent the majority of supply-chain relations, are not identified. Second, the SEC regulation does not apply in other countries. Existing research is therefore mostly limited to U.S. firms and disregards international supply-chain relationships.

and updated by FactSet analysts relying on a range of primary sources of information, including companies' annual reports and 10-K filings, investor presentations, company websites and press releases, corporate actions, and 10-Q and 8-K filings. Since one of the key variables in my tests, the percentage of sales a customer represents to a supplier, is sparsely populated in the FactSet Revere dataset, I supplement the sample by collecting supply-chain relationships from the Compustat Segment Files which is based on SEC reporting requirements, whenever available. Further, I use this second data source to verify that FactSet Revere includes all supplier-customer links obtained from SEC regulation S-K. Since the Compustat Segment Files do not provide standard firm identifiers and the reported customer names are often in abbreviation, I use a language based text-matching algorithm with manual inspection to match the customer names with the names of international public firms provided by Datastream, as in Cen, Doidge, and Schiller (2017).

In total, this dataset consists of 394,277 supplier-customer pair-year observations from 2003 to 2016 across 52 countries. The majority of the observations (357,882 pair-years) are from FactSet Revere. All results are robust to using FactSet Revere data only.

2.3 Firm-Level Financial Data

Standard firm financial data such as book value of total assets, total sales, and market capitalization are from Datastream and Worldscope. I further obtain data on international institutional investors and ownership from FactSet LionShares, whenever available. All accounting related variables are winsorized at the 1% level to minimize the effect of outliers likely driven by reporting errors.

2.4 Country-Level ESG Standards

I obtain country-level "E" and "S" proxies from a wide range of sources, including the 'Country Sustainability Ranking' from RobecoSAM, a widely used measure for the overall level of ESG standards in a given country, the 'Environmental Performance Index' from the Yale Center for Environmental Law and Policy, CO2 emissions per GDP (kg/USD) and air pollution related "loss of healthy life" in DALYs[5] from the World Bank and WHO as proxies for "E" related ESG standards. Similar to Ioannou and Serafeim (2012), I also collect 'Trade Union Density' and the 'Employment

[5]DALY stands for "Disability-Adjusted Life Year" and represents one lost year of healthy life. According to the World Health Organization (WHO), the sum of DALYs across the population can be interpreted as a measurement of the gap between current health status and an ideal health situation.

Protection Index' from the OECD as proxies for ESG standards related to the "S" dimension. Detailed definitions and data sources of all variables are provided in Appendix A1.

2.5 Sample Composition

The final sample used for the empirical tests in Sections 3, 4, and 5 varies, as I merge E&S-related data from the sources summarized above with the sample of supplier-customer relationships. For example, data on lawsuits from AuditAnalytics or emissions data from the EPA are only available for U.S. firms and do not overlap perfectly with E&S data from ASSET4. In each test, I maximize the sample size and statistical power by including each firm-year which is represented in both the respective E&S dataset and the supply-chain sample. The following summary statistics refer to the sample used for the first set of tests in Section 3, which requires ASSET4 E&S data for both the supplier and customer firms. Throughout the rest of the paper, I provide relevant summary statistics and details in the context of the respective empirical tests.

2.6 Summary Statistics

Merging the ASSET4 and the supply-chain dataset yields a sample of 67,002 customer-supplier pair-year observations (23,721 unique customer-supplier pairs), covering 52 countries over the period from 2003 to 2016. This sample is considerably smaller than the FactSet Revere supply-chain dataset, as it only includes firm-pair-years with ASSET4 E&S data for both the supplier and customer.

[Insert Table 1 here.]

Summary statistics describing customers, suppliers, and supply-chain relationships are presented in Panels A, B, and C of Table 1, respectively. As shown in Panel A, the ENV and SOC Scores from ASSET4 range from 0 to 100. The ENV (SOC) Score of the sample suppliers, measuring aspects related to both E&S policy adoption and performance, has a mean of 55 (56), and a standard deviation of 32 (31). The ENV (SOC) Index, constructed as the sum over 20 (12) indicator variables and re-scaled to be distributed between 0 and 100, has a mean of 38 (37) for supplier firms, and standard deviation of approximately 30. Panel B shows that customers in the sample on average have higher E&S policy adoption and performance than the suppliers, the mean customer ENV (SOC) Score is 74.85 (73.60), and the mean ENV (SOC) Index is 57.61 (50.63).

Table 1 also reports summary statistics on E&S related real outcomes and supply-chain specific (customer) E&S policies obtained from ASSET4. These variables are excluded when constructing the ENV and SOC indices, but used for cross-sectional tests in Section 3. As shown, environmental and social controversies at supplier firms, such as oil spills and human rights scandals, are rare. 3% to 6% of sample supplier firms experience such events in a given year. On the other hand, the adoption of supply-chain specific E&S policies at the sample customers is relatively common. Approximately 32% of customer firm-years have E&S training for suppliers, 48% have environmental or social selection criteria for suppliers, and 41% have active monitoring of supplier facilities.

The average supply-chain relationship in the sample lasts 3.14 years. There is an asymmetric mutual importance between customers and their suppliers: sample customer firms are typically much larger than their suppliers, similar to previous research (e.g. Banerjee et al., 2008). The average customer in the sample is about 10 times larger than the average supplier firm in terms of the book value of assets, and about 5 times larger in terms of market capitalization. Further, for firm-pairs where detailed sales data from supplier to customer is available (about 8% of the sample), the average *Pct of Supplier Sales* is 11.84%. The relationship asymmetry in terms of firm-size, combined with the large proportion of sales many customers represent to their suppliers suggest that customers on average have high bargaining power and influence over suppliers.

[Insert Figures 1 and 2 here.]

Fig. 1 shows that domestic relationships between North American suppliers and customers are the single largest group of firm-pairs in the sample. However, the majority of firm-relationships (54%) are between customers and suppliers located in different countries. As shown in Fig. 2, there are 36,433 cross-country firm-pair observations in the sample, across 49 countries. Although the sample contains a large number of suppliers from low income countries including India, Thailand, South Africa, Mexico, and Brazil, the majority of sample firms – especially customers – are located in developed or middle income countries. As summarized in Table 2, the largest number of observations are from the United States, United Kingdom, France, Japan, Canada, Germany, and Australia.

[Insert Table 2 here.]

Table 2 presents summary statistics regarding ESG standards, and environmental and social performance proxies at the country-level. Consistent with the literature (e.g. Ioannou and Serafeim,

2012), high income countries on average have higher ESG standards and exhibit better environmental performance regarding CO2 emissions and air pollution, among others. On the other hand, the summary statistics with respect to social aspects such as trade union density and employment protection do not exhibit a clear pattern across high and low income countries.

3 E&S Policy Propagation Along the Supply-Chain

Prior research shows that supply-chains are an important channel for the propagation of corporate policies. Due to legal and reputation risk exposure, customers have a strong incentive to influence suppliers' E&S policy adoption performance. At the same time, suppliers are often dependent on their corporate customers, who are typically large firms with high bargaining power. Hence, we would expect firm relationships with corporate customers to be an important driver of corporate E&S policy adoption and performance. In this section, I test whether E&S policies propagate along the supply-chain. I consider both the direct impact of customers on their suppliers and the propagation of foreign regulatory changes related to E&S policies to establish causality.

3.1 Do Customers Drive Suppliers' E&S Performance?

The main dependent variable in the following tests is the supplier ENV (SOC) Score from ASSET4, as it is both consistent with prior literature (e.g. Cheng, Ioannou, and Serafeim, 2014; Ferrell, Liang, and Renneboog, 2016; Liang and Renneboog, 2017; Dyck et al., 2018) and provides the most comprehensive measure of a supplier's E&S policies and performance. I use the customer ENV (SOC) Index as constructed in Section 2 as the main explanatory variable, as it allows me to measure E&S policy adoption at the customer firm while accounting for potentially confounding effects due supply-chain related data items. To test if customers' E&S policies drive suppliers' E&S policy adoption and performance, I estimate models of the following form:

$$ES\ Score_{i,t} = \alpha + \beta \times ES\ Index_{j,t-1} + \delta_1 \times Z_{i,t} + \delta_2 \times Z_{j,t} + \theta_t + \gamma_{i,j} + \epsilon_{i,j,t}, \quad (1)$$

where $ES\ Score_{i,t}$ is the ENV or SOC Score from ASSET4 of supplier i in year t. $ES\ Index_{j,t-1}$ is the ENV (SOC) Index of customer j in period $t-1$, measuring the adoption of environmental

(social) policies, initiatives, and commitments, respectively, as constructed in Section 2. The main coefficient of interest is β, capturing the impact of customer E&S policy adoption in the previous year on supplier E&S performance in the given year. I focus on lagged instead of contemporaneous customer E&S policy adoption, as it allows me to examine the direction of E&S propagation along the supply-chain.

The relationship fixed effects, $\gamma_{i,j}$, absorb all time-invariant customer (j), supplier (i), and firm-pair (i, j) characteristics (e.g. average relationship strength), including cross-sectional differences at the firm, industry, country, and country-pair level, such as language, culture, and geographical distance. Hence, β is estimated solely from within-firm-pair time-series variation. This empirical specification further alleviates potential concerns about the comparability of E&S Scores across firms and countries raised in the literature (e.g. Chatterji, Durand, Levine, and Touboul, 2016). θ_t are year fixed effects and $Z_{i,t}$ and $Z_{j,t}$ are vectors of supplier and customer firm-level and country-level controls, respectively. Standard errors are clustered at the relationship level in all regressions.

Since the specification in Equation (1) considers the customer E&S Index in $t-1$ and supplier E&S Score in t, each regression includes only firm-pairs with supply-chain relationships lasting more than 2 years. Singleton observations, i.e. customer-supplier pairs with exactly 2 consecutive years of supply-chain relationship, are perfectly saturated due to the inclusion of firm-pair fixed effects, and dropped from the estimation. The resulting sample size of 37,322 in column (1) of Table 3 is therefore smaller than the total number of supply-chain pair-years summarized in Table 1.

[Insert Table 3 here.]

The results, summarized in Panel A of Table 3, show a strong, positive effect of lagged customer "E" and "S" policy adoption on supplier "E" and "S" performance, controlling for supplier firm size, market-to-book ratio, ROA, sales turnover, GDP per capita (following e.g. Liang and Renneboog, 2017), and fixed effects as indicated. As shown in column (1), for an inter-quartile range increase in the customer environmental (ENV) Index, the supplier ENV Score increases by 3.6% in the following year, relative to the unconditional sample mean (calculated as $45 \times 0.0443/55.75$). The coefficient estimate of β is statistically significant at the 1% level. Similarly, for an inter-quartile range increase in the one-year lagged customer SOC Index, supplier social performance as measured by the SOC Score increases by 2.6% relative to the sample mean, significant at the 5% level, as

shown in column (3). Consistent with prior research, I also find that firm size and country-level GDP per capita are significantly and positively associated with E&S performance.

Dyck et al. (2018) show that institutional investors, especially from foreign countries, have an important influence on firms' E&S performance. This might endogenously drive the results, if institutional ownership is correlated with both customer E&S policy adoption and supplier E&S performance. To alleviate this concern, I include the percentage of domestic and foreign institutional ownership of the supplier from the FactSet LionShares database as additional controls. These additional data requirements considerably reduce the sample size. I also add firm-level and country-level controls for the customer firm. As shown in columns (2) and (4), the results are robust to the inclusion of these additional controls. $\hat{\beta}$ remains similar in magnitude and statistical significance for supplier ENV and SOC performance across all specifications.

Consistent with Dyck et al. (2018), I find a strong positive relationship between foreign institutional ownership and supplier E&S performance. An inter-quartile range increase in foreign institutional ownership is associated with a 3.7% increase in the supplier ENV Score relative to the sample mean, significant at the 1% level. The coefficient estimate for domestic institutional ownership is positive but not significant at standard levels. I find a similar effect for the supplier SOC Score. These results indicate that the impact of E&S propagation along the supply-chain is similar in economic magnitude to the impact of institutional investors, which has received considerable attention in the literature (e.g. Dimson et al., 2015; Barko, Cremers, and Renneboog, 2017). As noted above, including institutional ownership controls significantly reduces the sample size due to data availability. Therefore, I exclude these measures in the following tests.

I conduct several additional robustness tests summarized in Table B3 of the Supplementary Appendix. First, I include industry×year and country×year fixed effects, to account for within-industry (2 digit SIC codes) and within-country changes over time. Next, I include the lagged supplier SOC Score as an additional control, to alleviate residual concerns about spurious estimations. The results remain robust across all specifications. Third, I reverse the specification in Equation (1), using the customer ENV (SOC) Score as the dependent variable and the supplier ENV (SOC) Index as the key variable of interest. $\hat{\beta}$ in these tests is negative and statistically insignificant, indicating that E&S propagation is uni-directional, from customers to suppliers. In additional untabulated robustness tests I use the customer ENV (SOC) Score instead of the Index as the main explanatory

variable, to verify that my results are not due to way the ENV (SOC) Index is constructed. I find similar results.

If customers directly influence suppliers' E&S performance, the impact of customer policy adoption related to a specific E&S issue (e.g. emissions reductions), should be stronger for supplier E&S performance in the corresponding E&S area. To test this conjecture, I disaggregate the customer ENV and SOC Index into four sub-indices related to Emissions Reductions (ER), Resource Reduction (RR), Health & Safety (HS), and Human Rights (HR), and re-estimate Equation (1) using the corresponding supplier ENV (SOC) Sub-Scores as the dependent variables.

The results, presented in Panel B of Table 3, show that supply-chain E&S propagation is indeed specific to the respective E&S issue: while the supplier Resource Reduction (RR) Score increases by 3.4% ($= 43.75 \times 0.0427/55.42$) following an inter-quartile range increase in the lagged customer RR Index (significant at the 1% level), I do not find a similar effect for the customer Emissions Reduction (ER) Index on the supplier RR Score (column 1). The reverse is also true considering supplier Emissions Reduction (ER) performance, as shown in column (2). While the coefficient estimate on lagged customer ER Index is positive and significant at the 5% level, the estimate for lagged customer RR Index is small and statistically not significant at standard levels. As shown in columns (3) and (4), a similar pattern emerges regarding supplier social performance. Lagged customer policy adoption related to human rights (HR) has a positive, significant effect on the supplier HR Score, but not on the supplier health & safety (HS) Score.

3.2 The Role of Country, Relationship, and Firm Characteristics

The results up to this point document that corporate E&S policies propagate from customers to suppliers. However, the specific economic mechanisms driving E&S propagation along the supply-chain are still unclear. To shed light on this question, I examine the importance of country, supplier-customer relationship, and firm-level characteristics for E&S propagation in this section.

First, Ioannou and Serafeim (2012) and Liang and Renneboog (2017), among others, show that country-level characteristics are important for explaining cross-sectional variation in firm-level E&S policy adoption and performance. In my next set of tests, I therefore distinguish between international and domestic supply-chain relationships, and focus specifically on differences in ESG standards and enforcement between the supplier and customer country.

Banerjee, Chang, Fu, Li, and Wong (2015) argue that "E" performance is often the result of firms following the local 'Best Available Technology'. Hence, if customers directly impact suppliers' E&S policies to mitigate reputation and legal risks, we expect the results from Table 3 to be stronger in international supply-chains, as firms in the same country are subject to similar regulations and standards. To test this notion, I augment the model in Equation (1) by interacting the customer ENV (SOC) Index with two dummies, $\mathbb{1}_{Yes}$ and $\mathbb{1}_{No}$, which take the value of one if the supplier and customer are located in different countries (the same country), and zero otherwise. This specification is similar to a sample split, while allowing me to maximize statistical power, by setting the coefficients for the controls variables and the intercept equal for the $\mathbb{1}_{Yes}$ and $\mathbb{1}_{No}$ groups[6]:

$$\begin{aligned} ES\ Score_{i,t} = \alpha + \beta_1 \times ES\ Index_{j,t-1} \times \mathbb{1}_{Yes} + \beta_2 \times ES\ Index_{j,t-1} \times \mathbb{1}_{No} \\ + \delta_1 \times Z_{i,t} + \delta_2 \times Z_{j,t} + \theta_t + \gamma_{i,j} + \epsilon_{i,j,t}. \end{aligned} \tag{2}$$

$ES\ Score_{i,t}$ and $ES\ Index_{j,t-1}$ are the supplier ENV (SOC) Score and customer ENV (SOC) Index, respectively, and $Z_{i,t}$ and $Z_{j,t}$ are firm and country controls. The key coefficients of interest are β_1 and β_2, and the difference between the two coefficient estimates. θ_t and $\gamma_{i,j}$ are year and relationship fixed effects, similar to Equation (1).

[Insert Table 4 here.]

The results, presented in Panel A of Table 4, show that for both environmental (column 1) and social (column 4) supplier performance, the impact of customer E&S policies is significantly stronger when supplier and customer are located in different countries. For cross-border firm relationships, an inter-quartile range increase in the one-year lagged customer ENV (SOC) Index is associated with a 5.04% (7.29%) increase in the supplier ENV (SOC) Score relative to the sample mean, significant at the 1% level. In contrast, the coefficient for domestic firm relationships is three times smaller and not significant at conventional levels. Further, the difference between $\hat{\beta}_1$ and $\hat{\beta}_2$ is statistically significant for both the E and S dimension.[7]

Next, if customers indeed drive suppliers' E&S performance, we would further expect E&S policy propagation along the supply-chain to be stronger when the customer country has higher ESG

[6]This specification is equivalent to a model including $\mathbb{1}_{Yes}$, $ES\ Index_{j,t-1}$, and $ES\ Index_{j,t-1} \times \mathbb{1}_{Yes}$, since $\mathbb{1}_{Yes}$ is absorbed by the relationship fixed effects $\gamma_{i,j}$, and allows for an easy interpretation of $\hat{\beta}_1$ and $\hat{\beta}_2$.

[7]Since Panel B of Table 3 indicates that the effects regarding social supplier performance are concentrated in human rights (HR) related issues, I focus on HR policies and performance in the social dimension of Table 4.

standards than the supplier country. To test this notion, I define the dummy variables $\mathbb{1}_{Yes}$ and $\mathbb{1}_{No}$ in Equation (2) to take the value of one if ESG standards in the customer country are higher (lower) than in the country of the supplier firm, and zero otherwise.

As shown in columns (2) and (5), the coefficient estimate for β_1 corresponds to a 9.2% (8.1%) increase in the supplier ENV (SOC) Score, relative to the sample mean, for an inter-quartile range increase in the lagged customer ENV (SOC) Index, when the customer country has higher ESG standards than the supplier country. The estimate is statistically significant at the 1% level. On the other hand, the coefficient estimate for β_2 is close to zero and insignificant, and the difference between the two coefficients is significant at the 1% level. In columns (3) and (6), I consider two additional proxies for country level E and S standards used in the literature, air pollution related loss of healthy life (DALYs) and trade union (TU) density, respectively. The results are similar. E&S policy propagation is concentrated in supplier-customer pairs where supplier countries have relatively lower ESG standards. In further untabulated tests I use a number of additional proxies for country-level ESG standards to split the sample (GDP per capita, Environmental Performance Index, Employment Protection Index, etc.) and find similar results.

Second, I explore the importance of firm-level relationship asymmetry between customer and supplier. Following the literature (e.g. Cen, Dasgupta, and Sen, 2015), we expect customers to exert a stronger influence on suppliers' corporate policies when the one-sided dependency of suppliers is high. As proxies for relationship asymmetry I collect the percentage of sales the customer firm represents to the supplier relative to total sales (*Pct Sales Sup*). Additionally, I also use the ratio of customer firm size to supplier firm size, since *Pct Sales Sup* is reported for less than 10% of firm-year observations in my sample. I set $\mathbb{1}_{Yes}$ and $\mathbb{1}_{No}$ in Equation (2) to one (zero) if the measures are above (below) the median value, and estimate the model detailed in Equation (2).

Columns (1) and (2) in Panels B (ENV) and C (SOC) of Table 4 show that E&S propagation along the supply-chain is significantly stronger for firm-pairs with high relationship asymmetry, i.e. when customers have high bargaining power. While both $\hat{\beta}_1$ and $\hat{\beta}_1$ are positive and statistically significant, the coefficient for the lagged customer ENV Index is about twice as large for *High Asymmetry* compared to *Low Asymmetry* firm-pairs, and the difference between $\hat{\beta}_1$ and $\hat{\beta}_1$ is statistically significant at the 5% and 10% level, respectively. For example, an inter-quartile range increase in the customer ENV Index is equivalent to a subsequent increase in the supplier ENV

Score by 8.15% for firm-pairs with a high *Pct Sales Sup* value, compared to a 5.50% increase for the *low* group. The results are similar for both proxies of relationship asymmetry regarding both 'E' and 'S' policy adoption and performance.

Third, the high level of granularity in the ASSET4 dataset allows me to disentangle the specific channels customers use to impact supplier E&S performance. From ASSET4, I obtain data on the adoption of supply-chain specific policies at the customer firm, in particular indicating if the customer provides *ESG training* for suppliers, has *ENV (SOC) selection criteria* for suppliers, or enforces *ENV (SOC) monitoring* at supplier facilities. I define $\mathbb{1}_{Yes}$ and $\mathbb{1}_{No}$ Equation (2) to take the value of one, if the customer has (not) adopted a given policy, and zero otherwise.

The results, summarized in columns (3) and (4) of Table 4, show that both ENV (Panel B) and SOC (Panel C) propagation is significantly stronger when customers provide ESG training to suppliers. While both $\hat{\beta}_1$ and $\hat{\beta}_2$ are positive and significant, the coefficient estimate for the interaction of lagged customer ENV (SOC) Index with $\mathbb{1}_{Yes}$ is 33.5% (67.7%) larger than the estimate for the interaction with $\mathbb{1}_{No}$. The difference in coefficients is significant at the 5% level for both the ENV and SOC dimension. I find similar results using *ENV and SOC monitoring* in untabulated tests. On the other hand, the difference between $\hat{\beta}_1$ and $\hat{\beta}_2$ is not significant at standard levels when I use *ENV or SOC selection criteria* to define $\mathbb{1}_{Yes}$ and $\mathbb{1}_{No}$.

Taken together these findings indicate that E&S propagation along the supply-chain is at least partially due to direct intervention and influence of customers on suppliers' E&S performance.

3.3 Global Supply-Chains and ESG Regulation Changes Abroad

In the previous section, I show that the adoption of corporate E&S policies and practices at customer firms has a strong, positive impact on the subsequent E&S performance of their suppliers, after controlling for observable characteristics studied in the literature and for time-invariant characteristics at the firm-pair level. However, residual endogeneity concerns might remain.

To alleviate such endogeneity concerns, I hand-collect a comprehensive sample of major changes to mandatory ESG regulations and reporting requirements around the world. For example, in 2014 the European Union (EU) enacted Directive 2014/95/EU, making the disclosure of non-financial and diversity information mandatory for all publicly listed firms in the EU for the first time. While this regulation only went into effect starting in 2017, and hence does not affect the firms in my sample,

several European countries enacted precursory, national ESG reporting requirements throughout the previous decade, such as the "Grenelle Act 1 and 2" in France.

The main data source for ESG regulation changes in this paper is the 2016 edition of the "Carrots & Sticks" report, jointly published by KPMG International, the Global Reporting Initiative (GRI), the United Nations Environment Programme (UNEP), and the University of Stellenbosch Business School's "Centre for Corporate Governance". The corresponding database covers all mandatory and voluntary instruments that require or encourage firms to report sustainability-related information or adhere to E&S related regulations across 64 countries, going back to 2003. It was first introduced in 2006 and is updated continuously.[8] To the best of my knowledge, this is the first paper to use a comprehensive sample of ESG regulation changes as shocks to firm-level E&S propagation.[9]

I examine each ESG reporting requirement in the Carrots & Sticks database individually to determine the year it became effective, whether it was mandatory or voluntary, the set of firms affected in a given country, and the relevance for environmental or social firm performance, or both. For example, while the Grenelle Act 1 and 2 concern all aspects of ESG, other regulatory measures are focused solely on environmental or social issues. I retain only mandatory ESG regulations and requirements affecting all (listed) firms in a given country, resulting in 71 ESG regulation changes from 2003 to 2016 across 31 'treated' countries (23 related to 'E', 18 related to 'S', and 30 related to both). Table A2 in the Appendix provides a detailed overview of the sample.

In Supplementary Appendix Table B4, I first verify that the country-level regulation changes have a *direct* impact on corporate E&S policy adoption of the customers, by comparing the ENV (SOC) Score and Index of firms in 'treated' countries before and after the introduction of a new ESG requirement to firms in countries without such changes, following Ioannou and Serafeim (2017). The effect is particularly strong for supply-chain related E&S policies. The likelihood that a customer adopts ESG training and monitoring of suppliers increases by 20%, significant at the 1% level, compared to firms in countries without ESG regulation changes.

Hence, the introduction of ESG requirements provides a useful set of country-level regulatory shocks to the E&S policies of customer firms around the world. While the *direct* effect on firms in their home countries is potentially endogenous – for example due to close political connections

[8] The current version can be found at https://www.carrotsandsticks.net/.

[9] While Ioannou and Serafeim (2017) use similar E&S regulation changes, their paper focuses on a small sample of four countries and studies the *direct* effect of E&S reporting requirements on the E&S performance of local firms.

and lobbying – it is difficult to make a similar argument for the effect on supplier firms in foreign countries. I use this setting to estimate staggered difference-in-difference (DiD) models, estimating the effect of ESG regulation changes in the customer countries on E&S performance and policy adoption of foreign suppliers. Since this channel is not driven by reverse causality or unobservable common factors, the results can be interpreted as causal evidence of E&S policy propagation.

First, I retain only customer-supplier pairs where the two firms are located in different countries. Next, I construct a variable $ENV\ (SOC)\ Regulation_{j,t}$, taking the value of zero at the beginning of the sample, and one going forward once a new $E\ (S)$ regulation comes into effect in the country of customer j. By construction, the control sample comprises of all international customer-supplier pair-years in which the customer country did not introduce any new ESG requirements, by setting $ENV\ (SOC)\ Regulation_{j,t}$ to zero. Hence, $ENV\ (SOC)\ Regulation_{j,t}$ is equivalent to the interaction of $post_t$ and $treated_j$ in a standard DiD setting, as it takes the value of one for treated firm-pairs after the regulation change goes into effect, and zero otherwise.[10] I estimate the following model:

$$\begin{aligned} ES\ Score_{i,t} = \alpha + \beta \times ENV\ (SOC)\ Regulation_{j,t} \\ + \delta_1 \times Z_{i,t} + \delta_2 \times Z_{j,t} + \theta_{c(i),t} + \gamma_{i,j} + \epsilon_{i,j,t}, \end{aligned} \tag{3}$$

where $ENV\ (SOC)\ Regulation_{j,t}$ indicates the introduction of a new ENV (SOC) regulation in the country of customer j from year t onward. The dependent variable $ES\ Score_{i,t}$ is the ENV (SOC) Score of supplier firm i in year t. Since Table 3 shows that SOC policy propagation is concentrated in human rights (HR) related aspects, I focus on the supplier SOC Score for the HR sub-category. Including industry×year fixed effects $\theta_{c(i),t}$ absorbs the coefficients distinguishing 'pre' and 'post' treatment periods, and controls for supplier-industry level trends. Relationship fixed effects $\gamma_{i,j}$ absorb the coefficient indicating 'treated' and 'control' observations. Hence, the main coefficient of interest β estimates the difference-in-difference effect of foreign ESG regulation changes on suppliers' environmental (social) performance and policy adoption.

As in Equation (1), the relationship fixed effects ($\gamma_{i,j}$) absorb any time-invariant characteristics at the supplier-customer level, including supplier and customer country- and country-pair characteristics,

[10] If a country introduces multiple ESG requirements throughout a customer-supplier relationship, *ENV (SOC) Regulation Cus* increases by one increment after each ESG regulation becomes effective. This approach is similar to Bertrand and Mullainathan (2003). The results are robust when I consider only the first regulation during a given customer-supplier relationship.

as well as fixed firm (pair) characteristics. $Z_{i,t}$ and $Z_{j,t}$ are vectors of supplier and customer controls, including firm size, profitability, market-to-book ratio, and country GDP per capita, as before.

[Insert Table 5 here.]

The results, summarized in Panel A of Table 5, indicate that suppliers improve their E&S policy adoption and performance following the adoption of new environmental and social regulations in the countries of foreign customers, controlling for firm and country characteristics, industry time trends, and time-invariant firm- and firm-pair characteristics. As shown in column (1), the introduction of a new environmental requirement in a customer country is associated with a 1% increase in the supplier ENV Score relative to the sample mean, significant at the 5% level, compared to supplier-customer pairs without ENV regulation changes. Similarly, as shown in column (4), the introduction of a new social regulation in a foreign customer country increases the supplier SOC (HR) Score by 1.3% relative to the sample mean, weakly significant at the 10% level.

Next, I consider the importance of country-level differences in ESG standards and practices between the supplier and customer country for the supply-chain transmission of ESG regulations. We would expect the effect to be concentrated in supply-chain pairs where the suppliers are located in countries with lower ESG standards, as suppliers in 'high ESG' countries are more likely to already satisfy any new E&S requirements, and have less "room for improvement" (Barko et al., 2017). Further, suppliers in low ESG countries are more likely to have lower E&S performance (Ioannou and Serafeim, 2012) and hence pose a greater legal and reputation risk to customers. Using country-level air pollution DALYs, trade union (TU) density, and GDP per capita as proxies for 'E' and 'S' standards, respectively, I construct dummy variables $\mathbb{1}_{Yes}$ and $\mathbb{1}_{No}$ to take the value of one, if the environmental standards in the customer country are higher (lower) than in the supplier country, and zero otherwise, similar to Equation (2). I then estimate regressions similar to Equation (3), augmented by interactions of $ENV\ Regulation_{j,t}$ with $\mathbb{1}_{Yes}$ and $\mathbb{1}_{No}$.

The results are presented in columns (2)-(3), and (5)-(6) of Panel A of Table 5. I find a strong, positive effect of environmental regulation changes in foreign customer countries on the environmental performance of suppliers in countries with relatively lower environmental standards (the $\mathbb{1}_{Yes}$ sub-sample). The effect is not only statistically significant at the 1% level in each specification, but economically meaningful. For example, for suppliers in countries where air

pollution (DALYs) is higher than in the corresponding customer country, the introduction of new environmental requirements in the customer countries is associated with a 4% increase in the supplier ENV Score. On the other hand, the effect is negligible in both magnitude and statistical significance for the $\mathbb{1}_{No}$ sub-sample, and the difference between the coefficient estimates for the two groups is significant at the 1% level. I find very similar results using GDP per capita as an alternative proxy for ESG standards in column (3), and Robeco ESG Ratings, CO2/GDP, and the Yale Environmental Performance Index in additional untabulated tests.

I find similar results for the social dimension, using trade union (TU) density as the proxy for *'S'* standards. As shown in column (5), the introduction of a new SOC regulation in the customer country is associated with a 2.3% increase in the supplier SOC Score, significant at the 1% level, when the supplier country has lower ESG standards than the customer country. The coefficient estimate for the opposite sub-sample is small and insignificant, and the difference between the two estimates is significant at the 5% level. However, I do not find similar results when using alternative proxies for country-level ESG standards such as GDP per capita in column (6). Consistent with Panel B of Table 3, this suggests that the propagation of country-level ESG shocks is stronger considering environmental compared to social aspects of E&S performance. I therefore mainly focus on environmental aspects of E&S policy propagation in Sections 4 and 5.

One potential remaining concern is that foreign E&S regulation changes might impact suppliers' E&S performance through channels other than E&S propagation along the supply-chain, such as foreign subsidiaries. To address this concern, I use the foreign ENV regulation changes from Panel A as an Instrumental Variable (IV) for the customer ENV Index, in a standard 2-Stage-Least-Squares (2SLS) setting. This IV approach allows me to estimate the (local) sensitivity of supplier ENV performance to changes in customer ENV policy adoption caused by local regulation changes. Identification in this setting relies on the exclusion restriction that supplier ENV performance is related to foreign ENV regulations only through the customer firm. I estimate the following model:

$$ENV\ Index_{j,t} = \alpha + \beta \times ENV\ Regulation_{j,t} + \delta_1 \times Z_{i,t} + \delta_2 \times Z_{j,t} + \gamma_{i,j} + \theta_t + \epsilon_{i,j,t} \tag{4a}$$

$$E_{i,t} = \alpha + \beta \times \widehat{ENV\ Index}_{j,t} + \delta_1 \times Z_{i,t} + \delta_2 \times Z_{j,t} + \gamma_{i,j} + \theta_t + \epsilon_{i,j,t}, \tag{4b}$$

where $\widehat{ENV\ Index}_{j,t}$ is the predicted value of the ENV Index of customer j from the 1st stage

regression (4a), the ENV Score or Index of supplier i ($E_{i,t}$) is the main dependent variable in the 2nd stage regression, and all other variables are defined similarly as in Equation 3.[11] Because this estimation requires E&S data from ASSET4 for both supplier and customer, the sample is smaller compared to Panel A, which only requires E&S data for supplier firms. If the impact of foreign E&S regulations on supplier firms is indeed due to propagation along the supply-chain, we would expect a significant, positive coefficient estimate for β in both Equations (4a) and (4b).

Panel B of Table 5 reports the results for the 1st stage regression in column (1), and the second stage regression in columns (2) and (3), using the supplier E&S Score and E&S Index as the main dependent variable, respectively. First, the results show that $ENV\ Regulation_{j,t}$ is a strong instrument for customer environmental policy adoption. The coefficient estimate for β of 6.627 indicates a 12% increase in customer ENV Index following the introduction of new ENV requirements. $\hat{\beta}$ is significant at the 1% level, and the F Statistic for the Kleibergen-Paap weak IV test is 21.53, significantly above standard critical values. Second, the 2nd stage regression results confirm my findings from Panel A. The predicted value $\widehat{ES\ Index}_{j,t}$ is statistically significant at the 1% level, and positively associated with both the supplier ENV Score and ENV Index. The magnitude of the coefficient estimate is similar to the difference-in-difference estimate in Panel A, indicating a 1% to 2% increase in supplier E&S performance following ENV regulation changes in the customer countries, due to E&S policy propagation along the supply-chain.

Taken together, the results in this section show that supply-chain relationships are a key channel for the propagation of both corporate E&S policies and country-level E&S standards.

4 Real Effects or Green Washing?

A key concern about corporate E&S policies and performance is green washing, i.e. the idea that firms promote a socially and environmentally friendly public profile without any real effects on E&S-related outcomes (see e.g. Koehn and Ueng, 2010). Discerning between the effect of E&S policies on real outcomes and green washing is important: Fernando et al. (2017), among others, show that investors value E&S policies that reduce real environmental risk, and discount policies perceived as green washing efforts. However, previous literature has mainly relied on comprehensive

[11] I estimate this 2SLS model in a one-step specification, both as a Panel-IV model with firm-pair fixed effects, and as an IV model after removing firm-pair and industry-year means for each variable. The results are similar.

ESG ratings based on firms' CSR reports and other corporate disclosure, which might be biased due to strategic reporting (Chatterji et al., 2016). Further, standard ESG ratings typically conflate both aspects of E&S policy adoption and E&S outcomes, making it difficult to distinguish real E&S performance from green washing. In this section, I specifically examine the effect of E&S propagation along the supply-chain on real E&S outcomes focusing on suppliers' environmental risk using toxic environmental emissions, and their reputation and legal risk.

4.1 Toxic Emissions

To examine the real effects of E&S policy propagation along the supply-chain, I first focus on one key salient feature of environmental risk: toxic environmental emissions. As detailed in Section 2, I obtain emissions data for U.S. firms from the EPA's *Toxic Release Inventory* (TRI) program. In contrast to corporate CSR reporting, which is often voluntary and not standardized, all facilities in the U.S. with more than 10 employees, which "manufacture, process or otherwise use" at least one of 600 chemicals, are required by the EPA to provide detailed reports on toxic emissions. After aggregating the facility level data from the TRI at the parent firm level, I hand-match the firm names to U.S. supplier firms in the supply-chain sample. The sample consists of all U.S. supplier firms with TRI emissions data and their foreign customers.

The main environmental risk measure is the *Risk-Screening Environmental Indicators Score* (RSEI) as provided by the EPA. *RSEI* is a weighted score of all emitted chemicals and toxins, considering each toxin's transport through the environment, relative toxicity, and potential human exposure. If policy propagation along the supply-chain affects the environmental risk of upstream suppliers, we would expect the effect to be more pronounced for chemicals with higher risk for human health. I hence also consider two measures capturing the carcinogenic risk of the emitted substances, the *Cancer Hazard Score* and *Non-Cancer Hazard Score*, both from the TRI.

To alleviate endogeneity concerns, I again rely on the sample of country-level ESG regulation changes detailed in Section 3.3, focusing specifically on regulatory shocks pertaining to environmental policies. Since regulatory changes in foreign countries are unlikely to be driven by U.S. suppliers or common unobservable factors, they are exogenous E&S shocks from the suppliers' perspective. Similar to Section 2, *ENV Regulation* takes the value of zero at the beginning of the sample for each customer country, and it increases by one increment going forward once a new *ENV* requirement

goes into effect. To test the impact of foreign environmental requirements on the emissions of U.S. suppliers, I estimate the following model:

$$\begin{aligned} ENV\ Emissions_{i,t} = \alpha + \beta \times ENV\ Regulation_{j,t} \\ + \delta_1 \times Z_{i,t} + \delta_2 \times Z_{j,t} + \gamma_{i,j} + \theta_t + \epsilon_{i,j,t}, \end{aligned} \tag{5}$$

where $ENV\ Emissions_{i,t}$ is the emissions score for U.S. supplier i in year t, and $ENV\ Regulation_{j,t}$ indicates the introduction of a new ENV requirement in the country of customer j from year t onward. Similar to Equation 3, $ENV\ Regulation_{j,t}$ is equivalent to the interaction term of $treated_j \times post_t$ in a standard difference-in-difference setting. Including relationship ($\gamma_{i,j}$) and time fixed effects (θ_t) absorbs the coefficients for $treated_j$ and $post_t$, respectively, so that β estimates the DiD effect of foreign ENV regulation changes on suppliers' environmental toxic emissions. $Z_{i,t}$ and $Z_{j,t}$ are similar supplier and customer controls as before.

[Insert Table 6 here.]

Panel A of Table 6 reports the baseline results. The introduction of new environmental requirements abroad has a negative effect on the toxic emissions and environmental risk of U.S. suppliers. The effects are not only statistically significant at the 1% level, but also large in magnitude. I first consider the main measure of toxic emissions, *RSEI*, as the dependent variable in column (1) of Panel A. The coefficient estimate for $ENV\ Regulation_{j,t}$ ($\hat{\beta}$ = -7.138) indicates a 27.71% decrease in toxic emissions relative to the unconditional sample mean after new environmental requirements come into effect in foreign customer countries, compared to U.S. suppliers without E&S shocks in the countries of their customers.

Next, I examine how this effect differs for environmental emissions with high and low risk for human health, using the Cancer Score (high carcinogenic risk) and Non-Cancer Score as dependent variables in column (2) and (3), respectively. I find that the result is concentrated in toxic emissions with high human health risks. Considering the Cancer Hazard Score in column (2), the results remain virtually unchanged compared to the baseline specification in column (1). The coefficient estimate for β of -7.249 is very similar to column (1) and remains statistically significant at the 1% level. On the other hand, the coefficient estimate $\hat{\beta}$ is positive and insignificant using the Non-Cancer Hazard Score as the dependent variable in column (3). In additional robustness tests,

I include customer controls (column 4), and institutional ownership controls for the supplier and customer (column 5), which significantly reduces the sample size. The results are robust across all specifications, indicating that the propagation of environmental regulations along supply-chain links is above and beyond other factors studied in the literature.[12]

In Panel B of Table 6, I explore cross-sectional differences at the supplier firm, relationship, and customer-country level. First, I focus on supplier legal risk. If the propagation of *ENV* regulations is due to customers' exposure to supply-chain related reputation and legal risks, the effect should be stronger for riskier supplier firms. To test this notion, I partition the sample into supplier firms with and without at least one lawsuit related to environmental issues in the period before the foreign ENV regulation change. As a second legal risk proxy, I split the sample into supplier firms above ($\mathbb{1}_{High}$) and below ($\mathbb{1}_{Low}$) the median value of annual audit fees (following Bell et al., 2001), and augment equation (5) by interacting $ENV\ Regulation_{j,t}$ with $\mathbb{1}_{High}$ and $\mathbb{1}_{Low}$. The results in columns (1) and (2) of Panel B show that the effect is significantly larger for the sub-sample with high supplier legal risk. While foreign environmental regulation changes have a significantly negative effect on U.S. suppliers' toxic emissions in both groups, the coefficient is three times larger for the *high* compared to the *low* group, using ENV-related lawsuits in year $t-1$ to define $\mathbb{1}_{High}$ and $\mathbb{1}_{Low}$. The difference between the coefficient estimates is significant at the 1% level.

Second, we would also expect the results to be more pronounced when the relationship asymmetry between customers and suppliers is high, i.e. when suppliers are relatively more dependent on their customers. Splitting the sample by relative firm size of customer to supplier in column (3), I find that the coefficient estimate on $ENV\ Regulation_{j,t} \times \mathbb{1}_{High}$ is about three times larger than the coefficient on $ENV\ Regulation_{j,t} \times \mathbb{1}_{Low}$. The difference is significant at the 10% level, suggesting that the propagation of E&S regulations is stronger when customers have higher bargaining power.

Third, following Tables 4 and 5, we would expect E&S propagation to be stronger when the discrepancy between the supplier and customer country ESG standards is high. I confirm this notion by splitting the sample using above ($\mathbb{1}_{High}$) and below median ($\mathbb{1}_{Low}$) country ESG Ratings from Robeco and CO2/GDP, respectively. As shown in columns (4) and (5), when customer country ESG standards are high (i.e. CO2/GDP is low), $ENV\ Regulation_{j,t}$ has a large, negative effect on

[12] In untabulated results I further document that foreign ESG regulation changes in the customer countries also reduce the likelihood of environmental controversies, increase penalty fee payments (USD), as well as the likelihood of E&S-related lawsuits for U.S. supplier firms, conditional on the occurrence of an environmental controversy.

supplier RSEI. The same is not true for the sub-sample of customers in low ESG countries. The difference between the interaction terms with $\mathbb{1}_{High}$ and $\mathbb{1}_{Low}$ is significant at the 5% level.

4.2 Reputation and Legal Risk

The previous section shows that E&S propagation along the supply-chain has important real effects for firms' environmental risk. If customers drive suppliers' E&S performance to mitigate supply-chain related risks, we would further expect E&S policy propagation to also impact supplier legal and reputation risk. To test this notion directly, I examine the effects of corporate E&S policy adoption at the customer firm on supplier legal and reputation risk in this section.

I consider two samples in the following experiments. First, as detailed in Section 2, I obtain the number of lawsuits and legal cases related to environmental and social issues from AuditAnalytics as measures of E&S-related legal risk. A long literature in accounting shows that audit fees are closely related to litigation and reputation risk. For example, Bell et al. (2001) and Seetharaman, Gul, and Lynn (2002) document that firms with high perceived litigation and business risk pay higher audit fees, and Jha and Chen (2014) show that a firm's social capital can help reduce audit fees. I therefore also obtain the total sum of audit fee payments from AuditAnalytics, as an additional measure of litigation risk and social capital. Since data from AuditAnalytics is only available for U.S. firms, the first sample includes all available U.S. suppliers and their customers.

The second sample includes both U.S. and international suppliers and customers. I use environmental penalty payments, health & safety penalties, proactive environmental expenditures (y/n), work related injuries, and audit fees (in USD) for supplier firms from ASSET4 as measures of E&S-related legal and reputation risk, whenever available.

If E&S policy propagation from customers to suppliers reduces E&S-related risks, we would expect that the adoption of E&S policies at the customer firms has a negative effect on legal risk measures and audit fees of their suppliers. To test this notion, I estimate the following model:

$$ES\ Risk_{i,t} = \alpha + \beta \times ES\ Index_{j,t-1} + \delta_1 \times Z_{i,t} + \delta_2 \times Z_{j,t} + \theta_t + \gamma_{i,j} + \epsilon_{i,j,t}, \tag{6}$$

where $ES\ Risk_{i,t}$ denotes the measures of E&S-related legal risk of supplier i in year t outlined above, and $ES\ Index_{j,t-1}$ is the one-year lagged ENV (SOC) Index of customer j. Each regression includes

relationship ($\gamma_{i,j}$) and year fixed effects (θ_t), and controls for supplier and customer characteristics, similar to Equation (1). By including relationship fixed effects, all time-invariant characteristics related to supplier and customer firm-, industry-, and country, as well as the combination of supplier and customer are absorbed, so that β is identified solely from within-firm-pair changes.

[Insert Table 7 here.]

Table 7 summarizes the results. I find that both customer E and S policy adoption has a statistically and economically significant, negative effect on reputation and legal risk related to environmental and social aspects at supplier firms. As shown in Panel A, an inter-quartile range increase in the lagged customer ENV Index is associated with a 3.3% ($= 45 \times -0.0000132/0.0178118$) decrease in the number of environmental lawsuits (significant at the 1% level) relative to the unconditional sample mean (column 1), and a 2.1% decrease in audit fee payments at U.S. supplier firms (column 2), using the sample of U.S. suppliers. I find similar results using the international sample in columns (3) to (5). Moving from the first to the third quartile in $ENV\ Index_{j,t-1}$ is associated with a 12.89% increase in the likelihood that the supplier invests in proactive environmental measures (column 3), a 50% decrease in environmental penalties, and a 1.26% reduction in audit fees for the international sample, all significant at the 1% level.

Panel B of Table 7 focuses on customers' social policies and shows similar results. An increase in the lagged customer SOC Index is related to a significant decrease in supplier human rights and health & safety related legal and reputation risks. An inter-quartile range increase in $SOC\ Index_{j,t-1}$ leads to a 2.0% decrease in the number of lawsuits related to social issues, a 3.7% decrease in audit fees, a 17.5% decrease in work injuries, and 10.1% decrease in health & safety penalties at the supplier in the following year, relative to the unconditional sample mean, significant at the 1% level.

Taken together, the results in this section show that E&S policy propagation along supply-chains is not due to green washing, but has important effects on real outcomes such as environmental, legal, and reputation risk. These effects are especially prevalent when suppliers pose relatively high environmental risks, and when the discrepancy between the ESG standards in the country of the supplier and customer firms is large.

5 E&S Propagation and Financial Performance

The impact of corporate E&S policies on firm value and financial performance is widely debated in the literature. Conventional economic logic suggests that environmental requirements impose costs on firms through auditing, litigation, and potential cleanup costs. Empirically, Jaffe, Peterson, Portney, and Stavins (1995) find costs of compliance with environmental standards equivalent to 2.1% of GDP for U.S. firms. Greenstone, List, and Syverson (2012) document that new emissions restrictions are associated with a 4.8% decline in Total Factor Productivity. Traditional theory provides similar predictions regarding social policies, arguing that firms with high employee satisfaction and happiness are leaving "money on the table" (Gorton and Schmid, 2004).

In this vein, one strand of the literature (Hong et al., 2012; Cheng et al., 2013; Krüger, 2015) views corporate E&S activities as the result of agency conflicts within the firm, suggesting that managers "do good with other people's money", at the expense of shareholders. Recently, Chen, Hung, and Wang (2018) document a negative effect of mandatory CSR reporting requirements in China on firm profitability and shareholder value. On the other hand, previous research shows that firms can increase financial performance by being perceived as good by consumers (Servaes and Tamayo, 2013), employees (Edmans, 2011), investors (Lins et al., 2017), and creditors (Chava, 2014; Cheng et al., 2014), i.e. "do well by doing good".

It is challenging to disentangle the effects of E&S policies on firm performance empirically. Early research relies primarily on cross-sectional correlations (e.g. Klassen and McLaughlin, 1996). Evidence from quasi-natural experiments is often limited to narrow empirical settings (Deng et al., 2013; Flammer, 2015a) and special time periods (Lins et al., 2017). In this paper, I rely on the supply-chain setting as a novel identification strategy to provide new evidence on the relationship between E&S performance and firm value based on a wide sample of firms over 13 years.

I conduct two complementary experiments. First, I exploit changes in firm-level customer E&S policy adoption to study the effect on supplier financial performance. Second, I rely on E&S regulation changes in the countries of foreign customers as shocks to supplier E&S performance. Since E&S policies propagate from customers to suppliers, these shocks allow me to examine the impact of supplier E&S policies on firm performance, while mitigating concerns about reverse causality and other remaining endogeneity concerns.

5.1 Customer E&S Policies and Supplier Financial Performance

I first exploit changes in firm-level customer E&S policies to study the effect on supplier financial performance. Following the literature (e.g. Servaes and Tamayo, 2013; Flammer, 2015a), I consider two measures of firm performance: return-on-assets (ROA) and Tobin's Q, i.e. the book value of assets plus market value of equity minus book value of equity, scaled by book value of assets.

In the following tests, I focus on the sample of U.S. suppliers and their international customers for two main reasons. First, this is consistent with Section 4, which relies mainly on the sample of U.S. suppliers. Second, focusing on U.S. suppliers allows me to use the Hoberg and Phillips (2010) database to construct a control sample of placebo suppliers, i.e. industry rivals without a supply-chain relationship with the given customer. This allows me to estimate the differential effect of customer E&S policy changes on *real* suppliers compared to their industry rivals, to mitigate potential endogeneity concerns. If the effect of E&S adoption on firm performance was endogenously driven, for example by industry trends or export requirements, we would not expect to find a differential effect on real vs. placebo suppliers. Limited E&S coverage in ASSET4 makes it unfeasible to implement a similar empirical design in Sections 3 and 4.

For each U.S. supplier in the sample, I identify the closest industry peer *without* a supply-chain relationships with the given customer country, using the Hoberg and Phillips (2010) text-based product similarity score. I define the dummy $Treated_i$ to take the value of one for *real* supplier-customer relationships and zero for matched placebos, keeping the customer firm constant. This results in approximately 33,000 real and matched supplier-customer firm-pair-year observations. Using this sample, I estimate the *triple-difference* effect of customer E&S policy adoption on financial performance of the (placebo) suppliers as follows:

$$\begin{aligned} y_{i,t} = \alpha + \beta_1 \times ENV\ Policy_{j,t-1} + \beta_2 \times (ENV\ Policy_{j,t-1} \times Treated_i) \\ + \delta_1 \times Z_{i,t} + \delta_2 \times Z_{j,t} + \gamma_{i,j} + \theta_t + \epsilon_{i,j,t}, \end{aligned} \tag{7}$$

where $y_{i,t}$ is either the ROA or Tobin's Q of (placebo) supplier i in t, and $ENV\ Policy_{j,t-1}$ is the ENV Index of customer j in year $t-1$ in the baseline specifications. In additional tests, $ENV\ Policy_{j,t-1}$ is a dummy variable taking the value of one, if the customer provides ESG training for suppliers and zero otherwise, as a specific E&S policy directly related to supply-chain

aspects. Including relationship fixed effects ($\gamma_{i,j}$) absorbs any time-invariant supplier, customer, and relationship differences at the firm-, industry-, or country level, including the coefficient for $Treated_i$. Hence, β_1 measures the difference-in-difference effect of customer environmental policy adoption on treated and placebo supplier financial performance. The key coefficient of interest is β_2, estimating the triple-difference effect of customer E&S policy adoption on the financial performance of treated suppliers compared to their closest industry rivals. θ_t are yearly time fixed effects, $Z_{i,t}$ and $Z_{j,t}$ are vectors of supplier and customer controls, including firm size, profitability, market-to-book ratio, and customer-country GDP per capita.

[Insert Table 8 here.]

Table 8 shows that the introduction of new E&S policies at foreign customer firms has a large, positive effect on the financial performance of connected U.S. suppliers, relative to close competitor firms in the same industry. This is true for both the overall ENV Index in columns (1) and (3) as well as the introduction of ESG training for suppliers in columns (2) and (4).

The coefficient estimate $\hat{\beta}_2$ of 0.000420 in column (1) is statistically significant at the 1% level and indicates that the adoption of one additional customer ENV policy is associated with an increase of 0.525 percentage points in the ROA of the *real* U.S. supplier relative to the placebo firm, equivalent to 13.13% compared to the unconditional sample mean. On the other hand, $\hat{\beta}_1$ is negative and statistically not significant, suggesting that customer E&S adoption has no average effect on the profitability of the real and placebo supplier. Focusing on the adoption of on supply-chain specific E&S policy, *supplier ESG training*, the effect is larger in magnitude. The coefficient estimate $\hat{\beta}_2$ of 0.0192 in column (2), significant at the 5% level, indicates a relative increase in ROA of 48%.

I find a similar pattern using Tobin's Q of the (placebo) supplier as the dependent variable in columns (3) and (4). A one-standard deviation increase in the lagged ENV Index of the customer translates into a 1.9% increase in Tobin's Q of the real supplier compared to the placebo supplier, relative to the sample mean of 2.08. As before, the overall effect on real and placebo supplier, captured by $\hat{\beta}_1$ is statistically insignificant and negative. The value effect is stronger for the adoption of ESG supplier training. I find a 2.2% higher Tobin's Q for real U.S. suppliers after the policy adoption by customers compared to before, relative to the change in matched industry rivals. In untabulated tests I consider alternative supply-chain related E&S policies such as E&S monitoring

or selection criteria and find similar results. Further, I find that the result is stronger when customer firms have relatively higher bargaining power over suppliers.

5.2 ESG Regulations Abroad and Supplier Financial Performance

Since supplier firm performance is likely persistent over time, and customer E&S policies might in turn be affected by suppliers' financial performance, residual concerns about reverse causality might remain. In my next experiment, I therefore rely on ESG regulation changes in foreign customer-countries as in Sections 3.3 and 4.1. Because these regulatory shocks are plausibly exogenous from the suppliers' perspective and propagate along the supply-chain, this setting allows me to identify the value effects of E&S policy adoption. Sections 3 and 4 show that E&S propagation is strongest for environmental aspects. Hence, I focus on *ENV* regulation changes in this experiment.

I use the same sample of U.S. suppliers, matched industry placebos, and foreign customer firms as in the previous Section 5.1, and a similar empirical design as in Equation (7). Similar to Section 3.3, I construct the variable $ENV\ Regulation_{j,t}$ to take the value of zero at the beginning of the sample period for each customer country, and one going forward once a new regulatory requirement comes into effect. If a country introduces a second regulation change, $ENV\ Regulation_{j,t}$ increases by one. I estimate regressions of the following form:

$$\begin{aligned} y_{i,t} = \alpha + \beta_1 \times ENV\ Regulation_{j,t-1} + \beta_2 \times (ENV\ Regulation_{j,t-1} \times Treated_i) \\ + \delta_1 \times Z_{i,t} + \delta_2 \times Z_{j,t} + \delta_3 + \gamma_{i,j} + \theta_t + \epsilon_{i,j,t}, \end{aligned} \tag{8}$$

where the dependent variable $y_{i,t}$ is either the ROA or Tobin's Q of supplier i. The relationship fixed effects, $\gamma_{i,j}$, absorb the coefficient for $Treated_i$. Since the time fixed effects, θ_t, further absorb the coefficient distinguishing 'pre' and 'post' treatment period, β_1 captures the difference-in-difference effect of foreign ENV regulations on supplier and placebo firm performance, similar to Equation (7). The main variable of interest is β_2, measuring the differential effect of foreign ESG regulation changes on the financial performance of real suppliers over the placebo suppliers. $Z_{i,t}$ and $Z_{j,t}$ are vectors of supplier and customer controls, respectively.

[Insert Table 9 here.]

The results, summarized in Table 9, show that new environmental requirements and regulations in

the customer-countries have a significant, positive impact on the subsequent financial performance (ROA and Tobin's Q) of treated U.S. supplier firms relative to placebo suppliers, confirming my findings in Section 5.1. As shown in column (1), the triple-difference coefficient, $\hat{\beta}_2$, is positive and statistically significant at the 5% level, indicating a 0.73 percentage point increase in ROA for treated firms compared to placebo control firms after the introduction of a new environmental regulation in the customer country. That is equivalent to an 18.25% increase relative to the unconditional sample mean of 4%. On the other hand, I find no evidence of an overall effect of *ENV* regulations on U.S. firms: $\hat{\beta}_1$ is statistically insignificant and close to zero. I find similar results considering Tobin's Q in column (3). The coefficient $\hat{\beta}_2$ of 0.0947 is significant at the 1% level and equivalent to a 4.6% increase for treated suppliers compared to matched placebos, relative to the sample mean. In untabulated robustness tests I verify that this effect is driven by a positive effect of foreign ESG regulation changes on real suppliers' Tobin's Q rather than a negative effect on the placebo suppliers.

As shown in Section 3.3, the adoption of supply-chain specific E&S policies by customers enhances the propagation of ESG regulations along the supply-chain. If the firm performance effects documented above are due to the direct influence of customer on their suppliers, we would expect to find stronger results for customers who provide ESG training for suppliers. In columns (2) and (4) of Table 9, I augment Equation (8) by interacting $ENV\ Regulation_{j,t} \times Treated_i$ with two dummy variables $\mathbb{1}_{Yes}$ and $\mathbb{1}_{No}$, indicating the adoption of ESG training by the customer in year t.

The result shown in column (2) indicates a 1.13 percentage point increase in supplier ROA for treated firms compared to placebo control firms in the *post* environmental regulation period, when customers conduct ESG supplier training. The coefficient is significant at the 1% level and equivalent to a 28.25% increase relative to the sample mean. On the other hand, the coefficient estimate for $ENV\ Regulation_{j,t} \times Treated_i \times \mathbb{1}_{No}$ is negative and insignificant. The difference in coefficients is statistically significant at the 1% level. In find a similar result for the effect on supplier Tobin's Q in column (4). The E&S propagation effect on supplier-Q is larger when customers implement ESG training, although the difference in coefficient estimates is not significant at standard levels.

Taken together, these results provide support for the doing-well-by-doing-good perspective of corporate E&S activities: The adoption of corporate E&S policies at U.S. suppliers – due to E&S propagation along the supply-chain – has a positive effect on firm financial performance.

5.3 E&S Policy Adoption and Customer Retention

The results up to this point show that corporate E&S policy adoption due to supply-chain E&S propagation has a positive effect on supplier profitability and firm value. In the final test, I examine one potential channel through which E&S activities can affect firm performance: customer retention and acquisition. The results in Sections 3 and 4 indicate that customers drive supplier E&S policy adoption to mitigate litigation and reputation risk. Consequently, the adoption of corporate E&S policies might have a positive effect on supplier performance, if firms with stronger E&S policies are better at retaining and acquiring important corporate customers.

To test this notion, I consider how suppliers' E&S policy adoption and performance affects customer retention, focusing on extreme, negative E&S-related events: environmental and social controversies and penalty payments. From ASSET4, I obtain data on E&S related controversies and penalties, such as oil spills and child labor scandals, and define dummy variable $E\ (S)\ Issue_{i,t}$ to take the value of one, if supplier i has an E or S related scandal or penalty payment in year t, respectively, and zero otherwise.

I examine if the occurrence of an E&S issue affects the likelihood that the supply-chain relationship with the customer is terminated in the following year, and the interaction of this effect with supplier E&S policy adoption. If supply-chain related E&S risk is a key concern for corporate customers, we would expect that E&S-related supplier controversies increase the likelihood of relationship termination. Further, if the adoption of E&S policies can improve customer retention and mitigate the effect of E&S controversies, we would expect that high E&S policy adoption at the supplier firm reduces the sensitivity of relationship termination to E&S controversies.

To capture relationship termination, I define the dummy variable $y_{i,j,t}$ as one, if year t is the last observation for customer-supplier pair (i, j) in the sample, and zero otherwise. I further construct $\mathbb{1}_{E\ (S)\ High_{i,t}}$ to take the value of one, if the ENV (SOC) Index of supplier i is above the median in t, and zero otherwise. I drop the last year of my sample to avoid falsely classifying observations as relationship terminations, and estimate linear probability models of the following form:

$$\begin{aligned} y_{i,j,t} = \alpha &+ \beta_1 \times E\ (S)\ Issue_{i,t} + \beta_2 \times \mathbb{1}_{E\ (S)\ High_{i,t}} + \beta_3 \times E\ (S)\ Issue_{i,t} \times \mathbb{1}_{E\ (S)\ High_{i,t}} \\ &+ \delta_1 \times Z_{i,t} + \delta_2 \times Z_{j,t} + \gamma_{i,j} + \theta_{c(i),t} + \epsilon_{i,j,t}, \end{aligned} \tag{9}$$

where $E(S)\ Issue_{i,t}$ indicates the occurrence of an E or S controversy or penalty at supplier i in t, and $\mathbb{1}_{E\ (S)\ High_{i,t}}$ denotes high supplier ENV (SOC) policy adoption. $Z_{i,t}$, $Z_{j,t}$, $\theta_{c(i),t}$, and $\gamma_{i,j}$ are supplier and customer controls, and industry×year and relationship fixed effects, respectively.

[Insert Table 10 here.]

Table 10 reports the results. I find that the occurrence of an E&S controversy or E&S penalty payment significantly increases the likelihood that the customer-supplier relationship will be terminated in the following year. As shown in column (1), $\hat{\beta}_1$ is positive and statistically significant at the 1% level, indicating that an environmental supplier controversy increases the likelihood of relationship termination by 78%, relative to the sample mean of 0.099. I find similar results considering ENV penalties in column (2) and SOC penalties in column (4). Further, I find that the effect is greatly mitigated when supplier E&S policy adoption is high. For example, the coefficient estimate for β_3 in column (1) is negative and significant at the 5% level, indicating that the effect of a supplier environmental controversy on relationship termination is 69% ($= 0.0539/0.0778$) lower, when the supplier has an above median ENV Index in t. I find similar results considering ENV penalties in column (2), and SOC controversies and penalties in columns (3) and (4).

In additional, untabulated results I further show that an increase in E&S performance is associated with an increase in sales growth, and with a higher acquisition of customers in countries with high ESG standards in the following year, after controlling for the total number of customers. Taken together, these findings support my results in Sections 5.1 and 5.2, suggesting that firms can benefit from E&S policy adoption by reducing E&S related risks and customer retention and acquisition.

6 Conclusion

This paper studies the role of firm-level supply-chain relationships for the adoption of corporate E&S policies and practices, and the implications of E&S propagation along the supply-chain for real outcomes and firm financial performance. Using both panel data regressions and foreign E&S regulation changes as a quasi-natural experiment, I show that the adoption of corporate E&S policies propagates from customers to suppliers. The effect is stronger when the discrepancy in ESG

standards between the customer and supplier country is high, when suppliers pose large legal and reputational risks, and when customers have high bargaining power over suppliers.

The implications of corporate E&S performance and practices for shareholders and stakeholders have been widely debated in the literature. In this paper, I show that E&S policy propagation along the supply-chain has important real effects for E&S-related outcomes and firms' financial performance. Following the introduction of new E&S regulations in the countries of foreign customers, suppliers reduce their toxic emissions, and legal risk and audit fees decrease. Further, I use the supply-chain setting to show that U.S. suppliers exhibit stronger financial performance, relative to comparable firms in the same industry, following the adoption of corporate E&S policies at customer firms and the introduction of E&S regulations in the customer countries. Finally, following the occurrence of environmental or social controversies, supplier firms with high E&S policy adoption and performance are more likely to retain their relationships with corporate customers.

My findings indicate that supply-chain relationships are an important channel for the transmission of country-level regulations, standards, and requirements across borders. In light of the recent controversies in the U.S. and abroad regarding greenhouse gas emission reduction goals and the Paris Climate Accord, this mechanism could have important implications for firms' E&S practices around the world. Further, my results add to the literature on CSR and firm performance by highlighting a new channel through which firms can benefit from E&S policies and practices, providing new evidence that firms can "do well by doing good".

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Tables and Figures

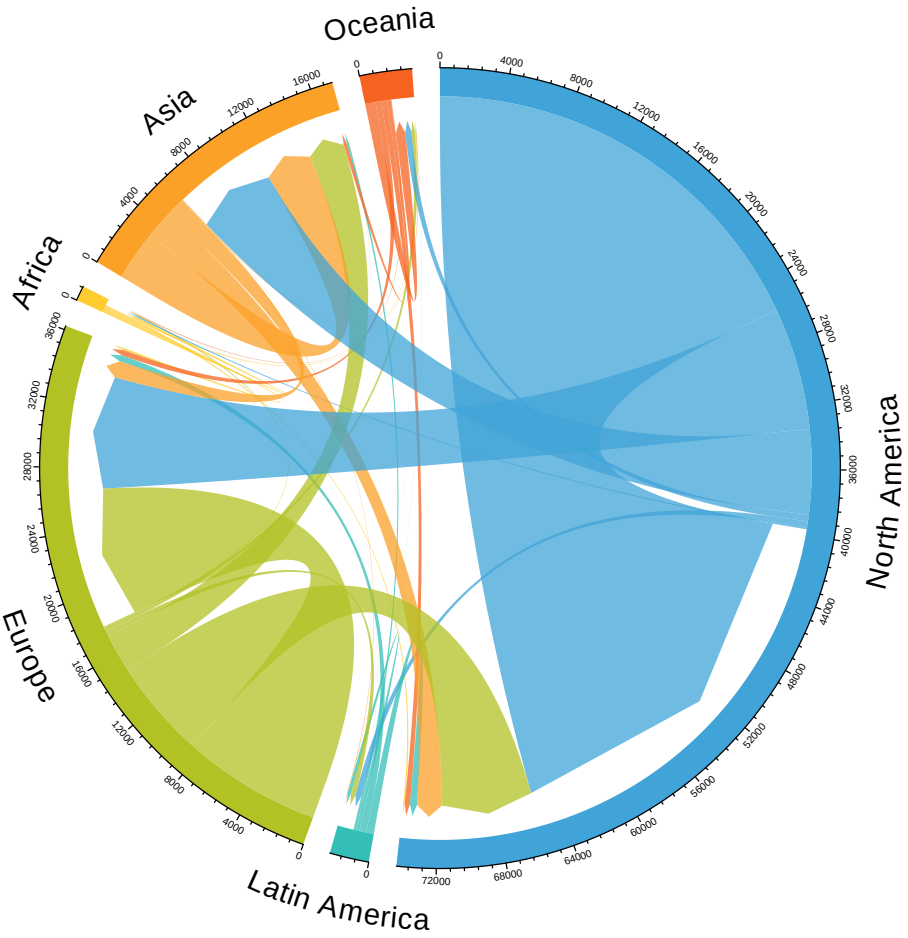

Figure 1: *Notes.* This figure shows the total number of supplier-customer pair-years in the sample, aggregated at the level of geographic regions. Only customer-supplier pair-years for which ESG performance data from the Thomson Reuters ASSET4 database is available in the given year for both the customer and supplier firm are included in this figure. The origin of an arrow indicates the geographic region of the supplier firm, the destination indicates the region of the customer firm, and the width of an arrow represents the number of pair-year observations between two regions. Tick marks show the number of pair-years in thousands. Arrows with identical destination and origin represent supply-chain relationships within the geographic region. The sample covers the period from 2003 to 2016 and includes 67,002 pair-years (23,721 unique customer-supplier pairs) across 52 countries.

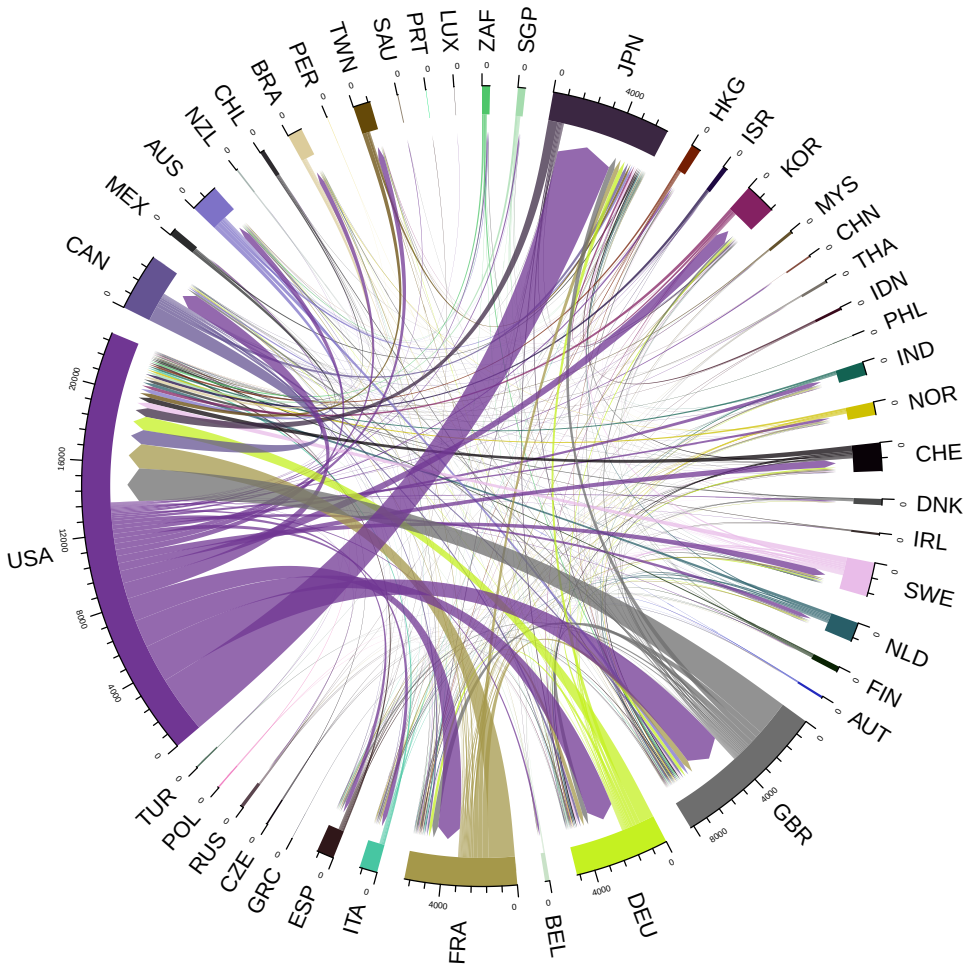

Figure 2: *Notes.* This figure shows the total number of supply-chain pair-year observations, in which the supplier and customer are located in different countries. I include only pair-year observations for which E&S data is available from ASSET4 for both the supplier and customer in a given year, and drop countries with less than 10 observations in the sample for the benefit of readability. The origin of an arrow indicates the country of the supplier firm, the destination indicates the country of the customer firm, and the width of an arrow represents the number of pair-year observations between two countries. Tick marks show the number of pair-years in thousands. The sub-sample represented in this figure covers the period from 2003 to 2016 and includes 34,048 pair-years across 40 supplier and 37 customer countries.

Table 1: Firm- and Relationship-Level Summary Statistics

Notes. This table reports the number of observations (N), the mean, and standard deviation, as well as the 25th, 50th, and 75th percentiles of the main variables used in this paper. Panel A presents summary statistics for the main variables for the supplier firms, Panel B Panel B reports the summary statistics for the customer firms, and Panel C summarizes relationship specific variables. This table includes only firm-pair relationship years for which ESG performance and policy data from the Thomson Reuters ASSET4 ESG Database is available for either the supplier or the customer firm. All variables are defined in detail in Appendix A1. The sample period is from 2003 to 2016.

Panel A: Supplier Variables

	N	Mean	SD	p25	p50	p75
ASSET4 E&S Performance & Policies						
ENV Score Overall	73275	55.75	32.38	20.04	61.77	89.12
ENV Resource Reduction (RR) Score	73275	55.42	32.00	20.14	64.30	87.30
ENV Emissions Reduction (ER) Score	73275	52.45	32.02	18.99	52.96	86.71
ENV Index Overall	73980	37.90	29.88	7.89	36.84	63.16
ENV Resource Reduction (RR) Index	73980	40.78	30.68	6.25	43.75	68.75
ENV Emissions Reduction (ER) Index	73980	35.37	30.39	8.33	29.17	62.50
SOC Score Overall	73554	55.84	30.64	26.16	60.41	85.79
SOC Health & Safety (HS) Score	73554	52.52	31.03	23.05	47.43	86.24
SOC Human Rights (HR) Score	73554	55.00	32.83	20.66	51.41	91.36
SOC Index Overall	79911	37.49	26.79	16.00	36.00	60.00
SOC Health & Safety (HS) Index	79911	51.48	32.04	30.00	50.00	80.00
SOC Human Rights (HR) Index	79911	26.41	26.64	0.00	25.00	50.00
ENV Controversy (y/n)	73980	0.06	0.26	0.00	0.00	0.00
ENV Fines (Mill. USD)	73980	1.92	42.00	0.00	0.00	0.00
ENV Proactive Expenditures (y/n)	73980	0.26	0.44	0.00	0.00	1.00
SOC Health & Safety Controversy (y/n)	79911	0.03	0.18	0.00	0.00	0.00
SOC Health & Safety Penalties (Mill. USD)	79911	0.11	3.18	0.00	0.00	0.00
SOC Human Rights Controversy (y/n)	73980	0.04	0.19	0.00	0.00	0.00
SOC Work Injuries/h	23110	6.25	9.22	1.80	3.65	7.25
EPA Toxics Release Inventory Program						
Mean Cancer Hazard Score	14331	24.90	91.30	0.00	0.12	9.42
Mean Non-Cancer Hazard Score	14331	1.13	5.76	0.01	0.08	0.58
Mean RSEI Score	14331	25.76	92.44	0.02	0.51	11.02
Controls						
Audit Fees (Mill. USD) U.S. Firms	61990	4.76	8.27	1.24	2.42	4.77
ENV Lawsuits	63447	0.02	0.15	0.00	0.00	0.00
SOC Lawsuits	63447	0.02	0.17	0.00	0.00	0.00
Log(Asset Size) (USD)	107021	15.17	1.50	14.15	15.14	16.09
Asset Size (1000 Mill. USD)	107021	13.00	32.800	1.40	3.78	9.77
Market Cap. (1000 Mill. USD)	112555	11.80	26.20	1.54	3.54	9.14
Market-to-Book	106715	1.47	1.37	0.60	1.02	1.82
ROA	107019	0.04	0.09	0.02	0.05	0.08
Sales Turnover	107013	0.78	0.52	0.42	0.71	1.04
Tangibility	76555	0.27	0.27	0.07	0.17	0.39
Leverage	76894	0.25	0.19	0.10	0.23	0.37
Total Inst. Ownership (%)	65714	0.66	0.29	0.41	0.74	0.92
Foreign Inst. Ownership (%)	65714	0.12	0.15	0.03	0.07	0.14
Audit Fees (Mill. USD)	65160	27.78	135.17	1.41	3.11	7.90

Panel B: Customer Variables

	N	Mean	SD	p25	p50	p75
ASSET4 E&S Performance & Policies						
ENV Score Overall	96082	74.85	27.11	65.91	89.23	93.32
ENV Resource Reduction (RR) Score	96082	74.02	26.21	67.50	87.00	91.77
ENV Emissions Reduction (ER) Score	96082	73.07	27.41	61.65	86.85	92.80
ENV Index Overall	96707	57.61	29.01	37.50	65.00	82.50
ENV Emissions Reduction (ER) Index	96707	56.85	30.90	33.33	62.50	83.33
ENV Resource Reduction (RR) Index	96707	58.74	28.73	37.50	68.75	81.25
SOC Score Overall	96318	73.60	23.89	62.36	83.55	91.63
SOC Health & Safety (HS) Score	96318	65.12	30.06	37.18	72.80	94.36
SOC Human Rights (HR) Score	96318	71.52	29.62	48.61	88.51	94.01
SOC Policy Index	101937	50.63	24.75	30.77	53.85	73.08
SOC Health & Safety (HS) Index	101937	65.53	27.64	50.00	70.00	90.00
SOC Human Rights (HR) Index	101937	41.31	27.09	12.50	43.75	62.50
ENV Controversy (y/n)	96707	0.23	0.55	0.00	0.00	0.00
ENV Fines (Mill. USD)	96707	225.00	2680.00	0.00	0.00	0.00
ENV Proactive Expenditures	96707	0.45	0.50	0.00	0.00	1.00
ESG Training for Suppliers (y/n)	96707	0.32	0.47	0.00	0.00	1.00
ENV Supplier Selection Criteria (y/n)	96707	0.68	0.46	0.00	1.00	1.00
SOC Health & Safety Controversy (y/n)	101937	0.11	0.31	0.00	0.00	0.00
SOC Health & Safety Penalties (Mill. USD)	101937	0.26	4.40	0.00	0.00	0.00
SOC Human Rights (HR) Controversy (y/n)	96707	0.08	0.33	0.00	0.00	0.00
SOC Work Injuries/h	41233	6.43	9.27	1.74	3.50	6.75
SOC Supplier Selection Criteria (y/n)	96707	0.48	0.43	0.00	0.50	1.00
SOC Human Rights Monitoring (y/n)	96707	0.41	0.49	0.00	0.00	1.00
Controls						
Audit Fees (Mill. USD) U.S. Firms	50746	13.90	16.70	3.64	7.47	18.10
ENV Lawsuits	52337	0.06	0.25	0.00	0.00	0.00
SOC Lawsuits	52337	0.07	0.32	0.00	0.00	0.00
Log(Asset Size) (USD)	107171	17.23	1.63	16.13	17.25	18.36
Asset Size (1000 Mill. USD)	107171	117.00	296.00	10.10	31.20	93.80
Market Cap. (1000 Mill. USD)	112310	51.00	69.60	7.51	21.80	61.50
Market-to-Book	106634	1.03	0.97	0.40	0.74	1.34
ROA	107164	0.05	0.06	0.01	0.04	0.08
Sales Turnover	107140	0.96	0.71	0.50	0.79	1.23
Tangibility	80942	0.30	0.22	0.12	0.25	0.45
Leverage	81129	0.26	0.15	0.16	0.24	0.36
Total Inst. Ownership (%)	70755	0.55	0.29	0.28	0.61	0.81
Foreign Inst. Ownership (%)	70755	0.12	0.11	0.06	0.09	0.15
Audit Fees (Mill. USD)	67311	247.22	843.05	5.00	14.00	35.74

Panel C: Relationship Variables

	N	Mean	SD	p25	p50	p75
Foreign Customer (y/n)	115109	0.49	0.50	0.00	0.00	1.00
Rel. Firm Size (Assets Cus/Assets Sup)	102963	83.11	468.38	1.87	7.68	31.31
Relationship Length (years)	115109	3.14	3.07	1.00	2.00	4.00
Pct Sales Sup (%)	10968	11.84	13.59	2.10	10.00	15.40

Table 2: Country-Level Summary Statistics

Notes. This table presents summary statistics by country of origin for high income (Panel A) and low income (Panel B) countries. Only relationship years for which ESG data from the ASSET4 ESG Database is available for either the supplier or the customer firm are included. *N Sup Years* and *N Cus Years* are the number of supplier-year and customer-year observations for each country, *ENV* and *SOC Score* are the average environmental and social z-Scores from the ASSET4 ESG dataset across sample firms in each given country. *GDP/Capita (USD)* and *CO2/GDP (kg/USD)* are from the World Bank's WDI database. Country-level ESG standards are from Robeco, the environmental performance index (EPI) is from the Yale EPI database, and air pollution related DALYs are from the 2012 World Health Organization report. Further, trade union density (TUD) and the Employment Protection Index (EMPL) are obtained from the OECD International Labour Organization database. The sample period is 2003 to 2016.

Panel A: High Income Countries

Country	N Sup Years	N Cus Years	ENV Score	SOC Score	GDP / Cap. (USD)	CO2 / GDP	EPI	Air Pollution DALYS	TUD	EMPL	ESG Stds.
Australia	1753	1712	35.05	36.46	30770.22	0.40	87.49	0.07	20.67	1.33	7.5
Austria	189	107	55.30	53.44	31702.77	0.20	84.58	6.49	32.38	2.61	6.8
Belgium	117	308	55.58	50.34	29869.70	0.28	78.79	6.16	54.80	1.88	6.4
Canada	2470	2635	37.32	38.70	29978.45	0.39	84.06	1.12	27.53	0.92	7.6
Denmark	277	283	58.67	55.34	39101.33	0.20	88.35	4.06	69.55	2.15	
Finland	390	251	74.62	68.78	31808.10	0.29	90.64	1.07	71.40	2.39	7.8
France	4267	4516	76.82	77.22	28593.74	0.17	86.59	3.50	7.77	2.39	6.6
Germany	2566	4680	65.97	66.36	30299.05	0.26	83.24	6.21	21.08	2.65	7.0
Hong Kong	360	417	34.14	34.59	24533.75	0.25					6.1
Ireland	119	39	43.65	40.33	32565.74	0.29	87.53	2.94	33.74	1.40	7.5
Japan	2426	9326	60.71	46.68	33756.76	0.23	80.44	4.60	19.17	1.62	
Luxembourg	43	37	49.00	47.43	64306.64	0.29	86.25	4.22	39.22	2.25	7.1
Netherlands	710	733	68.90	74.32	32922.73	0.26	80.80	5.12	20.09	2.92	
New Zealand	135	79	38.06	35.47	22066.59	0.27	88.17	0.09	21.14	1.40	7.5
Norway	419	570	54.66	59.56	51837.12	0.13	87.16	2.30	53.90	2.33	8.1
Qatar	2	14	15.24	10.62	39128.79	0.81	69.38	3.62			5.4
Singapore	458	309	35.33	38.01	27996.57	0.43	89.45	5.01			6.7
Sweden	1325	1375	66.31	63.90	36733.74	0.14	89.19	0.07	73.07	2.70	8.2
Switzerland	942	1291	58.50	56.28	50711.55	0.09	86.13	3.52	18.35	1.60	7.6
UAE	2	22	28.80	23.82	32507.82	0.47	70.49	3.42			
United Kingdom	6138	7355	58.51	61.94	29454.39	0.28	87.69	4.94	27.92	1.17	7.4
USA	41483	51412	40.43	43.44	36469.23	0.46	83.37	2.62	11.86	0.26	6.9
Total	66591	87471	48.49	48.14	34868.85	0.29	84.28	3.39	34.42	1.87	7.1

Panel B: Low Income Countries

Country	N Sup Years	N Cus Years	ENV Score	SOC Score	GDP / Cap. (USD)	CO2 / GDP	EPI	Air Pollution DALYS	TUD	EMPL	ESG Stds.
Brazil	466	724	54.71	65.73	5520.73	0.19	79.42	3.57		1.45	4.1
Chile	376	180	44.10	47.18	6932.17	0.37	78.40	3.94	13.88	2.63	
China	66	183	34.36	32.19	2262.01	2.11	65.13	17.53		3.26	3.3
Colombia	19	33	42.93	53.84	3353.30	0.32	77.51	3.72		1.37	4.0
Cyprus	3	2	35.43	30.33	18181.68	0.35	79.01	4.46			5.0
Czech Republic	114	23	48.31	57.29	11756.68	0.73	83.56	11.40	19.78	3.21	6.3
Egypt	2	18	20.15	26.30	1525.60	0.94	65.36	13.90			3.2
Greece	44	27	47.63	49.24	16011.94	0.34	83.27	8.35	23.93	2.74	
Hungary	12	6	76.63	80.56	8888.91	0.51	81.19	17.64	16.28	1.98	5.2
India	395	727	54.78	56.97	704.98	1.23	54.06	16.24		3.29	3.8
Indonesia	293	138	45.18	60.21	1490.42	0.57	64.17	7.11		4.08	
Israel	285	108	44.12	46.99	20367.60	0.34	78.21	3.12	31.94	2.04	6.0
Italy	481	950	54.59	63.25	25113.67	0.22	83.27	6.17	34.86	2.76	5.6
Korea, South	897	1994	60.51	56.64	14089.48	0.62	70.88	5.05	10.50	2.59	5.2
Kuwait	0	7	27.30	35.78	25630.27	0.70	59.61	4.87			
Malaysia	207	148	39.94	50.76	5333.97	0.78	76.99	5.68		2.84	4.7
Mexico	454	228	45.71	48.87	6172.19	0.47	72.70	3.61	15.51	2.18	4.2
Morocco	8		29.63	56.20	1809.47	0.58	72.09	7.36			4.1
Peru	38		21.78	29.47	2878.87	0.33	71.90	4.01		1.75	4.2
Philippines	70	68	38.37	43.47	1351.84	0.48	72.47	10.48			
Poland	193	116	35.48	40.30	7638.31	1.02	79.00	15.05	16.15	2.23	5.8
Russia	201	178	45.11	52.30	6177.02	1.47	81.91	22.55		3.06	3.8
Saudi Arabia	26	115	32.34	26.30	12317.62	0.81	69.89	7.58		1.37	
South Africa	499	438	51.91	66.78	4369.96	1.42	68.82	9.04		2.16	
Spain	567	934	70.78	75.60	19512.60	0.24	87.46	2.86	16.31	2.75	6.0
Taiwan	713	947	46.83	39.42			70.73				5.9
Thailand	169	158	51.90	61.52	2967.28	0.76	69.33	7.99		2.92	3.5
Turkey	86	95	53.29	55.83	5701.97	0.39	64.03	11.64	16.57	2.36	3.9
Total	6684	8611	50.10	54.31	8741.60	0.67	73.59	8.70	19.55	2.55	4.7
Overall	73275	96082	48.78	49.26	20678.91	0.50	78.17	6.38	28.90	2.12	5.80

Table 3: Customer E&S Policies and Supplier E&S Performance

Notes. This table presents OLS regression estimates on the impact of customer E&S policies on supplier E&S performance. **Panel A** reports the baseline results for supplier environmental (columns 1 and 2) and social (columns 3 and 4) performance, using the Environmental (ENV) and Social (SOC) Scores of the supplier firm as the dependent variables, respectively. The key variables of interest are the one-period lagged environmental and social policy index of the customer (ENV (SOC) Index$^{Cus}_{t-1}$), respectively. The control variables include firm size, market-to-book ratio, return-on-asset (ROA), sales turnover, and the logarithm of country GDP of the supplier firm in all regressions, and additionally similar controls for the customer and domestic and foreign institutional ownership in columns (3) and (4). **Panel B** presents the results for the four environmental and social subcategories 'environmental resource reduction' (RR) and 'environmental emissions reduction' (ER) in columns (1) and (2), and 'human rights' (HR) and 'health & safety' (HS) in columns (3) and (4), using the respective supplier ENV and SOC Score from ASSET4 as the dependent variable. The key variable of interest in each regression is the corresponding one-period lagged ENV and SOC Index of the customer. The controls are similar to columns (1) and (3) of Panel A. Firm-pair and year fixed effects are included as indicated. Detailed definitions of all variables are listed in Appendix A1. Continuous covariates are winsorized at the 1% level. t statistics, provided in parentheses, are calculated based on standard errors clustered at the supplier-customer relationship level in each model. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

Panel A: Baseline Results

	Dependent Variable:			
	Environmental (ENV) Score Sup (t)		Social (SOC) Score Sup (t)	
	(1)	(2)	(3)	(4)
ENV Index$^{Cus}_{t-1}$	0.0443***	0.0405**		
	(2.83)	(2.24)		
SOC Index$^{Cus}_{t-1}$			0.0341**	0.0267*
			(2.57)	(1.71)
log(Asset Size)$^{Sup}_{t}$	3.092***	-0.664	2.836***	1.083
	(4.64)	(-0.74)	(5.36)	(1.56)
Market-to-Book$^{Sup}_{t}$	-1.424***	-1.650***	-0.384**	-0.215
	(-6.89)	(-6.55)	(-2.20)	(-0.98)
ROA$^{Sup}_{t}$	-1.022	-3.585**	-0.816	-2.042
	(-0.75)	(-2.09)	(-0.71)	(-1.26)
Sales Turnover$^{Sup}_{t}$	1.291	-0.831	0.119	-1.321
	(1.03)	(-0.47)	(0.13)	(-1.09)
log(GDP)$^{Sup}_{t}$	14.75***	12.67***	10.43***	-3.481
	(8.14)	(2.98)	(7.13)	(-1.01)
Inst. Ownership Domestic$^{Sup}_{t}$		0.237		-3.457
		(0.09)		(-1.53)
Inst. Ownership Foreign$^{Sup}_{t}$		19.16***		12.14***
		(4.16)		(4.30)
Customer Firm Controls	No	Yes	No	Yes
Firm-Pair FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	37322	20120	37639	20120
R^2	0.912	0.891	0.922	0.893

Panel B: Environmental and Social Sub-Categories

	Dependent Variable:			
	ENV Scores Sup (t)		SOC Scores Sup (t)	
	Resource Reduction (RR)	Emissions Reduction (ER)	Human Rights (HR)	Health & Safety (HS)
	(1)	(2)	(3)	(4)
ENV RR Index$^{Cus}_{t-1}$	0.0427***	0.0170		
	(2.73)	(1.26)		
ENV ER Index$^{Cus}_{t-1}$	0.00733	0.0302**		
	(0.43)	(1.99)		
SOC HR Index$^{Cus}_{t-1}$			0.0420**	0.0128
			(2.57)	(1.00)
SOC HS Index$^{Cus}_{t-1}$			-0.00141	0.00524
			(-0.10)	(0.46)
log(Asset Size)$^{Sup}_{t}$	3.359***	5.760***	0.408	-2.003***
	(4.49)	(7.86)	(0.50)	(-2.64)
Market-to-Book$^{Sup}_{t}$	-1.544***	-0.561***	-0.809***	-1.447***
	(-6.27)	(-2.81)	(-3.59)	(-5.48)
ROA$^{Sup}_{t}$	-1.678	-2.414	-11.75***	4.677***
	(-1.09)	(-1.64)	(-7.13)	(3.18)
Sales Turnover$^{Sup}_{t}$	-1.796	2.180*	-1.878	-2.262**
	(-1.39)	(1.93)	(-1.50)	(-2.05)
log(GDP)$^{Sup}_{t}$	15.58***	7.153***	10.04***	13.34***
	(7.65)	(4.12)	(4.92)	(6.23)
Firm-Pair FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	37322	37322	37639	37639
R^2	0.881	0.903	0.879	0.862

Table 4: The Channels of Supply-Chain E&S Transmission

Notes. This table presents OLS regression estimates on the importance of country characteristics, relationship asymmetry, and supply-chain related policies of the customer firms for the propagation of E&S policies from customer to supplier. **Panel A** focuses on country-level differences between customer and supplier. The dependent variables are the supplier environmental (ENV) and human rights (SOC HR) Score from ASSET4, respectively. The key independent variable is the one-year lagged environmental and social (HR) policies index of the customer firm Index_{t-1}^{Cus}, interacted with the two dummy variables $\mathbb{1}_{Yes}$ and $\mathbb{1}_{No}$. $\mathbb{1}_{Yes}$ takes the value of one if the customer is a foreign firm (columns 1 and 4), and if the supplier country has lower ESG standards than the customer country (columns 2 and 5), higher air pollution related DALYs (column 3), or a lower trade union density (column 6). The indicator $\mathbb{1}_{No}$ takes the value of one if the opposite is true. **Panels B** and **C** focus on firm-level and relationship-level differences. The dependent variables are again the ENV and SOC HR Score from ASSET4, respectively. In both panels, $\mathbb{1}_{Yes}$ and $\mathbb{1}_{No}$ indicate if the customer represents a large percentage of sales to the supplier, is large relative to the supplier, has a policy for supplier ESG training, and environmental (social) criteria for supplier selection. The last two lines of each panel report the p-value and test statistic of an F-test evaluating whether the coefficients on $\text{Index}_{t-1}^{Cus} \times \mathbb{1}_{Yes}$ and *Index CUS*$\times\mathbb{1}_{No}$ are equal. Similar firm and country controls as in Table 3 are included for supplier and customer firms, along with relationship and year fixed effects in all specifications. Continuous covariates are winsorized at the 1% level. *t* statistics, provided in parentheses, are calculated based on standard errors clustered at the supplier-customer relationship level in each model. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

Panel A: Country-Level Differences

	Dependent Variable:					
	ENV Score Sup (t)			SOC (Human Rights) Score Sup (t)		
	$\mathbb{1}_{Yes}$ and $\mathbb{1}_{No}$ defined at country-level based on:					
	Foreign Customer	Sup ESG Standards Lower	Sup DALYs Higher	Foreign Customer	Sup ESG Standards Lower	Sup Trade Union Density Lower
	(1)	(2)	(3)	(4)	(5)	(6)
A: ENV $\text{Index}_{t-1}^{Cus} \times \mathbb{1}_{Yes}$	0.0624***	0.114***	0.0640***			
	(2.92)	(4.71)	(3.18)			
B: ENV $\text{Index}_{t-1}^{Cus} \times \mathbb{1}_{No}$	0.0205	0.0197	-0.00621			
	(1.02)	(1.12)	(-0.23)			
A: SOC (HR) $\text{Index}_{t-1}^{Cus} \times \mathbb{1}_{Yes}$				0.0781***	0.108***	0.0557***
				(3.41)	(3.83)	(3.13)
B: SOC (HR) $\text{Index}_{t-1}^{Cus} \times \mathbb{1}_{No}$				0.0175	0.0139	0.0300*
				(0.83)	(0.78)	(1.83)
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Pair FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	36575	36575	36575	36770	36770	36770
R^2	0.913	0.913	0.881	0.880	0.879	0.879
(A)=(B) (p-Value)	0.0994	0.0003	0.0155	0.0360	0.0023	0.0146
F-Stat	2.72*	13.04***	5.86**	4.40**	9.30***	5.96**

Panel B: Firm-Level Differences – Environmental Performance

	Dependent Variable: ENV Score Sup (t)			
	$\mathbb{1}_{Yes}$ and $\mathbb{1}_{No}$ defined based on:			
	Relationship Asymmetry:		Supply-Chain Policies:	
	High Pct. Sales Sup (t-1)	High Rel. Firm Size (t-1)	ESG Training (t-1)	Env. Criteria Sup Selection (t-1)
	(1)	(2)	(3)	(4)
A: ENV Index$^{Cus}_{t-1} \times \mathbb{1}_{Yes}$	0.101***	0.0528***	0.0506***	0.0423***
	(2.93)	(3.09)	(3.09)	(2.62)
B: ENV Index$^{Cus}_{t-1} \times \mathbb{1}_{No}$	0.0682**	0.0343**	0.0379**	0.0372**
	(2.21)	(2.07)	(2.39)	(2.01)
Firm & Country Controls	Yes	Yes	Yes	Yes
Firm-Pair FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	4698	36575	36575	36575
R^2	0.560	0.903	0.913	0.903
(A)=(B) (p-Value)	0.0759	0.0507	0.0155	0.5849
F-Stat	3.15*	3.82*	5.86**	0.30

Panel C: Firm-Level Differences – Social Performance

	Dependent Variable: SOC (Human Rights) Score Sup (t)			
	$\mathbb{1}_{Yes}$ and $\mathbb{1}_{No}$ defined based on:			
	Relationship Asymmetry:		Supply-Chain Policies:	
	High Pct. Sales Sup (t-1)	High Rel. Firm Size (t-1)	ESG Training (t-1)	Soc. Criteria Sup Selection (t-1)
	(1)	(2)	(3)	(4)
A: SOC (HR) Index$^{Cus}_{t-1} \times \mathbb{1}_{Yes}$	0.126**	0.0519***	0.0508***	0.0382**
	(2.29)	(2.87)	(2.93)	(2.36)
B: SOC (HR) Index$^{Cus}_{t-1} \times \mathbb{1}_{No}$	0.0801	0.0236	0.0303*	0.0189
	(1.57)	(1.37)	(1.87)	(0.87)
Firm & Country Controls	Yes	Yes	Yes	Yes
Firm-Pair FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	4697	36755	36755	36755
R^2	0.852	0.879	0.879	0.879
(A)=(B) (p-Value)	0.0969	0.0476	0.0139	0.2250
F-Stat	2.76*	3.92**	6.06**	1.47

Table 5: The Supply-Chain as a Transmission Channel for E&S Regulations

Notes. This table presents difference-in-difference and 2SLS IV estimates on the impact of ESG regulation changes in foreign customer countries on the environmental and social performance and policy adoption of suppliers. The sample includes only firm-pairs in which the two firms are located in different countries. **Panel A** summarizes the difference-in-difference estimations. The dependent variable are the ENV Score (columns 1 to 3) and the SOC Score of the supplier firm (columns 4 to 6), respectively. The key variable of interest in columns (1) and (4) are *ENV (SOC) Regulation Cus*, indicating that a new environmental or social regulation has come into effect in the customer-country, respectively. The key variable of interest in the other columns is the interaction term of *ENV (SOC) Regulation Cus* with two dummy variables $\mathbb{1}_{High}$ and $\mathbb{1}_{Low}$. $\mathbb{1}_{High}$ ($\mathbb{1}_{Low}$) takes the value of one, if the supplier country has higher air pollution DALYs (column 2), lower trade union density (TU) (column 5), and a lower GDP per capita (columns 3 and 6) than the customer country, respectively. The controls include asset size, market-to-book, ROA, sales turnover, and log(GDP) for both the supplier and customer, as detailed in Appendix A1. The last two lines report the p-value and F-test statistic for the hypothesis that the coefficients of the interaction terms with $\mathbb{1}_{Low}$ and $\mathbb{1}_{High}$ are equal. **Panel B** summarizes the 2SLS IV estimates. Column (1) presents the first stage regression, using the customer ENV Index as the dependent variable and *Env Regulation Cus* as the instrumental variable. Columns (2) and (3) present the second stage regression, using the predicted value of *ENV Index Cus* as the key variable of interest and the supplier ENV Score and ENV Index as the dependent variables, respectively. The controls are similar to panel A and constant across first and second stage regressions. The last lines present Cragg-Donald and Kleibergen-Paap F Statistics for underidentification and weak IV tests. Every specification controls relationship and industry×year fixed effects. Continuous covariates are winsorized at the 1% level. t statistics, based on standard errors clustered at the customer country level, are provided in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

Panel A: Difference-in-Difference Regressions

	Dependent Variable:					
	Environmental ENV Score Sup (t)			Social SOC Score Sup (t)		
	$\mathbb{1}_{Yes}$ and $\mathbb{1}_{No}$ defined at country-level based on:					
		Sup DALYs Higher	Sup GDP Lower		Sup TU Density Lower	Sup GDP Lower
	(1)	(2)	(3)	(4)	(5)	(6)
ENV (SOC) Regulation Cus	0.476**			0.705*		
	(2.26)			(1.80)		
A: E (S) Reg. Cus × $\mathbb{1}_{Yes}$		1.157***	0.983***		1.220***	0.330
		(4.24)	(2.93)		(2.76)	(0.93)
B: E (S) Reg. Cus × $\mathbb{1}_{No}$		0.198	0.366*		0.432	0.735
		(0.83)	(1.77)		(1.10)	(1.52)
Foreign Customers Only	Yes	Yes	Yes	Yes	Yes	Yes
Firm & Country Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Pair FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry×Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	34837	34837	34837	34530	34530	34530
R^2	0.934	0.934	0.934	0.904	0.904	0.903
(A)=(B) (p-Value)		0.0003	0.0497		0.0185	0.3100
F-Stat		15.10***	4.04**		5.93**	1.05

Panel B: 2SLS IV-Regressions – Environmental

	Dependent Variable:		
	1st Stage	2nd Stage	
	ENV Index Cus (t)	ENV Score Sup (t)	ENV Index Sup (t)
	(1)	(2)	(3)
ENV Regulation Cus (t)	6.627***		
	(4.640)		
ENV_Index Cus (t)		0.481***	0.853***
		(3.513)	(8.135)
Foreign Customers Only	Yes	Yes	Yes
Firm & Country Controls	Yes	Yes	Yes
Firm-Pair Residuals	Yes	Yes	Yes
Sup Industry×Year Residuals	Yes	Yes	Yes
N	22,082	22,082	22,172
R^2	0.923		
C-D Wald F Statistic	3840.007		
K-P Wald F Statistic	21.531		

Table 6: Environmental Regulations Abroad and U.S. Suppliers' Toxic Emissions

Notes. This table presents regression estimates on the impact of E&S regulation changes in the countries of the customer firms on the environmental emissions of their suppliers in the United States. The sample includes only U.S. suppliers with factory-level emissions data from the U.S. Environmental Protection Agency (EPA) and their foreign customers. **Panel A** reports the baseline results for supplier emissions. The dependent variables in columns (1) to (3) are the average Risk-Screening Environmental Indicators (RSEI) Score, Cancer Hazard Score, and the Non Cancer Hazard Score, respectively, all provided by the EPA on the basis of the Toxics Release Inventory (TRI). The main dependent variable is the RSEI Score, a risk-weighted measure of all chemicals and emissions released. The key variable of interest is *ENV Regulation Cus*, indicating that a new environmental regulation has come into effect in the customer-country. The controls include firm size, market-to-book, ROA, sales turnover, and foreign institutional ownership (IO), as indicated. Columns (4) and (5) include additional customer controls (column 4), and institutional ownership controls for suppliers and customers (column 5). **Panel B** examines the importance of supplier legal risk, relationship asymmetry between supplier and customer, and environmental standards in the customer country. The dependent variable in columns (1) to (6) is the aggregate RSEI Score for U.S. suppliers. The key variables of interest are *ENV Regulation Cus* as in Panel A, interacted with two dummy variables $\mathbb{1}_{High}$ and $\mathbb{1}_{Low}$. $\mathbb{1}_{High}$ ($\mathbb{1}_{Low}$) takes the value of one, if the supplier firm had an environment related law suit in the previous year (column 1), above (below) median Audit Fees per firm size (column 2), above median firm size (book assets) relative to the customer (column 3), and ESG standards (column 4) and CO2 emissions per GDP (column 5) at the country level of the customer firm. The last two lines of Panel B report the p-value and the test statistic of an F-test evaluating the hypothesis that the coefficients on $\mathbb{1}_{Low}$ and $\mathbb{1}_{High}$ are equal. Each regression includes similar controls as in Panel A and relationship and year fixed effects. All continuous covariates are winsorized at the 1% level. t statistics, provided in parentheses, are calculated based on standard errors clustered at the supplier-customer relationship level. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

Panel A: Baseline Results

	Dependent Variable:				
	EPA Emissions Scores			Robustness	
	RSEI Score (t)	Cancer Hazard Score (t)	Non Cancer Hazard Score (t)	RSEI Score (t)	
	(1)	(2)	(3)	(4)	(5)
ENV Regulation Cus	-7.138***	-7.249***	0.0126	-6.611**	-5.821**
	(-2.72)	(-2.76)	(0.10)	(-2.54)	(-2.17)
Supplier Controls	Yes	Yes	Yes	Yes	Yes
Customer Controls	No	No	No	Yes	Yes
Inst. Own. Controls	No	No	No	No	Yes
Firm-Pair FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
U.S. Suppliers only	Yes	Yes	Yes	Yes	Yes
Foreign Customer	Yes	Yes	Yes	Yes	Yes
N	11766	11766	11766	10849	8274
R^2	0.657	0.653	0.638	0.660	0.664

Panel B: Cross-Sectional Variation

	Dependent Variable: RSEI Score Sup (t)				
	$\mathbb{1}_{High}/\mathbb{1}_{Low}$ defined based on:				
	Supplier Legal Risk		Relation Asymmetry	Customer-Country Characteristics	
	Env. Lawsuits Sup (t-1)	Audit Fees /AT Sup (t)	Relative Firm Size (t)	ESG Stds (t)	CO2 / GDP (t)
	(1)	(2)	(3)	(4)	(5)
A: ENV Regulation Cus × $\mathbb{1}_{High}$	-17.74***	-7.758***	-14.15***	-13.34***	0.919
	(-3.48)	(-3.01)	(-2.09)	(-2.66)	(0.22)
B: ENV Regulation Cus × $\mathbb{1}_{Low}$	-5.385*	-6.965**	-5.371**	-0.667	-7.096**
	(-1.73)	(-2.56)	(-2.74)	(-0.23)	(-2.39)
log(Asset Size) Sup (t)	-8.090	-3.076	-3.397	-11.54	2.339
	(-0.84)	(-0.35)	(-0.37)	(-1.04)	(0.29)
Market-to-Book Sup (t)	-2.268	-1.151	-0.957	-2.054	-2.458
	(-1.40)	(-0.83)	(-0.61)	(-1.21)	(-1.49)
ROA Sup (t)	42.32***	23.99**	25.24**	27.53**	25.97**
	(2.96)	(2.32)	(2.22)	(2.04)	(2.44)
Sales Turnover Sup (t)	-38.46***	-27.36***	-26.79***	-30.67**	-22.52***
	(-4.03)	(-2.93)	(-2.73)	(-2.57)	(-3.11)
Firm-Pair FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Foreign Customer	Yes	Yes	Yes	Yes	Yes
N	7806	11741	10900	9006	9170
R^2	0.676	0.657	0.658	0.667	0.661
(A)=(B) (p-Value)	0.0056	0.5291	0.0706	0.0226	0.0993
F-Stat	7.69***	0.40	3.27*	5.20**	2.72*

Table 7: Customer E&S Policies and Supplier Legal Risk

Notes. This table presents estimates of OLS regressions and linear probability models regarding the impact of customer ESG policies on the E&S-related legal risk of their suppliers. **Panel A** reports the results for supplier environmental risk. The dependent variables in columns (1) to (5) are the number of environmental lawsuits, the total audit fees (USD) (for U.S. firms from AuditAnalytics), a dummy capturing proactive environmental expenditures, the sum of fines and penalties related to environmental issues, and the total audit fees (for all supplier firms from Worldscope). **Panel B** shows the results for supplier social risk, using the number of lawsuits related to social issues, the total audit fees (for U.S. firms from AuditAnalytics), the number of injuries per total hours worked, the sum of fines and penalties related to health & safety issues, and the total audit fees (for all supplier firms from Worldscope) as dependent variables. The key variables of interest are the one-period lagged index of environmental and social policies of the customer firm, *ENV Index Cus* and *SOC Index Cus*, respectively. I include similar firm and country-level controls as before for supplier and customer firms, as well as relationship and year fixed effects in all specifications. All continuous covariates are winsorized at the 1% level. t statistics, provided in parentheses, are calculated based on standard errors clustered at the supplier-customer relationship level in each model. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

Panel A: Environmental Customer Policies

	Dependent Variable: Supplier (t)				
	U.S. Sample		Global Sample		
	Environm. Lawsuits (1)	Audit Fees (USD) (2)	Proactive Env. Expend. (0/1) (3)	Environm. Fines (USD) (4)	Audit Fees (100s USD) (5)
ENV Index Cus (t-1)	-0.000132***	-2236.3*	0.000745***	-21345.3***	-77.89***
	(-3.77)	(-1.75)	(2.79)	(-3.37)	(-3.26)
Sup & Cus Controls	Yes	Yes	Yes	Yes	Yes
Country Controls	No	No	Yes	Yes	Yes
Firm-Pair & Year FE	Yes	Yes	Yes	Yes	Yes
N	33047	33032	37054	37054	32175
R^2	0.303	0.931	0.851	0.851	0.960

Panel B: Social Customer Policies

	Dependent Variable: Supplier (t)				
	U.S. Sample		Global Sample		
	Social Lawsuits (1)	Audit Fees (USD) (2)	Injuries / Work Hours (3)	Health & Safety Fines (USD) (4)	Audit Fees (100s USD) (5)
SOC Index Cus (t-1)	-0.0000858**	-4131.7***	-0.0259***	-2718.5***	-18.96
	(-2.26)	(-3.31)	(-3.35)	(-2.72)	(-0.35)
Sup & Cus Controls	Yes	Yes	Yes	Yes	Yes
Country Controls	No	No	Yes	Yes	Yes
Firm-Pair & Year FE	Yes	Yes	Yes	Yes	Yes
N	32164	33271	11403	38655	32212
R^2	0.292	0.913	0.908	0.457	0.960

Table 8: Customer E&S Policies and U.S. Supplier Firm Performance

Notes. This table presents triple-difference regression estimates on the effect of firm-level E&S policies of foreign customers on the financial performance of U.S. suppliers. For each U.S. supplier in the sample, a placebo supplier is matched by choosing the closest rival from the Hoberg and Phillips (2010) dataset, after excluding firms with major foreign customers from the set of possible matches. *Treated* takes the value of one for 'real' suppliers and zero for the placebo suppliers, keeping the customer constant. The dependent variable is return on assets (ROA) of the supplier firm in columns (1) and (2), and Tobin's Q in columns (3) to (4). The key variables of interest are the Environmental Policies Index of the customer (*ENV Index Cus*), lagged by one year, interacted with *Treated*, and a lagged dummy variable indicating if the customer firm provides ESG training to suppliers (*ESG Training Cus (y/n)*) and its interaction with *Treated*. Each regression includes firm and country controls for supplier and customer firms as well as relationship, supplier-firm, and year fixed effects. Continuous covariates are winsorized at the 1% level. t statistics, provided in parentheses, are calculated based on standard errors clustered at the supplier-customer relationship level in each model. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

	Dependent Variable:			
	ROA Supplier (t)		Tobin's Q Supplier (t)	
	(1)	(2)	(3)	(4)
ENV Index Cus (t-1)	-0.000128		-0.000484	
	(-1.05)		(-0.52)	
ENV Index Cus (t-1) × Treated	0.000420***		0.00134***	
	(3.10)		(2.88)	
ESG Training Cus (y/n) (t-1)		-0.00555		0.0532*
		(-0.90)		(1.70)
ESG Training Cus (y/n) (t-1) × Treated		0.0192**		0.0449**
		(2.31)		(2.06)
Log(Asset Size) Sup (t)	0.0497***	0.0502***	-0.722***	-0.679***
	(4.52)	(4.57)	(-15.44)	(-12.92)
Log(Asset Size) Cus (t)	0.00721	0.00746	0.140***	0.0895*
	(0.85)	(0.87)	(2.65)	(1.88)
Tobin's Q Sup (t)	0.0229***	0.0228***		
	(5.39)	(5.34)		
Tobin's Q Cus (t)	-0.00401	-0.00414	0.0870**	0.112***
	(-0.80)	(-0.82)	(2.51)	(3.12)
ROA Sup (t)			0.418***	0.306***
			(5.22)	(3.07)
ROA Cus (t)	0.0566***	0.0578***	-0.0179	-0.124
	(2.85)	(2.89)	(-0.12)	(-0.81)
Sales Turnover Sup (t)	0.0287	0.0290	0.0544	0.0833
	(0.86)	(0.87)	(1.09)	(1.64)
Sales Turnover Cus (t)	-0.00127	-0.000520	-0.0323	-0.0545
	(-0.17)	(-0.07)	(-0.49)	(-0.87)
Log(GDP) Cus (t)	0.0102	0.0106	-0.220**	-0.318***
	(0.82)	(0.84)	(-1.98)	(-2.81)
Year FE	Yes	Yes	Yes	Yes
Relationship FE	Yes	Yes	Yes	Yes
U.S. Suppliers & Foreign Customers only	Yes	Yes	Yes	Yes
N	31102	31102	31102	31102
R^2	0.659	0.658	0.752	0.768

Table 9: Environmental Regulations Abroad and U.S. Firm Performance

Notes. This table presents triple-difference estimates on the impact of environmental regulation changes in the countries of the customer firms on the financial performance of their U.S. suppliers. The control sample is generated similarly as in Table 8. *Treated* takes the value of one for 'real' suppliers and zero for the the closest rival in the same industry. The dependent variables are the return on assets (ROA) of the supplier firm in columns (1) and (2), and Tobin's Q in columns (3) and (4). The main variable of interest is the interaction of *ENV Regulation* and *Treated*, capturing the differential effect of environmental regulation changes abroad on 'real' and placebo supplier firms. Columns (2) and (4) interact *ENV Regulation* × *Treated* with two dummies $\mathbb{1}_{Yes}$ and $\mathbb{1}_{No}$, indicating if the customer firm provides ESG training to suppliers. The last two lines report the p-value and F-test statistic evaluating if the coefficients on *ENV Regulation* × *Treated* × $\mathbb{1}_{Yes}$ and *ENV Regulation* × *Treated* × $\mathbb{1}_{No}$ are equal. Each regression includes firm and country controls for the supplier and customer firms as well as relationship, supplier-firm, and year fixed effects. Continuous covariates are winsorized at the 1% level. *t* statistics, provided in parentheses, are calculated based on standard errors clustered at the supplier-customer relationship level in each model. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

	Dependent Variable:			
	ROA Supplier (t)		Tobin's Q Supplier (t)	
	$\mathbb{1}_{Yes}/\mathbb{1}_{No}$: *Customer provides ESG Training for Suppliers*			
	(1)	(2)	(3)	(4)
ENV Regulation Cus (t-1)	-0.00396	-0.00219	-0.0216	0.00626
	(-1.36)	(-0.69)	(-1.22)	(0.33)
ENV Regulation Cus (t-1) × Treated	0.00730***		0.0947***	
	(2.83)		(5.51)	
A: ENV Regulation Cus (t-1) × Treated × $\mathbb{1}_{Yes}$		0.0113***		0.0753***
		(3.53)		(3.47)
B: ENV Regulation Cus (t-1) × Treated × $\mathbb{1}_{No}$		-0.00145		0.0647***
		(-0.48)		(3.35)
Firm & Country Controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Relationship FE	Yes	Yes	Yes	Yes
Foreign Customers only	Yes	Yes	Yes	Yes
U.S. Suppliers only	Yes	Yes	Yes	Yes
N	23030	19748	23030	19748
R^2	0.621	0.667	0.741	0.746
(A)=(B) (p-Value)		0.0000		0.6038
F-Stat		19.38***		0.27

Table 10: Supplier E&S Scandals, E&S Policy Adoption, and Customer Retention

Notes. This table presents linear probability estimates on the impact of environmental and social controversies of supplier firms on customer retention. The dependent variable in all columns is a dummy taking the value of one, if t is the last year on record for the customer-supplier pair (and zero otherwise). The key variables of interest are dummy variables indicating the occurrence of an environmental or social (i.e. human rights related) controversy and the payment of an environmental or social fine or penalty. $\mathbb{1}_{E\ (S)\ High_{Sup,t}}$ is a dummy variable that takes the value of one, if the ENV (SOC) Index of the supplier firm is above the median, and zero otherwise. I include firm and country-level controls for the supplier and customer firm, as well as relationship and indusytr×year fixed effects in all specifications. All continuous covariates are winsorized at the 1% level. t statistics, provided in parentheses, are calculated based on standard errors clustered at the supplier-customer relationship level in each model. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

	Dependent Variable: Last Relationship Year (y/n) (t)			
	Environmental (E)		Social (S)	
	(1)	(2)	(3)	(4)
Controversy Sup (y/n) (t)	0.0778***		-0.00895	
	(3.71)		(-0.74)	
Penalties Sup (y/n) (t)		0.0906***		0.0661***
		(3.59)		(2.61)
Index Sup High (y/n) (t)	0.00121	0.00159	0.0132	0.0120
	(0.15)	(0.20)	(0.89)	(1.48)
Controversy Sup (y/n) (t)× $\mathbb{1}_{E\ (S)\ High_{Sup,t}}$	-0.0539**		-0.0257*	
	(-2.26)		(-1.76)	
Penalties Sup (y/n) (t)× $\mathbb{1}_{E\ (S)\ High_{Sup,t}}$		-0.0920***		-0.0535*
		(-3.28)		(-1.90)
Firm & Country Controls	Yes	Yes	Yes	Yes
Firm-Pair FE	Yes	Yes	Yes	Yes
Supplier Industry×Year FE	Yes	Yes	Yes	Yes
N	43261	43261	43211	43211
R^2	0.376	0.376	0.376	0.376

A Appendix

Table A1: Variable Definitions and Data Sources

Notes. This table summarizes the variable construction and data sources of the main variables used in this paper. *(E)* and *(S)* indicate that a variable is part of the Environmental and Social Subcategories of the ASSET4 ESG database. If not explicitly explained, each variable is observed for both the supplier (SUP) or customer (CUS) firm or country.

Variable	Short Description	Detailed Comments
ENV Score	Environmental z-Score (Overall)	Overall z-Score capturing the overall Environmental (E) firm performance. Measures a company's "impact on living and non-living natural systems, including the air, land and water, as well as complete ecosystems". (Data source: ASSET4)
ENV RR Score	Resource Reduction z-Score (E)	Subcategory z-Score capturing firm performance for environmental resource reduction. Measures a company's "management commitment and effectiveness towards achieving an efficient use of natural resources in the production process". (Data source: ASSET4)
ENV ER Score	Emissions Reduction z-Score	Subcategory z-Score capturing firm performance for environmental emissions reduction. Measures a company's "management commitment and effectiveness towards reducing environmental emission in the production and operational processes". (Data source: ASSET4)
ENV Index	Environmental Policies and Initiatives Index (E)	Index of all environmental policies and initiatives. Constructed by taking the sum over a number of dummy variables indicating the adoption (y/n) of 20 environmental policies and re-scaling to have minimum of zero and maximum of 100. (Data source: ASSET4)
ENV RR Index	Resource Reduction Index (E)	Index of corporate policies and initiatives related to environmental resource reduction. Constructed as the sum over 8 dummy variables indicating the adoption (y/n) of resource reduction policies. Re-scaled to be between 0 and 100. (Data source: ASSET4)
ENV ER Index	Emissions Reduction Index (E)	Index of corporate policies and initiatives related to environmental emissions reduction. Constructed as the sum over 12 dummy variables indicating the adoption (y/n) of emissions policies. Re-scaled to be between 0 and 100. (Data source: ASSET4)
SOC Score	Social z-Score (Overall)	Overall z-Score capturing the overall Social (S) firm performance. Measures a company's "capacity to generate trust and loyalty with its workforce, customers and society". (Data source: ASSET4)
SOC HS Score	Health & Safety z-Score	Subcategory z-Score capturing firm performance regarding health & safety. Measures a company's "management commitment and effectiveness towards providing a healthy and safe workplace". (Data source: ASSET4)

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Variable	Short Description	Detailed Comments
SOC HR Score	Human Rights z-Score	Subcategory z-Score capturing firm performance for environmental emissions reduction. Measures a company's "management commitment and effectiveness towards respecting the fundamental human rights conventions". (Data source: ASSET4)
SOC Index	Social Policies and Initiatives Index (S)	Index of all social policies and initiatives. Constructed by taking the sum over 13 dummy variables (y/n) indicating the adoption of human rights and health & safety policies, and re-scaling to have minimum of zero and maximum of 100. (Data source: ASSET4)
SOC HS Index	Health & Safety Policy Index	Index of corporate policies related to workplace health & safety. Constructed as the sum over 5 dummy variables indicating the adoption (y/n) of key health & safety policies. Re-scaled to be between 0 and 100. (Data source: ASSET4)
SOC HR Index	Human Rights Policy Index	Index of corporate policies related to human rights issues. Constructed as the sum over 8 dummy variables indicating the adoption (y/n) of key human rights provisions and policies. Re-scaled to be between 0 and 100. (Data source: ASSET4)
ENV Fines	Penalty Payments due to Environmental Controversies	All real or estimated penalties, fines from lost court cases, settlements or cases not yet settled regarding environmental controversies in Mill. USD. (Data source: ASSET4)
ENV Controversy	Environmental Controversy	Indicator (y/n) if the company is under media spotlight because of a controversy linked to either a) the environmental impact of its operations on natural resources or local communities, b) biodiversity, or c) the spill of chemicals, oils and fuels, gases (flaring) or controversy relating to the overall impacts of the company on the environment. (Data source: ASSET4)
ENV CO2 Emissions/AT	CO2 Emissions / Total Assets	Total CO2 and CO2 equivalents emission in tonnes denominated by firm size measured by Total Book Assets (AT). (Data sources: ASSET4 and Worldscope)
ENV Sup Selection	Environmental Supplier Selection Criteria	Indicator (y/n) if the company uses environmental criteria (ISO 14000, energy consumption, etc.) in the selection process of its suppliers or sourcing partners. (Data source: ASSET4)
SOC HS Controversy	Health & Safety Controversy	Indicator (y/n) if the company is under media spotlight because of a controversy linked to workforce health and safety. (Data source: ASSET4)
SOC HR Controversy	Human Rights Controversy	Indicator (y/n) if the company is under media spotlight because of a controversy linked to a) child labour, b) freedom of association, or c) general human rights issues. (Data source: ASSET4)

continued...

Variable	Short Description	Detailed Comments
SOC HS Fines	Penalty Payments due to Health & Safety Controversies	All real or estimated penalties, fines from lost court cases, settlements or cases not yet settled regarding health & safety controversies in Mill. USD. (Data source: ASSET4)
SOC HR Fines	Penalty Payments due to Human Rights Controversies	All real or estimated penalties, fines from lost court cases, settlements or cases not yet settled regarding human rights controversies in Mill. USD. (Data source: ASSET4)
ENV Proactive Expenditures	Proactive Environmental Expenditures	Indicator (y/n) if the company makes proactive environmental investments to reduce future environmental risks. (Data source: ASSET4)
SOC Work Injuries	Work Related Injuries and Fatalities	Total number of injuries and fatalities including no-lost-time injuries relative to one million hours worked. (Data source: ASSET4)
SOC Sup Selection	Social Supplier Selection Criteria	Indicator (y/n) if the company uses human rights criteria or monitoring in the selection process of its suppliers or sourcing partners. (Data source: ASSET4)
SOC Monitoring	Human Rights Supplier Monitoring	Indicator (y/n) if the company monitors human rights in its or its suppliers' facilities. (Data source: ASSET4)
ESG Training	Supplier ESG Training	Indicator (y/n) if the company provides training in environmental, social or governance factors for its suppliers. (Data source: ASSET4)
Cancer Hazard Score	Mean Score for Emissions with Cancer Hazard	The Unitless measure capturing the the pounds of emissions released or transferred, weighted by the chemical's toxicity for carcinogenic effects at the facility-year level. Aggregated at the firm level as the mean across all facilities. (Data source: EPA Toxic Release Inventory Program)
Non-Cancer Hazard Score	Mean Score for Emissions without Cancer Hazard	The Unitless measure capturing the the pounds of emissions released or transferred, weighted by the chemical's toxicity for noncarcinogenic effects at the facility-year level. Aggregated at the firm level as the mean across all facilities. (Data source: EPA TRI Program)
RSEI Score	Mean Risk-Screening Environmental Indicators Score	A unitless result that accounts for the size of the release, the chemical's toxicity, the fate and transport of the chemical through the environment, and the size and location of the exposed population. (Data source: EPA TRI Program)
Audit Fees U.S.	Total Audit Fees (USD)	Consists in all fees necessary to perform the audit or review in accordance with GAAS in USD. (Data source: AuditAnalytics)
ENV Lawsuits	Number of Lawsuits related to environmental issues	Number of lawsuits related to environmental issues (i.e. related to Energy Law, Environmental Law, or Natural Resources Law) filed against the company in the given year. (Data source: AuditAnalytics)
SOC Lawsuits	Number of Lawsuits related to social issues	Number of lawsuits related to social issues (i.e. Civil Rights, Disability Law, Health, Fair Labor Standards Act, Personal Injury) filed against the company in the given year. (Data source: AuditAnalytics)

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Variable	Short Description	Detailed Comments
Audit Fees Global	Audit Fee Payments	Total Audit Fees (Mill. USD). (Data source: Worldscope)
Asset Size	Book Value of Assets	Total Book Value of Assets in 100 Mill. USD. (Data source: Worldscope)
Market Cap.	Market Capitalization	Market Capitalization in 100 Mill. USD. (Data source: Datastream and Worldscope)
ROA	Return on Assets	Net Income/AT. (Data source: Worldscope)
Sales Turnover	Sales Turnover	Total Sales/ Asset Size. (Data source: Worldscope)
Tangibility	Asset Tangibility	Property, Plant and Equipment (PPE) / Asset Size. (Data source: Worldscope)
Leverage	Debt to Total Assets	Book Value Total Debt / Asset Size. (Data source: Worldscope)
Total IO	Total Institutional Ownership	Total proportion of shares held by institutional investors. (Data source: FactSet Lionshares)
Foreign Inst. Own.	Foreign Institutional Ownership	Proportion of shares held by foreign institutional investors. (Data source: FactSet Lionshares)
Foreign Cus	Foreign Customer Firm	Indicator (y/n) if supplier and customer country are from different countries. (Data source: Factset Revere)
Rel. Length	Duration of Supply-Chain Relationship	Number of years supplier and customer have been working together. (Data source: Factset Revere)
Pct. Sales	Percentage of Supplier Sales to Customer	Sales to Customer/Total Sales Supplier. (Data sources: Factset Revere and Compustat Segment Files)
GDP/Cap	GDP (USD) per capita	Gross Domestic Product in USD per country population. (Data source: World Bank WDI Database)
CO2/GDP	CO2 emissions (kg) / GDP (USD)	Total CO2 emissions in kg denominated by GDP (USD). (Data source: World Bank WDI Database)
ESG Standards	Country-level ESG Rating	Country-level ESG Rating. (Data source: Robeco)
EPI	Environmental Performance Index	Country-level Environmental Performance Index. (Data source: Yale EPI database)
Air Pollution DALYs	Air Pollution DALYs per capita	Air Pollution related Disability-Adjusted Life Years (DALYs) per country population in 2012. (Data source: WHO)
Trade Union Density	Trade Union Membership / Labor Force.	Percentage of Working Force as Member of a Trade Union. (Data source: OECD International Labour Organisation Database)
EPL	Employment Protection Index	The Index of employment protection is synthetic indicators of the strictness of regulation on dismissals and the use of temporary contracts. (Data source: OECD Employment Protection Database)

Table A2: ESG Regulation and Reporting Requirement Changes

Notes. This table summarizes all major ESG regulation changes around the world during the period from 2003 to 2016 as reported by the 2016 "Carrot & Sticks" report published jointly by KPMG International, the Global Reporting Initiative (GRI), the United Nations Environment Programme (UNEP), and the University of Stellenbosch Business School's Centre for Corporate Governance. I only include mandatory requirements and exclude non-binding guidelines and suggestions. *In Effect* captures the first year the ESG requirement was effective, *Scope* indicates if the measure is related to environmental (E), social (S), both (ES), or general ESG requirements. *Affected* describes the group of firms in the given country affected by the regulation, *Issuer* summarizes if the ESG measure was introduced and is enforced by a government body, regulatory agency, or stock exchange, and *Mandates/Requires* gives a short description of the regulation change. A detailed description of each measure can be found at https://www.carrotsandsticks.net.

Country	In Effect	Scope	Affected	Issuer	Mandates / Requires
Argentina	2004	S	Firms in Buenos Aires with >300 employees	Government	Report on social impact
Argentina	2009	ESG	Firms in Buenos Aires with >300 employees	Government	Report on sustainability
Argentina	2012	ESG	Firms in Mendoza with >300 employees	Government	Report on CSR
Australia	2003	ESG	All listed	Regulator	Report extent following recommendations by ASX Council
Australia	2008	E	All	Government	Emissions reporting scheme
Australia	2012	E	All	Government	Carbon Emissions trading
Australia	2015	E	All	Government	Report whether subject to enviromental regulation
Austria	2005	G	large firms	Government	Annual publication of a Corporate Governance Report
Belgium	2003	S	All	Government	Social Balance sheet
Belgium	2008	S	All	Government	Updated: Social Balance sheet
Brazil	2007	ESG	Energy and utility companies	Government	Annual sustainability report
Brazil	2010	E	All firms producing hazardous waste	Government	Report waste management measures
Brazil	2012	E	All mining firms	Government	Report GHG
Canada	2005	ESG	All listed	Regulator	Timeline disclosure of material news including ES issues
Canada	2015	S	All listed	Regulator	Disclosure of women on boards/management
Chile	2016	S	All listed	Regulator	Disclosure of diversity on boards/management
Chile	2016	ESG	All listed	Regulator	Disclosure of ESG practices
Chile	2017	E	All	Government	Taxes and reporting on pollutant emissions
China	2008	S	SSE listed	Regulator	Mandatory social responsibility report
China	2008	E	SSE listed	Regulator	Mandatory disclosure of environmental information
Denmark	2009	S	>250 employees	Regulator	Report on social responsibility policies
Denmark	2013	ESG	>250 employees	Regulator	Mandatory reporting on climate change, human rights, diversity
Denmark	2016	ESG	Listed firms	Regulator	Stricter ESG regulations extending (2014/95/EU)

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Country	In Effect	Scope	Affected	Issuer	Mandates / Requires
Finland	2004	S	All firms	Government	Equality and anti discrimination law
Finland	2006	S	All firms	Government	Occupational Safety Training and Health Enforcement
Finland	2015	S	All firms	Government	Equality and anti discrimination law
France	2002	S	>50 employees	Government	Report on Gender Equality
France	2002	ESG	All listed	Government	Report on Social and Environmental Impacts
France	2013	E	>500 employees	Government	Report on GHG
France	2013	ESG	All listed	Government	Mandatory ESG reporting (extends Grenelle Act II)
France	2015	ESG	All Firms	Government	Mandatory ESG reporting (further extends Grenelle Act II)
France	2015	E	All listed	Government	Report Climate Change Risks
France	2016	E	Large, listed firms	Government	Improved environmental reporting
Germany	2005	ES	Listed firms	Government	Disclosure of environmental and social information (2003/51/EC)
Germany	2012	ES	Listed firms	Government	Improved disclosure of environmental and social information (2003/51/EC)
Greece	2007	ES	Listed firms	Government	Disclosure of environmental and social information (2003/51/EC)
Hong Kong	2014	ESG	All HK incorporate	Regulator	Mandatory ESG report, including stakeholders
Hong Kong	2016	ESG	All listed	Regulator	Mandatory ESG report, including stakeholders
Hungary	2004	ES	Listed firms	Government	Disclosure of environmental and social information (2003/51/EC)
India	2012	ESG	Top 100 listed	Regulator	Mandatory ESG report
India	2012	ESG	Top 500 listed	Regulator	Mandatory ESG report
India	2013	ESG	All very large firms	Government	Spend 2% of revenues on CSR
Italy	2006	ES	Listed firms	Government	Disclosure of environmental and social information (2003/51/EC)
Japan	2005	E	All	Government	Report GHG
Japan	2005	E	All	Government	Publish environmental report
Netherlands	2006	ES	Listed firms	Government	Disclosure of environmental and social information (2003/51/EC)
Norway	2013	ESG	Large firms	Government	Report on human rights, labour rights and social issues, the environment and anti-corruption
Portugal	2009	S	All listed	Government	Social Balance report, including information on employment, labor/management relations, occupational health/safety training
Portugal	2010	E	All	Regulator	Disclosure of environmental issues in the annual accounts and annual reports
Russia	2013	ESG	Large state owned	Government	Annual ESG impact in reports
Russia	2014	ESG	Listed in Russia	Stock Exchange	Report use of energy resources, code of corporate governance, and economic impact
Slovakia	2015	ESG	All listed	Government	Annual ESG impact in reports

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Country	In Effect	Scope	Affected	Issuer	Mandates / Requires
South Africa	2010	ESG	All listed	Stock Exchange	Mandatory ESG report, listing requirement
South Africa	2012	S	All	Government	Affirmative Action and reporting on Employment Equality
South Korea	2012	E	All	Government	Disclose environmental information
South Korea	2012	E	All listed	Regulator	disclose GHG
South Korea	2013	S	Large listed	Regulator	Disclose gender of executives
Spain	2002	E	All	Regulator	Include environmental assets, provisions, investments and expenses in annual financial statements
Spain	2006	E	GHG emitters	Regulator	Report GHG
Sweden	2005	ES	Listed firms	Government	Disclosure of environmental and social information (2003/51/EC)
Taiwan	2015	ESG	Large Listed	Stock Exchange	Mandatory CSR reporting
Turkey	2003	S	All	Government	Report accident rates, hire individuals with special needs
Turkey	2006	E	All	Government	Report solid, liquid, air, waste emissions, GHG
Turkey	2007	E	large firms	Government	Report energy consumption
Turkey	2011	S	Istanbul Stock Exchange	Stock Exchange	Report on human resources policy, responsibilities towards customers, suppliers and other stakeholders, code of ethics and social responsibility
Turkey	2012	S	All	Government	Improve health and safety
Turkey	2014	E	Extraction companies	Government	Report GHG
Turkey	2015	G	Istanbul Stock Exchange	Stock Exchange	Report on social rights and professional training of employees, and CSR initiatives
United Kingdom	2008	E	All	Government	Report GHG
United Kingdom	2010	E	large firms	Regulator	Report GHG
United Kingdom	2014	ESG	All listed	Stock Exchange	Report on GHG emissions, human rights and diversity
United Kingdom	2015	S	All	Government	Report on modern slavery
United States	2010	E	Large firms	Regulator	Mandatory GHG reporting

B Supplementary Appendix – Online Only

Table B1: E&S Policy and Performance Propagation – Sustainalytics Sample

Notes. This table presents OLS estimates on E&S propagation from customers to suppliers using data from Sustainalytics. **Panel A** reports the results for supplier environmental performance. The dependent variable is the supplier overall environmental (ENV) Score from Sustainalytics. The key independent variable is the one-year lagged ENV Score of the customer firm ($ENV\ Score^{Cus}_{t-1}$), and the interactions of $ENV\ Score^{Cus}_{t-1}$ with the two dummy variables $\mathbb{1}_{Yes}$ and $\mathbb{1}_{No}$. $\mathbb{1}_{Yes}$ takes the value of one, if the customer is a foreign firm, or represents a large proportion of sales to the supplier in columns (3) to (4). $\mathbb{1}_{No}$ takes the value of one if the opposite is true. **Panel B** reports the results for supplier social performance. The key variables of interest are the lagged SOC Score of the customer $SOC\ Score^{Cus}_{t-1}$, as well as the interaction terms of $SOC\ Score^{Cus}_{t-1}$ with $\mathbb{1}_{Yes}$ and $\mathbb{1}_{No}$, defined similarly as in Panel A. The last two lines of each panel report the p-value and test statistic of an F-test evaluating if the coefficients on $Score^{Cus}_{t-1} \times \mathbb{1}_{Yes}$ and $Score^{Cus}_{t-1} \times \mathbb{1}_{No}$ are equal. All specifications include controls for firm size, market-to-book, ROA, sales turnover, and GDP for the supplier and customer, and relationship and year fixed effects. Continuous covariates are winsorized at the 1% level. t statistics, provided in parentheses, are calculated based on standard errors clustered at the relationship level. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

Panel A: Environmental Performance

	Dependent Variable: ENV Score SUP (t)			
			$\mathbb{1}_{Yes}/\mathbb{1}_{No}$ *defined as:*	
	Full Sample		Foreign Customer	High % Sales Sup (t-1)
	(1)	(2)	(3)	(4)
$ENV\ Score^{Cus}_{t-1}$	0.0185**	0.0210**		
	(2.39)	(2.29)		
A: $ENV\ Score^{Cus}_{t-1} \times \mathbb{1}_{Yes}$			0.0252**	0.0737*
			(2.40)	(1.78)
B: $ENV\ Score^{Cus}_{t-1} \times \mathbb{1}_{No}$			0.0172	0.0632
			(1.48)	(1.43)
Firm & Country Controls	Yes	Yes	Yes	Yes
Firm-Pair & Year FE	Yes	Yes	Yes	Yes
N	42279	29365	29365	2599
R^2	0.931	0.927	0.927	0.882
F-Stat (A)=(B)			0.39	0.61

Panel B: Social Performance

	Dependent Variable: SOC Score SUP (t)			
			$\mathbb{1}_{Yes}/\mathbb{1}_{No}$ *defined as:*	
	Full Sample		Foreign Customer	High % Sales Sup (t-1)
	(1)	(2)	(3)	(4)
$SOC\ Score_{t-1}^{Cus}$	0.00535***	0.00464**		
	(2.91)	(2.30)		
A: $SOC\ Score_{t-1}^{Cus} \times \mathbb{1}_{Yes}$			0.00785***	0.0135**
			(2.84)	(1.97)
B: $SOC\ Score_{t-1}^{Cus} \times \mathbb{1}_{No}$			0.000814	0.00209
			(0.29)	(0.35)
Firm & Country Controls	No	Yes	Yes	Yes
Firm-Pair & Year FE	Yes	Yes	Yes	Yes
N	42926	29762	29762	3127
R^2	0.921	0.918	0.918	0.926
F-Stat (A)=(B)			3.25*	2.99*

Table B2: The Propagation of E&S Regulations – Sustainalytics Sample

Notes. This table presents OLS regression estimates on the propagation of E&S regulation changes along international supply-chains, using Sustainalytics data. The sample includes only pairs of suppliers and customers in which the two firms are located in different countries. The dependent variable in columns (1) to (3) is the environmental (ENV) Score of the supplier firm from Sustainalytics. Columns (4) to (6) consider real E&S-related outcomes: Emissions Reductions Targets, Membership in the Carbon Disclosure Project, and Carbon Emissions denominated by firm size. The key variable of interest is *ENV Regulation Cus*, indicating that a new environmental regulation has become effective in the customer country. I interact *ENV Regulation Cus* with the two dummy variables $\mathbb{1}_{High}$ and $\mathbb{1}_{Low}$, taking the value of one if the supplier country has above (below) median CO2 emissions per GDP (column 2), and air pollution related deaths per capita (columns 3). The last two lines report the p-value and the test statistic of an F-test evaluating if the coefficients for *ENV Regulation* $\times \mathbb{1}_{High}$ and *ENV Regulation* $\times \mathbb{1}_{Low}$ are equal. Similar firm and country-level controls as before as well as relationship and year fixed effects are included in all specifications. Continuous covariates are winsorized at the 1% level. t statistics, provided in parentheses, are calculated based on standard errors clustered at the supplier-customer relationship level. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

	Dependent Variable: ENV Score SUP (t)			*Dependent Variable:*		
		$\mathbb{1}_{High}/\mathbb{1}_{Low}$ defined based on:				
	Full Sample	CO2/ GDP	Air Pollution DALYs	Emissions Reduction Targets (t)	Member Carbon Disclosure Project (t)	Carbon Emissions Intensity (t)
	(1)	(2)	(3)	(4)	(5)	(6)
ENV Regulation Cus	0.0668			1.567**	2.235**	3.156**
	(0.67)			(2.23)	(2.18)	(2.55)
A: ENV Regulation Cus $\times \mathbb{1}_{High}$		1.327***	0.523**			
		(4.25)	(2.27)			
B: ENV Regulation Cus $\times \mathbb{1}_{Low}$		0.0423	0.0649			
		(0.30)	(0.62)			
Firm-Pair & Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Foreign Customer	Yes	Yes	Yes	Yes	Yes	Yes
ESG Regulation Sample	All	All	All	All	GHG only	GHG only
N	31131	11819	30526	5547	15792	11848
R^2	0.929	0.929	0.931	0.850	0.827	0.765
(A)=(B) (p-Value)		0.0000	0.0662			
F-Stat		18.92***	3.38*			

Table B3: Robustness – Customer E&S Policies and Supplier E&S Performance

Notes. This table presents robustness tests on the impact of customer E&S policies on supplier E&S performance, corresponding to Table 3. The dependent variable is the Environmental (ENV) and Social (SOC) Score of the supplier firm and customer firm, respectively, as indicated. The key variables of interest are the one-period lagged environmental and social policy index of the customer and supplier, respectively, (ENV (SOC) Index$_{t-1}^{Cus\ (Sup)}$), as indicated. The control variables include firm size, market-to-book ratio, return-on-asset (ROA), sales turnover, and the logarithm of country GDP of the supplier firm in all regressions. Firm-pair and year fixed effects, as well as industry×year, and country×year fixed effects for the supplier firm are included as indicated. Detailed definitions of all variables are listed in Appendix A1. Continuous covariates are winsorized at the 1% level. t statistics, provided in parentheses, are calculated based on standard errors clustered at the supplier-customer relationship level in each model. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

	Dependent Variable:					
	ENV Score Sup (t)		ENV Score Cus (t)	SOC Score Sup (t)		SOC Score Cus (t)
	(1)	(2)	(3)	(4)	(5)	(6)
ENV Index$_{t-1}^{Cus}$	0.0261***	0.0259**				
	(3.75)	(2.10)				
ENV Score$_{t-1}^{Sup}$		0.378***				
		(39.87)				
ENV Index$_{t-1}^{Sup}$			-0.0134			
			(-1.21)			
SOC Index$_{t-1}^{Cus}$				0.0236***	0.0269**	
				(3.40)	(2.42)	
SOC Score$_{t-1}^{Sup}$					0.310***	
					(32.39)	
SOC Index$_{t-1}^{Sup}$						-0.0217**
						(-2.40)
Supplier Controls	Yes	Yes	No	Yes	Yes	No
Customer Controls	No	No	Yes	No	No	Yes
Sup.-Industry×Year FE	Yes	No	No	Yes	No	No
Sup.-Country×Year FE	Yes	No	No	Yes	No	No
Firm-Pair FE	No	Yes	Yes	No	Yes	Yes
Year FE	No	Yes	Yes	No	Yes	Yes
N	47135	35491	36439	47373	35808	36542
R^2	0.581	0.926	0.916	0.620	0.930	0.898

Table B4: The Direct Impact of Local E&S Regulation Changes on Customers

Notes. This table presents difference-in-difference regression results on the impact of country-level ESG regulation changes on the E&S policies of firms located in the respective countries. **Panel A** focuses on environmental performance. The dependent variables are the Overall Environmental Score from the ASSET4 database, the number of environmental goals and policies, the number of environmental initiatives, a dummy indicating if the firm is using environmental criteria for supplier selection and a dummy capturing if the firm has a policy to mitigate environmental impact of its suppliers in columns (1) to (5) respectively. **Panel B** focuses on social performance. The dependent variables are the Overall Social Score, the Human Rights Score, a dummmy variable indicating if the firm is using social criteria for supplier selection, a dummy indicating if the firm is monitoring human rights performance at her suppliers, and a dummy indicating if the firm provides ESG training to supplier firms, in columns (1) to (5) respectively. The key variable of interest in Panels A and B is *ENV Regulation Cus* and *SOC Regulation Cus* respectively, indicating the introduction of a new environmental (social) country level ESG regulation. In years before the enactment of the regulation, and firms in countries that did not introduce new ESG regulation *ENV (SOC) Regulation Cus* is zero. Firm and country controls include firm size, market-to-book ratio, ROA, foreign institutional ownership, and log(GDP). I include relationship and industry × year fixed effects in all specifications, industry is defined at the 2-digit SIC level. All continuous covariates are winsorized at the 1% level. t statistics, provided in parentheses, are calculated based on standard errors clustered at the firm level. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

Panel A: Environmental Performance

	Dependent Variable:				
	ENV Score Overall (t)	ENV Goals & Policies (t)	ENV Initiatives (t)	ENV Criteria for Supplier Selection (t)	E Supplier Impact Policy (t)
	(1)	(2)	(3)	(4)	(5)
ENV Regulation Cus	1.662***	0.206***	0.133***	0.0350***	0.0270***
	(5.12)	(6.90)	(4.86)	(4.87)	(4.10)
Firm & Country Controls	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Industry × Year FE	Yes	Yes	Yes	Yes	Yes
N	22737	22730	22730	22730	22730
R^2	0.852	0.873	0.869	0.740	0.733

Panel B: Social Performance

	Dependent Variable:				
	SOC Score Overall (t)	Human Rights Score (t)	SOC Criteria for Supplier Selection (t)	Human Rights Supplier Monitoring (t)	ESG Training for Suppliers (t)
	(1)	(2)	(3)	(4)	(5)
SOC Regulation Cus	1.025**	2.397***	0.0368***	0.0878***	0.0259***
	(2.22)	(3.78)	(4.14)	(6.39)	(2.59)
Firm & Country Controls	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Industry × Year FE	Yes	Yes	Yes	Yes	Yes
N	21473	21473	21434	21434	21434
R^2	0.867	0.797	0.746	0.620	0.613