

Climate Disclosure, Shareholder Bases, and Green Investment: Theory and Evidence*

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Abstract

This paper investigates the real effects of climate disclosure requirements. I develop a model where investors are heterogeneous in their aversion to pollution and show that stricter disclosure reallocates ownership of more polluting firms toward less environmentally-friendly investors, reducing their incentives to adopt green technologies. Using data on the staggered adoption of mandatory disclosure requirements, I find that, after adoption, institutional investors divest from polluting firms. Firms also increase emissions intensity and reduce R&D, with stronger effects among more polluting firms, as predicted by the model. These findings highlight the unintended real effects of climate disclosure through a shareholder-base channel.

Keywords: Socially responsible investing, disclosure, greenwashing, shareholder composition.

JEL Classification: G11, G14, G18, G32, G38.

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1 Introduction

Climate disclosure requirements have become increasingly prominent over the last decade. For example, the Corporate Sustainability Reporting Directive (CSRD), a new EU regulation that entered into force on 5 January 2023, strengthens rules regarding the social and environmental information that firms must report. The Council of the EU emphasized that the CSRD could “attract additional investment and funding to facilitate the transition to a sustainable economy”.¹ In California, two landmark climate-disclosure laws were adopted in October 2023. These laws require large firms to disclose their greenhouse gas emissions, climate-related financial risk, as well as measures they take to mitigate those risks.²

Conventional wisdom suggests that promoting more transparent information benefits sustainable investments, for example, by enabling green firms to raise more capital. Recent empirical studies also view climate disclosure requirements as beneficial. [Ilhan, Krueger, Sautner, and Starks \(2023\)](#) document that institutional investors value and demand climate risk disclosures. [Krueger, Sautner, Tang, and Zhong \(2024\)](#) find a positive relation between firms’ ESG disclosure requirements and stock liquidity and conclude that regulations promoting ESG disclosure benefit capital markets.

However, despite the growing adoption of climate disclosure requirements across the globe, there is a lack of direct evidence on their real effects. In this paper, I aim to study this question both theoretically and empirically. I start by developing a model showing that,

¹In the US, the SEC adopted comprehensive climate-related disclosure rules on March 6, 2024, which would require publicly listed firms to report qualitative and quantitative information on greenhouse gas emissions, climate-related risks, and transition strategies. However, shortly after adoption, the rules were challenged in multiple legal proceedings, and the SEC voluntarily stayed their implementation pending judicial review. Subsequently, the SEC announced that it would no longer defend the rules in court, effectively suspending their enforcement.

²SB 253 (the Climate Corporate Data Accountability Act) requires large companies doing business in California to publicly report their greenhouse gas emissions, including direct (Scope 1), indirect energy-related (Scope 2), and, eventually, value-chain emissions (Scope 3). SB 261 (the Climate-Related Financial Risk Act) requires large firms to disclose their climate-related financial risks and the measures they take to mitigate and adapt to those risks. Together, these laws significantly expand mandatory climate and sustainability reporting for both public and private companies operating in California.

under endogenous shareholder base formation, improving climate disclosure requirements has ambiguous effects on pollution and welfare in equilibrium when accounting for heterogeneous shareholder preferences toward externalities.

On the one hand, more stringent climate disclosure requirements reduce the mass of investors investing in the dirty sector, thereby reducing pollution. On the other hand, it also reshapes firms' shareholder bases, resulting in dirty firms financed by investors who are, on average, less concerned about pollution. This latter effect undermines the adoption of green technology by dirty firms. Thus, more stringent climate disclosure requirements can backfire and result in lower welfare and/or a higher level of pollution.

More specifically, I develop a model in which two firms (clean and dirty) are financed by a continuum of responsible investors. The dirty firm is more productive than the clean firm, but also generates more pollution. After receiving funding from investors, the dirty firm decides whether to operate its current production technology or to adopt a less polluting or green technology at a cost. Investors are heterogeneous in their aversion to holding polluting firms and decide which firm to invest in, anticipating firms' adoption decisions. In particular, while some investors are mainly concerned with financial returns, others suffer from a high disutility when investing in a polluting firm. More specifically, investors exhibit warm-glow disutility in investing in polluting firms, in line with empirical evidence on social preferences (see [Riedl and Smeets \(2017\)](#), [Heeb, Kölbel, Paetzold, and Zeisberger \(2023\)](#), or [Bonnefon, Landier, Sastry, and Thesmar \(2025\)](#)). Moreover, investors do not know the externalities produced by the dirty firm. Just before investing, they receive a signal about its externalities. The precision of the signal reflects the stringency of the climate disclosure requirements imposed by the regulator.

In this framework, I demonstrate that improving climate disclosure requirements decreases the mass of investors who choose to invest in the dirty firm, thereby reducing the size of the dirty sector. However, it also reshapes firms' shareholder base, resulting in the dirty firm being financed by investors who are, on average, less concerned about pollution. The latter effect undermines the incentive of the dirty firm to adopt green technology. Depending on which of these effects dominates, more stringent climate disclosure requirements could

result in more pollution and lower welfare in equilibrium. This challenges the conventional view that improving climate disclosure is always beneficial and suggests that some level of greenwashing could be optimal.

I also provide empirical evidence supporting the novel predictions of my theory. Using data from [Krueger et al. \(2024\)](#) on the staggered implementation of mandatory ESG disclosure requirements across countries, I show that after the implementation of mandatory disclosure requirements, the share of institutional investors invested in polluting firms decreases. As institutional investors have been recognized as an important driver of firms' sustainability (see [Dyck, Lins, Roth, and Wagner \(2019\)](#) or [Azar, Duro, Kadach, and Ormazabal \(2021\)](#)), this suggests that polluting firms' shareholders are becoming less environmentally friendly after the implementation of more stringent disclosure requirements, in line with the theoretical prediction of the model.

I also show that firms tend to increase their emissions intensity following the introduction of mandatory disclosure requirements, and this effect is more pronounced for more polluting firms. This is consistent with the model's prediction that, after the implementation of more stringent climate disclosure requirements, capital is reallocated away from dirty to clean firms, with dirty firms ultimately being financed by investors who care less about pollution, thereby undermining the incentives for these firms to adopt greener technologies. Furthermore, I show that firms, and in particular more polluting firms, spend less on R&D after the implementation of the laws, consistent with the fact that firms reduce their investment in green technologies and become more polluting, as predicted by the theory.

Moreover, I show that, perhaps surprisingly, following the adoption of mandatory climate disclosure requirements and the divestment by institutional investors, firms' cost of capital does not increase. This is consistent with relatively elastic demand and that financial markets can easily absorb the trade from green to non-green stocks without generating a large price impact. I also show that more polluting firms do not seem to become more financially distressed. Therefore, these findings reveal that firms do not reduce green investments in response to a higher cost of capital or due to financial distress.³ Interestingly, the fact that

³[Bellon and Boualam \(2024\)](#) find that financially distressed firms increase their pollution.

firms' cost of capital is not affected by the divestment of institutional investors shows that my results are driven by a distinct channel than the cost of capital channel, which has been the subject of an extensive research in sustainable finance but whose real effects are still highly debated ([Hartzmark and Shue \(2022\)](#), [Berk and Van Binsbergen \(2025\)](#)). This reinforces the evidence in favor of the channel highlighted in the model, that firms reduce green investments because, following the adoption of more stringent climate disclosure requirements, polluting firms end up being held by shareholders who are less averse to pollution, and not because of an impact on their cost of capital.

Related Literature. This paper contributes to several strands of literature. First, it belongs to the growing theoretical literature on sustainable investing. Research has shown how divestment could incentivize firms to adopt environmentally friendly technologies ([Heinkel, Kraus, and Zechner \(2001\)](#), [Davies and Van Wesep \(2018\)](#), [Chowdhry, Davies, and Waters \(2019\)](#), [Edmans, Levit, and Schneemeier \(2022\)](#), [Allen, Barbalau, and Zeni \(2023\)](#), [Oehmke and Opp \(2024\)](#), [Landier and Lovo \(2024\)](#)). Other articles have investigated the impact of activism on environmental corporate policies (see [Broccardo, Hart, and Zingales \(2022\)](#) or [Gryglewicz, Mayer, and Morellec \(2024\)](#)). Although activism and divestment are often treated separately in the literature and seen as substitutes, they are interrelated in my model. Indeed, funding for clean and dirty sectors is endogenously determined alongside shareholder bases, and firms' adoption decisions in turn depend on the composition of their shareholder bases.

Second, I contribute to the growing literature on ESG or climate disclosure. Recent empirical studies suggest that better disclosure requirements are beneficial to sustainable investments ([Ilhan et al. \(2023\)](#), [Emiris, Harris, and Koulischer \(2024\)](#), [Krueger et al. \(2024\)](#)). [Ilhan et al. \(2023\)](#) provide evidence that institutional investors value and demand climate risk disclosure. [Emiris et al. \(2024\)](#) show that mutual funds tend to decrease their emissions' intensity following the implementation of ESG disclosure rules, while [Krueger et al. \(2024\)](#) document a positive effect of enhanced climate disclosure requirements on firm-level stock liquidity. In contrast to these papers, I focus on the real effect of climate disclosure requirements. I show that more stringent climate disclosure requirements negatively affect firms'

green investments. This paper also relates to the empirical accounting literature studying the real effects of mandatory climate disclosure requirements (see [Downar, Ernstberger, Reichelstein, Schwenen, and Zaklan \(2021\)](#), [Kim, Wang, Wu, et al. \(2022\)](#), and [Yang, Muller, and Liang \(2023\)](#)). Using UK and US settings respectively, [Downar et al. \(2021\)](#) and [Kim et al. \(2022\)](#) show that firms tend to reduce carbon emissions following the adoption of more stringent climate disclosure requirements. In contrast, I find that mandatory disclosure requirements increase firms' emissions intensity and reduce R&D expenditures. While [Yang et al. \(2023\)](#) show that mandatory greenhouse gas disclosure for highly emitting US facilities leads firms to reallocate emissions across plants — implying that emission reductions at regulated facilities do not fully translate into firm-level reductions — I emphasize a different economic mechanism. Specifically, I show that stricter climate disclosure requirements can reshape polluting firms' shareholder bases toward less environmentally-friendly investors, thereby weakening firms' incentives to adopt green technologies and contributing to higher emissions intensity.

I am also contributing to the theoretical literature on climate disclosure ([Chen and Schneemeier \(2022\)](#), [Aghamolla and An \(2023\)](#), [Xue \(2023\)](#), [Gupta and Starmans \(2024\)](#)). [Chen and Schneemeier \(2022\)](#) investigate the effect of disclosure in the presence of informed trading and stock market feedback. They demonstrate that managers' ability to manipulate (or greenwash) their disclosure reduces investors' incentives to acquire information but also encourages investors to trade on private information. [Aghamolla and An \(2023\)](#) study mandatory versus voluntary disclosure requirements in the presence of agency conflict between managers and shareholders. They show that when the manager can privately select projects that vary in sustainability and profitability, mandatory disclosure requirements can result in overinvestment in green technologies compared to shareholders' preferred level. [Xue \(2023\)](#) studies optimal ESG disclosure requirements in a noisy rational expectations model. He shows that more precise disclosure requirements are not necessarily desirable as they change how investors use information. I pin down a different economic mechanism, as in my model, an increase in precision of disclosure requirements reshapes firms' shareholder bases, resulting in the dirty firm being held by shareholders who are less averse to pollution, which undermines incentives for this type of firm to adopt green technology. My paper also differs

from [Gupta and Starmans \(2024\)](#), who study dynamic climate disclosure requirements. They show that under certain conditions, disclosure requirements that become more stringent over time can be preferable to full transparency. In contrast, I study the precision of climate disclosure requirements in a static framework, and I show that more precise requirements are not necessarily beneficial due to shareholders’ endogenous response. This is different, as my model remains agnostic about the optimal dynamics of climate disclosure requirements.

Third, my paper belongs to the literature that studies firms’ decisions under endogenous shareholder base formation ([Döttling, Levit, Malenko, and Rola-Janicka \(2024\)](#), [Levit, Malenko, and Maug \(2024\)](#)). [Levit et al. \(2024\)](#) study secondary market trading and voting in a single-firm setting. They show that inefficiencies arise when post-trade voting outcomes are determined by the median rather than the average shareholders. In this paper, I focus on the primary market to study the impact of disclosure requirements on capital allocation in an economy, and I abstract from differences between the average and the median shareholder. In a recent paper, [Bisceglia, Piccolo, and Schneemeier \(2022\)](#) show that when socially responsible investors and profit-motivated investors interact, the former tend to concentrate on a subset of firms that crowd out green investments of excluded firms and create product market power. However, they only consider secondary market trading and abstract from disclosure. [Huang and Kopytov \(2023\)](#) study optimal taxation and subsidy under endogenous shareholder base formation and show that pollution can increase with regulation stringency. In contrast, I focus on the impact of climate disclosure requirements under endogenous shareholders’ base formation. Moreover, while [Huang and Kopytov \(2023\)](#) is a purely theoretical study, I also provide extensive empirical support for my predictions.

2 The Model

The model is based on [Huang and Kopytov \(2023\)](#). It differs as I consider imperfect information about firms’ externality to investigate the implications of climate disclosure under endogenous shareholders’ base formation.

I consider an economy that consists of two sectors or firms $i \in \{c, d\}$, where c stands for

clean (or less polluting) firms, and d for dirty (or polluting) firms. The firms are financed by a continuum of mass one of risk-neutral investors who are heterogeneous in their preference for greenness. Investors do not observe externalities produced by the dirty firm. Just before investing, they receive a signal about its externalities. The clean firm is less polluting but also less profitable than the dirty firm. The dirty firm is endowed with brown technology and can adopt a less polluting technology (green technology) at a cost.

There are two periods, $t = 1, 2$, and no discounting. At time $t = 1$, after receiving an informative signal about which firm is polluting, investors choose the firm they invest in, trading off the productivity with its sustainability. At time $t = 2$, the dirty firm chooses whether to operate under brown production technology or to adopt green technology at a cost. The firm's manager is risk-neutral and maximizes the average shareholder's utility.

2.1 Production technology

Firms receive capital from investors and produce final goods using an AK production technology. The clean firm produces $y_c = \alpha_c k_c$, where α_c and k_c denote respectively the productivity and the capital allocated to the clean firm. The clean firm produces a negative externality $e_c = \underline{e}$ per unit of capital, and the dirty firm produces a negative externality $e_d \in \{0, \bar{e}\}$, where $\bar{e} > \underline{e} > 0$.

The dirty firm receives capital and decides whether to operate under the brown production technology resulting in a level of pollution (or negative externality) e_d per unit of capital or to adopt a green production technology by facing a proportional cost $f > 0$ per unit of capital, and resulting in a level of externality κe_d per unit of capital with $\kappa \in (\underline{\kappa}, 1)$, where $\underline{\kappa} > 0$.⁴ For simplicity, I assume that the clean firm cannot reduce its externality. The output of the dirty firm is $y_d = k_d(\alpha_d - f\mathbb{1}_{\{a=1\}})$, where $\mathbb{1}_{\{a=1\}}$ denotes the adoption decision of the dirty firm. Moreover, I assume that $\Delta \equiv \alpha_d - \alpha_c > 0$, which implies that the clean firm is less productive than the dirty firm but pollutes less.

⁴As shown in Section 3.1.2, $\underline{\kappa} > 0$ ensures that the dirty firm raises nonzero capital when it decides to adopt the green technology.

2.2 Investor preferences

There is a unit mass of risk-neutral atomistic investors who are heterogeneous in their preferences for greenness. Each investor is endowed with one unit of capital and chooses which type of firm to invest in, considering the firm’s decision to adopt a greener production technology. Investors value financial payoff and suffer from disutility for the (negative) externality generated by the firm in which they decide to invest. That is, investors suffer from a warm-glow disutility from investing in a polluting firm, in line with the empirical evidence on social preferences (see [Riedl and Smeets \(2017\)](#), [Heeb et al. \(2023\)](#) or [Bonnefon et al. \(2025\)](#)). Specifically, investors of type λ suffer from non-pecuniary disutility λe_i when holding shares of the firm of type i .⁵ $\lambda \in [0, \bar{\lambda}]$ governs the aversion to holding polluting firms and differs across investors with a cumulative distribution function $G(\cdot)$.

As emphasized by [Goldstein, Kopytov, Shen, and Xiang \(2022\)](#), investors may exhibit social preferences for a variety of reasons, and the specification adopted here is consistent with multiple interpretations of investor motivation. Social preferences may be intrinsic, belief-based, or incentive-driven. For instance, some investors may derive disutility from holding polluting assets due to an intrinsic “warm-glow” motive, while institutional investors may be sensitive to the environmental impact of their portfolios because of reputational concerns or contractual mandates. Ultimately, what matters is that investors behave as if they internalize the sustainability-related consequences of their investment decisions.

The productivity α_i for $i = c, d$ is observable for investors. However, investors do not observe the level of externality produced by the dirty firm e_d . For simplicity, I assume that investors observe the level of externality produced by the clean firm e_c . That is, investors observe firms’ productivity and know that the clean firm produces externality $e_c = \underline{e}$; however, they do not observe the level of externality produced by the dirty firm, but they are aware that it can be either low ($e_d = 0$) or high ($e_d = \bar{e}$), with $\bar{e} > \underline{e} > 0$. Before investing, they

⁵More precisely, the preferences of the investors can also be labeled as narrow-consequentialist. Their preferences can be considered as warm glow in the sense that they derive disutility from their holding in the dirty firm. However, since the negative externalities they internalize are evaluated relative to a counterfactual scenario in which they invest in the clean firm, they can also be considered narrow-consequentialists as in [Allen et al. \(2023\)](#), for instance.

receive a signal $s \in \{H, L\}$ about the dirty firm's externalities. The precision of the signal is denoted by $\pi = \mathbb{P}(s = H|e_d = \bar{e}) = \mathbb{P}(s = L|e_d = 0) \in (0, 1]$ and reflects the quality of the climate disclosure requirements. A more precise signal (i.e., a higher π) means that investors have better information about firms' externalities and can be interpreted as a legal framework that prompts firms to report more information regarding their sustainability. Without loss of generality, I assume that before observing the signal, $\mathbb{P}(e_d = \bar{e}) = \mathbb{P}(e_d = 0) = \frac{1}{2}$ for investors.

Investors form expectations about firms' adoption decisions. Investors' valuation v_i of one dollar invested in each type of firm $i = c, d$ is given by

$$\begin{aligned} v_c &= \alpha_c - \lambda e_c \\ v_d &= \alpha_d - (f + \kappa \lambda \mathbb{E}[e_d|s]) \mathbb{1}_{\{a=1\}} - (1 - \mathbb{1}_{\{a=1\}}) \lambda \mathbb{E}[e_d|s] \end{aligned} \quad (1)$$

Using Bayes' Law we have that $\mathbb{P}(e_d = \bar{e}|s = H) = \mathbb{P}(e_d = 0|s = L) = \pi$ and $\mathbb{P}(s = H) = \mathbb{P}(s = L) = \frac{1}{2}$. We can compute the expected externality for the two firms as a function of the realization of the signal

$$\begin{aligned} \mathbb{E}[e_d|s = H] &= \pi \bar{e}, \\ \mathbb{E}[e_d|s = L] &= (1 - \pi) \bar{e}. \end{aligned}$$

Moreover, from (1) we have that an investor with preference λ invests all her wealth in the firm with the highest valuation. As the valuation of investors v_i decreases in λ , there exists a cut-off $\hat{\lambda}$ such that investors with $\lambda > \hat{\lambda}$ invest in the clean firm and investors with $\lambda < \hat{\lambda}$ invest in the dirty firm. This leads to the following lemma.

Lemma 1. *There exists a cut-off $\hat{\lambda}$ so that investors with preference $\lambda < \hat{\lambda}$ invest in the dirty firm and investors with $\lambda > \hat{\lambda}$ invest in the clean firm.*

2.3 Green technology adoption

At $t = 2$, after investors have chosen the firm in which they invest and the shareholder bases have been formed, we have that the dirty firm adopts green technology if this maximizes the

average utility of its shareholders. Hence, the dirty firm chooses to adopt green technology if

$$\int_0^{\hat{\lambda}} (\alpha_d - f - \lambda \kappa \mathbb{E}[e_d|s]) dG(\lambda) > \int_0^{\hat{\lambda}} (\alpha_d - \lambda \mathbb{E}[e_d|s]) dG(\lambda)$$

which is equivalent to

$$f < (1 - \kappa) \mathbb{E}[e_d|s] \psi(\hat{\lambda}) \quad (2)$$

with

$$\psi(\hat{\lambda}) = \frac{\int_0^{\hat{\lambda}} \lambda dG(\lambda)}{G(\hat{\lambda})} \quad (3)$$

where $\psi(\cdot)$ is a continuous function, with $\lim_{\hat{\lambda} \rightarrow 0} \psi(\hat{\lambda}) = 0$, $\psi(\hat{\lambda}) < \hat{\lambda}$, and $\frac{\partial \psi(\hat{\lambda})}{\partial \hat{\lambda}} > 0$.

3 Equilibrium Characterization

There are two potential equilibria to be considered: one in which the dirty firm adopts the green technology (green equilibrium) and one in which the dirty firm does not adopt the green technology and chooses to operate under the current technology (brown equilibrium). In what follows, I characterize the different equilibria as a function of the realization of the signal $s = \{H, L\}$.

3.1 Signal is $s = H$

First, consider the case where the signal is $s = H$. There are two different equilibria.

3.1.1 Brown equilibrium

In the brown equilibrium, the dirty firm does not adopt the green technology at time $t = 2$. From (1), assuming that $\pi \bar{e} - \underline{e} > 0$,⁶ we have that at $t = 1$, investors choose to invest in the clean firm if and only if

$$\alpha_d - \lambda \mathbb{E}[e_d|s = H] < \alpha_c - \lambda e_c$$

which yields

$$\lambda > \frac{\Delta}{\pi \bar{e} - \underline{e}} \equiv \hat{\lambda}_B, \quad (4)$$

⁶This equality is verified whenever $\kappa > \underline{\kappa}$ which is assumed to be true (see Section 3.1.2).

we have that $\frac{\partial \hat{\lambda}_B}{\partial \pi} < 0$, which implies that the size of the dirty sector shrinks as disclosure requirements become more accurate.

Thus, in equilibrium, investors with $\lambda \in [0, \hat{\lambda}_B]$ invest in the dirty firm and investors with $\lambda \in [\hat{\lambda}_B, \bar{\lambda}]$ invest in the clean firm. For this to be an equilibrium, it must be that the dirty firm finds it optimal not to adopt the green technology at time $t = 2$, which is the case if and only if

$$f > (1 - \kappa)\mathbb{E}[e_d|s = H]\psi(\hat{\lambda}_B) = (1 - \kappa)\pi\bar{e}\psi(\hat{\lambda}_B) \quad (5)$$

Looking at (5), we have that this equilibrium exists if $\hat{\lambda}_B$ is sufficiently small, which means that shareholders of the dirty firm are not too averse to holding polluting firms. By equation (4), this happens if Δ is sufficiently small. The intuition for this result is as follows. When Δ is small, the dirty firm has a small financial advantage over the clean firm, and only investors with very low λ , i.e., profit-oriented investors, are willing to hold the polluting firm. In turn, dirty firms owned by profit-oriented investors do not find it optimal to adopt green technology. In this equilibrium, output Y_B^H , (expected) pollution P_B^H and welfare W_B^H are given by

$$Y_B^H = \alpha_d G(\hat{\lambda}_B) + \alpha_c (1 - G(\hat{\lambda}_B)) \quad (6)$$

$$P_B^H = G(\hat{\lambda}_B) \frac{1}{2} \bar{e} + (1 - G(\hat{\lambda}_B)) \underline{e} \quad (7)$$

$$\begin{aligned} W_B^H &= \alpha_d G(\hat{\lambda}_B) + \alpha_c (1 - G(\hat{\lambda}_B)) - \int_0^{\hat{\lambda}_B} \lambda dG(\lambda) \mathbb{E}[e_d|s = H] - \underline{e} \int_{\hat{\lambda}_B}^{\bar{\lambda}} \lambda dG(\lambda) \\ &= \alpha_c + \Delta G(\hat{\lambda}_B) - \pi \bar{e} \int_0^{\hat{\lambda}_B} \lambda dG(\lambda) - \underline{e} \int_{\hat{\lambda}_B}^{\bar{\lambda}} \lambda dG(\lambda) \end{aligned} \quad (8)$$

where welfare is defined as the aggregate utility of investors.

3.1.2 Green equilibrium

In this equilibrium, the dirty firm adopts green technology at time $t = 2$. In equilibrium, at time $t = 1$, investors with $\lambda \in [0, \hat{\lambda}_G)$ invest in dirty firm, and investors with $\lambda \in [\hat{\lambda}_G, \bar{\lambda}]$ invest in clean firm, where $\hat{\lambda}_G$ is given by

$$\hat{\lambda}_G = \frac{\Delta - f}{\kappa \pi \bar{e} - \underline{e}} \quad (9)$$

and assuming that $\Delta > f$ and that $\kappa > \underline{\kappa} \equiv \frac{\underline{e}}{\pi\bar{e}}$, we have that the dirty firm raises nonzero capital in this equilibrium. Moreover, we have that $\frac{\partial \hat{\lambda}_G}{\partial \pi} < 0$, which implies that when disclosure requirements become more accurate, the size of the dirty firm is shrinking.

For this to be an equilibrium, it must be that the dirty firm finds it optimal to adopt the green technology at time $t = 2$, which is the case whenever

$$f < (1 - \kappa)\mathbb{E}[e_d|s = H]\psi(\hat{\lambda}_G) = (1 - \kappa)\bar{e}\pi\psi(\hat{\lambda}_G). \quad (10)$$

As $\frac{\partial \psi(\hat{\lambda})}{\partial \lambda} > 0$, the green equilibrium exists if $\hat{\lambda}_G$ is sufficiently large which is the case if Δ is sufficiently large (see equation (9)). The intuition for this result is as follows. Δ sufficiently large means that the dirty firm has a large financial advantage over the clean firm, which implies that only investors with a strong aversion to holding polluting firms, i.e., a high λ , will decide to invest in the clean firm. Hence, in equilibrium, the dirty firm will also be held by investors with a relatively high aversion to pollution, and therefore, it will find it optimal to adopt green technology.

In this equilibrium, output Y_G^H , (expected) pollution P_G^H and welfare W_G^H are given by

$$Y_G^H = (\alpha_d - f)G(\hat{\lambda}_G) + \alpha_c(1 - G(\hat{\lambda}_G)) \quad (11)$$

$$P_G^H = G(\hat{\lambda}_G)\kappa\frac{1}{2}\bar{e} + (1 - G(\hat{\lambda}_G))\underline{e} \quad (12)$$

$$W_G^H = \alpha_c + (\Delta - f)G(\hat{\lambda}_G) - \kappa\pi\bar{e} \int_0^{\hat{\lambda}_G} \lambda dG(\lambda) - \underline{e} \int_{\hat{\lambda}_G}^{\bar{\lambda}} \lambda dG(\lambda) \quad (13)$$

The following proposition summarizes the conditions for the existence of the two equilibria.

Proposition 1. *When the signal is $s = H$, if $f > (1 - \kappa)\bar{e}\pi\psi(\bar{\lambda})$, only the brown equilibrium exists. If $f \leq (1 - \kappa)\bar{e}\pi\psi(\bar{\lambda})$, there exists $\bar{\lambda}(\pi\bar{e} - \underline{e}) \geq \bar{\Delta} > \underline{\Delta} > \frac{(\pi\bar{e} - \underline{e})f}{(1 - \kappa)\pi\bar{e}}$ such that*

- i) if $\Delta < \underline{\Delta}$, only the brown equilibrium exists;*
- ii) if $\Delta \geq \bar{\Delta}$, only the green equilibrium exists;*
- iii) if $\Delta \in [\underline{\Delta}, \bar{\Delta})$, both equilibria co-exist.*

Moreover, if both equilibria coexist, then $\hat{\lambda}_G > \hat{\lambda}_B$, where $\hat{\lambda}_B$ and $\hat{\lambda}_G$ are given by equations (4) and (9) respectively.

First, Proposition 1 states that in case the signal is $s = H$, the green equilibrium does not exist if the cost of adopting green technology is too high. From Lemma 1, we have that the dirty firm is held by low- λ investors. This means that if the adoption cost is so large that even an average investor in the population does not want the dirty firm to adopt the green technology, i.e., $f > (1 - \kappa)\bar{e}\pi\psi(\bar{\lambda})$, then the dirty firm does not adopt the green technology and the brown equilibrium prevails. Second, if the adoption cost f is not too large, then both equilibria can exist depending on how large the difference in productivity between the clean and dirty firm Δ is. As mentioned above, if Δ is sufficiently small, that is, $\Delta < \underline{\Delta}$ the dirty firm does not find it optimal to adopt green technology and the green equilibrium does not exist while if Δ is sufficiently large, that is, $\Delta > \bar{\Delta}$, then the dirty firm finds optimal to adopt green technology and the brown equilibrium does not exist. Moreover, both equilibria can co-exist if Δ is intermediate. In this case, Proposition 1 states that the size of the dirty sector is always larger when the dirty firm chooses to adopt green technology, i.e., $\hat{\lambda}_G > \hat{\lambda}_B$. The intuition for this result is that more investors decide to invest in the dirty firm when it decides to adopt green technology.

3.1.3 Equilibrium comparison

In the brown equilibrium, the dirty firm does not adopt green technology. Therefore, it only attracts investors whose aversion to holding polluting firms is low, that is, investors with $\lambda < \hat{\lambda}_B$. In the green equilibrium where the dirty firm chooses to adopt the green technology to reduce its pollution, the size of the dirty firm becomes larger as more investors decide to hold the dirty firm, i.e., $G(\hat{\lambda}_G) > G(\hat{\lambda}_B)$ when both equilibria co-exist. Therefore, the pollution may be larger in the green equilibrium. As in Acemoglu and Rafey (2023) or Huang and Kopytov (2023), I assume that this is not the case.

Assumption 1. *Adoption of the green technology reduces aggregate pollution if $G(\hat{\lambda}_G)\kappa < G(\hat{\lambda}_B)$, where $\hat{\lambda}_B$ and $\hat{\lambda}_G$ are respectively given by equations (4) and (9).*

Under Assumption 1, the adoption of green technology always leads to a lower level of pollution. However, as adopting green technology is costly, it might not be socially desirable. The following lemma shows that under a mild assumption, provided that the cost of adopting

the green technology is low enough, welfare is always higher under the green equilibrium, which implies that adopting the green technology is socially desirable.

Lemma 2. *There exists a threshold $\bar{f}^1 > 0$ so that the green equilibrium exists and is socially preferable, that is, $W_G^H > W_B^H$ for $f < \bar{f}^1$. A sufficient condition for the existence of $\bar{f}^1$ is that W_G^H is a decreasing function of κ .*

Furthermore, we make the following assumption to determine which equilibrium prevails when both coexist.

Assumption 2. *If the two equilibria coexist, the socially preferable one is played.*

This latter assumption is similar to [Huang and Kopytov \(2023\)](#) and ensures that my results are driven by economic forces rather than coordination failures.

3.2 Signal is $s = L$

Now consider the case where the signal is $s = L$. I make the following assumption.

Assumption 3. *When the signal indicates that the dirty firm has a low level of externality, that is, $s = L$, the dirty firm is perceived as being weakly less polluting than the clean firm if $\pi \geq \frac{\bar{e} - \underline{e}}{\bar{e}}$.*

Under this assumption, we have that $\mathbb{E}[e_d|s = L] \leq e_c$, so that when the signal indicates that the level of externality of the dirty firm is low, the dirty firm is perceived as less polluting than the clean firm, and therefore all investors decide to invest in the dirty firm as it is more productive and also perceived as less polluting.

In this case, since $\alpha_d > \alpha_c$ and $\mathbb{E}[e_d|S = L] = \bar{e}(1 - \pi) \leq e_c = \underline{e}$, we have from (1) that all investors invest in firm d that is the polluting firm. In this case, the green equilibrium in which the dirty firm chooses to adopt the green technology prevails if

$$f < (1 - \kappa)(1 - \pi)\bar{e}\psi(\bar{\lambda}). \quad (14)$$

Otherwise, the brown equilibrium prevails.

Equation (14) reveals that in case the signal is $s = L$, the green equilibrium is less likely to prevail when disclosure requirements increase. Indeed, as π increases the right-hand side

of (14) decreases. The intuition for this result is that when the signal is $s = L$, all investors invest in the dirty firm, and as π increases, the perceived externality generated by the dirty firm becomes less important for investors. Hence, investors are less willing for the dirty firm to adopt the green technology at time $t = 2$. This result suggests that increasing disclosure requirements can have adverse effects on firms' willingness to adopt green technologies.

In this brown equilibrium, we have that output Y_B^L , pollution P_B^L and welfare W_B^L are respectively given by

$$Y_B^L = \alpha_d \tag{15}$$

$$P_B^L = \frac{1}{2}\bar{e} \tag{16}$$

$$W_B^L = \alpha_d - \mathbb{E}[e_d|s = L] \int_0^{\bar{\lambda}} \lambda dG(\lambda) = \alpha_d - \bar{e}(1 - \pi)\psi(\bar{\lambda}) \tag{17}$$

Similarly, in the green equilibrium, we have

$$Y_G^L = \alpha_d - f \tag{18}$$

$$P_G^L = \kappa \frac{1}{2}\bar{e} \tag{19}$$

$$W_G^L = \alpha_d - f - \kappa\bar{e}(1 - \pi)\psi(\bar{\lambda}) \tag{20}$$

This leads to the following proposition.

Proposition 2. *When the signal is $s = L$, then the green equilibrium prevails if $f < (1 - \kappa)(1 - \pi)\bar{e}\psi(\bar{\lambda})$, and otherwise the brown equilibrium prevails.*

Proposition 2 states that when the signal is $s = L$, the dirty firm decides to adopt green technology provided that the cost of adoption f is not too large. Otherwise, the dirty firm does not adopt green technology. In this case, the equilibrium is always unique and depends only on the cost of adoption, as when the signal is $s = L$, all investors decide to invest in the dirty firm, and the clean firm receives zero funding.

4 Model Analysis

In this Section, I investigate the impact of more stringent disclosure requirements, i.e., an increase in π , on the model's outcomes. In my model, more precise disclosure requirements

can be interpreted as regulations that force firms to disclose (more) information about ESG-related issues, as mandated by recent changes in the law.⁷ To gain insight into the economic mechanisms at play, it is useful to analyze the impact of the signal in the different states of nature separately, that is, for $s = H$ and $s = L$.

4.1 Signal is $s = H$

As shown by equation (10), when $s = H$ the green equilibrium prevails if

$$\underbrace{f}_{\text{Adoption cost}} < \underbrace{(1 - \kappa)\bar{e}\pi}_{\text{Expected reduction in pollution}} \times \underbrace{\psi(\hat{\lambda}_G(\pi))}_{\text{Average shareholder disutility}} \quad (21)$$

An increase in π has two opposite effects on the green equilibrium. First, as π increases, the expected reduction in pollution increases as shareholders have a better estimation of the quantity of pollution generated by the dirty firm. On the other hand, an increase in π results in a lower average shareholder disutility (shareholder base effect)

$$\frac{\partial \psi(\hat{\lambda}_G(\pi))}{\partial \pi} = \underbrace{\frac{\partial \psi}{\partial \hat{\lambda}_G}}_{>0} \times \underbrace{\frac{\partial \hat{\lambda}_G}{\partial \pi}}_{<0} < 0$$

An increase in π results in a lower $\hat{\lambda}_G$ and since shareholders investing in the dirty firm are shareholders with $\lambda \in [0, \hat{\lambda}_G]$, this in turn implies that the average shareholder investing in the dirty firm becomes less concerned about pollution as π increases. Hence, the dirty firm has less incentive to adopt green technology. This is the shareholder base effect. This implies that the green equilibrium is less likely to exist under better disclosure requirements. Using similar arguments, it is also possible to show that the same mechanism also makes the brown equilibrium more likely to prevail.

Moreover, equations (6) and (11) show that when the signal is $s = H$, the output decreases in the precision of the signal in both green and brown equilibria. The reason is that when the precision of the signal increases, the mass of shareholders invested in the dirty

⁷For example, in the EU, the Corporate Sustainability Reporting Directive (CSRD) prompts firms to disclose detailed information on their sustainability efforts. Moreover, the International Sustainability Standards Board (ISSB) launched its first set of proposals on ESG reporting standards in June 2023.

firm becomes smaller, which means that the dirty firm receives less funding (i.e., the size of the dirty firm shrinks) to the benefit of the clean firm. As the dirty firm is more profitable, output and pollution decrease as the size of the dirty firm shrinks.

Furthermore, looking at equations (7)-(8) and (12)-(13) reveals that in both green and brown equilibria, the impact of signal precision π on pollution and welfare is ambiguous. This leads to the following proposition.

Proposition 3. *When the signal is $s = H$:*

1. *An increase in precision π leads to two opposite effects. First, a more precise signal increases the expected reduction in pollution perceived by shareholders. Second, a more precise signal makes the average shareholder of the dirty firm less averse to pollution (shareholder base effect). A more precise signal facilitates (hampers) the adoption of green technology if the former (latter) effect dominates the latter (former).*
2. *In any given equilibrium (green and brown), an increase in precision leads to lower output and has an ambiguous effect on pollution and welfare.*

4.2 Signal is $s = L$

When the signal is $s = L$, recall that all investors choose to invest their wealth in the dirty firm and that the clean firm receives zero funding. In this case, the dirty firm chooses to adopt the green technology at time $t = 2$ if

$$f < (1 - \kappa)(1 - \pi)\bar{e}\psi(\bar{\lambda}).$$

It is immediate to see that an increase in precision π makes the green equilibrium harder to achieve. The increase in precision implies that the expected pollution is lower for shareholders; hence, as shareholders perceive pollution as less costly, they are less willing for the dirty firm to adopt the green technology. Moreover, in this case, the shareholder base effect is absent, as the precision of the signal does not affect the composition of the dirty firm's shareholder base.

Moreover, equations (15) and (18) show that the output is independent of the precision

of the signal when the signal is $s = L$. Furthermore, equations (16) and (19) also show that pollution is independent of the precision of the signal. The reason is that the shareholder base is not affected by the precision of the signal, since all investors decide to invest in the dirty firm.

In addition, (17) and (20) reveal that in both green and brown equilibria, the welfare increases with the precision of the signal. This is because when the signal is $s = L$, all investors invest in the dirty firm, and as previously mentioned, the perceived externality decreases as the precision of the signal increases, resulting in higher welfare. This leads to the following proposition.

Proposition 4. *When the signal is $s = L$:*

1. *The green equilibrium is less likely to prevail as the signal becomes more precise.*
2. *In a given equilibrium (green and brown), output and pollution are independent of precision, while a more precise signal increases welfare.*

Hence, taking the equilibrium as given, better disclosure requirements improve welfare. However, it also makes the green equilibrium less likely to prevail, which could reduce welfare and increase pollution, as pollution is lower and welfare is higher under the green equilibrium than under the brown equilibrium.

4.3 Equilibrium

Finally, I assess the impact of more stringent disclosure requirements on the expected adoption of green technology. To that extent, consider the condition for green adoption at time $t = 2$ given by (2). The dirty firm is expected to adopt the green technology at time $t = 2$ if

$$f < (1 - \kappa) \frac{\bar{e}}{2} \left[\pi(\psi(\hat{\lambda}_G(\pi)) - \psi(\bar{\lambda})) + \psi(\bar{\lambda}) \right] \equiv \hat{f} \quad (22)$$

with $\psi(\hat{\lambda}_G(\pi)) < \psi(\bar{\lambda})$, and we have that

$$\frac{\partial \hat{f}}{\partial \pi} = (1 - \kappa) \frac{\bar{e}}{2} (\psi(\hat{\lambda}_G(\pi)) - \psi(\bar{\lambda})) + (1 - \kappa) \frac{\bar{e}}{2} \pi \frac{\partial \psi}{\partial \pi} < 0 \quad (23)$$

This implies that increasing the stringency of disclosure requirements makes the dirty firm less likely to adopt green technology. Equation (23) shows the marginal effect of an increase in precision π on the constraint for the adoption of green technology.

The first term of equation (23) represents the marginal effect of increasing the precision π on the expected reduction in externality when the signal is $s = H$, multiplied by the difference in shareholders' bases between the case where the signal is $s = H$ and $s = L$. This effect is negative, given that the difference in shareholder bases is negative. Indeed, a smaller mass of shareholders is invested in the dirty firm when the signal is $s = H$, and these shareholders are, on average, less concerned about pollution. This makes the adoption of green technology more difficult when the signal becomes more precise.

The second term of equation (23) represents the shareholder base effect. It shows the impact of increasing the signal precision on the dirty firm's shareholder base when the signal is $s = H$. We have $\frac{\partial \psi}{\partial \pi} = \frac{\partial \psi}{\partial \hat{\lambda}_G} \frac{\partial \hat{\lambda}_G}{\partial \pi} < 0$, which means that increasing the precision of the signal makes the average shareholder invested in the dirty firm less averse to pollution when π increases. Hence, this implies that the dirty firm is less willing to adopt green technology following an increase in precision. Thus, we can see that both effects go in the same direction and make the constraint on the adoption of green technology tighter, making the dirty firm less likely to adopt green technology at the time $t = 2$. This leads to the following proposition.

Proposition 5. *An increase in signal precision π reduces the incentive of the dirty firm to adopt green technology.*

Moreover, recall from Section 3 that when the signal is $s = H$, the size of the dirty sector shrinks, following an increase in precision π , while the size of the dirty sector is independent of the precision when the signal is $s = L$. Hence, an increase in the precision of the signal reduces the expected size of the dirty sector. On the other hand, increasing the precision of the signal is beneficial.

However, Proposition 5 shows that increasing the precision of the signal also reduces the incentive for the dirty firm to adopt green technology. This highlights a trade-off behind

climate disclosure requirements. On the one hand, improving climate disclosure requirements reduces the size of the dirty sector, thereby reducing externalities. On the other hand, improving climate disclosure requirements also makes the dirty firm less likely to adopt green technology. If this second effect dominates, better climate disclosure requirements could increase pollution and/or result in lower welfare.

This result contradicts the conventional wisdom that better climate disclosure requirements promote the green transition and suggests that some level of greenwashing could be optimal. It also cautions against recent regulations that aim to strengthen climate disclosure requirements. My findings predict that such regulations undermine firms' adoption of green technologies and do not necessarily improve welfare or reduce pollution due to shareholders' endogenous response. This is a novel finding specific to my theory. Before turning to the empirical analysis, I summarize below the testable predictions generated by my theory.

Prediction 1. *Following the implementation of more stringent climate disclosure requirements, polluting firms are held by shareholders who are less averse to pollution.*

Prediction 2. *Following the implementation of more stringent climate disclosure requirements, green investment from polluting firms should decrease.*

Prediction 1 follows directly from the first part of Proposition 3 that states that if the signal is $s = H$, a more precise signal makes the average shareholder invested in the dirty firm less averse to pollution, and from the result of Section 3.2 that in the case where the signal is $s = L$ all investors invest in the dirty firm. Taken together, this implies that more stringent climate disclosure requirements (i.e., a more precise signal) make, on average, the shareholders of the dirty firm less averse to pollution.

The first part of Prediction 2 follows directly from the result of Proposition 5, which states that the incentive for the dirty firm to adopt green technology is decreasing in the precision of the signal. Therefore, my model predicts that more stringent climate disclosure reduces green investments from more polluting firms. Since polluting firms decrease their green investments, they should also become more polluting in terms of emissions per unit of capital.

5 Empirical Analysis

I test the model’s predictions using data on the staggered adoption of mandatory ESG disclosure requirements across countries from [Krueger et al. \(2024\)](#). I test the implications of the adoption of mandatory climate disclosure requirements on firms’ change in shareholder base using institutional investors’ data to test Prediction 1. Moreover, I use firm future carbon emissions intensity and R&D expenditures to investigate the impact of these regulations on firms’ green investments to test Prediction 2.

5.1 Data and Variables

I combine data from multiple sources. I use data on mandatory ESG disclosure requirements from [Krueger et al. \(2024\)](#). This dataset concerns 38 countries that have adopted mandatory ESG disclosure requirements between 2001 and 2019.⁸

Emissions data are obtained from Trucost for the sample period 2010 to 2020. Following the literature ([Hartzmark and Shue \(2022\)](#), [Albuquerque, Kruttli, Ma, and Watugala \(2025\)](#)), I focus on Scope 1 and Scope 2 emissions as they directly originate from firms’ activities,⁹ and I use firms’ emission intensity (defined as the sum of Scope 1 and 2 emissions scaled by revenue) to distinguish between relatively clean and dirty firms. Given the strong skewness of this measure, I take its natural logarithm and, for brevity, refer to it as emissions hereafter.

I also download quarterly institutional ownership data from FactSet. Motivated by the findings of [Dyck et al. \(2019\)](#) and [Azar et al. \(2021\)](#), which highlight the role of institutional investors in shaping firms’ sustainability outcomes, I assume that institutional investors are more averse to pollution than other investors. Under this interpretation, institutional investors are more likely to divest following the introduction of mandatory disclosure requirements, providing a test of Prediction 1.

Finally, I obtain firm-level financial information from Compustat Global and North

⁸The dataset is publicly available and can be downloaded from the *Journal of Accounting Research* website.

⁹The sample begins in 2010, as Trucost coverage for emerging markets is limited before this date.

America over the period 2010–2020. I exclude financial firms (SIC 6000–6999), utilities (SIC 4900–4999), and observations with negative book equity or missing key variables. All continuous variables are winsorized at the 1st and 99th percentiles. The final sample comprises 4,464 firm-year observations with 907 unique firms located in 39 different countries. Appendix B.1 provides detailed variable definitions, and Table 1 reports summary statistics.

5.2 Institutional investors ownership

My model predicts that following the implementation of mandatory disclosure requirements, capital will be reallocated from dirty to clean firms, with dirty firms ending up being held by less responsible investors (Prediction 1), undermining their incentives to make green investments (Prediction 2). As mandatory disclosure requirements are adopted at different points in time for different countries, this corresponds to a staggered difference-in-difference specification.

In what follows, I estimate how the share of institutional investors varies following the implementation of mandatory ESG disclosure requirements as a function of firms’ emissions. In line with the findings of Dyck et al. (2019) and Azar et al. (2021), who show that the firms’ E&S performance tends to improve with institutional investor ownership, and that this relationship seems to be causal, I assume that institutional investors are, on average, more concerned about pollution than other investors. Hence, according to Prediction 1, the share of institutional investors should decline more for more polluting firms after the implementation of mandatory disclosure requirements.¹⁰ My baseline specification to test Prediction 1 is the following:

$$\begin{aligned}
Y_{i,c,t+1} = & \beta_1 \text{Mandatory Disclosure}_{c,t} \times \text{Above Median Emissions}_{i,c,t} \\
& + \beta_2 \text{Mandatory Disclosure}_{c,t} + \beta_3 \text{Above Median Emissions}_{i,c,t} \\
& + \gamma' X_{i,c,t} + \delta_i + \delta_{t+1} + \epsilon_{i,c,t+1}
\end{aligned} \tag{24}$$

¹⁰In Section 6.3, I sharpen this prediction by considering PRI and non-PRI signatory institutional investors, and show PRI signatory investors divest relatively more following the adoption of mandatory disclosure, although non-PRI signatory investors also divest.

where $Y_{i,c,t+1}$ is the median share of institutional investors invested in firm i in country c and year $t + 1$. Institutional investors' holding data are available at a quarterly frequency; hence, I take the median over the year as the regression is estimated at a yearly frequency. $\text{Mandatory Disclosure}_{c,t}$ is a dummy variable equal to one if there is a mandatory ESG disclosure requirement in the country c at year t , $\text{Above Median Emissions}_{i,c,t}$ is a dummy variable equal to one in case firm i in country c has above median emissions (intensity) in year t . I also use the natural logarithm of emissions, which I interact with the treatment variable $\text{Mandatory Disclosure}_{c,t}$, and show that the results remain similar.

$X_{i,c,t}$ is a vector of firm and country-level control variables. As control variables, I follow the literature (see [Ferreira and Matos \(2008\)](#), [Dyck et al. \(2019\)](#)) and include a set of variables that are determinants of institutional investors' ownership. The control variables are $\log(\text{Market-cap})$, Dividend yield, $\log(\text{Capex}/\text{Assets})$, Leverage, Cash/Assets, Market-to-Book and $\log(\text{Market-cap}/\text{GDP})$. δ_i and δ_{t+1} represent, respectively, firm and year fixed-effects. In the baseline specification, I include firm fixed effects δ_i to account for potential unobserved firm-level heterogeneity and document with-firm variation. I also include year fixed effects to control for time-varying factors that affect all firms, and in some specifications, industry-year fixed effects to control for industry-wide shocks, where industries are defined by two-digit SIC codes. Standard errors are clustered at the country-year level, as laws are adopted at the country level in different years. As the implementation of mandatory ESG disclosure is staggered over time, I use the estimator proposed by [Gardner, Thakral, Tô, and Yap \(2024\)](#) to address the potential bias arising from standard OLS estimators in settings with staggered treatment adoption.¹¹

The coefficient of interest in this specification is β_1 and shows how the relation between institutional investors' share and the implementation of mandatory disclosure requirements varies with firms' pollution. According to Prediction 1, β_1 should be negative, as more polluting firms should be held by less responsible investors following the implementation of mandatory climate disclosure requirements.

¹¹Throughout the paper, unless otherwise stated, I always rely on the estimator of [Gardner et al. \(2024\)](#) to estimate staggered difference-in-differences specifications.

The results are presented in Table 2. The coefficient of interest, β_1 (i.e., the coefficient on the interaction term), is negative and statistically significant at the 1% level across all specifications. This indicates that, following the implementation of mandatory climate disclosure requirements, the share of institutional investors allocated to more polluting firms declines, consistent with Prediction 1. Column (3) shows that for firms with above-median emissions, the introduction of mandatory climate disclosure reduces their share of institutional investors by approximately 26% relative to firms with below-median emissions. This effect corresponds to roughly 35% of the sample mean, indicating that the result is not only statistically significant but also economically meaningful. Moreover, the results are robust to an alternative specification in which the dummy variable $\text{Mandatory disclosure}_{c,t}$ is interacted with the natural logarithm of emissions instead of the above-median emissions indicator, yielding a similar pattern.

A necessary assumption for identifying the treatment effect in a difference-in-difference specification is the parallel trends assumption. That is, in the absence of treatment, the average change in the outcome variable would have been the same for both treated and control firms. Although this assumption cannot be tested directly as it concerns the evolution of counterfactual outcomes for the treated group in the absence of treatment, I plot in Figure 1 the difference in the share of institutional investors over time between firms with above and below-median emissions.

The figure shows that for the years before the treatment, the coefficients are close and not statistically different from zero. This implies that the trends in outcomes for the treatment and control groups are similar before the treatment, consistent with the parallel trends assumption. The coefficients only become negative from year $t = +1$ onward, due to the treatment.

5.3 Carbon emissions

My model predicts that more stringent climate disclosure requirements have a negative impact on green investments by polluting firms (see Prediction 2). In this Section, I test this prediction using firms' CO_2 emissions intensity as an indirect measure of green investments.

If firms reduce their green investments, then they should also become more polluting, in particular for polluting firms.

Although the model predicts a negative relationship between the stringency of climate disclosure requirements and green investments by polluting firms, it predicts no clear relationship between the stringency of climate disclosure requirements and aggregate pollution due to two different effects. First, more stringent climate disclosure requirements reduce capital allocated to dirty firms, thereby reducing pollution; however, it also reduces incentives for these firms to undertake green investments, resulting in an ambiguous impact between the stringency of climate disclosure requirements and aggregate pollution. However, the model predicts an unambiguously positive relation between climate disclosure requirements and dirty firms' pollution per unit of capital, due to the reduction in green investments. Hence, the model predicts that empirically, the relation between climate disclosure requirements and emissions intensity (i.e., defined as emissions scaled by revenue) should be positive.

I estimate a specification similar to (24), using the natural logarithm of one-year-ahead CO_2 emissions as the dependent variable.¹² For this specification, I include as control variables variables that are likely to influence firms' emissions and that have been used in the literature.¹³ The control variables are: Size is defined as the natural logarithm of sales, Leverage, Market-to-book, Tangibility, and ROA. The coefficient of interest in equation (24) is β_1 and is expected to be positive when the dependent variable is the natural logarithm of firms' emissions, according to Prediction 2. A positive β_1 means that polluting firms are becoming more polluting following the adoption of mandatory disclosure requirements.

Table 3 illustrates the impact of climate disclosure requirements on firms' emissions. The results show that firm emissions tend to increase after the implementation of mandatory climate disclosure requirements, particularly for more polluting firms. All the coefficients on the interaction terms are positive and statistically significant at 1%. Column (6) reveals that following the implementation of mandatory disclosure requirements, above median emissions

¹²Following the literature, I take the natural logarithm of emissions intensity as emissions intensity is highly skewed in the data.

¹³I use similar controls as Azar et al. (2021), who investigate the impact of institutional investors on firms' emissions.

firms increase their (log of) emissions by 1.104 relative to below median emissions firms, which corresponds to an increase of 25% relative to the average emissions intensity. Hence, the effect is not only statistically significant but also economically important.

Furthermore, columns (1)-(3) show that in aggregate, firms' emissions also tend to increase following the adoption of mandatory disclosure requirements. The effect is also economically important. In column (3), the increase in emissions corresponds to about 10% of its mean. Although the model does not predict a clear relationship between the stringency of climate disclosure requirements and aggregate pollution, I find, empirically, that the increase in emissions by polluting firms also translates into more emissions overall. The fact that firms' emissions increase more for more polluting firms, as shown by the interaction terms, is consistent with the theoretical prediction that following the implementation of mandatory disclosure requirements and the divestment of institutional investors, more polluting firms have lower incentives to adopt green technologies, and therefore become more polluting.

Figure 2 plots the event-time dynamic of the implementation of mandatory disclosure requirements on firms' emissions, both for the total effect and for the difference between above and below median emissions firms. In both cases, we can see that the coefficients before the treatments are close to zero and do not exhibit any particular trend, consistent with the parallel trend assumption, and only start to become positive after the treatment.

These findings relate to [Azar et al. \(2021\)](#), who documents that following the investment of large shareholders, polluting firms tend to reduce their carbon emissions, consistent with the fact that those investors engage with firms. This is also consistent with the findings of [Dyck et al. \(2019\)](#) showing that firms tend to improve on E&S dimensions following the investment of institutional investors, and that this effect is causal. Finally, this also relates to the findings of [Hartzmark and Shue \(2022\)](#) showing that although divestment campaigns from polluting firms by socially responsible investors tend to increase their cost of capital, these firms also tend to become more polluting. However, I consider another economic mechanism as my results do not rely on the cost of capital channel as explained in Section 6.2.1. In my setup, polluting firms become more polluting because, following the divestment by socially responsible investors, they end up being held by shareholders who care less about pollution,

thereby undermining their incentives to undertake green investments.

6 Additional Implications and Robustness

6.1 R&D expenditures

In Section 5.3, I rely on carbon emissions data to test Prediction 2, which states that following the adoption of mandatory climate disclosure requirements, polluting firms reduce green investments and, as a consequence, become more polluting. I use an alternative empirical strategy to test Prediction 2, by using R&D expenditures as a measure of green investments. Although I cannot differentiate between green and non-green R&D expenditures, I use total R&D expenditures as a proxy for green R&D expenditures, a proxy commonly used in the sustainable finance literature (see Brown, Martinsson, and Thomann (2022), Brown, Martinsson, Strömberg, and Thomann (2024)).

I re-estimate specification (24) using the natural logarithm of R&D expenditures scaled by total assets as a dependent variable (henceforth referred to as R&D expenditures).¹⁴ As control variables, I follow the empirical literature on innovation (see Schroth and Szalay (2010), Aghion, Van Reenen, and Zingales (2013)) and include the following variables: Size (measured by $\log(\text{Sale})$), $\log(K/L)$, Leverage, Market-to-book, Tangibility, ROA, Cash/Assets, R&D/Assets, $\log(\text{GDP})$, GDP Growth. The coefficient of interest in equation (24) is β_1 and is expected to be negative when the dependent variable is R&D expenditures, as Prediction 2 predicts that following the adoption of mandatory disclosure requirements, polluting firms should undertake less green investments.

Table 4 shows that following the adoption of mandatory climate disclosure requirements, firms invest significantly less in R&D, and that this effect is more pronounced for more polluting firms, as predicted by the model. The results are both economically and statistically significant. Notably, column (3) shows that R&D expenditures fall by 1.465, corresponding to more than 40% of the average R&D expenditures in the sample, while column (6) shows

¹⁴I scale R&D by total assets, although scaling by sales would give similar results. I also take the natural logarithm because R&D/Assets is skewed in the data.

that the difference between above and below median emissions firms is 1.738, corresponding to more than 50% of the average R&D expenditures.

6.2 Alternative channels

6.2.1 Cost of capital channel

A potential concern is that the decrease in green investments and the increase in pollution following the implementation of mandatory climate disclosure requirements may be driven by an increase in firms' cost of capital rather than a change in their shareholder base composition.

Indeed, as shown in Section 5.2, the share of institutional investors invested in more polluting firms drops following the implementation of mandatory climate disclosure requirements. If institutional investors have price impacts, this could result in an increase in the cost of capital for more polluting firms, thereby leading to underinvestment in green technologies.¹⁵

I test this hypothesis by using two different proxies for firms' cost of capital. First, I use the one-year-ahead firms' equity return. If, following the implementation of mandatory climate disclosure requirements, divestment from institutional investors generates price impact, then the one-year-ahead equity return should decrease, corresponding to an increase in the cost of capital for those firms. Hence, if this channel is effective, the coefficient from the regression of the one-year ahead cost of capital on the dummy for the mandatory disclosure implementation should be negative, and more importantly, the same should hold for the coefficient of the interaction term between the mandatory disclosure dummy and the above median emission dummy, reflecting that the effect should be more pronounced for more polluting firms from which institutional investors divest.

The results are shown in Table 5. The results show no robust relation between the annual return and the introduction of mandatory disclosure requirements; the coefficients are

¹⁵A body of literature in asset pricing has demonstrated that investors can have price impact when rebalancing from brown to green stocks, thereby raising brown firms' cost of capital (see, for instance [Pástor, Stambaugh, and Taylor \(2022\)](#), [Van der Beck \(2021\)](#)).

positive and not statistically significant. This contradicts the hypothesis that the divestment of institutional investors from polluting firms affects their cost of capital and that firms' green investments decrease due to an increase in their cost of capital.

As an additional robustness check, I consider an alternative measure for the cost of capital based on the implied cost of capital (ICC) developed by [Lee, So, and Wang \(2021\)](#).¹⁶ The change in ICC (Δ ICC thereafter) is designed to be a measure of the portion of past returns that is due to changes in the cost of capital, not changes in expected cash flows. Therefore, if following the adoption of mandatory disclosure requirement, firms' cost of capital increases, the coefficient of the regression of the one-year ahead Δ ICC on mandatory disclosure should be positive, and similarly for the coefficient of the interaction term between the mandatory disclosure dummy and the above median emission dummy. The results are shown in Table 5 show that these relations do not hold, rejecting the hypothesis that firms' cost of capital (and in particular of polluting firms) increases following the implementation of mandatory disclosure requirements.

6.2.2 Financial distress

Finally, another concern could be that following the implementation of mandatory disclosure requirements, firms reduce green investments because they are becoming more financially distressed (due to an increase in reputational risk, for instance) and not because they end up being financed by shareholders who are less concerned about pollution.¹⁷

I test for this alternative channel using the Altman Z-Score as a measure of financial distress. Specifically, I use a dummy variable that takes the value one in case the firm has an Altman Z-Score in the bottom decile of the year, and I regress the one-year-ahead value of this variable on the dummy variable for mandatory disclosure and the interaction between the dummy for mandatory disclosure and above median emissions. The results in Table 5

¹⁶Following best practice described in [Lee et al. \(2021\)](#), I consider the mechanical ICC of [Gebhardt, Lee, and Swaminathan \(2001\)](#) (GLS) as measure of ICC, which is also the measure used by [Hartzmark and Shue \(2022\)](#).

¹⁷This relates to the findings of [Bellon and Boualam \(2024\)](#), who shows that firms tend to increase pollution intensity when becoming financially distressed.

show that although the coefficients on the mandatory disclosure dummy are positive, polluting firms are not becoming more financially distressed following the implementation of mandatory disclosure requirements, as the coefficient on the interaction terms is not significant. Therefore, this rules out the potential explanation that polluting firms would reduce green investments in response to enhanced climate disclosure requirements because it makes them more financially distressed.

6.3 PRI signatory institutional investors

In the baseline analysis of Section 5.2, I assume that institutional investors, being more sensitive to environmental concerns than other investors, reduce their exposure to polluting firms following the introduction of mandatory climate disclosure requirements.

In this section, I refine the analysis by distinguishing between PRI signatory and non-PRI signatory institutional investors. Specifically, I identify whether an investor is a signatory to the UN Principles for Responsible Investment (PRI). PRI signatories commit, among other things, to incorporating environmental, social, and governance considerations into their investment decisions and to acting as active owners on these dimensions. I therefore expect stronger responses from PRI signatories. To test this, I re-estimate the specification (24) separately for each group, using the share of PRI signatory and non-PRI signatory institutional investors as dependent variables.

Interestingly, the results reported in Table 6 show that mandatory disclosure is associated with a decline in institutional ownership of more polluting firms for both types of investors. However, this decline is economically more pronounced for PRI signatory investors. Comparing columns (2) and (6), the estimated reduction in ownership of above-median emission firms (relative to below-median emissions firms) is 2.683% for PRI signatories and 5.73% for non-PRI signatories. These effects correspond to approximately 27% and 9% of their respective sample means. Thus, although the absolute reduction is larger for non-PRI investors, the effect is substantially stronger for PRI investors when measured relative to their baseline holdings. This finding is consistent with the theoretical prediction that, following the introduction of more stringent climate disclosure requirements, responsible investors divest from

polluting firms.

7 Conclusion

In this paper, I develop a model where two firms, clean and dirty, are financed by a mass of responsible investors who are heterogeneous in their aversion to holding polluting firms. The dirty firm is more productive than the clean firm but generates more pollution. After receiving funding from investors, the dirty firm decides whether to operate its current production technology or to adopt a less polluting or green technology at a cost. Investors decide which firm to invest in, anticipating firms' adoption decisions. However, investors do not observe the externalities produced by the dirty firm, but they receive a signal before investing. The precision of the signal is exogenous and represents the stringency of climate disclosure requirements.

In this framework, I demonstrate that increasing the stringency of climate disclosure requirements decreases the mass of investors who choose to invest in the dirty firm, thereby reducing pollution. On the other hand, more stringent climate disclosure requirements also reshape firms' shareholder base, resulting in the dirty firm being financed by investors who, on average, are less concerned about pollution. The latter effect undermines the incentive of the dirty firm to adopt green technology. Therefore, the impact of more stringent climate disclosure requirements on pollution and welfare is ambiguous. This result challenges the conventional view that improving climate disclosure requirements is beneficial and suggests that some level of greenwashing could be optimal. It also constitutes caution against recent regulations that aim to strengthen climate disclosure requirements.

I also provide empirical evidence supporting the novel predictions of my theory. Using data on the staggered implementation of mandatory ESG disclosure requirements across countries, I show that after the implementation of mandatory disclosure requirements, the share of institutional investors, who have been recognized as an important driver of firms' sustainability, invested in polluting firms decreases. I also show that firms' emissions intensity increases and firms' R&D expenditures decrease, and that these effects are driven

by more polluting firms. This is consistent with the theoretical prediction that, after the implementation of more stringent climate disclosure requirements, dirty firms will ultimately be financed by investors who care less about pollution, thereby undermining incentives for these firms to adopt green technologies.

References

- Acemoglu, D., & Rafey, W. (2023). Mirage on the horizon: Geoengineering and carbon taxation without commitment. *Journal of Public Economics*, 219, 104802.
- Aghamolla, C., & An, B.-J. (2023). Mandatory vs. voluntary esg disclosure, efficiency, and real effects. *Nanyang Business School Research Paper*(22-41).
- Aghion, P., Van Reenen, J., & Zingales, L. (2013). Innovation and institutional ownership. *American economic review*, 103(1), 277–304.
- Albuquerque, R., Kruttli, M. S., Ma, Y., & Watugala, S. W. (2025). Financing and the green paradox. *Available at SSRN 5768944*.
- Allen, F., Barbalau, A., & Zeni, F. (2023). Reducing carbon using regulatory and financial market tools. *Available at SSRN, 4357160*.
- Azar, J., Duro, M., Kadach, I., & Ormazabal, G. (2021). The big three and corporate carbon emissions around the world. *Journal of Financial Economics*, 142(2), 674–696.
- Bellon, A., & Boualam, Y. (2024). Pollution-shifting vs. downscaling: How financial distress affects the green transition. *Kenan Institute of Private Enterprise Research Paper*(4761314).
- Berk, J. B., & Van Binsbergen, J. H. (2025). The impact of impact investing. *Journal of Financial Economics*, 164, 103972.
- Bisceglia, M., Piccolo, A., & Schneemeier, J. (2022). Externalities of responsible investments. *Available at SSRN 4183855*.
- Bonnefon, J.-F., Landier, A., Sastry, P., & Thesmar, D. (2025). The moral preferences of investors: Experimental evidence. *Journal of Financial Economics*, 163, 103955.
- Broccardo, E., Hart, O., & Zingales, L. (2022). Exit versus voice. *Journal of Political Economy*, 130(12), 3101–3145.
- Brown, J. R., Martinsson, G., Strömberg, P., & Thomann, C. (2024). *Carbon pricing and investment* (Tech. Rep.). Working Paper.
- Brown, J. R., Martinsson, G., & Thomann, C. (2022). Can environmental policy encourage technical change? emissions taxes and r&d investment in polluting firms. *The Review of financial studies*, 35(10), 4518–4560.
- Chen, H., & Schneemeier, J. (2022). Responsible investors and stock market feedback.

Available at SSRN 4296418.

- Chowdhry, B., Davies, S. W., & Waters, B. (2019). Investing for impact. *The Review of Financial Studies*, 32(3), 864–904.
- Davies, S. W., & Van Wesep, E. D. (2018). The unintended consequences of divestment. *Journal of Financial Economics*, 128(3), 558–575.
- Döttling, R. J., Levit, D. Y., Malenko, N., & Rola-Janicka, M. A. (2024). *Voting on public goods: Citizens vs. shareholders* (Tech. Rep.). National Bureau of Economic Research.
- Downar, B., Ernstberger, J., Reichelstein, S., Schwenen, S., & Zaklan, A. (2021). The impact of carbon disclosure mandates on emissions and financial operating performance: B. downar et al. *Review of Accounting Studies*, 26(3), 1137–1175.
- Dyck, A., Lins, K. V., Roth, L., & Wagner, H. F. (2019). Do institutional investors drive corporate social responsibility? international evidence. *Journal of financial economics*, 131(3), 693–714.
- Edmans, A., Levit, D., & Schneemeier, J. (2022). Socially responsible divestment. *European Corporate Governance Institute–Finance Working Paper*(823).
- Emiris, M., Harris, J., & Koulischer, F. (2024). The effect of environmental preferences on investor responses to esg disclosure. *Available at SSRN 4457989*.
- Ferreira, M. A., & Matos, P. (2008). The colors of investors’ money: The role of institutional investors around the world. *Journal of financial economics*, 88(3), 499–533.
- Gardner, J., Thakral, N., Tô, L. T., & Yap, L. (2024). Two-stage differences in differences.
- Gebhardt, W. R., Lee, C. M., & Swaminathan, B. (2001). Toward an implied cost of capital. *Journal of accounting research*, 39(1), 135–176.
- Goldstein, I., Kopytov, A., Shen, L., & Xiang, H. (2022). *On esg investing: Heterogeneous preferences, information, and asset prices* (Tech. Rep.). National Bureau of Economic Research.
- Gryglewicz, S., Mayer, S., & Morellec, E. (2024). Investor activism and the green transition.
- Gupta, D., & Starmans, J. (2024). Dynamic green disclosure requirements. *Available at SSRN 4557187*.
- Hartzmark, S. M., & Shue, K. (2022). Counterproductive sustainable investing: The impact elasticity of brown and green firms. *Available at SSRN 4359282*.

- Heeb, F., Kölbel, J. F., Paetzold, F., & Zeisberger, S. (2023). Do investors care about impact? *The Review of Financial Studies*, 36(5), 1737–1787.
- Heinkel, R., Kraus, A., & Zechner, J. (2001). The effect of green investment on corporate behavior. *Journal of Financial and Quantitative Analysis*, 36(4), 431–449.
- Huang, S., & Kopytov, A. (2023). Sustainable finance under regulation.
- Ilhan, E., Krueger, P., Sautner, Z., & Starks, L. T. (2023). Climate risk disclosure and institutional investors. *The Review of Financial Studies*, 36(7), 2617–2650.
- Kim, J.-B., Wang, C., Wu, F., et al. (2022). The real effects of risk disclosures: evidence from climate change reporting in 10-ks. *Review of Accounting Studies*.
- Krueger, P., Sautner, Z., Tang, D. Y., & Zhong, R. (2024). The effects of mandatory esg disclosure around the world. *Journal of Accounting Research*, 62(5), 1795–1847.
- Landier, A., & Lovo, S. (2024). Socially responsible finance: How to optimize impact. *The Review of Financial Studies*, hhae055.
- Lee, C. M., So, E. C., & Wang, C. C. (2021). Evaluating firm-level expected-return proxies: implications for estimating treatment effects. *The Review of Financial Studies*, 34(4), 1907–1951.
- Levit, D., Malenko, N., & Maug, E. (2024). Trading and shareholder democracy. *The Journal of Finance*, 79(1), 257–304.
- Oehmke, M., & Opp, M. M. (2024). A theory of socially responsible investment. *Review of Economic Studies*, rdae048.
- Pástor, L., Stambaugh, R. F., & Taylor, L. A. (2022). Dissecting green returns. *Journal of financial economics*, 146(2), 403–424.
- Riedl, A., & Smeets, P. (2017). Why do investors hold socially responsible mutual funds? *The Journal of Finance*, 72(6), 2505–2550.
- Schroth, E., & Szalay, D. (2010). Cash breeds success: The role of financing constraints in patent races. *Review of Finance*, 14(1), 73–118.
- Van der Beck, P. (2021). *Flow-driven esg returns* (Tech. Rep.). Swiss Finance Institute.
- Xue, H. (2023). Esg disclosure, market forces, and firm investment.
- Yang, L. Y., Muller, N. Z., & Liang, P. J. (2023). Intended and unintended consequences of facility-level mandatory csr disclosure: Evidence from the greenhouse gas reporting

program. *Journal of Accounting, Auditing & Finance*, 0148558X251413807.

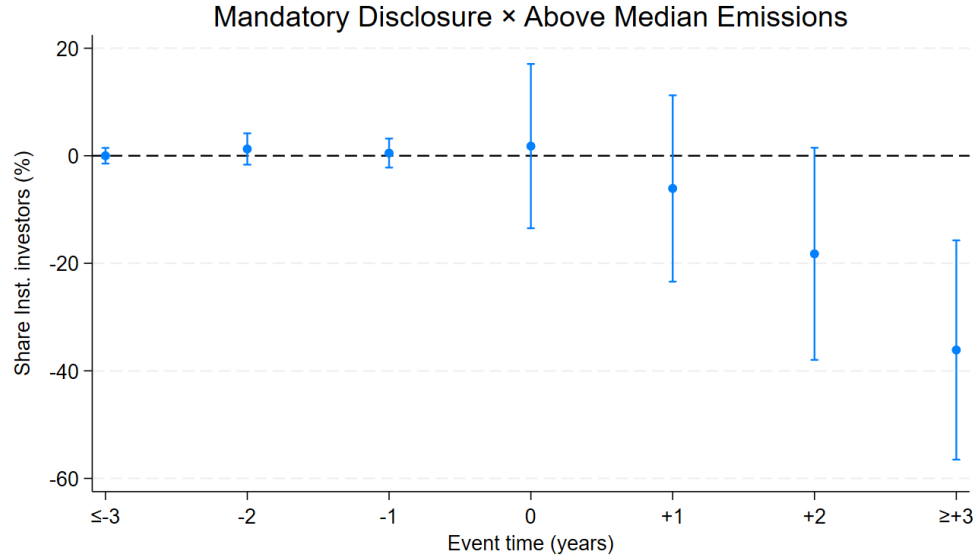


Figure 1: This figure shows the event-time dynamic of mandatory disclosure requirements on the share of institutional investors. The point estimate represents the estimated coefficient on the treatment group interacted with each year around mandatory disclosure adoption, together with 95% confidence intervals. The regression includes firm and industry-year fixed effects and control variables.

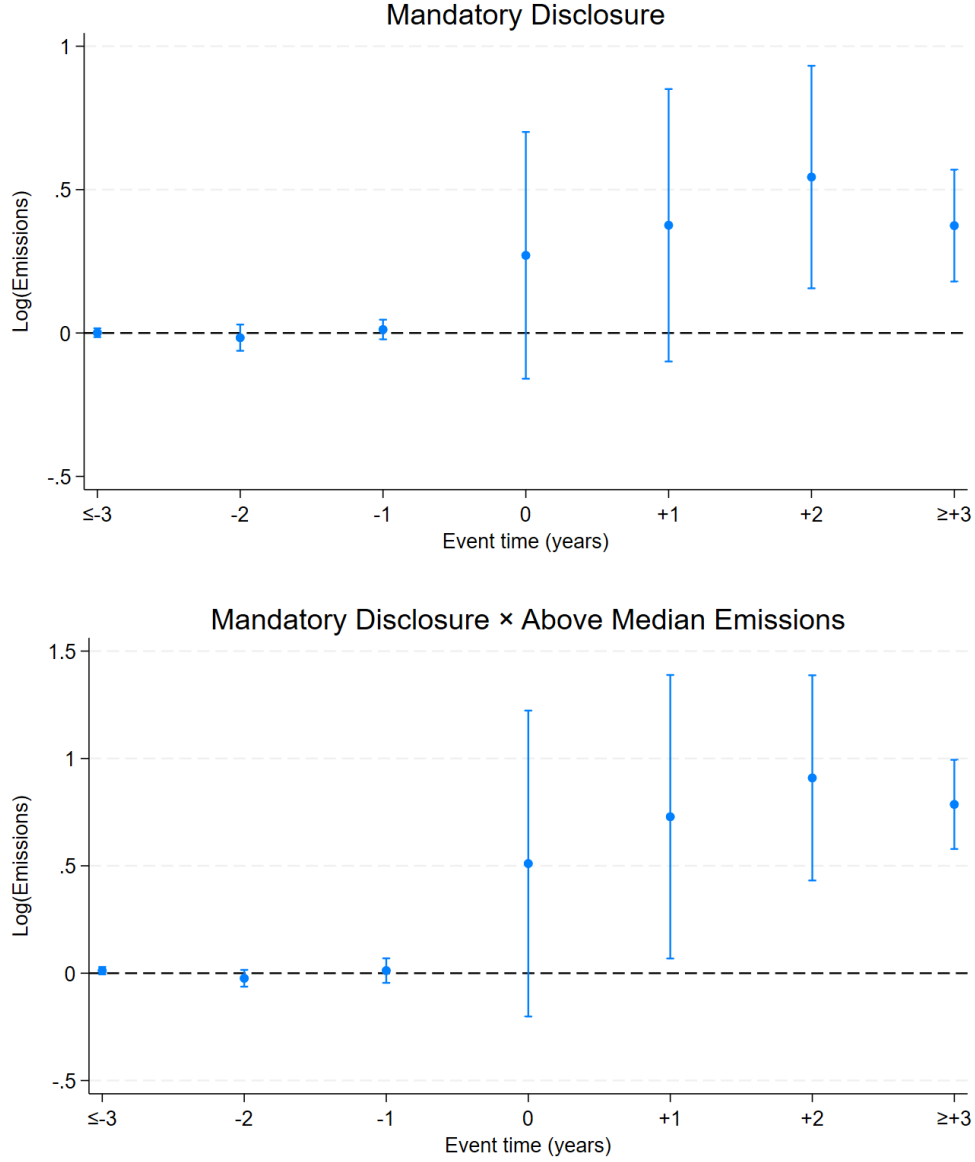


Figure 2: This figure shows the event-time dynamic of mandatory disclosure requirements on firms' emissions (in log). In the first panel, the point estimate represents the estimated coefficient on the treatment group interacted with each year around mandatory disclosure adoption, together with 95% confidence intervals. In the second panel, the point estimate represents the estimated coefficient on the treatment group interacted with each year around mandatory disclosure adoption and with a dummy variable that takes the value 1 for above median emissions firms (and 0 otherwise). The regression includes firm and industry-year fixed effects and control variables.

Table 1: Descriptive statistics

	N	Mean	Std Dev	Q25	Median	Q75
Panel A: Main variables						
Mandatory Disclosure	4464	0.130	0.337	0.000	0.000	0.000
Share inst. investors	4464	73.683	26.647	58.969	83.488	94.885
log(Emissions)	4464	4.014	1.476	2.933	3.677	4.638
Panel B: Firm characteristics						
log(Market-cap)	4464	7.790	1.755	6.501	7.835	8.998
Dividend yield	4464	0.012	0.024	0.000	0.000	0.017
log(Capex/Assets)	4464	-3.564	1.174	-4.172	-3.463	-2.804
Leverage	4464	0.266	0.198	0.094	0.256	0.409
Cash/Assets	4464	0.209	0.209	0.052	0.134	0.298
Market-to-book	4464	1.978	1.772	0.900	1.371	2.299
Size	4464	7.164	1.952	6.019	7.256	8.458
Tangibility	4464	0.277	0.259	0.076	0.168	0.422
ROA	4464	0.002	0.150	-0.017	0.032	0.073
log(R&D/Assets)	2491	-3.353	1.585	-4.462	-2.986	-2.182
log(K/L)	4418	4.513	1.847	3.354	4.190	5.389
Panel C: Macroeconomic variables						
log(Market-cap/GDP)	4464	-21.311	3.188	-23.551	-21.972	-19.582
log(GDP)	4464	10.774	0.680	10.853	10.962	11.059
GDP Growth (in %)	4464	1.844	2.231	1.772	2.458	2.946
Panel D: Additional outcomes						
Annual return	4204	0.167	0.821	-0.207	0.037	0.331
Δ ICC	2716	-0.000	0.033	-0.014	-0.001	0.012
Altman Z- Score	4072	4.070	6.212	1.426	2.622	4.661

This table provides descriptive statistics for all variables defined in Appendix B.1. The sample period is 2010 to 2020. All continuous variables are winsorized at the 1st and 99th percentiles.

Table 2: Institutional investors

	(1)	(2)	(3)	(4)	(5)	(6)
Mandatory Disclosure $\times$ Above Median Emissions	-11.58*** (1.977)	-8.302*** (2.248)	-26.09*** (7.608)			
Mandatory Disclosure $\times$ Log Emissions				-4.759*** (0.652)	-3.792*** (0.716)	-9.768*** (2.244)
Mandatory Disclosure	-2.762 (1.829)	2.334 (2.399)	-5.048 (3.217)	11.98*** (3.589)	14.67*** (3.569)	23.74*** (6.495)
Above Median Emissions	-0.0294 (0.0454)	-0.0297 (0.0467)	-0.0146 (0.0455)			
Log Emissions				-0.00330 (0.00269)	-0.00267 (0.00245)	-0.00188 (0.00196)
Mean dep. var.	73.602	73.602	73.602	73.602	73.602	73.602
Std dep. var.	26.633	26.633	26.633	26.633	26.633	26.633
Controls	No	Yes	Yes	No	Yes	Yes
Year FE	Yes	Yes	No	Yes	Yes	No
Industry $\times$ Year FE	No	No	Yes	No	No	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
N. obs.	4464	4464	4464	4464	4464	4464

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

This table shows the results from specification (24), where the dependent variable is the one-year-ahead share of institutional ownership (median over the year computed from quarterly holding data). The regressors include an interaction term $\text{Mandatory Disclosure}_{c,t} \times \text{Above Median Emissions}_{i,c,t}$ ($\text{Mandatory Disclosure}_{c,t} \times \text{Log Emissions}_{i,c,t}$), along with the corresponding uninteracted terms. Emissions are defined as the sum of Scope 1 and 2 emissions scaled by revenue. All regressions include firm, year, or industry $\times$ year fixed effects and control variables as indicated. The controls are listed in Section 5.2. Standard errors (in parentheses) are clustered at the country-year level.

Table 3: CO_2 emissions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Mandatory Disclosure $\times$ Above Median Emissions				0.943*** (0.139)	1.979*** (0.173)	1.104*** (0.108)			
Mandatory Disclosure $\times$ Log Emissions							0.440*** (0.0403)	0.763*** (0.0497)	0.507*** (0.0379)
Mandatory Disclosure	0.527*** (0.0860)	0.381 (0.401)	0.383*** (0.0806)	-0.0951 (0.114)	-0.919*** (0.331)	-0.344*** (0.0882)	-1.556*** (0.191)	-3.228*** (0.274)	-2.016*** (0.179)
Above Median Emissions				0.0129*** (0.00283)	0.0186*** (0.00435)	0.0127*** (0.00287)			
Log Emissions							0.00142*** (0.000290)	0.00200*** (0.000420)	0.00140*** (0.000289)
Mean dep. var.	4.050	4.050	4.050	4.050	4.050	4.050	4.050	4.050	4.050
Std dep. var.	1.495	1.495	1.495	1.495	1.495	1.495	1.495	1.495	1.495
Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Year FE	No	Yes	No	No	Yes	No	No	Yes	No
Industry $\times$ Year FE	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. obs.	4170	4170	4170	4170	4170	4170	4170	4170	4170

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

This table shows the results from specification (24), where the dependent variable is the one-year-ahead natural logarithm of firms' emissions. The regressors include either the dummy variable (i) Mandatory Disclosure $_{c,t}$, or (ii) an interaction term Mandatory Disclosure $_{c,t} \times$ Above Median Emissions $_{i,c,t}$ (Mandatory Disclosure $_{c,t} \times$ Log Emissions $_{i,c,t}$), with the corresponding uninteracted terms. Emissions are defined as the sum of Scope 1 and 2 emissions scaled by revenue. All regressions include firm, year, or industry $\times$ year fixed effects and control variables as indicated. The controls are listed in Section 5.3. Standard errors (in parentheses) are clustered at the country-year level.

Table 4: R&D expenditures

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Mandatory Disclosure $\times$ Above Median Emissions				-0.568*** (0.157)	-0.635*** (0.158)	-1.738*** (0.570)			
Mandatory Disclosure $\times$ Log Emissions							-0.359*** (0.0638)	-0.553*** (0.0537)	-1.136*** (0.353)
Mandatory Disclosure	-1.260*** (0.112)	-1.273*** (0.210)	-1.465*** (0.534)	-0.901*** (0.111)	-0.874*** (0.190)	-0.376 (0.246)	0.262 (0.251)	1.068*** (0.246)	3.345*** (1.054)
Above Median Emissions				-0.00658** (0.00285)	-0.00427* (0.00251)	-0.00482** (0.00194)			
Log Emissions							-0.000283 (0.000190)	-0.000216* (0.000129)	-0.000177* (0.000101)
Mean dep. var.	-3.387	-3.387	-3.387	-3.387	-3.387	-3.387	-3.387	-3.387	-3.387
Std dep. var.	1.571	1.571	1.571	1.571	1.571	1.571	1.571	1.571	1.571
Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Year FE	No	Yes	No	No	Yes	No	No	Yes	No
Industry $\times$ Year FE	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. obs.	2622	2622	2622	2622	2622	2622	2622	2622	2622

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

This table shows the results from specification (24), where the dependent variable is the one-year-ahead natural logarithm of R&D expenditures (scaled by total assets). The regressors include either the dummy variable (i) Mandatory Disclosure_{c,t}, or (ii) an interaction term Mandatory Disclosure_{c,t} $\times$ Above Median Emissions_{i,c,t} (Mandatory Disclosure_{c,t} $\times$ Log Emissions_{i,c,t}), with the corresponding uninteracted terms. Emissions are defined as the sum of Scope 1 and 2 emissions scaled by revenue. All regressions include firm year, or industry $\times$ year fixed effects and control variables as indicated. The controls are listed in Section 6.1. Standard errors (in parentheses) are clustered at the country-year level.

Table 5: Financing channel

	Annual return		Δ ICC		Low Z-score	
	(1)	(2)	(3)	(4)	(5)	(6)
Mandatory Disclosure $\times$ Above Median Emissions		0.0394 (0.0667)		-0.00108 (0.00550)		0.0186 (0.0283)
Mandatory Disclosure	0.0597 (0.0845)	0.0400 (0.0815)	0.00430 (0.00370)	0.00483 (0.00500)	0.100*** (0.0185)	0.0870*** (0.0222)
Above Median Emissions		-0.00886* (0.00454)		0.000173 (0.000195)		0.00157** (0.000780)
Controls	No	No	No	No	No	No
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
N. obs.	4204	4204	2716	2716	4072	4072

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

This table shows the results from specification (24), where the dependent variable is either (i) annual stock returns, (ii) the change in implied cost of capital (Δ ICC), or (iii) a dummy variable indicating a low Altman Z-score. The regressors include an interaction term $\text{Mandatory Disclosure}_{c,t} \times \text{Above Median Emissions}_{i,c,t}$, with the corresponding uninteracted terms. Emissions are defined as the sum of Scope 1 and 2 emissions scaled by revenue. All regressions include firm and year fixed effects as indicated. Standard errors (in parentheses) are clustered at the country-year level.

Table 6: PRI signatory vs Non-PRI signatory investors

	PRI Signatory Investors				Non-PRI Signatory Investors			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Mandatory Disclosure $\times$ Above Median Emissions	-3.071*** (0.662)	-2.683*** (0.675)			-8.307*** (1.856)	-5.730*** (2.172)		
Mandatory Disclosure $\times$ Log Emissions			-0.847*** (0.192)	-0.709*** (0.204)			-3.862*** (0.561)	-3.068*** (0.649)
Mandatory Disclosure	1.370** (0.578)	1.301* (0.704)	3.360*** (1.047)	2.900** (1.131)	-4.664*** (1.631)	-0.321 (2.119)	7.979*** (2.990)	10.27*** (3.080)
Above Median Emissions	0.0213 (0.0240)	0.0236 (0.0234)			-0.0601 (0.0429)	-0.0621 (0.0428)		
Log Emissions			0.000120 (0.00118)	0.000194 (0.00120)			-0.00294 (0.00200)	-0.00246 (0.00185)
Mean dep. var.	10.077	10.077	10.077	10.077	63.093	63.093	63.093	63.093
Std dep. var.	7.408	7.408	7.408	7.408	23.911	23.911	23.911	23.911
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. obs.	4464	4464	4464	4464	4464	4464	4464	4464

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

This table shows the results from specification (24), where the dependent variable is either the one-year-ahead share of PRI signatory institutional investors/Non-PRI signatory institutional investors (median over the year computed from quarterly holding data). The regressors include an interaction term $\text{Mandatory Disclosure}_{c,t} \times \text{Above Median Emissions}_{i,c,t}$ ($\text{Mandatory Disclosure}_{c,t} \times \text{Log Emissions}_{i,c,t}$), with the corresponding uninteracted terms. Emissions are defined as the sum of Scope 1 and 2 emissions scaled by revenue. All regressions include firm and year fixed effects, and control variables as indicated. The controls are listed in Section 5.2. Standard errors (in parentheses) are clustered at the country-year level.

Appendix

A Theory

A.1 Proof of Lemma 2

The green equilibrium exists if $f < (1 - \kappa)\bar{e}\pi\psi(\hat{\lambda}_G(f))$. Let f^1 be the solution of the equation $f = (1 - \kappa)\bar{e}\pi\psi(\hat{\lambda}_G(f))$. Since the right-hand side of this equation increases in f and is positive when $f = 0$, this implies that this equation has a unique solution $f^1 > 0$. Hence, the green equilibrium exists whenever $f \in [0, f^1]$. Moreover, we have

$$W_G^1 = \alpha_c + (\Delta - f)G(\hat{\lambda}_G) - \kappa\pi\bar{e} \int_0^{\hat{\lambda}_G} \lambda dG(\lambda) - \underline{e} \int_{\hat{\lambda}_G}^{\bar{\lambda}} \lambda dG(\lambda) = W_G^H(f, \kappa)$$

$$W_B^1 = \alpha_c + \Delta G(\hat{\lambda}_B) - \pi\bar{e} \int_0^{\hat{\lambda}_B} \lambda dG(\lambda) - \underline{e} \int_{\hat{\lambda}_B}^{\bar{\lambda}} \lambda dG(\lambda)$$

Assuming that W_G^H is decreasing in κ ,¹⁸ we have that $W_G^H(0, \kappa) > W_G^H(0, 1)$ as and by assumption $\kappa < 1$. Moreover, inspection of equations (4), (9) and W_G^H above reveal that $W_G^H(0, 1) = W_B^H$ thus $W_G^H(0, \kappa) > W_B^H$. Now, consider $f \in [0, f^1]$ so that the green equilibrium exists. Define $\bar{f}^1 = f^1$ if $W_G^H(f) > W_B^H \forall f \in [0, f^1]$. If $\exists \tilde{f} \in [0, f^1]$ such that $W_G^H(\tilde{f}) < W_B^H$ then $\bar{f}^1 = \inf\{f \in [0, f^1] : W_G^H(f) < W_B^H\}$.

A.2 Proof of Proposition 1

Case 1: If $f > (1 - \kappa)\bar{e}\pi\psi(\bar{\lambda})$ then we have that $\psi(\hat{\lambda}) < \psi(\bar{\lambda}) < \frac{f}{(1 - \kappa)\bar{e}\pi}$ for $\hat{\lambda} \in [0, \bar{\lambda}]$, therefore the green equilibrium does not exist.

Case 2: If $f \leq (1 - \kappa)\bar{e}\pi\psi(\bar{\lambda}) \iff \psi(\bar{\lambda}) \geq \frac{f}{(1 - \kappa)\bar{e}\pi}$, then there exists a unique $\underline{\Delta}$ such that $\psi(\hat{\lambda}_G(\underline{\Delta})) = \frac{f}{(1 - \kappa)\bar{e}\pi}$. Similarly, there exists a unique $\bar{\Delta} \leq \bar{\lambda}(\pi\bar{e} - \underline{e})$ such that $\psi(\hat{\lambda}_B(\bar{\Delta})) = \frac{f}{(1 - \kappa)\bar{e}\pi}$. This implies that the green equilibrium exists for $\Delta \geq \underline{\Delta}$ and the brown equilibrium exists for $\Delta < \bar{\Delta}$. Next, we can show that $\bar{\Delta} > \underline{\Delta}$. Assume that $\Delta = \bar{\Delta}$, then $\psi(\hat{\lambda}_B(\bar{\Delta})) = \frac{f}{(1 - \kappa)\bar{e}\pi}$ which implies that $\bar{\Delta} > \frac{(\pi\bar{e} - \underline{e})f}{(1 - \bar{e}\kappa)\pi}$, by using (4) and the fact that $\psi(\hat{\lambda}) < \hat{\lambda}$. Moreover, using (9), after tedious computations we can show that $\hat{\lambda}_G(\bar{\Delta}) > \hat{\lambda}_B(\bar{\Delta})$ and

¹⁸This assumption is sufficient but not necessary.

therefore $\psi(\hat{\lambda}_G(\bar{\Delta})) > \psi(\hat{\lambda}_B(\bar{\Delta})) = \frac{f}{(1-\kappa)\bar{e}\pi}$ which implies that the green equilibrium exists if $\Delta = \bar{\Delta}$ and that $\bar{\Delta} > \underline{\Delta}$ as $\psi(\hat{\lambda}_G(\bar{\Delta})) > \psi(\hat{\lambda}_G(\underline{\Delta})) = \frac{f}{(1-\kappa)\bar{e}\pi}$.

Finally, we can show that when both equilibria exist, then $\hat{\lambda}_G > \hat{\lambda}_B$. First, we have that $\hat{\lambda}_G(\Delta = \frac{(\pi\bar{e}-e)f}{(1-\kappa)\pi\bar{e}}) = \frac{f}{(1-\kappa)\bar{e}\pi}$. Moreover, we have $\psi(\hat{\lambda}_G(\Delta = \frac{(\pi\bar{e}-e)f}{(1-\kappa)\pi\bar{e}})) = \psi(\frac{f}{(1-\kappa)\bar{e}\pi}) < \frac{f}{(1-\kappa)\bar{e}\pi}$ which implies that the green equilibrium does not exist if $\Delta = \frac{(\pi\bar{e}-e)f}{(1-\kappa)\pi\bar{e}}$. Hence, $\underline{\Delta} > \frac{(\pi\bar{e}-e)f}{(1-\kappa)\pi\bar{e}}$ as the green equilibrium exists for $\Delta \geq \underline{\Delta}$. If the green equilibrium exists then $\Delta \geq \underline{\Delta} > \frac{(\pi\bar{e}-e)f}{(1-\kappa)\pi\bar{e}}$ and $\hat{\lambda}_G - \hat{\lambda}_B > 0 \iff \Delta > \frac{(\pi\bar{e}-e)f}{(1-\kappa)\pi\bar{e}}$. Therefore, if both green and brown coexist, then $\hat{\lambda}_G > \hat{\lambda}_B$. When both equilibria coexist, we have that $\hat{\lambda}_G > \hat{\lambda}_B$, which implies that polluting firms receive more capital in the green equilibrium but also pollute less. Hence, it could be that pollution is higher in the green than in the brown equilibrium, as shown by [Huang and Kopytov \(2023\)](#).

A.3 Proof of Proposition 3

The first part of the proposition follows directly from the interpretation of equation (21) in the text. The second part of the proposition can be demonstrated by taking the derivative of equations (6)-(8) and (11)-(13) with respect to π .

A.4 Proof of Proposition 4

The first part of the proof follows directly from the text. The proof for the second part follows directly from equations (15)-(17) and (18)-(20).

B Empirics

B.1 Variables Definitions

Table B1: Variable Descriptions and Sources

Variable	Description	Source
Mandatory Disclosure	Dummy variable equal to one starting in the first year in which a country introduced mandatory ESG disclosure, and zero otherwise.	Krueger et al. (2024)
Share inst. investors	Share of institutional investors in a given firm, computed as the median of quarterly institutional ownership over the year.	FactSet
log(Emissions)	Natural logarithm of the sum of Scope 1 and 2 emissions scaled by sales.	Trucost
Above Median Emissions	Dummy variable equals one if a firm has above median emissions (defined by scope 1 and 2 emissions scaled by sales) during a given year, and zero otherwise.	Trucost
log(Market-cap)	Natural logarithm of market capitalization, measured as <code>prcc_f * csho</code> .	Compustat
Dividend yield	Ratio of dividend per share ex-date (<code>dvpsx_f</code>) to the closing share price (<code>prccm</code>).	Compustat
log(Capex/Assets)	Natural logarithm of capital expenditures (<code>capx</code>) divided by total assets (<code>at</code>).	Compustat
Leverage	Ratio of total debt (<code>dlc + dlтт</code>) to total assets (<code>at</code>).	Compustat
Cash/Assets	Ratio of cash and short-term investments (<code>che</code>) to total assets (<code>at</code>).	Compustat
Market-to-book	Ratio of the sum of market value of equity (<code>prcc_f * csho</code>) and total debt (<code>dlc + dlтт</code>) to total assets (<code>at</code>).	Compustat

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Variable	Description	Source
Size	Natural logarithm of sales, $\log(\text{sale})$.	Compustat
Tangibility	Ratio of property, plant, and equipment (ppent) to total assets (at).	Compustat
ROA	Return on assets, calculated as net income (ni) divided by total assets (at).	Compustat
$\log(\text{R\&D}/\text{Assets})$	Natural logarithm of R\&D expenditures (xrd) divided by total assets (at).	Compustat
$\log(\text{K}/\text{L})$	Natural logarithm of physical capital (ppent) divided by labor (emp).	Compustat
$\log(\text{Market-cap}/\text{GDP})$	Natural logarithm of market capitalization ($\text{prcc_f} * \text{csho}$) divided by total GDP.	Compustat / World Bank
$\log(\text{GDP})$	Natural logarithm of total GDP.	World Bank
GDP Growth (in %)	Annual growth rate of total GDP, expressed in percent.	World Bank
Annual return	Annual stock return.	Compustat
Altman Z-Score	Altman Z-Score measure of financial distress.	Compustat
ΔICC	Change in implied cost of capital, using the GLS measure of Gebhardt et al. (2001) as evaluated by Lee et al. (2021).	Lee et al. (2021)
Low Z-score	Dummy variable equal to one if the firm's Altman Z-Score falls in the bottom decile, and zero otherwise.	Compustat