Information Frictions and the Real Effects of Sustainable Investing*

Minsu Ko† Cynthia Yin‡

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Abstract

Investors can influence firms only through what outsiders can measure. We present a simple model in which sustainable demand creates a pricing wedge, but the firm chooses both a costly internal social action and the precision of disclosure about it. When disclosure is too noisy or too costly, the wedge does not translate into real action. We test this prediction using confidential U.S. Census administrative wage records to measure firm-year employee gender pay gaps. With rich fixed effects, socially responsible ownership is unrelated to pay gaps. The relation turns more negative when boards include female directors, and these firms talk more about gender equality in earnings calls. Our results suggest that information asymmetry limits investors' ability to change hard-to-observe internal policies.

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†SC Johnson College of Business, Cornell University. E-mail: minsu.ko@cornell.edu.

‡SC Johnson College of Business, Cornell University. E-mail: cynthia.yin@cornell.edu.

1 Introduction

Can investors change what firms do when the relevant actions are hard to observe? This question is central to corporate governance: suppliers of capital can discipline managers only to the extent that markets and monitors can measure what managers choose. The same question has become central in the debate over socially responsible investing. A growing set of investors wants firms to pursue specific social objectives, and firms publicly commit to a wide range of social policies. Yet many of the underlying actions—pay practices, promotion decisions, workplace conditions, internal compliance—are not directly observable to outsiders. When actions are opaque, investor pressure may affect prices, ownership, and public communication without necessarily changing what happens inside the firm.

This paper studies information asymmetry as a friction that limits the real effects of investor preferences on firm actions. The basic logic is simple. If investors care about an outcome and can verify it, their demand can raise the price of firms that deliver the outcome, creating incentives for managers to supply it. But if the outcome is not verifiable, the "pricing" channel is weak: investors can reward only what they can observe, and firms can respond by supplying observable proxies or "talk" rather than costly real changes. In that environment, investor influence can look strong in outcomes that are easy to monitor (such as board composition) while remaining weak in outcomes that are economically important but hidden from outsiders (such as employee pay equity).

We formalize this mechanism in a stylized model that combines a taste-based wedge in prices with endogenous information production. Investor demand creates an incremental valuation benefit for perceived social performance, as in a taste-based asset-pricing wedge (Pástor, Stambaugh, and Taylor, 2021). The firm then chooses a real action and also chooses the precision of disclosure that allows outsiders to infer that action. Following the logic of endogenous disclosure (e.g., Admati and Pfleiderer, 2000), disclosure is costly, and it is more costly when credible measurement is difficult. Our key extension is that board quality lowers the cost of producing precise and credible disclosure

about an otherwise hard-to-observe social action. The model delivers a sharp "null under opacity": when information is too noisy or too costly, equilibrium features no meaningful disclosure and no real action, even if investors have strong social preferences. The model also delivers an "active" region in which investor demand has real effects, and those effects are stronger when board quality is higher because disclosure is cheaper and the action becomes more "priceable."

We then take the model to a setting where the outcome is important, costly to change, and typically not observable to investors: the employee-level gender pay gap. During our sample period, U.S. firms rarely disclose standardized measures of employee pay gaps, and wage information is proprietary. We measure employee pay gaps using restricted-access administrative wage records from the U.S. Census Bureau's Longitudinal Employer-Household Dynamics (LEHD) program. These data allow us to compute within-firm gender pay gaps while controlling for worker characteristics, following the residual-based approach in Goldin et al. (2017). Importantly for our question, this information is not publicly visible to investors. In some cases, the confidentiality of LEHD can be viewed as a limitation because it prevents investors from using the same data. Under our framework, that feature becomes an advantage: LEHD provides a clean laboratory for testing whether investor preferences have real effects when the relevant outcome is opaque to outsiders.

We merge LEHD to Compustat, CRSP, BoardEx, and institutional ownership data. We construct two complementary measures of socially responsible ownership. First, we use a revealed-preference approach that identifies institutional investors who increase holdings when firms appoint female directors over a rolling window, consistent with the idea that institutions use board gender composition as a public signal of gender-related policies (e.g., Friedman, 2020; Knippen, Shen, and Zhu, 2019). Second, we use mutual fund names that explicitly reflect social agendas to capture a cleaner but narrower measure of social preferences (following Van der Beck, 2025). We then estimate firm-year panel regressions of the employee gender pay gap on lagged socially responsible ownership with rich fixed effects that absorb broad correlated trends across industries, regions, and time. Throughout, we use causal language sparingly and interpret the estimates as

reduced-form correlations, since ownership and governance are endogenous and may co-move with unobserved firm policies.

Our first finding supports the model's null under opacity. Socially responsible ownership is negatively related to the employee gender pay gap in simple specifications, but the relation becomes economically small and statistically insignificant once we absorb time-varying industry and regional trends with granular fixed effects. This pattern is consistent with the idea that investor demand does not translate into real changes in an outcome that investors cannot verify. At the same time, socially responsible ownership is positively related to board-level gender diversity—an outcome that is publicly observable and easily monitored—and market valuations are related to board gender diversity but not to the employee pay gap. These contrasts suggest that investor influence can be strong where information is readily available, and weak where the relevant outcome is hidden.

Our second set of results examines heterogeneity consistent with the model's complementarity between sustainable demand and information production. The model predicts that sustainable ownership should have stronger real effects when disclosure is cheaper and more credible. We proxy for this channel using board composition: female directors may increase board attention to pay equity, improve internal measurement and oversight, and facilitate credible communication to outsiders. Empirically, the SRI–pay-gap slope is more negative in firms with at least one female director, and the interaction is strongest when there are two female directors. We also find that firms with female directors discuss gender equality more in earnings calls, consistent with greater information production. We interpret these patterns as suggestive reduced-form evidence rather than definitive causal effects.

The broader message is not limited to "ESG." The paper speaks to a general question in finance: when can outside investors affect real firm policies, and when do information frictions blunt that influence? Sustainable investing is an economically important context in which this question is visible, but the mechanism is older and more general. It is the same friction emphasized in the

disclosure and corporate governance traditions: without credible information, market discipline and external monitoring are weak, and equilibrium incentives can shift toward observable proxies rather than the underlying action.

Related Literature. This paper contributes to the literature on corporate governance and investor influence by emphasizing information production as a prerequisite for investor-driven change. The governance problem starts from the classic question of how suppliers of finance assure themselves of getting a return (Shleifer and Vishny, 1997; see also La Porta et al., 2002). A central insight of the disclosure literature is that information is endogenous and costly, and that forcing or facilitating disclosure can change incentives (e.g., Admati and Pfleiderer, 2000). Our model applies this logic to investor preferences over nonfinancial actions and highlights a simple prediction: investor demand can affect prices and ownership even when actions are opaque, but real effects on the action require credible information. This perspective is also consistent with evidence that board structure and governance are linked to firms' information environments and transparency (Adams, Hermalin, and Weisbach, 2010; Armstrong, Core, and Guay, 2014).

We also contribute to the sustainable-investing and impact-investing literature by providing a tractable mechanism that connects investor demand to real outcomes only when outcomes are measurable and communicable. Pástor, Stambaugh, and Taylor (2021) formalizes a taste-based pricing wedge in equilibrium, and related models link screening or investor tastes to prices and firm behavior (Heinkel, Kraus, and Zechner, 2001; Hong and Kacperczyk, 2009). On the demand side, investors respond strongly to salient sustainability signals and rankings, generating flow-induced reallocation toward "sustainable" assets (Hartzmark and Sussman, 2019; Riedl and Smeets, 2017). A growing literature studies when these preferences translate into corporate behavior through exit and engagement: Edmans, Levit, and Schneemeier (2024) models socially responsible divestment as a disciplinary force, while active ownership and shareholder engagement can affect firm policies and outcomes (Dimson, Karakaş, and Li, 2015; Flammer, 2015); Dyck et al., 2019 provides

international evidence linking institutional ownership to corporate social performance. We add an information-production margin to these channels and show why investor influence can be strong for highly observable governance proxies (such as board composition) yet weak for opaque internal outcomes (such as employee pay equity). This mechanism also speaks to evidence that ESG signals are noisy and often disagree across data providers (Berg, Koelbel, and Rigobon, 2022; Boffo and Patalano, 2020; Chen, Cohen, and Gurun, 2021; Gibson Brandon et al., 2022).

Finally, we contribute to the literature on gender inequality inside firms by bringing capital-market forces and information frictions into the analysis of employee pay gaps. We build employee-level gender pay gaps using administrative wage records and established residual-based methods (Goldin et al., 2017; see also Blau and Kahn, 2017), and we relate within-firm pay gaps to ownership and governance. Our approach complements matched employer-employee work showing that firms are central to wage-setting and pay gaps (Card, Cardoso, and Kline, 2016). We connect these outcomes to board composition and leadership, consistent with evidence that female leadership can shape gender-related labor outcomes (Dezső and Ross, 2012; Tate and Yang, 2015) and with the broader literature on board gender diversity and governance (Adams and Ferreira, 2009; Ahern and Dittmar, 2012; Matsa and Miller, 2013). We also speak to policy debates about gender-pay disclosure requirements by showing that the effectiveness of investor demand depends on whether the underlying outcome is observable and credibly communicated (Bennedsen et al., 2022; Lagaras et al., 2022).

The remainder of the paper is organized as follows. Section 2 presents the model and derives testable implications. Section 3 describes the data and measurement of the employee gender pay gap and socially responsible ownership. Sections 4–5 present the main empirical results and additional evidence on communication. Section 6 concludes.

2 A Stylized Model

This section presents a deliberately simple model of how sustainable investing can, and often cannot, affect a firm's *internal* social outcomes when outsiders face severe information frictions. The model combines two ingredients. First, a segment of investors derives utility from holding firms they believe to treat stakeholders well, which creates a valuation wedge in the spirit of Pástor, Stambaugh, and Taylor (2021). Second, the firm can invest in the *precision* (credibility) of disclosure about a hard-to-observe social action, in the spirit of Admati and Pfleiderer (2000). Our key extension is that board quality governs the cost of producing credible information.

The central mechanism is simple: sustainable investors can only reward what they can *price*, and they can only price what they can *infer*. When the firm's social action is opaque, the pricing wedge attaches to beliefs that do not move with reality. In that case, sustainable tastes do not induce real action. When disclosure becomes sufficiently informative—especially when board quality is high—the wedge becomes a real shadow price on the firm's social action, and sustainable ownership has bite.

Throughout, the model is not meant to be realistic. It is meant to isolate an economic logic: *prices discipline firms only through measurable objects*. Detailed derivations appear in Appendix B.

2.1 Setup

There is a representative firm with baseline fundamental value V_0. The firm can take a costly social action $a \geq 0$. In the application, think of a as a bundle of internal policies and investments that reduce an employee-level gender pay gap: pay audits, pay adjustments, promotion and hiring reforms, manager accountability, and related HR systems.

The firm has a board characterized by an observable quality parameter $q > 0$. Higher q means the board can (i) acquire and process internal information about a at lower cost, and (ii) credibly communicate that information to outsiders at lower cost. In the data, we proxy this board-quality

dimension using female board representation. The model is agnostic about whether this proxy works through attention, expertise, monitoring, credibility, or all of the above; it only requires that it reduces the marginal cost of producing credible information about the action.

There is a mass of investors. A share $\lambda \in [0,1]$ of them are "sustainable" in the sense that their demand shifts upward in the perceived social action of the firm. We summarize the strength of this demand by a reduced-form pricing wedge $\omega(\lambda) \geq 0$ with $\omega'(\lambda) > 0$. We treat λ as predetermined within the period; later we discuss what changes when sustainable ownership is itself endogenous.

Timing. (i) The firm begins with predetermined (λ, q); (ii) the board chooses disclosure precision $\tau \geq 0$; (iii) the manager chooses action $a \geq 0$; (iv) a public signal about a is realized; (v) investors price the firm.

2.2 Costs, information, and pricing

Board. The board chooses disclosure precision $\tau \geq 0$ at convex cost

$$H(\tau; q) = \frac{\kappa}{2q}\tau^2, \qquad \kappa > 0,\ q > 0. \tag{1}$$

This formulation captures, in the simplest possible way, that better boards make credible information cheaper.

Information. The market does not observe a. Instead it observes a noisy signal

$$y = a + \varepsilon, \qquad \varepsilon \sim \mathcal{N}\left(0, \frac{1}{\tau}\right). \tag{2}$$

We adopt a normal prior for outsiders' beliefs about a, $a \sim \mathcal{N}(0, \sigma^2)$. This prior variance σ^2 is a reduced-form measure of how uncertain outsiders are about the firm's internal social policy

absent disclosure. Under normal-normal updating, the posterior mean is

$$m(y,\tau) \equiv \mathbb{E}[a \mid y,\tau] = K(\tau)\, y, \qquad K(\tau) = \frac{\tau\sigma^2}{1+\tau\sigma^2} \in [0,1). \tag{3}$$

Pricing wedge. Following Pástor, Stambaugh, and Taylor (2021), we assume the time-0 price includes an additive wedge proportional to the market's *perceived* social action:

$$P = V_0 - C(a) - H(\tau; q) + \omega(\lambda)\, m(y,\tau). \tag{4}$$

The wedge is deliberately reduced form. It captures that when sustainable investors are marginal, expected social action commands a higher price (equivalently, a lower required return). The key point is that the wedge attaches to beliefs $m(y,\tau)$, not to the true action a.

Firm objective. Taking expectations conditional on (a,τ) and using $\mathbb{E}[m(y,\tau) \mid a,\tau] = K(\tau)a$, the firm-board chooses (a,τ) to maximize expected price:

$$\max_{a\geq 0,\ \tau\geq 0} \; V_0 - \frac{\theta}{2}a^2 - \frac{\kappa}{2q}\tau^2 + \omega(\lambda)\, K(\tau)\, a. \tag{5}$$

Action has convex cost

$$C(a) = \frac{\theta}{2}a^2, \qquad \theta > 0. \tag{6}$$

This objective can be interpreted as a reduced form for a firm that cares about its stock price because of managerial compensation, takeover discipline, or because it raises external finance and thus values a lower cost of capital. The analysis below does not depend on which interpretation one prefers.

2.3 Equilibrium

Fix $\tau \geq 0$. Maximizing (5) with respect to a yields

$$a^*(\lambda,\tau) = \frac{\omega(\lambda)}{\theta} K(\tau). \tag{7}$$

If disclosure is uninformative ($\tau = 0$), then $K(0) = 0$ and therefore $a^*(\lambda, 0) = 0$. Sustainable tastes in prices do not induce real action when actions cannot be credibly inferred from public information.

Substituting (7) into (5), the board chooses τ by trading off the cost of precision against the benefit of making action more "priceable." Define

$$A(\lambda, q) \equiv \frac{\omega(\lambda)^2 \sigma^4 q}{\theta \kappa}. \tag{8}$$

Then equilibrium disclosure precision is

$$\tau^*(\lambda, q) = \begin{cases} 0, & \text{if } A(\lambda, q) \leq 1, \\ \dfrac{1}{\sigma^2}\left(A(\lambda, q)^{1/3} - 1\right), & \text{if } A(\lambda, q) > 1, \end{cases} \tag{9}$$

so when $A(\lambda, q) \leq 1$, equilibrium features *no meaningful disclosure and no real action* ($\tau^* = 0$ and $a^* = 0$). In the active region $A(\lambda, q) > 1$, equilibrium action has the closed form

$$a^*(\lambda, q) = \frac{\omega(\lambda)}{\theta}\Big(1 - A(\lambda, q)^{-1/3}\Big). \tag{10}$$

2.4 Economic mechanism and discussion

What gets priced is beliefs, not reality. Equation (4) is the whole story. Sustainable investors pay for what they *think* the firm does, not for what the firm *actually* does. The gap between beliefs and reality is an information problem, and in the model that problem is governed by τ.

This perspective is useful because it separates two questions that are often conflated in discussions of ESG: (i) do investors care, and by how much (captured by $\omega(\lambda)$)? and (ii) can investors tell which firms actually take costly actions (captured by $K(\tau)$)? The model says that without (ii), (i) does not deliver real effects.

Disclosure and action are complements, which creates tipping. The reason we obtain a sharp threshold is that disclosure is valuable only if the firm takes action, and action is valuable

only if disclosure makes it priceable. To see this, start from $a = 0$. Then the benefit of raising τ is zero because there is nothing to learn. Similarly, if $\tau = 0$, then $K(0) = 0$ and the marginal return to a is zero. This complementarity yields the "inactive" region $A(\lambda, q) \leq 1$ and the "active" region $A(\lambda, q) > 1$.

The parameter $A(\lambda, q)$ has a transparent interpretation: it is a signal-to-cost ratio. Higher sustainable demand (higher $\omega(\lambda)$), greater outsider uncertainty (higher σ^2), and better boards (higher q) all increase the value of information and therefore make it more likely that the firm crosses the threshold.

Why board quality matters here. In many models, the board matters because it monitors the CEO. Here the board matters because it reduces the cost of producing credible information about a socially relevant internal action. In practice, this can arise because (i) some boards are better at getting the organization to measure internal outcomes (pay audits and dashboards), and/or (ii) outsiders are more willing to believe disclosure coming from boards with certain characteristics, including gender diversity.

Observable proxies and "window dressing." The model above treats a as the only socially relevant action, and it is hard to observe. In the gender-equality application, that is exactly what makes the problem interesting: the employee-level pay gap is typically not directly observable to outside investors in real time. But investors do see (and many explicitly use) board composition.

A simple way to capture this is to add a second action $b \geq 0$ that is *perfectly observable*, with cost $C_b(b) = \frac{\theta_b}{2} b^2$, and with a pricing wedge $\omega_b(\lambda)\, b$. Think of b as a visible governance choice (e.g., appointing female directors, adopting a public policy, or joining a pledge). Then the firm chooses

$$b^*(\lambda) = \frac{\omega_b(\lambda)}{\theta_b}$$

regardless of τ and regardless of what happens to a. In other words, sustainable tastes can move

visible objects even when they do not move *hidden* ones. We use the term "observable proxy" without implying deception: when outsiders monitor b but cannot verify a, equilibrium incentives tilt toward the measurable dimension. This extension motivates our empirical contrast between board gender diversity and employee pay gaps (Tables 3 and 4).

Endogenous sustainable ownership and self-fulfilling transparency. We have taken λ as predetermined. In reality, sustainable ownership often follows disclosure: as firms communicate more, they enter ESG screens, attract ESG funds, and face different marginal investors. If we allow λ to increase in perceived action or disclosure (e.g., $\lambda = \Lambda(m, \tau)$ with Λ increasing), then the complementarity between action and disclosure can generate tipping dynamics. In such an extension, an increase in sustainable ownership raises disclosure, which raises perceived action, which raises sustainable ownership further. This can produce multiple regimes (low disclosure/low action vs. high disclosure/high action), and small shifts in attention can move firms across regimes.

Appendix C develops a minimal dynamic extension in which sustainable ownership adjusts gradually to perceived social performance, generating path dependence and low-information traps.

Forced disclosure. Finally, it is straightforward to introduce a forced-disclosure policy (a lower bound $\tau \geq \underline{\tau}$). By construction, forced disclosure increases $K(\tau)$ and therefore raises the return to action a in (7). In settings where transparency rules change, the model predicts that sustainable ownership becomes more potent precisely when disclosure becomes more credible.

2.5 Testable predictions

The model delivers three testable implications that map directly to our empirical design. Full derivations are in Appendix B.

Proposition 1 (Null under opacity). *If employee-pay equity is not credibly inferable from public information, sustainable-investing tastes in prices do not induce real action: equilibrium features*

no meaningful disclosure and no real action.

Proof. If disclosure is uninformative, then $\tau = 0$ and $K(0) = 0$ in (3). The manager's best response in (7) satisfies

$$a^*(\lambda, 0) = \frac{\omega(\lambda)}{\theta} K(0) = 0.$$

Moreover, equilibrium precision in (9) is

$$\tau^*(\lambda, q) = 0 \quad \text{whenever} \quad A(\lambda, q) \leq 1,$$

which implies $a^*(\lambda, q) = 0$ in that region.

Intuition. The pricing wedge rewards only what investors can *credibly infer* about the firm's social action. When the signal is too noisy (or too costly to make precise), investors' beliefs do not move with the true action. The firm therefore cannot raise its price by taking costly action, and the board does not pay to produce disclosure precision.

Proposition 2 (Board quality amplifies sustainable ownership). *In the active region, both disclosure and action increase in sustainable-investor intensity and board quality, and the effect of sustainable ownership on action is larger when board quality is higher.*

Proof. For $A(\lambda, q) > 1$, equilibrium action is

$$a^*(\lambda, q) = \frac{\omega(\lambda)}{\theta}\Big(1 - A(\lambda, q)^{-1/3}\Big) \quad \text{from (10)}.$$

Let $A \equiv A(\lambda, q)$. Differentiating yields

$$\frac{\partial a^*}{\partial \omega} = \frac{1}{\theta}\Big(1 - \frac{1}{3}A^{-1/3}\Big) > 0, \qquad \frac{\partial a^*}{\partial q} = \frac{\omega(\lambda)}{3\theta q} A^{-1/3} > 0, \tag{11}$$

and the complementarity is captured by

$$\frac{\partial}{\partial q}\Big(\frac{\partial a^*}{\partial \omega}\Big) = \frac{1}{9\theta q} A^{-1/3} > 0. \tag{12}$$

Since $\omega'(\lambda) > 0$, the same comparative statics hold with respect to λ.

Intuition. Sustainable ownership increases the valuation benefit from making the firm's action "priceable." A higher-quality board reduces the marginal cost of producing precise and credible information. This raises τ, strengthens the mapping from action to investors' posterior mean, and increases the return to taking real action. Because disclosure and action are complements in (5), sustainable ownership has a larger effect when board quality is higher.

Proposition 3 (Board quality predicts more disclosure/communication). *Higher board quality leads to more information production and makes it more likely that the firm operates in the active region.*

Proof. Equilibrium precision is given by (9). When $A(\lambda, q) > 1$,

$$\tau^*(\lambda, q) = \frac{1}{\sigma^2}\big(A(\lambda, q)^{1/3} - 1\big), \qquad \frac{\partial \tau^*}{\partial q} = \frac{1}{3\sigma^2 q} A(\lambda, q)^{1/3} > 0.$$

Because $A(\lambda, q)$ is increasing in q, higher q also expands the set of (λ, q) such that $A(\lambda, q) > 1$.

Intuition. When the board can generate credible disclosure at lower cost, it chooses higher precision. This makes investors' beliefs more sensitive to the firm's true action, which increases the payoff to taking real action and moves the equilibrium into the "active" region more often.

Empirical mapping. We map the model's objects to the data as follows. **Action**, a, is the employee gender pay gap constructed inside each firm-year from LEHD micro wage records, following Goldin et al. (2017) (Section 3.2); we also report mean/median difference measures. **Sustainable demand**, λ, (and the associated wedge $\omega(\lambda)$) is proxied by firm-year socially responsible ownership, constructed either from institutions' revealed preference around female-director appointments or from mutual-fund names (Section 3.3). **Board quality / information production**, q, is proxied by female board representation (BoardEx). **Disclosure precision**, τ, is not observed directly; in Section 5.2 we use earnings-call gender-equality language as a public proxy for information production.[1] With these mappings, we test Proposition 1 in

[1] We use two word lists to separate narrow gender terms from broader diversity terms.

Section 4 (Table 2); Proposition 2 in Section 5 via interaction and heterogeneity tests (Tables 5 and 7); and Proposition 3 using earnings-call transcripts (Table 8). The observable-proxy extension motivates the additional contrast that sustainable ownership predicts visible governance outcomes (female directors) more strongly than it predicts the opaque employee pay gap (see Tables 3 and 4). We interpret the evidence as reduced-form associations consistent with the model's mechanisms rather than a one-for-one structural mapping from theory to empirics.

Proposition 1 implies a sharp benchmark: when employee pay equity is hard to verify, sustainable-investing demand should have little bite on the underlying outcome, so the reduced-form relation between SRI and the employee-level gender pay gap should be weak once we absorb broad correlated trends with rich fixed effects. Proposition 2 then pinpoints when investor influence should reappear: because disclosure and action are complements, the sensitivity of the pay gap to SRI should be more negative in firms with higher board quality, proxied by female directors. Proposition 3 shifts attention from outcomes to information: higher board quality should be associated with greater information production, so firms with female directors should communicate more about gender equality (for example, in earnings calls). We take these implications to the data in Sections 4–6

3 Data and Measures

The model emphasizes that the central friction is informational: investors can easily observe governance choices such as board composition, but they do not directly observe employee-level pay equity. This distinction guides our measurement choices. We therefore combine administrative employee data that allow us to measure the gender pay gap within firm-year with public data on board composition, institutional ownership, and managerial communication, so that the objects in the empirics align closely with the model's action, sustainable demand, board quality, and disclosure precision.

3.1 Data and Sample Construction

We construct a longitudinal dataset of public companies from 2001 to 2021 using the 2021 snapshot of the U.S. Census Bureau's Longitudinal Employer-Household Dynamics (LEHD) data. LEHD data are collected from the unemployment insurance records of states participating in the program. The missing types of employment differ slightly from state to state due to variations in state unemployment laws, but these data generally exclude agricultural employees, federal employees, domestic workers, employees of nonprofit organizations, and employees of religious organizations. LEHD research extracts are released in discrete vintages ("snapshots") rather than being updated annually. Our analysis uses the 2021 LEHD snapshot, which contains wage records spanning 2001–2021 for participating states. Prior work relying on older vintages (e.g., the 2014 snapshot) was mechanically constrained to a shorter panel that largely predates the rapid post-2014 growth in sustainable investing (Gibson Brandon et al., 2022). Using the 2021 snapshot is therefore critical for studying sustainable investing in the modern era. The starting year of analysis is 2001 because eight states were first included in LEHD data in early 2000, and the socially responsible investment variable was made available in 2001.[2] Researchers who are not affiliated with the U.S. Census Bureau have access to the 26 states.[3] Some companies may be headquartered in non-sample states (for example, in Florida) but have establishments in LEHD states (for example, California), and they are included in the sample as long as they pass the filing criteria described below.

The LEHD data are merged with Compustat data at the firm-year level using the Compustat–SSEL Bridge; and are further merged with BoardEx and CRSP. After merging these data with Compustat, BoardEx, and CRSP, we filter the data to include only U.S.-incorporated firms (Compustat or CRSP acronym: FIC) whose common stocks ($10 \leq \text{SHRCD} \leq 11$) are listed on the NYSE, AMEX, and Nasdaq exchanges ($1 \leq \text{EXCHCD} \leq 3$). Additionally, sample firms need to

[2]BoardEx data starts from 2000. As Section 3.3 elaborates, we use female directors and institutional investment in the rolling window to identify gender-sensitive institutional investors. Therefore, the analysis starts from 2001.

[3]The states are Arizona, California, Colorado, Connecticut, Delaware, Indiana, Iowa, Maine, Maryland, Massachusetts, Nevada, New Jersey, New Mexico, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Utah, Virginia, Washington, Wisconsin, and Wyoming.

have at least 10 employees after the top seven highest-paid employees have been removed. Because we do not directly observe the occupations of individuals, we exclude the top seven highest-paid employees to focus on the employee-level gender pay gap. The median number of members of the board of directors during the sample period is seven. We further restrict the sample to firms with at least one member on their board of directors per BoardEx data and with valid institutional ownership data within LSEG 13F Holding data. After filtering, we combine the data with data from the CRSP Mutual Fund database. The resulting number of observations is 54,000 firm-years, which is rounded to the nearest 500 observations for the observance of the US Census disclosure requirement.

3.2 Measures: Gender Pay Gap

We measure the gender pay gap by estimating abnormal salary differences after controlling for individual characteristics within a firm-year, as is done in Goldin et al. (2017). Using this residual-based approach, we can measure the unexplained part of the wage difference between male and female employees after controlling for age, experience, race, education levels, and country of origin. Specifically, for each firm-year, we construct a panel with all employees except for the top seven highest-paid employees. In this way, we can more accurately measure the gender pay gap at the employee level, rather than at the director level. We then regress the logarithm of annual wages on an indicator variable for gender along with other individual characteristics within each firm-year.[4]

$$\begin{aligned}\log\left(AnnualWage\right)_{i,t} =& \beta_{f,t} * 1\left(Female\right)_i \\ &+ Race_i + BirthCountry_i + Education_i + Experience_{i,t} + Age_{i,t} \quad (13)\end{aligned}$$

The definitions of other individual characteristics are given in Appendix Table A.1. Here, the coefficient $\beta_{f,t}$ is the within-firm-year *log wage* difference between female and male employees after

[4]LEHD classifies gender only based on gender-at-birth, rather than individuals' sexual identities by year. In this paper, we use the term "gender" to represent gender-at-birth for the sake of brevity.

controlling for worker characteristics. We take the negative value of $\beta_{f,t}$ and define it as the gender pay gap; for readability, we report the pay gap in percentage-point units (i.e., $Gap_{f,t} \equiv -100 \times \beta_{f,t}$). Because the dependent variable is log wages, $Gap_{f,t} = x$ can be interpreted as female wages being approximately x% lower than male wages (exactly, $w_F/w_M = \exp(-x/100)$).

Figure 1 depicts the kernel density plot of the gender pay gap. To avoid the risks of revealing the identities of individual companies as required by the Census Bureau, we use a kernel density plot instead of a histogram and truncate the data at the 5% and 95% levels. The figure indicates that the gender pay gap of all firm-years after truncation lies in positive regions, meaning that females are disadvantaged in most companies across the years examined. The average gender pay gap is 24.8%, which is close to that reported in the literature.[5] Interpreting the log-wage specification, this magnitude corresponds to female wages about 22% lower than male wages in logs (i.e., $e^{-0.248} \approx 0.78$). The standard deviation of the gender pay gap is 15.5%. This implies that some firms have a near-zero gender pay gap while others have large gender pay gaps.

As an alternative, we do not rely on the parametric assumptions of equation (13). We take a simple approach, subtracting the mean (median) of the female workers' wages from the mean (median) of the male workers' wages. We scale this value on the basis of the mean (median) wages of all workers. The average gender pay gap is 29.3% based on the difference in the mean and 28.8% based on the difference in the median. The simple difference in the mean or in the median is greater than the gender pay gap estimated with equation (13), and this difference is statistically significant at the 1% level. A greater gender pay gap without controlling for characteristics implies that social discrimination outside firms results in undesirable characteristics for females, such as lower education levels and limited experience.

While the gender pay gap can be interpreted as inequality in the quality aspect of job supply, we also examine the quantity aspect by examining the proportions of female workers in a company.

[5]Previous papers find that the gender pay gap is 24.7% from 2009 to 2011 in the United States (Goldin, 2014), 21.2% from 1993 to 2019 in the United Kingdom (Lagaras et al., 2022), and 15.4% from 2003 to 2005 in Denmark (Bennedsen et al., 2022)

Specifically, we measure the proportion of female employees within a firm-year. Similar to the gender pay gap, we exclude the top seven highest-paid individuals within each firm-year. During the entire sample period, the proportion is 42.2%, implying that there are fewer females than males in a firm. This number is consistent with statistics from the Bureau of Labor Statistics, showing that the female labor participation rate (56.5%) is lower than that of its male counterpart (67.8%) in 2021.

Figure 2 shows a time series of the gender pay gap and the proportions of employees by gender. Panel A shows that the gender pay gap has decreased steadily over the last two decades. The results are consistent for different measures of the gender pay gap. The gap is 28% for 2001, and it decreases to 21% for 2021. When we use the difference in the mean (median), it decreases from 34% (33%) to 24% (24%).[6] These results regarding a secular decline in the gender pay gap are consistent with those of prior studies. For example, Blau and Kahn (2017) finds a decreasing trend in the gender pay gap from 1980 to 2010 in the Panel Study of Income Dynamics (PSID). Additionally, the proportion of female employees decreases slightly from 43% in 2001 to 41% in 2021. This finding is consistent with those of previous studies (Olivetti and Petrongolo, 2016) and policy reports showing that female participation rates decreased after the Global Financial Crisis and the COVID-19 crisis.[7] However, the proportion of female board directors dramatically increases, rising from 9% to 28%. This is because of investors' recent preference for more females on the board of directors and because some jurisdictions, such as California in 2018, require certain quotas in terms of female directors at companies (Gertsberg, Möllerstrom, and Pagel, 2021).

3.3 Measures: Socially Responsible Investments

For the main explanatory variables, we utilize two separate methods to identify socially responsible investments. First, we adopt the revealed preference approach, measuring changes in institutional holdings around changes in the composition of the board of directors with regard to female members

[6]The difference between the residual-based measure and the two simple measures decreases over time from 7% to 3%, and it implies that the disadvantages in characteristics that women had decrease over time.

[7]For further discussions, see the Bureau of Labor Statistics Report 1103, Apr 2023.

over the previous 5 years. Institutional investors usually use the proportion of female directors to gauge gender equality within a company. For example, State Street Global Advisor, Vanguard, and BlackRock, which are the three largest investment companies, use the number of female directors to measure gender equality. Prior studies also suggest that institutional investors have a preference for firms with more female directors (Knippen, Shen, and Zhu, 2019; Friedman, 2020). By examining institutional investors' trades when firms appoint female directors, we identify institutions that reveal a preference for gender equality.

Revealed-preference SRI (13F). We construct the revealed-preference measure in three steps. *Step 1 (estimate institution-year sensitivity).* For each institution-year (i, t), we estimate how the institution reallocates across firms in response to changes in board gender composition using a rolling five-year window of firm-year observations:

$$\Delta \frac{Investment}{AssetsUnderManagement}_{i,f,t-n} = \gamma_{i,t} * \Delta \frac{FemaleDirectors}{AllDirectors}_{f,t-n} + Controls_{f,t-n} \quad (1 \leq n \leq 5) \qquad (14)$$

Step 2 (classify socially responsible institutions). Controls include firm size, past returns, and profitability. We classify institution i as socially responsible in year t if $\gamma_{i,t} > 0$ and is statistically significant.

Step 3 (aggregate to firm-year ownership). We then aggregate holdings by socially responsible institutions and scale by shares outstanding to obtain firm-year socially responsible ownership.[8] This approach offers an advantage in that it can capture the general demand for social responsibility regardless of institution types because 13F includes various institutional investors, such as mutual funds, hedge funds, and pension funds. However, it may capture other demands if the nomination of a female director and institutional investment are jointly correlated with omitted demands for stocks. Additionally, it may capture the potential demands of institutional investors who have a preference for board-level gender equality but not necessarily for employee-level gender equality.

[8] It measures ownership rather than investment, i.e., changes in ownership. We still name it as socially responsible investment, since it is a commonly used phrase in literature and media.

To complement the aforementioned drawbacks of the first measure, we select mutual fund names that include words related to social concerns, as outlined in Van der Beck (2025), classifying these funds as socially responsible institutional investors. We aggregate socially responsible mutual funds' holdings within a firm-year and divide them by the number of shares outstanding.[9] This approach more cleanly targets stated social preferences because the fund name signals a social mandate, though it is narrower than 13F-based ownership and may understate the total universe of socially motivated capital. We cannot conduct a similar analysis with other types of investors than mutual funds because data on fund-level names are not available except for mutual funds. However, it significantly underestimates the entire demand for social responsibility because it does not include institutional investors other than mutual funds and because mutual funds are known to incorporate social factors in their prospectus even though they are not focused on ESG funds (Nofsinger, Sulaeman, and Varma, 2019). In summary, compared to the first approach, the second approach has a lower probability of type-1 errors at the cost of a higher probability of type-2 errors. Thus, we use both approaches to complement each other.

Table 1 describes the summary statistics of the main variables and control variables. Since ranking variables (such as the median and maximum) are subject to higher disclosure requirements by the U.S. Census Bureau, we report the mean, standard deviation, and skewness. All continuous variables are winsorized at the 1% and 99% levels. The definitions of control variables are provided in Appendix Table A.1. As shown in Figure 1, the gender pay gap is positive and subject to large standard deviations. The positive skewness of the pay gap also indicates that some firm-years have a very large gender gap. When we control for characteristics, under this measure, the standard deviation is lower, and the skewness is closer to zero than it is under measures based on the mean or median. This implies that a large portion of the variation in the gender pay gap arises from

[9] Van der Beck (2025) measures the mutual funds' demand for environmental, social, and/or governance factors. We start with his list of words. However, because gender equality is only clearly related to the social factor, we do not include words that are related to only environmental or governance concerns. After filtering them, the word list we use is: social, impact, fair, gender, screen, ethical, conscious, SRI, ESG, and CSR. The last three words are case-sensitive, and other words are not.

variations in preexisting discrimination against female employees, such as education.

Socially responsible investment accounts for 0.65% of outstanding shares when we use the revealed preference approach and 0.03% when we use mutual fund names. This number is significantly smaller than that provided by media reports on ESG investing.[10] This is because we focus only on social factors while other measures rely on the self-reporting of institutional investors, which is subject to self-reporting biases (Boffo and Patalano, 2020; Chen, Cohen, and Gurun, 2021; Gibson Brandon et al., 2022). We rely on investors' actions, such as adjustments made to ownership and fund names, so our measures account for companies with less investment.

In the last column of Table 1, we show the averages of the Compustat companies. We restrict the Compustat firms to those incorporated in the United States, those with common stocks that are traded on the NYSE, AMEX, or Nasdaq, those that have at least ten employees, and those with nonmissing observations in the LSEG 13F Holding data. Because there are no data on employees' gender and wage in Compustat, we do not report the gender equality variables. The characteristics of the sample firms are comparable to the average characteristics across Compustat firms. If all employees are hired in non-LEHD states, they are omitted from our samples, so the number of our sample firms is approximately 6.3% less than the number of Compustat firm-years during the sample periods.

4 Relation Between Socially Responsible Investment and the Gender Pay Gap

We begin with the simplest implication of the model. Proposition 1 predicts a "null under opacity": if employee-level pay equity is not credibly inferable from public information, sustainable-investing demand should not systematically induce real action, and the reduced-form relation between SRI and the employee gender pay gap should weaken once we control for broad time trends and other

[10]For example, Gibson Brandon et al. (2022) reports that 38.4% of institutional holdings are by institutional investors that signed the UN Principles for Responsible Investment (PRI) in North America in 2017.

correlated shocks with rich fixed effects. We therefore estimate standard firm-year panel regressions of the pay gap on lagged SRI ownership under progressively more demanding fixed-effect structures.

We employ a standard empirical methodology, regressing the gender pay gap on lagged socially responsible investment with a firm-year panel. Although we use the lagged independent variables to alleviate endogeneity, the results are qualitatively similar when we examine the contemporaneous relation. We include control variables related to labor costs, such as firm size, profitability, and investment (e.g. Brown and Medoff, 1989; Card, Devicienti, and Maida, 2014). Depending on the columns, we include various fixed effects such as industry-fixed effects (3-digit Standard Industrial Classification (SIC)), state-fixed effects, and year-fixed effects.[11] Alternatively, we include industry-times-year fixed effects or state-times-year fixed effects, which account for time-varying industry shocks or regional shocks to the size of the gender pay gap. Because both the dependent variable and the explanatory variables are correlated within a firm, we cluster standard errors at the firm level.

Table 2 shows the relation between the gender pay gap and socially responsible investment. The relation is negative in every specification, but the statistical and economic significance differ sharply with the fixed effects. Column 1 shows that the coefficient of socially responsible investment is -0.481 and statistically significant at the 1% level. Interpreting units, a one-percentage-point increase in SRI ownership (about 0.73 standard deviations) is associated with a 0.48 *percentage-point* lower pay gap. Relative to the mean pay gap of 24.8 percentage points (Table 1), this is about a 2% reduction in the average gap. Adding firm characteristics in Column 2 does not materially change the estimate. However, the relation attenuates once we absorb broad correlated shocks with fixed effects. Column 3 includes industry-, state-, and year-fixed effects, and Column 4 includes industry×year and state×year fixed effects. In Column 4, the coefficient decreases to -0.058 and is statistically indistinguishable from zero (p-value equals 30.8%). The sharp attenuation suggests

[11] Firms can have multiple establishments in different states for each year. In this case, we set the establishment with the most employees as their location of the state-fixed effects.

that the negative relation in parsimonious specifications is largely driven by common trends and other broad shocks rather than within-industry/region variation.

Regarding the control variables, we find a robust positive relation between the gender pay gap and both firm age and firm size. Previous papers note that male employees benefit in larger firms, possibly because of the career interruption female employees experience due to motherhood (Oi and Idson, 1999; Bertrand, Goldin, and Katz, 2010). The effects of leverage flip the signs depend on the inclusion of fixed effects.

Column 5 uses an alternative measure of the gender pay gap based on the difference in mean, and Column 6 relies on the difference in the median. The results are qualitatively the same as Column 4, meaning that the effects of socially responsible investment are not significantly different from zero. In Column 7, we measure socially responsible investment with the names of mutual funds and reach the same conclusion.

Our preferred specification in Column 4 delivers the paper's central benchmark for economic magnitude once we net out broad time-varying industry and regional shocks. The 90% confidence interval for the SRI coefficient ranges from -0.152 to 0.036, implying that even the most negative plausible slopes are modest in size. We interpret this pattern as consistent with Proposition 1's "null under opacity": when the underlying outcome is hard for outsiders to verify, sustainable demand can exist without translating into systematic changes in the real internal action. At the same time, the confidence interval leaves room for heterogeneity across governance environments, which motivates the interaction and heterogeneity tests in Section 5.

In Appendix Table A.2, we redo the analysis in Table 2 but replace socially responsible investment with all institutional investment or non-socially responsible investment. All institutional investment is defined as the sum of institutional holdings in 13F over outstanding shares, and non-socially responsible investment is all institutional investments minus socially responsible investments. There is a positive and significant relation between the gender pay gap and all

institutional investment (or non-socially responsible investment), implying that in Table 2, socially responsible investment is at least more negatively sensitive to the gender pay gap than general institutional investment is.

Next, we replace the gender pay gap with the proportion of female employees in a firm. Table 3 presents the results indicating that socially responsible investment is weakly correlated with a lower proportion of female workers in a company. The relation is statistically significant at the 10% level when we include various fixed effects, as shown in Columns 2 and 3. A negative relation indicates that socially responsible investment is at least not positively correlated with the proportion of female workers in a company. This effect is strikingly different from the effects of socially responsible investment on the proportion of female directors on the board. Columns 4 to 6 indicate that socially responsible investment is positively correlated with the proportion of female directors, and this relation is statistically significant at the 5% level when we include fixed effects. This finding is consistent with the prior studies showing that socially responsible investment is correlated with director-level gender equality. Our results indicate that the argument cannot be directly extended to employees.

The results in Tables 2 and 3 show that, although socially responsible investments are associated with a greater proportion of female directors, they are not significantly related to the gender pay gap. This discrepancy arises from differences in the level of information availability regarding directors versus employees. Information on the proportions of directors is readily available to all investors in disclosures, but the proportions and wage information of employees are not available to investors.

Furthermore, we test the implications of the availability of information related to gender equality for the market valuation of a company. When investors prefer firms with a lower gender pay gap, we can expect firms to have higher market valuations after controlling for firm characteristics. However, if the employee-level gender pay gap is not communicated to investors, the gender pay gap may have a nonsignificant relation with market valuations.

Specifically, in Table 4, we regress the year-end market value of assets over the book value of assets on the current year's employee-level gender pay gap and the proportion of female directors. We include control variables for firm size, firm age, and profitability to control for the determinants of market valuations. We also include industry-times-year fixed effects and state-times-year fixed effects.

Column 1 in Table 4 indicates that the employee-level gender pay gap is not significantly related to market valuations. Although not significant, the sign of the coefficient is negative. This finding is starkly different from the results regarding the proportion of female board of directors in Column 2. A percentage point increase in the proportion of female directors is related to a 0.59 percentage point increase in the market valuation, and these relations are economically and statistically significant. In Column 3, we include both the gender pay gap and the proportion of female directors. Surprisingly, the coefficient of the gender pay gap is negative and statistically significant at the 10% level. The results show that although director-level gender equality is positively related to the demand of investors, the employee-level gender pay gap is not related to higher market valuations.

In summary, once we absorb time-varying industry and regional shocks with granular fixed effects, socially responsible investment is not significantly related to the employee gender pay gap or the proportion of female employees, even though it is positively related to female board representation. This contrast is consistent with the idea that investors can move outcomes that are easy to observe, while having weaker effects on opaque employee-level outcomes. In the following section, we show that the relation between socially responsible investment and the gender pay gap becomes stronger in firms with at least one female director, and we examine why.

5 Sensitivities Depending on the Female Board of Directors

The model also delivers a sharper cross-sectional prediction. Proposition 2 implies that sustainable ownership has stronger real effects when board quality is higher, because higher-quality boards

reduce the cost of producing credible information and thereby make action more "priceable." In the data, we proxy this board-quality channel with female board representation. We therefore test whether the relation between SRI and the employee gender pay gap is more negative in firms with female directors by estimating interaction specifications and related heterogeneity tests.

5.1 Interaction Between Socially Responsible Investment and Female Directors

The drive for gender equality on the board of directors has been prominent. Many institutional investors voluntarily implement explicit or implicit investment mandates expressing that they will not invest in a company without female members on their boards of directors (e.g., State Street, BlackRock, and California State Teachers' Retirement System). Owing to this social drive, the proportion of female directors on firms' boards increased from 9% in 2001 to 28% in 2021. In this section, we investigate whether the presence of female directors relates to the sensitivity between socially responsible investment and the employee-level gender pay gap. Firms with more female directors pay more attention to employee-level gender equality. Also, females in higher ranks have a preference for gender equality by themselves. Previous studies, such as Tate and Yang (2015), find that female leadership in a plant leads to a lower gender pay gap.

The presence of female directors can strengthen the aforementioned relation in two ways. First, female directors can convey information about gender equality to outside investors, decreasing information asymmetry. Second, female directors are more likely to implement equal pay for employees when there are institutional demands for equal pay. Previous studies, such as Tate and Yang (2015), find that female leadership decreases the gender pay gap, implying decreased agency problems for female leadership on the topic of gender equality.

To test the effects of female directors on the relation between socially responsible investment and the gender pay gap, we include an interaction variable between socially responsible investment and an indicator variable for female directors. This indicator equals one when a firm-year includes at least one female director at the end of the year. The unconditional average of this indicator

variable of the Compustat company is 61.8%.

Table 5 presents interaction specifications. The coefficient on lagged SRI captures the slope in firms without female directors ($1(\#FemaleDirectors \geq 1) = 0$), and the interaction coefficient captures the incremental slope when the board includes at least one female director. In specifications with richer fixed effects (Columns 2–3), the interaction term is negative and statistically significant. In Column 3 (with industry×year and state×year fixed effects), the SRI slope is 0.117 when the board has no female director, while the incremental slope is -0.266 when the board has at least one female director; the implied slope for firms with female directors is therefore negative (0.117-0.266 = -0.149). This pattern is consistent with Proposition 2's complementarity: sustainable ownership is more strongly associated with smaller pay gaps in governance environments where information production and credible communication are plausibly cheaper. The interaction results are qualitatively similar when we use alternative pay-gap measures (Columns 4–5) and when we use the independent fund-name SRI proxy (Column 6). Column 7 shows no comparable interaction for the fraction of female employees, suggesting the heterogeneity operates through pay rather than headcount.

The standalone female-director indicator is not robust once we absorb time-varying industry and state shocks, which is not surprising given the strong secular trends in board composition. The key object for Proposition 2 is the *interaction*—the differential SRI–pay-gap slope in firms with female directors—and that estimate remains negative in our preferred specifications. We interpret this interaction as suggestive reduced-form evidence of complementarity between sustainable demand and information production, not as a claim that either female directors or sustainable ownership are individually "necessary" for reducing pay gaps.

In Appendix Table A.3, we replace the gender pay gap with the proportion of female employees. Unlike the results on the gender pay gap in Table 5, the interaction between socially responsible investment and female directors is not statistically or economically significant. This result implies

that socially responsible investment is not related to the quantity-related aspects of gender inequality, regardless of whether there are female directors.

Alternative Explanations Subsection 4.1. shows the robust coefficient of the interaction between socially responsible investment and the female director indicator. However, the significant coefficient of the interaction term may arise from an omitted variable that is correlated with the existence of female directors.

First, firms with at least one female director are more likely to have a female CEO, and the presence of a female CEO may explain the significance of the previous results. In Column 1 of Table 6, we replace the female director indicator with a female CEO indicator. Alone, the female CEO indicator variable is significantly correlated with a smaller gender pay gap, which is consistent with previous findings showing that female managers alleviate the gender inequality (Tate and Yang, 2015). However, the interaction effect between socially responsible investment and the female CEO indicator is not significantly different from zero, making this effect clearly different from the effects of female directors. Together, these findings imply that female CEOs alleviate the gender pay gap, but this effect does not depend on the level of socially responsible investment. This is a stark difference from the case of female directors, as Column 3 in Table 5 indicates that female directors are effective when coupled with socially responsible investment.

Second, the existence of a female director is not linked to a positive relation between non-socially responsible investment and the gender pay gap. In Column 2, we measure non-socially responsible investment by subtracting socially responsible investment from total institutional ownership as identified in 13F. Although the interaction between non-socially responsible investment and the existence of a female director is positive marginally significant at the 10% level, the magnitude (-0.016) of this effect is much smaller than that of the interaction between socially responsible investment and the existence of a female director (-0.266 of Column 3 in Table 5). It is also smaller than the magnitude of the coefficient of the non-socially responsible investment variable alone

(0.022). This implies that there is no negative relation between non-socially responsible investment and the gender pay gap in firms with at least one female director.

The significant coefficient of the interaction effect between female directors and socially responsible investment may stem from the non-linear relation between socially responsible investment and the gender pay gap. In other words, the gender pay gap may be negatively related to socially responsible investment only under high levels of such investment. If the existence of a female director is a proxy of higher socially responsible investment, the coefficient of the interaction term may come from the nonlinear effects of socially responsible investment. In Column 3 of Table 6, we address this concern by including the squared term of socially responsible investment as an additional control variable. The interaction term remains highly significant. More importantly, the magnitude of the coefficient (0.265) does not change much from that in the benchmark results (0.266) in Table 5. The coefficient of squared socially responsible investment is zero, implying that the relation between socially responsible investment and the gender pay gap is not quadratic. Taken together, Column 2 indicates that the effect of female directors is not due to the nonlinear effect of socially responsible investment.

Finally, the existence of female directors may be a proxy for the effects that arose during the latter part of the sample. Van der Beck (2025) argues that attention to ESG-friendly funds has increased since 2012. A total of 48.4% of firms had at least one female director before 2012, and this number has increased to 74.0% that time. Therefore, the significance of the interaction term may indicate that socially responsible investment had a greater effect after 2012, when ESG investing increased in popularity. However, we show that the significance of the interaction term remains highly significant when we include year-fixed effects in Table 5. Additionally, we include the interaction between the indicator variable for years after 2012 and socially responsible investment in Column 4 of Table 6. The interaction between socially responsible investment and female directors remains significant, and the magnitude does not change substantially. This result indicates that the effect of the board of directors does not arise from the changes that occurred during the sample

period.

Sensitivities Depending on the Number of Female Directors We show that the relation between socially responsible investment and the gender pay gap becomes significant when there is at least one female director. However, a natural question arises: How many female directors should be in a firm to strengthen the relation between socially responsible investment and a smaller pay gap?

In this subsection, we divide the indicator variable for female directors into multiple indicators to denote the number of female directors. Specifically, we include indicator variables for one female director, two female directors, and at least three female directors. Then, we interact each indicator variable with socially responsible investment. Table 7 presents the results. The coefficient of the interaction between socially responsible investment and "1(Female Director = n)" indicates the extent to which the effect of socially responsible investment differs under n female directors versus zero female directors. The interaction between two female directors and socially responsible investment has the largest coefficient, and it is statistically significant at the 1% level regardless of which fixed effects we use. In contrast, the interaction effect between one female director and socially responsible investment is negative but smaller in magnitude than the interaction for two female directors when we include industry-, state-, and year-fixed effects. The interaction between at least three female directors and socially responsible investment is not statistically significant at the 5% level, but the coefficient is negative, and it is not statistically significantly different from the interaction between two female directors and socially responsible investment.

The results of this exercise indicate that two female directors have the most significant reinforcing effect on the sensitivity between the gender pay gap and socially responsible investment.

5.2 Communication on Gender Equality and Female Directors

Finally, Proposition 3 makes a prediction about information rather than outcomes: higher board quality should be associated with greater information production, and thus with more disclosure or

communication about gender equality. To test this implication directly, we examine whether firms with female directors talk more about gender equality in earnings calls. This provides evidence on the disclosure channel that the model highlights as a prerequisite for sustainable ownership to affect hard-to-observe employee outcomes.

This exercise is not meant to establish that firms implement pay-equity changes; earnings-call language can be strategic and may reflect "cheap talk." In our framework, however, the relevant object is public-facing information production: more gender-equality discussion is consistent with higher disclosure precision τ and with a lower cost of communicating gender-related policies to outsiders. We therefore treat the transcript-based measure as a noisy proxy for information production rather than as a direct measure of underlying action.

This section investigates how firms communicate with investors when there are female directors. The results show that firms talk more about topics about gender equality when there are female directors, consistent with the previous findings that the relation between socially responsible investment and gender equality is stronger in a firm with female directors. The existence of female directors may indicate that firms have a preference for gender equality. Alternatively, female directors can be directly related to a stronger sensitivity of socially responsible investment to gender equality.

Assuming that socially responsible investors have a clear preference for gender equality among employees, information asymmetry between principals (institutional investors) and agents (managers) causes friction in implementing employee gender equality. If the information exchanged between investors and managers is not perfect, managers' actions may be inconsistent with investors' preferences. Additionally, such imperfect information may prevent institutional investors from identifying companies with good gender equality.

Prior studies indicate that females in higher ranks can alleviate the discrimination of the lower-rank labor force (Cohen, Broschak, and Haveman, 1998; Dezső and Ross, 2012; Tate and

Yang, 2015). For example, Tate and Yang (2015) finds that income loss from plant closure is more serious for female workers, but the effect is alleviated when there are female leaders at a new plant.

We test whether companies with female directors pay more attention to gender-related information than companies without female directors. To do so, we test whether managers mention gender issues more often in earnings calls when there are more female directors.

Specifically, we combine earnings calls from Seeking Alpha, financial information from Compustat, and board compositions from BoardEx.[12] The number of Compustat firm-years with at least one valid director dataset in BoardEx is 63,215 from 2006 to 2021. After filtering out firm-years without earnings calls and gender-related industries (apparel and cosmetic industries), 38,153 firms remain. We use a simple bag-of-words method to examine whether more words related to gender equality are mentioned in the calls of firms with more female directors. We use two groups of word lists. The first wordlist consists of "gender," "female," "DEI," and "D&I," and the second wordlist consists of the first wordlist plus "diversity," "inclusion," and "equality." We separate the word lists because the latter three may include topics unrelated to the gender equality of employees (such as "product diversity"). To remove the effects of gender words related to products, we exclude firms in apparel industries ($2300 \leq SIC < 2400$ or $SIC = 5621$) and cosmetic industries ($SIC = 2844$ or 7231). The dependent variable of this analysis is the proportion of words that are related to gender equality, that is, the number of words related to gender equality mentioned in earnings calls throughout the year, scaled by the total number of words spoken in earnings calls. We use managers' scripts, including both introductory presentations and answers to the Q&A sessions. We aggregate all the quarterly earnings calls within a year to increase the power of the analysis. A firm has missing data when there are no earnings calls in a given year. We regress the proportion of gender equality-related words on the previous year-end presence of female directors. To be consistent with the main

[12]For this analysis, we use different samples from previous analyses. It is because the U.S. Census Bureau recommends that researchers should conduct analyses with public datasets, if the analysis does not require the use of restricted data. This section of analysis does not directly include employees' wage information, so we conduct the analysis with public datasets. As Table 1 indicates, the firm characteristics of Compustat companies are comparable to the samples used in previous analyses.

analysis, we use the indicator variable for at least one female director. As control variables, we use the same set of control variables used in the previous tables. Since fixed effects account for large variations in the previous analyses, we also include different sets of fixed effects in this analysis.[13]

Table 8 shows the results of the analysis. Columns 1 to 4 use the proportion corresponding to the first wordlist as the dependent variable. The columns have different sets of control variables and fixed effects. Column 1 indicates that there is a statistically significant relation between the presence of a female director and the proportion of gender-related words in earnings calls. The coefficient of 0.765 indicates that the number of mentions of the focal words is 22.1% higher than the unconditional average (0.04% of total words in the script) when there is at least one female director. This magnitude decreases as we include control variables and more granular fixed effects. Column 4 shows that the coefficient for female directors is 0.155. This finding indicates that the number of mentions of the focal words is 4.5% higher than the unconditional average when there is at least one female director. Columns 5 to 8 use the second wordlist word proportions as the dependent variables. The statistical and economic magnitudes of the effect of female directors are stronger than they are when we use the first wordlist. Note that this is not a mechanical result of including more words on the list because the coefficient captures the covariance between the proportion of words and the presence of female directors. The coefficient for female directors is 13.007 in Column 5 and 2.392 in Column 8. This means that in earnings calls of firms with female directors, the number of mentions of gender-related words is 32.4% and 6.0% higher than the unconditional average (0.40% of the total number of words in the script), respectively.

In summary, the earnings-call evidence points in the same direction: firms with female directors devote a higher share of their calls to gender-equality language, and this difference remains, though it shrinks, once we add controls and granular fixed effects. The effect is stronger when we use the broader word list, consistent with female directors being associated with greater communication

[13]Unlike the analyses with Census restricted data, we use the state information on Compustat. They are the most recent locations of the headquarters, so it captures the different location if firms move their headquarters during the sample periods.

about gender-related issues.

6 Conclusion

This paper studies when socially responsible investors can change firms' *internal* labor outcomes in the presence of information frictions. Guided by the model in Section 2, we focus on an outcome that investors typically cannot observe—the employee-level gender pay gap measured in restricted-access LEHD data—and test the "null under opacity" prediction in Section 4. After controlling for unobservable covariance within industries, regions, and time with rich fixed effects, we find an insignificant relation between socially responsible investment and the employee-level gender pay gap. The 90% confidence interval of the coefficient indicates that a one percentage-point increase in socially responsible investment is related to a -0.152% to 0.036% percentage point change in the gender pay gap in a firm. The relation is robust to the use of different measures for the gender pay gap and socially responsible investment, and socially responsible investment is not positively correlated with the proportion of female workers in a company. At the same time, socially responsible investment is positively related to female board representation, and market valuations are related to board gender diversity but not to the employee pay gap.

We then test the model's cross-sectional prediction that investor demand has stronger real effects when governance makes information more credible. In Section 5, we find that the existence of female directors reinforces the relation between socially responsible investment and the gender pay gap. The 90% confidence interval indicates that a one percentage-point increase in socially responsible investment in a company with female directors is related to a -0.458% to -0.074% percentage point change in the gender pay gap. The results are not driven by the time trends of female directors, manager effects, or quadratic effects of socially responsible investment, and the relation between socially responsible investment and the gender pay gap is strongest when there are two female directors within a firm. Consistent with the information channel emphasized by the model, we also find suggestive evidence that firms with female directors communicate more about

gender equality in earnings calls.

Although there is increasing demand for gender equality, most countries do not have disclosure requirements for gender equality. The lack of disclosure is an obstacle for investors striving to choose companies with gender equality. A few countries, such as Denmark in 2006 and the United Kingdom in 2017, have implemented disclosure requirements (Lagaras et al., 2022; Bennedsen et al., 2022). The United States attempted to implement a similar requirement, but the discussion halted in 2018. The findings of this paper imply that detailed and credible information on gender equality is needed for socially responsible investment to be effective in changing opaque employee-level outcomes.

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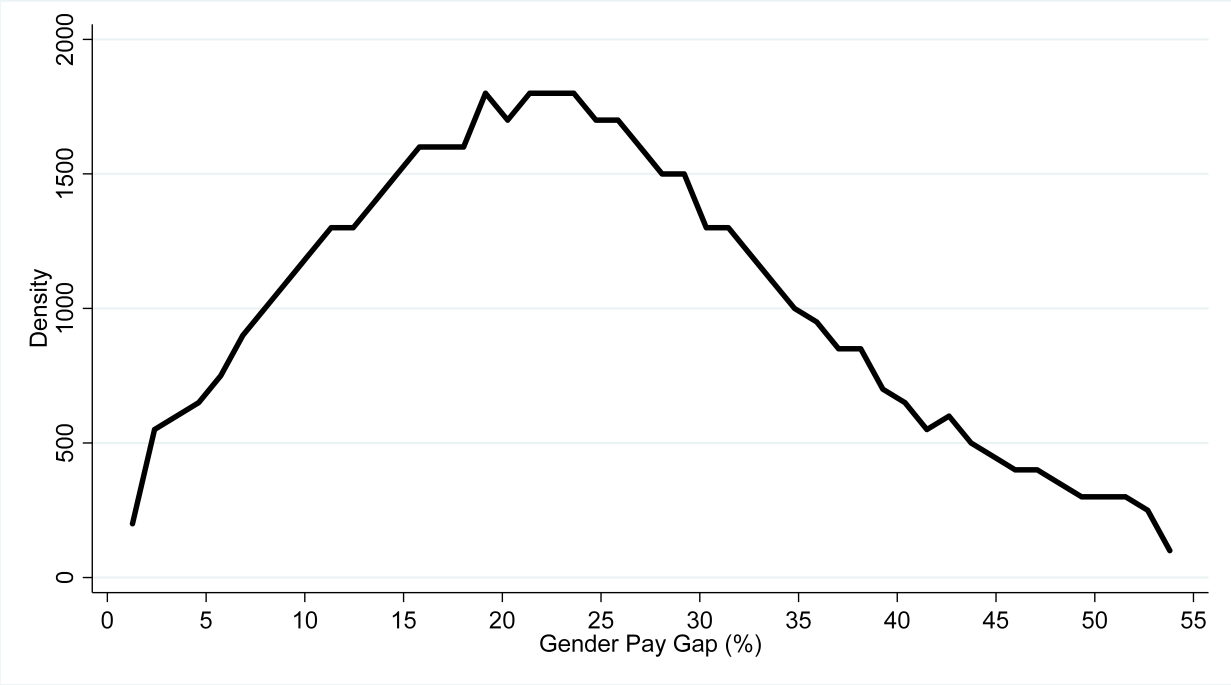
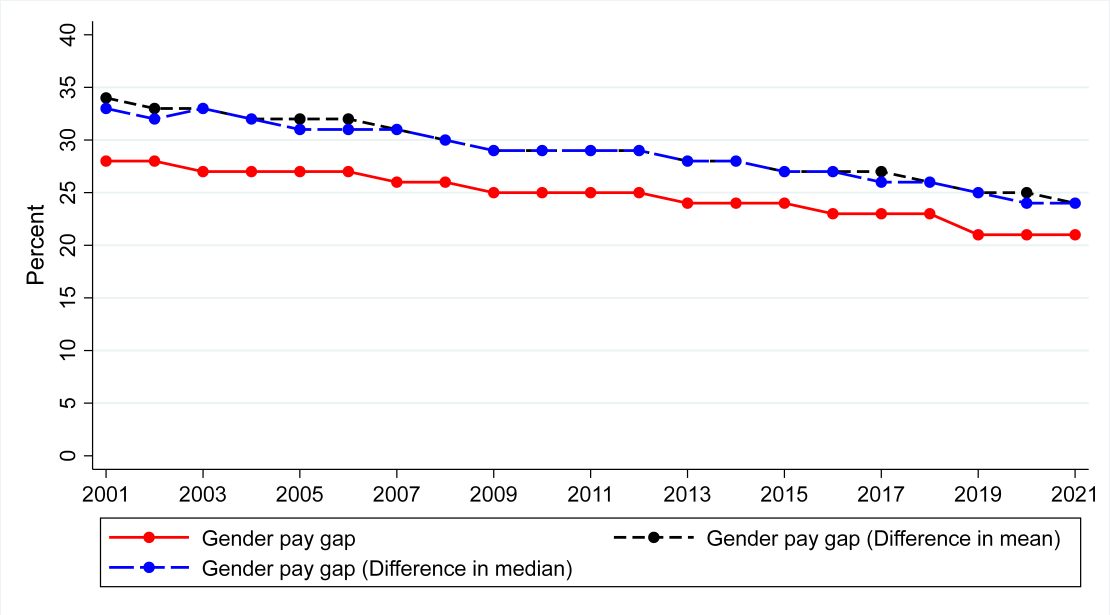
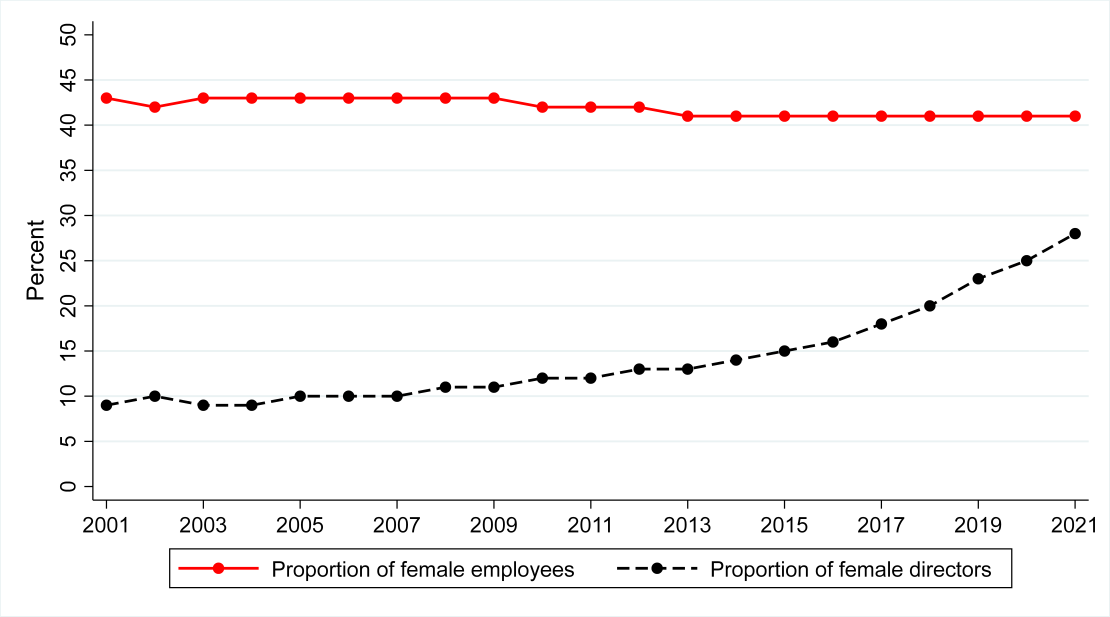


Figure 1: Kernel density plot of the gender pay gap. This figure presents the kernel density plot of the gender pay gap. We measure the gender pay gap by regressing the log annual salary on female indicators and other individual characteristics within a firm-year. Section 3.2 provides details on the definition of the gender pay gap. To comply with the US Census disclosure requirements, we drop the top 5% and the bottom 5% of the firm-year observations. The sample firms consist of all companies with at least 10 employees in Longitudinal Employer-Household Dynamics (LEHD) with valid financial data in Compustat from 2001 to 2021.



(a) Time trends of gender pay gaps



(b) Time trends of gender compositions of employees and directors

Figure 2: Time trend of the within-firm gender gap and gender composition. The figure shows the equally weighted average gender pay gap and female proportions of public companies from 2001 to 2021. Panel A shows the time trend of three measures of gender pay gaps. The benchmark measure is calculated by regressing the log annual salary on female indicators and other individual characteristics within a firm-year. The other two measures compare the mean (median) male wages and female wages. Section 3.2 provides details on the definition of the three measures of the gender pay gap. Panel B shows the time trends of the number of female employees over all employees and the number of female directors over all directors. Prior to averaging, we winsorize numbers at the 1% and 99% levels.

Table 1: Summary Statistics

The table provides summary statistics for the gender pay gap. The sample firms consist of all companies with at least 10 employees in Longitudinal Employer-Household Dynamics (LEHD) with valid financial data in Compustat from 2001 to 2021. The gender pay gap is measured in three different ways. First, it is measured as a regression coefficient on female employee indicators within a firm-year. Sections 3.2 and 3.3 provides additional details on the construction of the measure. The second measure is the mean of male wages minus the mean of female wages scaled by the mean of all employees' wages. The third measure is the median male wage minus the median female wage, scaled by a median of all employees. Definitions of other control variables are explained in Appendix Table A.1. We winsorize ratios at the 1% and 99% levels. In the last column, we report the average characteristics of all Compustat companies from 2001 to 2021 for comparison.

	Sample firms			Compustat firms
	Mean	Std	Skewness	Mean
Gender pay gap	24.80	15.49	0.54	-
Gender pay gap (Difference in mean)	29.28	20.60	0.87	-
Gender pay gap (Difference in median)	28.83	25.48	1.29	-
Proportion of female employees	42.04	20.26	0.38	-
Proportion of female directors	13.89	12.57	0.60	12.43
Socially responsible investment	0.65	1.36	3.50	0.85
SRI by mutual funds' name	0.03	0.09	4.10	0.03
Institutional investment	67.97	29.02	-0.64	60.86
Non-socially responsible investment	67.28	28.75	-0.64	59.98
ln(Assets)	21.21	1.94	0.28	20.61
ln(Employment)	7.55	1.70	0.37	7.14
ln(Firm age)	3.24	0.50	-1.58	2.45
Profitability	7.00	10.40	-1.50	3.16
Book leverage	59.28	25.87	0.25	55.67
Number of female directors	1.21	1.17	0.90	1.10
Number of firm-years	54,000			58,564

Table 2: Gender pay gap and socially responsible investment

The table presents regression results for the gender pay gap on lagged socially responsible investment and firm characteristics. The dependent variable is the gender pay gap, measured in three ways. The benchmark measure is calculated by regressing the log annual salary on female indicators and other individual characteristics within a firm-year. The other two measures compare the mean (median) male wages and female wages. Socially responsible investment of a firm is an aggregation of socially responsible institutional investors' holdings in 13F divided by the number of shares outstanding. An institutional investor is classified as a socially responsible institutional investor if it increases its holding when the proportion of female directors increases over the previous five years. Alternatively, we use mutual fund names and classify a mutual fund as a socially responsible investor if the name of the fund includes words related to the social agenda. Sections 3.2 and 3.3 provides details on the definition of the main dependent and independent variables. Definitions of all control variables can be found in Appendix Table A.1. All continuous variables are winsorized at the 1% and 99% levels. Numbers in parentheses represent t-statistics, with standard errors clustered by firm. Significance levels are denoted by *, **, and ***, indicating significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable	Gender pay gap	Gender pay gap	Gender pay gap	Gender pay gap	Gender pay gap (Mean)	Gender pay gap (Median)	Gender pay gap
Socially responsible	-0.481***	-0.446***	-0.073	-0.058	-0.004	-0.020	
Investment	(-7.49)	(-7.20)	(-1.43)	(-1.02)	(-0.06)	(-0.21)	
SRI by fund name							-0.557
							(-0.52)
ln(Assets)		1.537***	0.338***	0.366***	0.296*	0.457**	0.371***
		(10.99)	(2.88)	(2.92)	(1.77)	(2.35)	(2.95)
ln(Employment)		-1.518***	0.116	0.092	0.966***	-0.435*	0.093
		(-9.54)	(0.81)	(0.60)	(4.71)	(-1.77)	(0.61)
ln(Firm age)		1.137***	0.989***	0.927**	0.918*	1.259**	0.927**
		(3.00)	(2.65)	(2.33)	(1.79)	(1.98)	(2.33)
Profitability		-0.053***	-0.014	-0.019	-0.016	-0.056***	-0.019
		(-3.54)	(-1.19)	(-1.50)	(-0.99)	(-2.76)	(-1.49)
Leverage		0.019**	-0.028***	-0.030***	-0.045***	-0.037***	-0.030***
		(2.44)	(-4.86)	(-4.83)	(-5.65)	(-3.89)	(-4.83)
Constant	24.73***	-0.852	14.97***	14.92***	15.06***	20.39***	14.80***
	(110.10)	(-0.35)	(6.82)	(6.38)	(4.93)	(5.60)	(6.33)
SIC3-fixed	No	No	Yes	No	No	No	No
State-fixed	No	No	Yes	No	No	No	No
Year-fixed	No	No	Yes	No	No	No	No
SIC3*Year-fixed	No	No	No	Yes	Yes	Yes	Yes
State*Year-fixed	No	No	No	Yes	Yes	Yes	Yes
Adj. R-squared	0.00	0.04	0.37	0.35	0.40	0.37	0.35
N of firm-years	54,000	54,000	54,000	54,000	54,000	54,000	54,000

Table 3: Proportion of females and socially responsible investment

The table presents regression results for the proportion of females with lagged socially responsible investment and firm characteristics. The dependent variable is the number of female employees over total employment (Columns 1 to 3) or the number of female directors over all directors (Columns 4 to 6). Socially responsible investment of a firm is an aggregation of socially responsible institutional investors' holdings in 13F divided by the number of shares outstanding. An institutional investor is classified as a socially responsible institutional investor if it increases its holding when the proportion of female directors increases over the previous five years. Alternatively, we use mutual fund names and classify a mutual fund as a socially responsible investor if the name of the fund includes words related to the social agenda. Sections 3.2 and 3.3 provides details on the definition of socially responsible investment. Definitions of all control variables can be found in Appendix Table A.1. All continuous variables are winsorized at the 1% and 99% levels. Numbers in parentheses represent t-statistics, with standard errors clustered by firm. Significance levels are denoted by *, **, and ***, indicating significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	Proportion of female employees			Proportion of female directors		
Socially responsible	-0.421***	-0.089*	-0.096*	0.285***	0.116**	0.114**
investment	(-4.81)	(-1.81)	(-1.70)	(5.60)	(2.52)	(2.18)
ln(Assets)	0.076	-0.498***	-0.520***	1.812***	1.634***	1.606***
	(0.40)	(-3.89)	(-3.80)	(22.26)	(18.38)	(16.92)
ln(Employment)	-0.582**	(0.20)	-0.215	0.272***	0.409***	0.428***
	(-2.35)	(-1.33)	(-1.34)	(2.74)	(3.92)	(3.80)
ln(Firm age)	-1.476***	0.830**	0.853**	1.814***	-0.051	0.016
	(-2.98)	(2.41)	(2.36)	(6.63)	(-0.19)	(0.06)
Profitability	-0.060***	-0.001	-0.004	0.001	0.030***	0.026**
	(-3.28)	(-0.11)	(-0.30)	(0.10)	(2.95)	(2.31)
Leverage	0.166***	0.017***	0.016**	0.012**	0.019***	0.019***
	(15.65)	(2.65)	(2.25)	(2.13)	(3.59)	(3.20)
Constant	40.42***	50.45***	51.04***	-33.39***	-25.13***	-24.83***
	(12.62)	(22.80)	(21.73)	(-23.19)	(-15.07)	(-13.98)
SIC3-fixed	No	Yes	No	No	Yes	No
State-fixed	No	Yes	No	No	Yes	No
Year-fixed	No	Yes	No	No	Yes	No
SIC3*Year-fixed	No	No	Yes	Yes	No	Yes
State*Year-fixed	No	No	Yes	Yes	No	Yes
Adj. R-squared	0.05	0.7	0.69	0.12	0.33	0.31
N of firm-years	54,000	54,000	54,000	54,000	54,000	54,000

Table 4: Market valuations and employee-level and board-level gender equality

The table presents regression results for the market valuations on the same-year employee-level gender pay gap and the proportion of female directors. The dependent variable is the market value of assets over the book value of assets in percentage. The employee-level gender pay gap is calculated by regressing the log annual salary on female indicators and other individual characteristics within a firm-year. The proportion of the female board of directors is the number of female directors over the total number of directors at the end of the fiscal year. Definitions of all control variables can be found in Appendix Table A.1. All continuous variables are winsorized at the 1% and 99% levels. Numbers in parentheses represent t-statistics, with standard errors clustered by firm. Significance levels are denoted by *, **, and ***, indicating significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)
Dependent variable	Market Assets/Book Assets		
Gender pay gap	-0.139		-0.152*
	(-1.60)		(-1.74)
Proportion of female directors		0.593***	0.598***
		(5.36)	(5.40)
ln(Assets)	-5.806***	-6.707***	-6.773***
	(-5.08)	(-5.84)	(-5.88)
ln(Employments)	1.206	0.972	0.947
	(0.97)	(0.78)	(0.76)
ln(Firm age)	-41.57***	-41.45***	-41.59***
	(-12.26)	(-12.29)	(-12.31)
Profitability	3.247***	3.228***	3.232***
	(14.86)	(14.8)	(14.82)
Leverage	0.163**	0.148*	0.153*
	(2.07)	(1.88)	(1.94)
Constant	403.7***	420.4***	418.3***
	(19.28)	(19.88)	(19.85)
SIC3*Year-fixed	Yes	Yes	Yes
State*Year-fixed	Yes	Yes	Yes
Adj-R-squared	0.29	0.30	0.30
N of firm-years	54,000	54,000	54,000

Table 5: Gender pay gap on interaction between female directors and socially responsible investment

The table presents regression results for the gender pay gap on lagged socially responsible investment, female directors, and firm characteristics. The dependent variable is the gender pay gap, measured in three ways, and the proportion of female employees over total employment. The benchmark measure is calculated by regressing the log annual salary on female indicators and other individual characteristics within a firm-year. The other two measures compare the mean (median) male wages and female wages. "1(Number of female directors $\geq$ 1)" equals one if there is at least one female director at the end of the previous year. Socially responsible investment of a firm is an aggregation of socially responsible institutional investors' holdings in 13F divided by the number of shares outstanding. An institutional investor is classified as a socially responsible institutional investor if it increases its holding when the proportion of female directors increases over the previous five years. Alternatively, we use mutual fund names and classify a mutual fund as a socially responsible investor if the name of the fund includes words related to the social agenda. Sections 3.2 and 3.3 provides details on the definition of the main dependent and independent variables. Definitions of all control variables can be found in Appendix Table A.1. All continuous variables are winsorized at the 1% and 99% levels. Numbers in parentheses represent t-statistics, with standard errors clustered by firm. Significance levels are denoted by *, **, and ***, indicating significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable	Gender pay gap	Gender pay gap	Gender pay gap	Gender pay gap (Difference in mean)	Gender pay gap (Difference in median)	Gender pay gap	Proportion of female employees
[1] Socially Responsible	-0.200*	0.106	0.117	0.179	0.252		-0.147
investment	(-1.86)	(1.18)	(1.16)	(1.45)	(1.53)		(-1.62)
[2] 1(Number of	-2.907***	-0.531*	-0.437	-0.552	-0.133	-0.456	1.518***
female directors $\geq$ 1)	(-7.52)	(-1.70)	(-1.29)	(-1.27)	(-0.24)	(-1.37)	(5.02)
[1] * [2]	-0.333***	-0.271***	-0.266**	-0.278*	-0.416**		0.065
	(-2.62)	(-2.60)	(-2.28)	(-1.88)	(-2.17)		(0.61)
[3] SRI by fund name						5.703***	
						(3.57)	
[2] * [3]						-8.082***	
						(-4.07)	
ln(Assets)	1.792***	0.390***	0.411***	0.350**	0.484**	0.419***	-0.640***
	(12.41)	(3.26)	(3.21)	(2.06)	(2.43)	(3.27)	(-4.57)
ln(Employment)	-1.473***	0.132	0.106	0.984***	-0.426*	0.112	-0.251
	(-9.30)	(0.92)	(0.69)	(4.79)	(-1.73)	(0.73)	(-1.57)
ln(Firm age)	1.330***	1.002***	0.941**	0.933*	1.273**	0.948**	0.830**
	(3.51)	(2.69)	(2.36)	(1.82)	(2.00)	(2.38)	(2.31)
Profitability	-0.055***	-0.014	-0.019	-0.016	-0.056***	-0.019	-0.004
	(-3.77)	(-1.17)	(-1.50)	(-0.99)	(-2.76)	(-1.49)	(-0.30)
Leverage	0.021***	-0.027***	-0.030***	-0.045***	-0.036***	-0.030***	0.015**
	(2.78)	(-4.79)	(-4.77)	(-5.59)	(-3.85)	(-4.77)	(2.09)
Constant	-5.412**	14.03***	14.09***	14.07***	19.78***	13.87***	52.99***
	(-2.16)	(6.31)	(5.94)	(4.53)	(5.32)	(5.85)	(22.13)
SIC3-fixed	No	Yes	No	No	No	No	No
State-fixed	No	Yes	No	No	No	No	No
Year-fixed	No	Yes	No	No	No	No	No
SIC3*Year-fixed	No	No	Yes	Yes	Yes	Yes	Yes
State*Year-fixed	No	No	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.04	0.04	0.04	0.40	0.37	0.35	0.69
N of firm-years	54,000	54,000	54,000	54,000	54,000	54,000	54,000

Table 6: Alternative specifications determinants of the gender pay gap

The table presents regression results for the gender pay gap on lagged socially responsible investment, firm characteristics, and other determinants. The dependent variable is the gender pay gap, calculated by regressing the log annual salary on female indicators and other individual characteristics within a firm-year. The socially responsible investment of a firm is an aggregation of socially responsible institutional investors' holdings in 13F divided by the number of shares outstanding. An institutional investor is classified as a socially responsible institutional investor if it increases its holding when the proportion of female directors increases over the previous five years. Definitions of all control variables can be found in Appendix Table A.1. All continuous variables are winsorized at the 1% and 99% levels. Numbers in parentheses represent t-statistics, with standard errors clustered by firm. Significance levels are denoted by *, **, and ***, indicating significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)
Dependent variable		Gender pay gap		
[1] Socially responsible	-0.063		0.112	0.121
investment	(-1.09)		-1.07	-1.17
[2] 1(Number of female		0.364	-0.437	-0.438
directors $\geq$ 1)		-0.52	(-1.29)	(-1.29)
[3] Non-Socially responsible		0.022***		
investment		-2.84		
[4] 1(Female CEO)	-1.748**			
	(-2.26)			
[1] * [4]	0.139			
	-0.42			
[2] * [3]		-0.016*		
		(-1.78)		
[1] * [2]			-0.265**	-0.264**
			(-2.27)	(-2.20)
[1] * [1(Year $\geq$ 2012)]				-0.012
				(-0.11)
[Socially responsible			0	
investment]^2			-0.31	
ln(Assets)	0.371***	0.347***	0.411***	0.411***
	-2.96	-2.66	-3.21	-3.21
ln(Employment)	0.092	0.095	0.106	0.106
	-0.6	-0.61	-0.69	-0.69
ln(Firm age)	0.947**	0.984**	0.941**	0.941**
	-2.38	-2.47	-2.36	-2.36
Profitability	-0.019	-0.025*	-0.019	-0.019
	(-1.48)	(-1.90)	(-1.50)	(-1.50)
Leverage	-0.030***	-0.028***	-0.030***	-0.030***
	(-4.82)	(-4.52)	(-4.77)	(-4.77)
Constant	14.81***	14.06***	14.09***	14.09***
	-6.34	-5.95	-5.94	-5.94
SIC3*Year-fixed	Yes	Yes	Yes	Yes
State*Year-fixed	Yes	Yes	Yes	Yes
Adj. R-squared	0.35	0.35	0.35	0.35
N of firm-years	54,000	54,000	54,000	54,000

Table 7: The relation between the gender gap and female director composition by the number of female directors

The table presents regression results for the gender pay gap on lagged socially responsible investment, female directors, and firm characteristics. The dependent variable is the gender pay gap, calculated by regressing the log annual salary on female indicators and other individual characteristics within a firm-year. 1(Number of female directors = n) equals one if there are n female directors at the end of the previous year. The socially responsible investment of a firm is an aggregation of socially responsible institutional investors' holdings in 13F divided by the number of shares outstanding. An institutional investor is classified as a socially responsible institutional investor if it increases its holding when the proportion of female directors increases over the previous five years. All continuous variables are winsorized at the 1% and 99% levels. Numbers in parentheses represent t-statistics, with standard errors clustered by firm. Significance levels are denoted by *, **, and ***, indicating significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)
Dependent variable		Gender pay gap	
[1] Socially responsible	-0.211**	0.101	0.114
investment	(-1.96)	(1.12)	(1.13)
1(Female Director = 1)	-1.696***	-0.423	-0.35
	(-4.38)	(-1.34)	(-1.02)
[1]* 1(Female Director = 1)	-0.285**	-0.187	-0.180
	(-2.00)	(-1.59)	(-1.38)
1(Female Directors = 2)	-3.711***	-0.649*	-0.447
	(-7.76)	(-1.66)	(-1.04)
[1]* 1(Female Directors = 2)	-0.460***	-0.382***	-0.404***
	(-2.92)	(-3.00)	(-2.81)
1(Female Directors $\geq$ 3)	-7.162***	-1.527***	-1.485***
	(-10.65)	(-2.93)	(-2.61)
[1] * 1(Female Directors $\geq$ 3)	-0.124	-0.294*	-0.273
	(-0.62)	(-1.91)	(-1.53)
ln(Assets)	2.083***	0.452***	0.470***
	(14.16)	(3.74)	(3.63)
ln(Employment)	-1.477***	0.136	0.110
	(-9.41)	(0.95)	(0.72)
ln(Firm age)	1.577***	1.013***	0.953**
	(4.16)	(2.72)	(2.39)
Profitability	-0.056***	-0.013	-0.019
	(-3.87)	(-1.15)	(-1.48)
Leverage	0.023***	-0.027***	-0.029***
	(3.06)	(-4.68)	(-4.67)
Constant	-12.09***	12.76***	12.86***
	(-4.64)	(5.68)	(5.36)
SIC3-fixed	No	Yes	No
State-fixed	No	Yes	No
Year-fixed	No	Yes	No
SIC3*Year-fixed	No	No	Yes
State*Year-fixed	No	No	Yes
Adj. R-squared	0.06	0.37	0.35
N of firm-years	54,000	54,000	54,000

Table 8: Discussion of gender-related words during earnings calls

The table presents regression results for the proportion of gender-related words in earnings calls on female directors and firm characteristics. The dependent variable is the number of gender-related words spoken by firm insiders over the total number of words by insiders during earnings calls. We use two groups of wordlists. The first wordlist includes "gender," "female," "DEI," and "D&I," and the second wordlist is the first word list plus "diversity," "inclusion," and "equality." "1(Number of female directors $\geq$ 1)" equals one if there is at least one female director at the end of the previous year. Definitions of all control variables can be found in Appendix Table A.1. All continuous variables are winsorized at the 1% and 99% levels. Numbers in parentheses represent t-statistics, with standard errors clustered by firm. Significance levels are denoted by *, **, and ***, indicating significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep. variable	Proportion of List 1 gender-related words				Proportion of List 2 gender-related words			
1(Number of female	0.765***	0.407***	0.185**	0.155**	13.007***	6.000***	2.306***	2.392***
directors $\geq$ 1)	(7.78)	(4.08)	(2.00)	(2.11)	(19.49)	(9.31)	(3.89)	(3.54)
ln(Assets)		0.372***	0.387***	0.412***		0.536**	0.790**	0.776*
		(8.62)	(5.89)	(5.38)		(1.97)	(2.00)	(1.72)
ln(Employment)		-0.135***	-0.083	-0.105		3.515***	3.800***	3.799***
		(-3.17)	(-1.24)	(-1.34)		(13.02)	(9.03)	(7.84)
ln(Firm age)		-0.088*	-0.106**	-0.109*		0.033	-0.384	-0.394
		(-1.78)	(-2.06)	(-1.84)		(0.11)	(-1.32)	(-1.19)
Profitability		0.282	0.602**	0.447		10.395***	11.610***	10.485***
		(1.18)	(2.40)	(1.54)		(7.27)	(7.94)	(6.39)
Leverage		-0.003	-0.003	-0.003		0.054***	0.024*	0.024*
		(-1.30)	(-1.44)	(-1.19)		(4.28)	(1.91)	(1.69)
Constant	2.943***	-2.254***	-3.046***	-3.299***	31.316***	-29.648***	-33.864***	-33.609***
	(37.94)	(-3.53)	(-4.00)	(-3.76)	(59.90)	(-7.23)	(-7.58)	(-6.65)
SIC3-fixed	No	No	Yes	No	No	No	Yes	No
State-fixed	No	No	Yes	No	No	No	Yes	No
Year-fixed	No	No	Yes	No	No	No	Yes	No
SIC3*Year-fixed	No	No	No	Yes	No	No	No	Yes
State*Year-fixed	No	No	No	Yes	No	No	No	Yes
Adj. R-squared	0.01	0.02	0.10	0.07	0.05	0.14	0.32	0.31
N of firm-years	38,153	38,153	38,153	38,153	38,153	38,153	38,153	38,153

A Additional Tables

Table A.1: Construction methods for variables

The table explains how we construct dependent variables and control variables. All fractional numbers are expressed in percentage terms.

Variable	Description
Gender pay gap	Following Goldin et al. (2017), we regress the logarithm of annual wage on an indicator variable for gender along with other individual characteristics within each firm-year. We exclude top seven high income individuals within a firm-year in order to exclude managers or directors. After the regression, we take the negative value of $\beta_{f,t}$ to measure the gender pay gap. $\log\left(AnnualWage\right)_{i,t} = \beta_{f,t} * 1\left(Female\right)_i + Race_i + BirthCountry_i + Education_i + Age_{i,t} + Experience_{i,t}$ "1(Female)" takes one if the gender at birth is female and zero if it is male. "Race" is four indicator variables, taking value of one if an individual at birth is an Asian-American, African-American, Hispanic-American, or other races, respectively. White-American individuals are benchmark. "BirthCountry" is an indicator variable which takes one if an individual is born outside of the United States. "Education" is three indicator variables, taking value of one if an individual's final education level is high school or equivalent, college or associate degree, and Bachelor's degree or advanced degree, respectively. Individuals without high school diploma are benchmark. "Age" is a integer variable of biological age. "Experience" is number of years since an individual had first valid salary data in each firm.
Gender pay gap (Difference in mean)	Within a firm-year, we subtract female employees' average wage from male employees' average salary and divide it by all employees' average wage. We exclude top seven high income individuals within a firm-year in order to exclude managers or directors.
Gender pay gap (Difference in median)	Within a firm-year, we subtract female employees' median wage from male employees' median salary and divide it by all employees' median wage. We exclude top seven high income individuals within a firm-year in order to exclude managers or directors.
Socially responsible investment (SRI)	Sensitivity of institution-year holdings to changes in board gender composition, estimated over a rolling five-year window. *Step 1:* Estimate $\gamma_{i,t}$ from $\Delta \frac{Investment}{AssetsUnderManagement}_{i,f,t-n} = \gamma_{i,t} \Delta \frac{FemaleDirectors}{AllDirectors}_{f,t-n} + Controls_{f,t-n}$ for $1 \leq n \leq 5$. *Step 2:* Institution i is classified as socially responsible in year t if $\gamma_{i,t} > 0$ and significant. *Step 3:* Firm-year SRI is the fraction of shares held by socially responsible institutions.
SRI by fund name	As outlined in Van der Beck (2025), we use mutual fund names with words related to social concerns to classify them as socially responsible institutional investors. The word list we use is: social, impact, fair, gender, screen, ethical, conscious, SRI, ESG, and CSR. The last three words are case-sensitive, and other words are not case-sensitive. We aggregate socially responsible mutual funds' holdings within a firm-year and divide them by the number of shares outstanding
Institutional investment	Sum of shares held by all institutional investors observed in LSEG 13F Holding data divided by the number of shares outstanding.

Table A.1: (Continued) Construction methods for variables

Variable	Description
Non-socially responsible investment	Institutional investment minus socially responsible investment
Market-to-book assets	Market value of assets (PRCC_F*CSHO) as a percentage of book value of assets (AT) at the fiscal year end.
1(Number of female directors ≥ 1)	Indicator variable equal to one if there is at least one female director at the end of the fiscal year
ln(Assets)	Log of real assets (AT*1,000,000).
ln(Employment)	Log of total employments. It includes entire states, not only the LEHD states.
ln(Firm age)	Log of years since first CRSP listing
Profitability	Net Income (NI) divided by lagged assets (AT)
Leverage	Book leverage defined as total debt (DLC + DLTT) divided by total assets (AT)
Proportion of List n gender-related words	Proportion of gender-related words spoken by managers during the earnings call. We use managers' scripts, including both introductory presentations and answers to the Q&A sessions. We aggregate quarterly earnings calls within a year to increase the power of the analysis. We use two groups of word lists. The first wordlist includes "gender," "female," "DEI," and "D&I," and the second wordlist is the first-word list plus "diversity," "inclusion," and "equality." We separate the word list because the latter three may include topics unrelated to gender equality of employees (such as "product diversity"). The dependent variable of this analysis is the proportion of gender equality words, which is the number of words related to gender equality mentioned in earnings calls throughout the year, scaled by the total number of words spoken in earnings calls.

Table A.2: Additional evidence on determinants of gender pay gap

The table presents regression results for the gender pay gap on lagged investor and firm characteristics. The dependent variable is the gender pay gap, calculated by regressing the log annual salary on female indicators and other individual characteristics within a firm-year. Institutional investment is the aggregate holding of any institutional investors on LSEG 13F holding data divided by total outstanding shares. Non-socially responsible investment is calculated by subtracting socially responsible investment from the total institutional investment. An institutional investor is classified as a socially responsible institutional investor if they increase the holding when the proportion of female directors increases for the previous five years. Section 2 provides details on the definition of the main dependent and independent variables. Definitions of all control variables can be found in Appendix Table A1. All continuous variables are winsorized at the 1% and 99% levels. Numbers in parentheses represent t-statistics, with standard errors clustered by firm. Significance levels are denoted by *, **, and ***, indicating significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)
Dependent variable		Gender pay gap	
Institutional investment	0.011**		
	(1.98)		
Non-socially responsible		0.012**	
investment		(2.02)	
Proportion of			-0.028**
female board of directors			(-2.06)
log(Total employments)	0.078	0.078	0.103
	(0.51)	(0.50)	(0.67)
log(Firm age)	0.960**	0.961**	0.929**
	(2.41)	(2.41)	(2.33)
Net income/Assets	-0.024*	-0.024*	-0.019
	(-1.83)	(-1.84)	(-1.46)
log(Assets)	0.308**	0.307**	0.410***
	(2.41)	(2.40)	(3.23)
Book Leverage	-0.029***	-0.029***	-0.030***
	(-4.66)	(-4.66)	(-4.75)
Constant	15.31***	15.33***	14.21***
	(6.56)	(6.57)	(6.04)
SIC3*Year-fixed	Yes	Yes	Yes
State*Year-fixed	Yes	Yes	Yes
Adj-R-squared	0.35	0.35	0.35
N of firm-years	54,000	54,000	54,000

Table A.3: Proportion of females and socially responsible investment and female directors

The table presents regression results for the proportion of females with lagged socially responsible investment, female directors, and firm characteristics. The dependent variable is the number of female employees over total employment. Socially responsible investment of a firm is an aggregation of socially responsible institutional investors' holding in LSEG 13F Holding data divided by the number of shares outstanding. An institutional investor is classified as a socially responsible institutional investor if they increase the holding when the proportion of female directors increases for the previous five years. "1(Number of female directors $\geq$ 1)" equals one if there is at least one female director at the end of the previous year. Definitions of all control variables can be found in Appendix Table A1. All continuous variables are winsorized at the 1% and 99% levels. Numbers in parentheses represent t-statistics, with standard errors clustered by firm. Significance levels are denoted by *, **, and ***, indicating significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)
Dependent variable	Proportion of female employees		
[1] Socially responsible investment	-0.521***	-0.116	-0.147
	(-3.82)	(-1.45)	(-1.62)
[2] 1(Number of	4.219***	1.587***	1.518***
female directors $\geq$ 1)	(7.81)	(5.62)	(5.02)
[1] * [2]	0.089	0.028	0.065
	(0.53)	(0.30)	(0.61)
ln(Assets)	-0.278	-0.623***	-0.640***
	(-1.41)	(-4.75)	(-4.57)
ln(Employment)	-0.641***	-0.237	(0.251)
	(-2.61)	(-1.58)	(-1.57)
ln(Firm age)	-1.740***	0.811**	0.830**
	(-3.52)	(2.37)	(2.31)
Profitability	-0.057***	-0.002	-0.004
	(-3.12)	(-0.14)	(-0.30)
Leverage	0.163***	0.016**	0.015**
	(15.41)	(2.49)	(2.09)
Constant	46.6***	52.46***	52.99***
	(14.02)	(23.25)	(22.13)
SIC3-fixed	No	Yes	No
State-fixed	No	Yes	No
Year-fixed	No	Yes	No
SIC3*Year-fixed	No	No	Yes
State*Year-fixed	No	No	Yes
Adj-R-squared	0.06	0.7	0.69
N of firm-years	54,000	54,000	54,000

B Model Derivations

This appendix provides the full algebra underlying the equilibrium expressions and comparative statics used in Section 2. To keep notation light, throughout we write

$$\omega \equiv \omega(\lambda),$$

treating λ as predetermined within the period.

B.1 Bayesian updating: deriving the posterior mean $m(y, \tau)$ and pass-through $K(\tau)$

Prior and likelihood. The prior is

$$a \sim \mathcal{N}(0, \sigma^2),$$

and the public signal is

$$y = a + \varepsilon, \qquad \varepsilon \sim \mathcal{N}\left(0, \frac{1}{\tau}\right),$$

so the likelihood is

$$y \mid a \sim \mathcal{N}\left(a, \frac{1}{\tau}\right).$$

Posterior density. Bayes' rule implies

$$\begin{aligned} p(a \mid y) &\propto p(y \mid a)\, p(a) \\ &\propto \exp\left\{-\frac{\tau}{2}(y-a)^2\right\} \cdot \exp\left\{-\frac{1}{2\sigma^2}a^2\right\}. \end{aligned}$$

Combine terms in the exponent:

$$\begin{aligned} -\frac{\tau}{2}(y-a)^2 - \frac{1}{2\sigma^2}a^2 &= -\frac{\tau}{2}(y^2 - 2ay + a^2) - \frac{1}{2\sigma^2}a^2 \\ &= -\frac{\tau}{2}y^2 + \tau a y - \frac{1}{2}\left(\tau + \frac{1}{\sigma^2}\right)a^2. \end{aligned}$$

Ignoring the constant term $-\frac{\tau}{2}y^2$ (constant in a), we can write the kernel as

$$\exp\left\{\tau a y - \frac{1}{2}\left(\tau + \frac{1}{\sigma^2}\right)a^2\right\}.$$

Completing the square. Let the posterior precision be

$$\pi \equiv \tau + \frac{1}{\sigma^2}.$$

Then

$$\begin{aligned}\tau a y - \frac{\pi}{2}a^2 &= -\frac{\pi}{2}\left(a^2 - 2\frac{\tau y}{\pi}a\right) \\ &= -\frac{\pi}{2}\left[\left(a - \frac{\tau y}{\pi}\right)^2 - \left(\frac{\tau y}{\pi}\right)^2\right] \\ &= -\frac{\pi}{2}\left(a - \frac{\tau y}{\pi}\right)^2 + \frac{\pi}{2}\left(\frac{\tau y}{\pi}\right)^2.\end{aligned}$$

The last term is constant in a, so the posterior is Normal:

$$a \mid y \sim \mathcal{N}\left(\frac{\tau}{\tau + \sigma^{-2}}\, y,\ \ \frac{1}{\tau + \sigma^{-2}}\right).$$

Posterior mean and the Kalman gain. Define the posterior mean as

$$m(y, \tau) \equiv \mathbb{E}[a \mid y, \tau] = \frac{\tau}{\tau + \sigma^{-2}}\, y = \frac{\tau\sigma^2}{1 + \tau\sigma^2}\, y.$$

Define the pass-through (Kalman gain)

$$K(\tau) \equiv \frac{\tau\sigma^2}{1 + \tau\sigma^2} \in [0, 1). \tag{15}$$

Then

$$m(y, \tau) = K(\tau)\, y.$$

Expected perceived action given the true action. Since $\mathbb{E}[y \mid a] = a$,

$$\mathbb{E}[m(y, \tau) \mid a, \tau] = \mathbb{E}[K(\tau)y \mid a, \tau] = K(\tau)\mathbb{E}[y \mid a] = K(\tau)a. \tag{16}$$

B.2 Ex ante objective: expected price as a function of (a, τ)

The reduced-form price is

$$P = V_0 - \frac{\theta}{2}a^2 - \frac{\kappa}{2q}\tau^2 + \omega\, m(y, \tau).$$

Taking expectations conditional on (a, τ) and using (16),

$$\begin{aligned}\mathbb{E}[P \mid a, \tau] &= V_0 - \frac{\theta}{2}a^2 - \frac{\kappa}{2q}\tau^2 + \omega\, \mathbb{E}[m(y, \tau) \mid a, \tau] \\ &= V_0 - \frac{\theta}{2}a^2 - \frac{\kappa}{2q}\tau^2 + \omega\, K(\tau)a.\end{aligned}$$

Thus the firm-board objective is

$$\max_{a\geq 0,\ \tau\geq 0}\ V_0 - \frac{\theta}{2}a^2 - \frac{\kappa}{2q}\tau^2 + \omega\, K(\tau)a. \tag{17}$$

B.3 Stage 2: optimal action $a^*(\lambda, \tau)$ given τ

Fix $\tau \geq 0$. The a-dependent part of (17) is

$$-\frac{\theta}{2}a^2 + \omega K(\tau)a.$$

Differentiate with respect to a:

$$\frac{\partial}{\partial a}\left(-\frac{\theta}{2}a^2 + \omega K(\tau)a\right) = -\theta a + \omega K(\tau).$$

The first-order condition is

$$-\theta a + \omega K(\tau) = 0 \quad \Longrightarrow \quad a^*(\lambda, \tau) = \frac{\omega}{\theta}K(\tau).$$

Using $K(\tau) = \frac{\tau\sigma^2}{1+\tau\sigma^2}$ gives

$$a^*(\lambda, \tau) = \frac{\omega(\lambda)}{\theta} \cdot \frac{\tau\sigma^2}{1 + \tau\sigma^2}. \tag{18}$$

In particular, if $\tau = 0$ then $K(0) = 0$ and $a^*(\lambda, 0) = 0$.

B.4 Stage 1: board choice of τ (endogenous precision)

B.4.1 Step 1: substitute the best response $a^*(\lambda, \tau)$

Plug (18) into (17). The a-dependent terms become

$$\begin{aligned} -\frac{\theta}{2}a^{*2} + \omega K(\tau)a^* &= -\frac{\theta}{2}\left(\frac{\omega}{\theta}K(\tau)\right)^2 + \omega K(\tau)\left(\frac{\omega}{\theta}K(\tau)\right) \\ &= -\frac{\omega^2}{2\theta}K(\tau)^2 + \frac{\omega^2}{\theta}K(\tau)^2 \\ &= \frac{\omega^2}{2\theta}K(\tau)^2. \end{aligned}$$

Therefore the board solves

$$\max_{\tau \geq 0} \; V_0 - \frac{\kappa}{2q}\tau^2 + \frac{\omega^2}{2\theta}K(\tau)^2. \tag{19}$$

Dropping V_0 does not affect the argmax.

B.4.2 Step 2: compute $K'(\tau)$ and $K(\tau)K'(\tau)$

Recall

$$K(\tau) = \frac{\tau\sigma^2}{1+\tau\sigma^2}.$$

Differentiate:

$$K'(\tau) = \frac{\sigma^2(1+\tau\sigma^2) - (\tau\sigma^2)(\sigma^2)}{(1+\tau\sigma^2)^2} = \frac{\sigma^2}{(1+\tau\sigma^2)^2}.$$

Then

$$K(\tau)K'(\tau) = \left(\frac{\tau\sigma^2}{1+\tau\sigma^2}\right)\left(\frac{\sigma^2}{(1+\tau\sigma^2)^2}\right) = \frac{\tau\sigma^4}{(1+\tau\sigma^2)^3}. \tag{20}$$

B.4.3 Step 3: first-order condition for τ

Let

$$f(\tau) \equiv -\frac{\kappa}{2q}\tau^2 + \frac{\omega^2}{2\theta}K(\tau)^2.$$

Then

$$f'(\tau) = -\frac{\kappa}{q}\tau + \frac{\omega^2}{\theta}K(\tau)K'(\tau) = \tau\left[-\frac{\kappa}{q} + \frac{\omega^2\sigma^4}{\theta(1+\tau\sigma^2)^3}\right].$$

Thus $\tau = 0$ is always a stationary point. For an interior solution $\tau > 0$, the bracketed term must equal zero:

$$-\frac{\kappa}{q} + \frac{\omega^2\sigma^4}{\theta(1+\tau\sigma^2)^3} = 0 \quad \Longleftrightarrow \quad (1+\tau\sigma^2)^3 = \frac{\omega^2\sigma^4 q}{\theta\kappa}. \tag{21}$$

Define

$$A(\lambda, q) \equiv \frac{\omega(\lambda)^2\sigma^4 q}{\theta\kappa}. \tag{22}$$

Then (21) becomes

$$(1+\tau\sigma^2)^3 = A(\lambda, q),$$

so the interior candidate is

$$\tau^{\text{int}}(\lambda, q) = \frac{1}{\sigma^2}\left(A(\lambda, q)^{1/3} - 1\right). \tag{23}$$

B.4.4 Step 4: why there is a threshold (when $\tau^* = 0$ vs. $\tau^* > 0$)

From (23), $\tau^{\text{int}}(\lambda, q) > 0$ if and only if $A(\lambda, q) > 1$.

Define the bracketed term in $f'(\tau)$ for $\tau > 0$:

$$g(\tau) \equiv -\frac{\kappa}{q} + \frac{\omega^2\sigma^4}{\theta(1+\tau\sigma^2)^3}.$$

Note: (i) $g(\tau)$ is strictly decreasing in τ; (ii) $g(0) = \frac{\kappa}{q}\left(A(\lambda, q) - 1\right)$; (iii) $\lim_{\tau\to\infty} g(\tau) = -\kappa/q < 0$. Therefore:

- If $A(\lambda, q) \leq 1$, then $g(0) \leq 0$ and $g(\tau) < 0$ for all $\tau > 0$, so $f'(\tau) < 0$ for all $\tau > 0$ and the maximizer is the corner $\tau^*(\lambda, q) = 0$.
- If $A(\lambda, q) > 1$, then $g(0) > 0$ and $g(\tau) \to -\kappa/q < 0$ as $\tau \to \infty$, so there exists a unique $\tau > 0$ with $g(\tau) = 0$, which is the unique interior maximizer.

Putting the cases together,

$$\tau^*(\lambda, q) = \begin{cases} 0, & \text{if } A(\lambda, q) \leq 1, \\ \dfrac{1}{\sigma^2}\left(A(\lambda, q)^{1/3} - 1\right), & \text{if } A(\lambda, q) > 1. \end{cases} \tag{24}$$

B.5 Closed-form equilibrium $K(\tau^*)$ and $a^*(\lambda, q)$ on the active region

Assume $A(\lambda, q) > 1$, so $\tau^* > 0$. From (21),

$$(1 + \tau^*\sigma^2)^3 = A(\lambda, q) \quad \Longrightarrow \quad 1 + \tau^*\sigma^2 = A(\lambda, q)^{1/3}.$$

Then

$$K(\tau^*) = \frac{\tau^*\sigma^2}{1 + \tau^*\sigma^2} = \frac{A^{1/3} - 1}{A^{1/3}} = 1 - A^{-1/3}.$$

Substitute into $a^* = \frac{\omega}{\theta} K(\tau^*)$ to obtain

$$a^*(\lambda, q) = \frac{\omega(\lambda)}{\theta}\Big(1 - A(\lambda, q)^{-1/3}\Big), \qquad A(\lambda, q) = \frac{\omega(\lambda)^2\sigma^4 q}{\theta\kappa}, \tag{25}$$

valid on the active region $A(\lambda, q) > 1$. On the null region $A(\lambda, q) \leq 1$, we have $\tau^* = 0$ and therefore $a^* = 0$.

B.6 Comparative statics in the active region

Throughout, assume $A(\lambda, q) > 1$.

B.6.1 How a^* varies with precision (for fixed τ)

For fixed τ, from (18),

$$a^*(\lambda, \tau) = \frac{\omega}{\theta} K(\tau), \quad K'(\tau) = \frac{\sigma^2}{(1 + \tau\sigma^2)^2} > 0,$$

so

$$\frac{\partial a^*(\lambda, \tau)}{\partial \tau} = \frac{\omega}{\theta} K'(\tau) > 0, \qquad \frac{\partial a^*(\lambda, \tau)}{\partial \omega} = \frac{1}{\theta} K(\tau) > 0 \quad (\tau > 0).$$

B.6.2 How τ^* varies with q and ω

On $A(\lambda, q) > 1$, (23) implies

$$\tau^*(\lambda, q) = \frac{1}{\sigma^2}\left(\left(\frac{\omega(\lambda)^2\sigma^4 q}{\theta\kappa}\right)^{1/3} - 1\right),$$

hence

$$\frac{\partial\tau^*(\lambda, q)}{\partial q} > 0, \qquad \frac{\partial\tau^*(\lambda, q)}{\partial\omega} > 0.$$

B.6.3 Board quality amplifies the marginal effect of sustainable investor strength (complementarity)

Rewrite $A^{-1/3}$ as

$$A(\lambda, q)^{-1/3} = \left(\frac{\theta\kappa}{\sigma^4}\right)^{1/3} \omega(\lambda)^{-2/3} q^{-1/3}.$$

Define

$$B \equiv \left(\frac{\theta\kappa}{\sigma^4}\right)^{1/3}.$$

Then, on the active region,

$$a^*(\lambda, q) = \frac{\omega}{\theta}\left(1 - B\,\omega^{-2/3} q^{-1/3}\right) = \frac{1}{\theta}\left(\omega - B\,\omega^{1/3} q^{-1/3}\right).$$

Differentiate:

$$\frac{\partial a^*}{\partial\omega} = \frac{1}{\theta}\left(1 - \frac{B}{3}\omega^{-2/3} q^{-1/3}\right), \qquad \frac{\partial^2 a^*}{\partial q\,\partial\omega} = \frac{B}{9\theta}\omega^{-2/3} q^{-4/3} > 0.$$

Thus, in the active region, the marginal effect of sustainable-investor strength on action is larger when board quality is higher.

B.7 Mapping to the outcome (e.g., gender pay gap)

Suppose the empirical outcome satisfies

$$G = \bar{G} - \psi a + u, \qquad \psi > 0.$$

Then for any parameter x,

$$\frac{\partial \mathbb{E}[G]}{\partial x} = -\psi \frac{\partial a^*}{\partial x}.$$

In particular, on the active region:

$$\frac{\partial^2 \mathbb{E}[G]}{\partial q \, \partial \omega} = -\psi \frac{\partial^2 a^*}{\partial q \, \partial \omega} < 0,$$

so the (negative) sensitivity of the gender pay gap to sustainable investor strength becomes more negative when board quality is higher.

B.8 Forced disclosure / minimum precision ("forcing firms to talk")

Consider a rule imposing $\tau \geq \underline{\tau}$ for some $\underline{\tau} > 0$. Given any feasible τ, the best response remains

$$a^*(\lambda, \tau) = \frac{\omega(\lambda)}{\theta} K(\tau).$$

If the constraint binds, induced action is

$$a^{reg}(\lambda) = \frac{\omega(\lambda)}{\theta} K(\underline{\tau}) = \frac{\omega(\lambda)}{\theta} \cdot \frac{\underline{\tau}\sigma^2}{1 + \underline{\tau}\sigma^2} > 0 \quad \text{whenever} \quad \omega(\lambda) > 0.$$

Thus, minimum disclosure can restore real effects for firms that would otherwise choose $\tau^* = 0$.

C A Minimal Dynamic Extension

This appendix provides a minimal dynamic extension of Section 2. The extension preserves the same three building blocks: a taste-based pricing wedge tied to perceived social performance (Pástor, Stambaugh, and Taylor (2021)), endogenous and costly information production (Admati and Pfleiderer (2000)), and a forward-looking firm that cares about market valuation over time, in the spirit of dynamic, calibratable repeated-signaling environments (Hennessy, Livdan, and Miranda (2010)).

The new ingredient is that the sustainable investor base is *slow-moving*: sustainable ownership is predetermined within a period (matching the empirical design) but adjusts gradually in response to perceived social performance. This creates a feedback loop from disclosure to beliefs to investor composition, which can generate *path dependence* and *low-information traps*.

Relative to the static model, the genuinely new economic force is intertemporal: disclosure and social action become investments in the *future* investor base. Even if the within-period inference problem is unchanged, the firm may value current information production because it shifts future ownership composition and therefore future pricing incentives. This dynamic motive is absent in the static setting.

C.1 Environment and timing

Time is discrete, $t = 0, 1, 2, \ldots$. The firm has an observable board-quality parameter $q > 0$, taken as fixed over time for simplicity. The state variable is the sustainable-ownership intensity $\lambda_t \in [0, 1]$, which is predetermined at the start of period t.

Within each period t: (i) the firm observes (λ_t, q); (ii) the board chooses disclosure precision $\tau_t \geq 0$; (iii) the manager chooses a costly internal social action $a_t \geq 0$; (iv) a public signal is realized; (v) investors update beliefs, price the firm, and sustainable ownership evolves to λ_{t+1}.

C.2 Costs, information, and beliefs

Action has convex cost

$$C(a_t) = \frac{\theta}{2} a_t^2, \qquad \theta > 0, \tag{26}$$

and disclosure precision has convex cost

$$H(\tau_t; q) = \frac{\kappa}{2q} \tau_t^2, \qquad \kappa > 0,\ q > 0. \tag{27}$$

Higher board quality q lowers the marginal cost of producing precise and credible disclosure.

The market does not observe a_t. Instead it observes a noisy signal

$$y_t = a_t + \varepsilon_t, \qquad \varepsilon_t \sim \mathcal{N}\left(0, \frac{1}{\tau_t}\right), \tag{28}$$

and begins the period with a normal prior $a_t \sim \mathcal{N}(0, \sigma^2)$. Under normal-normal updating, the posterior mean is

$$m_t \equiv \mathbb{E}[a_t \mid y_t, \tau_t] = K(\tau_t)\, y_t, \qquad K(\tau) \equiv \frac{\tau\sigma^2}{1 + \tau\sigma^2} \in [0, 1). \tag{29}$$

The key object is the belief pass-through $K(\tau_t)$: when $\tau_t = 0$, beliefs do not move with the true action.

Taking expectations conditional on (a_t, τ_t) yields

$$\mathbb{E}[m_t \mid a_t, \tau_t] = K(\tau_t)\, a_t. \tag{30}$$

C.3 Pricing wedge and slow-moving sustainable ownership

As in Section 2, the period-t price contains a taste-based wedge proportional to perceived social performance:

$$P_t = V_0 - C(a_t) - H(\tau_t; q) + \omega(\lambda_t)\, m_t, \tag{31}$$

where $\omega(\lambda) \geq 0$ and $\omega'(\lambda) > 0$. The wedge attaches to beliefs m_t, not to the true action a_t.

Sustainable ownership is predetermined within the period but adjusts gradually over time. We capture this with the reduced-form law of motion

$$\lambda_{t+1} = (1-\rho)\bar{\lambda} + \rho\,\lambda_t + \gamma\,m_t, \qquad \rho \in [0,1),\ \gamma > 0,\ \bar{\lambda} \in [0,1], \tag{32}$$

where ρ captures inertia (slow rebalancing / benchmark stickiness), $\bar{\lambda}$ is baseline sustainable ownership absent new information, and γ measures how strongly sustainable flows tilt toward firms with higher *perceived* social action.

Taking expectations conditional on (λ_t, a_t, τ_t) and using (30), we obtain the expected transition

$$\mathbb{E}[\lambda_{t+1} \mid \lambda_t, a_t, \tau_t] = (1-\rho)\bar{\lambda} + \rho\,\lambda_t + \gamma\,K(\tau_t)a_t. \tag{33}$$

This is the dynamic feedback channel: higher precision and higher action increase expected perceived action, which draws sustainable ownership over time.

C.4 Firm problem and equilibrium

The firm cares about market valuation over time (for example because it repeatedly raises external finance, or because compensation and monitoring load on valuation), so it chooses (a_t, τ_t) to maximize a discounted sum of expected prices, a standard motive in dynamic signaling environments (Hennessy, Livdan, and Miranda (2010)). Formally, let $\beta \in (0,1)$ be the discount factor. The firm's Markov value function solves

$$V(\lambda; q) = \max_{a \geq 0,\ \tau \geq 0} \left\{ -\frac{\theta}{2}a^2 - \frac{\kappa}{2q}\tau^2 + \omega(\lambda)\,K(\tau)a + \beta\,V\Big(\underbrace{(1-\rho)\bar{\lambda} + \rho\,\lambda + \gamma\,K(\tau)a}_{\equiv \lambda'};\, q \Big) \right\}. \tag{34}$$

Constants such as V_0 can be dropped because they do not affect policy rules.

Equilibrium (Markov). A Markov equilibrium consists of policy functions $a(\lambda; q)$ and $\tau(\lambda; q)$ and a value function $V(\lambda; q)$ such that: (i) given (λ, q), $(a(\lambda; q), \tau(\lambda; q))$ solves (34); and (ii) λ evolves according to (33) under these policies.

When an interior solution exists, the first-order condition for a can be written as

$$\theta\, a(\lambda; q) = K(\tau(\lambda; q))\Big(\omega(\lambda) + \beta\,\gamma\, V_\lambda(\lambda'; q)\Big), \tag{35}$$

and the first-order condition for τ is

$$\frac{\kappa}{q}\,\tau(\lambda; q) = a(\lambda; q)\, K'(\tau(\lambda; q))\Big(\omega(\lambda) + \beta\,\gamma\, V_\lambda(\lambda'; q)\Big). \tag{36}$$

These expressions make the new dynamic force transparent: relative to the static model, the taste wedge $\omega(\lambda)$ is augmented by the continuation-value term $\beta\gamma V_\lambda(\lambda'; q)$, which captures the marginal value of raising future sustainable ownership.

C.5 What is new relative to the static model

The static model in Section 2 takes λ as predetermined and yields a within-period complementarity between action and disclosure. The dynamic extension adds a second, distinct complementarity across time: higher (a_t, τ_t) raises expected λ_{t+1} via (33), which raises the future wedge $\omega(\lambda_{t+1})$ and therefore strengthens incentives for future disclosure and action. This generates path dependence: two firms with the same current fundamentals but different ownership histories can rationally follow different disclosure/action paths.

Because the within-period objective remains non-convex (action is valuable only when it is informative, and information is valuable only when action is taken), the dynamic model can feature multiple regimes: a low-information region with $\tau \approx 0$ and $a \approx 0$, and an active region where both are positive. The dynamic novelty is that the boundary between these regions is no longer purely static: it depends on how valuable it is to *build* the investor base (captured by ρ, γ, and the continuation-value derivative V_λ).

C.6 Low-information traps and policy levers

A low-information trap arises when sustainable ownership is low and the firm does not find it worthwhile to incur disclosure and action costs to move beliefs (and thus future ownership). In such a region, the equilibrium policies satisfy $\tau(\lambda; q) = 0$ and $a(\lambda; q) = 0$, which implies $K(\tau) = 0$, $\mathbb{E}[m_t] = 0$, and the ownership dynamics collapse to simple mean reversion:

$$\mathbb{E}[\lambda_{t+1} \mid \lambda_t = \lambda] = (1 - \rho)\bar{\lambda} + \rho\,\lambda. \tag{37}$$

Because $\rho \in [0, 1)$, this recursion converges geometrically to $\bar{\lambda}$, so the economy can remain persistently stuck near baseline sustainable ownership with no meaningful information production and no real action.

The model highlights two natural ways to escape such traps. First, higher board quality q lowers the cost of precision in (27), which makes it cheaper to move beliefs and therefore increases the return to building a sustainable investor base. Second, a forced-disclosure policy (a lower bound $\tau_t \geq \underline{\tau} > 0$) prevents belief pass-through from collapsing, directly activating the channel in (33) in the spirit of Admati and Pfleiderer (2000).

C.7 Roadmap for structural estimation

The dynamic extension introduces parameters that are disciplined by time-series variation and are natural targets for structural work: ρ (ownership inertia) and γ (flow sensitivity to perceived social performance) are identified from ownership transitions, while κ/q is disciplined by how disclosure intensity responds to governance and ownership, and θ is disciplined by how real outcomes respond when the informational channel becomes active. The one-dimensional state variable λ_t and the explicit transition (33) make the model suitable for calibration or structural estimation in the spirit of dynamic, calibratable signaling models such as Hennessy, Livdan, and Miranda (2010).