ESG: A Panacea for Market Power?

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Abstract

We study the equilibrium effects of the “S” dimension of ESG under imperfect competition in labor or product markets. We model ESG policies as constraints that boards place on managers to treat their stakeholders well. “Doing Well by Doing Good” holds for moderate ESG policies, which are strategically beneficial. Aggressive ESG policies backfire, both for adopting firms and many stakeholders. Under shareholder primacy, competition in ESG policies generally reduces shareholder value, while coordination on policies raises new anti-trust concerns. Under stakeholder capitalism, competition in ESG policies is a panacea to market power and delivers the first-best outcome in equilibrium.

Keywords: ESG, Shareholder Primacy, Stakeholder Capitalism, Corporate Social Responsibility, Corporate Governance, Market Power

JEL Classifications: D74, D82, D83, G34, K22

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ESG: A Panacea for Market Power?*

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December 24, 2023

Abstract

We study the equilibrium effects of the "S" dimension of ESG under imperfect competition in labor or product markets. We model ESG policies as constraints that boards place on managers to treat their stakeholders well. "Doing Well by Doing Good" holds for moderate ESG policies, which are strategically beneficial. Aggressive ESG policies backfire, both for adopting firms and many stakeholders. Under shareholder primacy, competition in ESG policies generally reduces shareholder value, while coordination on policies raises new anti-trust concerns. Under stakeholder capitalism, competition in ESG policies is a panacea to market power and delivers the first-best outcome in equilibrium.

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1 Introduction

There is a long-running debate in academic and policy circles over whether the purpose of the corporation is or, should be, to maximize value for shareholders or, instead, to operate in the interest of all of its various stakeholders. These questions have far-reaching implications, including whether and how companies and boards take into account Environmental, Social and Governance (ESG) considerations when developing and delivering products and services, making business decisions, managing risk, developing long-term strategies, recruiting and retaining talent and investing in the workforce, implementing compliance programs, and crafting public disclosures. A growing number of empirical studies have examined whether firms indeed pursue ESG policies, whether these policies achieve their putative aims, and whether equity markets reward such policies. Theoretical studies have also examined whether and how shareholder actions incentivize firms to behave in socially responsible ways. However, largely absent from the literature is an examination of how firms' ESG policies affect equilibrium outcomes in the real input and output markets that they operate in. Our paper aims to fill this gap, and to study the "basic economics" of ESG policies.

We develop a benchmark model of the equilibrium effects of corporate social responsibility, thereby focusing on the "S" component of ESG in labor and product markets. In our framework, two oligopolistic firms interact in either the labor or product market. Imperfect competition results in excessive market power and as such leaves room for meaningful corporate social responsibility.[1] We model an ESG policy as a constraint that a firm's board of directors places on its manager to treat workers/customers/suppliers well. A firm's manager maximizes profits (i.e., shareholder value) subject to satisfying the constraints imposed by the firm's ESG policies. For example, in the context of labor markets, an ESG policy is a promise to pay employees above market wages,[2] provide generous benefits, invest in worker training,

[1] We focus on externalities imposed by firms on industry participants such as competitors, suppliers, and customers. Corporate responsibility with respect to the environment or society at large can be meaningful even under perfect competition.

[2] As a representative example of such policies: In recent years, Bank of America has adopted a nationwide minimum hourly wage for its employees, which has risen from \$15 in 2017 to \$23 in 2023. According to Bank of America's CHRO Sheri Bronstein, "Providing a competitive minimum rate of pay is foundational to being a great place to work." Moreover, "By investing in a variety of benefits to attract and develop talented teammates, we are investing in the long-term success of our employees, customers and communities. Our commitment to \$25 by 2025 is how we share success with you and lead the way for other companies." (www.shrm.org, "Bank of America Bumps Up Minimum Wage").

and create a friendly work environment; the manager then chooses how many workers to hire, taking these policies as given. In the context of product markets, an ESG policy is a promise to offer products with low environmental impact, high safety standards, protection of customer privacy, cybersecurity, low prices and/or high quality-to-price, etc.; then the manager chooses production levels, taking the above policies as given. For concreteness, we focus on the labor market application, while emphasizing that the product- and input-market applications are isomorphic, as we explicitly discuss at the end of the paper.

Our analysis highlights two natural consequences of ESG policies. First, an ESG policy potentially strengthens a firm's competitive position with respect to its competitors. Specifically, a promise to treat workers well limits the manager's ability to exercise monopsony power, thereby increasing hiring. But second, an ESG policy potentially weakens a firm's competitive position by increasing the cost of hiring employees. We characterize how these two different effects play out.

We first characterize the labor-market equilibrium, taking firms' ESG policies as given. If a firm adopts a moderate ESG policy, the pro-competitive effect dominates. Consequently, a moderate ESG firm raises both its market share and profits, at the expense of competitors. Workers at the ESG firm benefit; the firm hires more of them, and at more generous terms. Workers at non-ESG competitors also benefit, via competition in the labor market. In contrast, if a firm adopts an aggressive ESG policy then the anti-competitive effect dominates. Such a firm hires fewer workers, though it treats this smaller workforce better. Because the firm's workforce is both smaller and more expensive, profits and market share shrink, benefiting competitors. Workers at these competitors are worse off, because of reduced competition.

This first set of equilibrium results illustrates several key points. First, firms benefit from adopting moderate ESG policies even absent any "warm glow" social preferences of its shareholders or corporate decision makers. Put differently: no matter the reason behind an adoption of ESG policies, we should not be surprised to see that such policies sometimes increase profits; "Doing Well by Doing Good" applies in our setting. Second, ESG policies that target a firm's stakeholders affect other firms' stakeholders also, and hence have broader welfare implications. Third, the non-monotonic relationship between the strength of a firm's ESG policies and their impact on social welfare underscores that more isn't necessarily better when it comes to ESG, and an externally imposed one-size-fits-all ESG standard could be counter-productive. Fourth, our analysis highlights a novel benefit to firms from publicizing their ESG policies (or pretending to adopt such policies, i.e., social-washing); it gives them a competitive advantage in input and output markets. Without effective disclosure, the strategic effect of the firm's ESG policies is muted. Finally, the benefit from adopting and advertising an ESG policy depends on the firm's market power and the competitiveness of the markets in which it operates.

Nothing that we have said so far requires either shareholders or board members to have preferences that extend beyond the traditional assumption of profit maximization. But in practice, such concerns are likely to motivate at least some ESG adoptions, and be driven in part by socially conscious investors and/or directors. Accordingly, in addition to analyzing firms under the shareholder primacy model, we analyze firms under "stakeholder capitalism," that is, firms that set ESG policies to maximize the total surplus that they generate, viz., the sum of profits and worker surplus. We label such firms as "purposeful" firms, because they internalize their policies' effects on other stakeholders. Importantly, we maintain the assumption that firms' managers aim to maximize profits; as such, we distinguish between corporate decision makers who set the firm's ESG policies (i.e., the board of directors) and those who execute them (i.e., managers).

Loosely speaking, purposeful firms want to be large, and as one might expect, they adopt more aggressive ESG policies than shareholder-value maximizing firms, and thereby increase worker welfare at all firms. Nevertheless, a purposeful firm adopts excessively aggressive ESG policies, and grows too large relative to other firms, both from the perspective of total industry surplus. Intuitively, purposeful firms fail to internalize how their ESG policies affect surplus generated by competitors. Consequently, a purposeful firm would do more good (i.e., generate a labor-market equilibrium with higher industry surplus) if it were less purposeful, that is, if it over-weighted shareholder value relative to worker welfare, for example, by changing the composition of its board. In some cases, the industry surplus created by a shareholder-value maximizing firm can even be higher than the one created by a purposeful firm.

The above implications are all for the case in which just one firm adopts ESG policies. While this case is often relevant—for example, if only a few firms are able to make credible promises to treat stakeholders well, or if some firms are simply "thought leaders" in ESG—there are also cases in which competition in ESG policies is of first-order importance.

We first consider the shareholder primacy model in which firms' boards set ESG policies with the objective of maximizing shareholder value. We show that at moderate levels of ESG, firms' choices are strategic complements. Intuitively, each firm benefits from at least marginally outdoing its competitors' ESG policies, as a means of attracting workers and gaining market share. However, as ESG policies become more extreme, the cost to a firm of being more generous to workers than its competitors is too high, and firms' ESG choices are instead strategic substitutes. Specifically: Although a firm increases its profits by marginally outdoing its competitors' ESG policies, it does even better by instead abandoning ESG policies so that it can compete in an unconstrained way. In equilibrium, shareholder-value maximizing firms adopt ESG policies that result in higher wages, higher employment, but lower total shareholder value. Interestingly, larger and more productive firms gain more from adopting ESG policies, and when they do, the effect on social welfare is typically positive. In contrast, when smaller and less productive firms use ESG policies as a means to create a competitive advantage in real markets, they create distortions that are beneficial to their shareholders but can be costly from a social perspective.

While the unintended consequences of profit-motivated ESG policies can be socially beneficial, equilibrium ESG policies are always too moderate to fully remove market power distortions, and equilibrium social surplus falls short of the first-best. Importantly, shareholder-value maximizing firms would benefit from coordinating on low impact ESG policies, raising antitrust concerns related to the adoption of industry-wide ESG standards.

ESG-competition between purposeful firms plays out differently. The main reason is that ESG policies are stronger strategic complements for purposeful firms than for shareholder-value maximizing ones. Intuitively, and similar to a shareholder-value maximizing firm, a purposeful firm benefits from marginally outdoing its competitors' ESG policies. Unlike shareholder-value maximizing firms, however, a purposeful firm is never tempted to fully undercut its competitors by abandoning ESG policies; it has incentives to grow beyond even the first-best employment level. However, since hiring decisions are made by profit-maximizing managers, ESG policies that are more aggressive then the first-best wage backfire and reduce hiring. In this case, we obtain a striking welfare theorem: Competing purposeful firms pick equilibrium ESG policies that lead to the first-best outcome in labor markets. In other words, competition in ESG policies between purposeful firms entirely eliminates the oligopolistic distortion and maximizes industry surplus. This is true even though each individual firm aims only to maximize its own surplus, which as discussed above, can have adverse welfare effects when only a subset of firms are purposeful. Moreover, the result holds even if the purposeful firms differ in their productivity and as long as the weight they put on worker welfare is non-trivial.

Finally, our analysis has important implications that go beyond the specific context of our model. First, while we discuss our model's predictions in terms of labor markets, we re-emphasize that our analysis generates parallel implications for ESG policies in product markets and other input markets. Furthermore, ESG policies in one market create strategic and positive spillover effects in interconnected input and product markets. Thus, ESG policies that target different stakeholder groups substitute for one another. Second, our analysis suggests three possible drivers for the recent rise in ESG: the rise of concentration and market power in key industries across the US economy, a shift in the strength of investors' pro-social preferences, and the emergence of ESG-cycles, stemming from ESG polices being strategic complements at moderate levels and strategic substitutes at extreme levels. Third, relative to non-ESG firms, the output of firms that adopt moderate ESG policies is less sensitive to own productivity shocks, but more sensitive to productivity shocks hitting competitors. Fourth, our analysis suggests that ESG-linked executive pay offers no discernible social value, and stakeholder capitalism is best served when managers maintain a focus on profit-maximization, with boards strategically setting ESG policies to mitigate any adverse impacts that profit-maximization may have on other stakeholders of the firm.

We conclude with a large set of novel empirical predictions for how ESG policies affect profits, market shares, margins, responsiveness to productivity shocks, wages/prices, welfare of stakeholders; and also for how competition, transparency, peer-firms' ESG policies, and firms' models of corporate governance affect ESG policies.

Overall, the social purpose of the corporation is a panacea to excessive marker power. More broadly, our analysis relates the adoption of ESG policies to the nature of competition between firms and their model of corporate governance.

Related literature

The literature on the consequences of ESG policies for the equilibria of the real markets in which firms operate, and in turn for the ESG choices of competing firms, is relatively small.

Stoughton, Wong and Yi (2020) characterizes the consequences of firms committing to ESG policies before interacting in imperfectly competitive product or labor markets. They model ESG by committing the manager to the more diffuse objective of putting weight on worker or customer surplus. Allen, Carletti, and Marquez (2015) study the strategic behavior of stakeholder-oriented firms in the product market, and define a stakeholder firm as a firm that overweights its survival above and beyond what own shareholders would internalize. Both papers argue that shareholder value is potentially raised by a firm's commitment to deviate from profit-maximizing behavior. Magill, Quinzii, and Rochet (2015) note that just including the surpluses of the firm's own consumers and workers in the firm's objective does not lead to efficiency, and that underweighting these stakeholders in the firm's objective function could improve efficiency.

Relative to this strand of the literature, we model ESG as a clear promise to deliver a minimum level of utility to workers or customers. This difference in how we conceptualize ESG policies has important implications for our analysis, including, for example, the observations that aggressive ESG policies hurt stakeholders in other firms; that there is a strong force pushing each firm to marginally out-do the ESG policies of its competitors; and that a firm's best response to its competitors adopting aggressive ESG policies is to abandon ESG altogether. Moreover, our framework allows us to investigate differences in optimal ESG policies adopted by purposeful and shareholder-value maximizing firms, and to derive a striking welfare theorem that competition between purposeful firm delivers efficiency.

Xiong and Yang (2022) explore a different motive for ESG policies by shareholder-value maximizing firms that operates for network goods, namely that since each customer benefits from an increase in the total number of customers, an ESG policy can increase a firms' profits by incentivizing a firm to charge lower prices, thereby attracting more customers. Albuquerque, Koskinen, and Zhang (2019) conceptualize ESG very differently, and in particular, as a characteristic that directly impacts consumer demand by decreasing consumers' elasticity of substitution. As such, ESG policies raise profit margins, and reduces exposure to shocks. Dewatripont and Tirole (2022) study a model of imperfect competition with socially responsible consumers. Unlike our framework, in their model firms can adopt ESG policies that affect consumers' welfare above and beyond the price they charge. They show that the degree of competitive pressure is irrelevant for the adoption of ESG policies in equilibrium if prices are flexible. In a non-ESG setting, Rey and Tirole (2019) study the use of price caps by firms selling complementary goods, and show that such price caps can alleviate double-marginalization problems for firms. In their analysis, firms collectively agree to price-cap arrangements

At an abstract level, the idea of firms' ESG choices affecting subsequent equilibrium outcomes under imperfect competition is related to literature studying the effects of other types of firm decisions, including, for example, Brander and Lewis (1986)'s analysis of debt choices and Fershtman and Chaim (1987)'s, as well as Sklivas (1987)'s analysis of managerial contracts. A central theme in much of this literature is that firms can effectively commit to compete more aggressively via decisions made prior to product market interactions, and that doing so is a potential source of advantage. Perhaps surprisingly, this same effect operates in our setting also—after all, it isn't obvious whether constraining managers to pay workers more leads firms to compete more or less aggressively. More generally, the application of the idea that commitment helps in imperfect competition settings to the specific context of ESG yields numerous insights, including the extent to which competition in ESG firms pushes the equilibrium outcome towards the socially optimal one.

A sizeable literature has addressed the topic of a firm's objectives. See, for example, Tirole (2001); or for a recent survey, Gorton, Grennan, and Zentefis (2022). Geelen, Hajda and Starmans (2023) study how differences in social preferences between the firm's manager and owner affect the sustainability of the organization. Allcott et al (2022) quantitatively estimate the relative importance of firm's profits, consumer surplus, worker surplus, and a subset of externalities including carbon emissions.

While the theoretical literature on the effects of ESG policies on product and labor market is small, a larger theoretical literature considers the effects of responsible investment on corporate policies: Heinkel, Kraus, and Zechner (2001), Davies and Van Wesep (2018), Oehmke and Opp (2020), Edmans, Levit, and Schneemeier (2022), Landier and Lovo (2020), Green and Roth (2021), and Chowdhry, Davies, and Waters (2019), Huang and Kopytov (2022), Deeksha, Kopytov and Starmans (2022), and Piccolo, Schneemeier, and Bisceglia (2022).

Finally, in the labor-market application of our model, a firm can increase its profits by paying above market-clearing wages to its workers. In this respect, our paper adds a new channel to the extensive literature on efficiency wages that has explored a variety of ways in which firms may benefit from above market-clearing wages (see Katz (1986) for a literature review). An important distinction between our mechanism and those in the existing literature is that paying higher wages ends up lowering (rather than raising) the productivity of a firm's marginal worker, since the benefit of higher pay is an increased market share for the firm. Related, unlike the literature on minimum wages, in our model minimum wages are self-imposed, allowing for variations across firms and richer welfare implications. Nonetheless, our model is consistent with recent empirical evidence by Azar et al. (2023), who show that minimum wage increases lead to positive employment effects in concentrated labor markets.[3]

2 Set-up

Consider an imperfectly competitive labor market with two firms.[4] Each firm $i \in \{1, 2\}$ deploys labor $l_i \in [0, 1]$ to produce $f_i(l_i)$, where $f_i(\cdot)$ is strictly increasing and concave. Throughout, we assume firms hire a strictly positive number of workers by imposing the standard Inada condition $f_i'(0) = \infty$. The productivity of the two firms is unambiguously ordered, i.e., the comparison between $f_1'(l)$ and $f_2'(l)$ is independent of l. Without loss, firm 1 is weakly more productive,

$$f_1'(\cdot) \geq f_2'(\cdot). \tag{1}$$

We write $L \equiv l_1 + l_2$ for total labor employed at all firms. There is a continuum of workers, with a measure normalized to 1, and ordered on $[0, 1]$ by outside option $W(l)$ for worker $l \in [0, 1]$, where $W'(\cdot) > 0$. Hence the inverse labor supply curve is $W(L)$.

Firms compete in Cournot fashion. That is, firms' managers simultaneously announce hiring l_1, l_2, and the market wage is determined by $W(L)$. There is significant evidence that employers enjoy market power in labor markets; see, for example, Lamadon et al. (2022).

The objective of the manager of each firm is to maximize its profits. We assume

$$W''(L)L + W'(L) > 0, \tag{2}$$

[3]For more evidence on the effects of minimum wages see, e.g., Card and Krueger (1995), Neumark and Wascher (2008) and references in Azar et al. (2023).

[4]In Section G of the Online Appendix, we analyze a competition between one ESG firm and $N \geq 2$ non-ESG firms, and show that the results are similar to those reported in Section 4. Moreover, the analysis of one ESG firm and a competitive fringe is also similar to the analysis in Section 4 since the competitive fringe will never adopt an ESG policy. Analyzing competition between $N > 2$ ESG firms is substantially more complicated and left for future research.

which ensures both that managers' reaction functions to other managers' hiring decisions slope down (see Lemma 1 below) and that the employment cost $W(L)L$ faced by a monopsonistic firm is convex (i.e., $W''(L)L + 2W'(L) > 0$).

The key innovation of our analysis is that firms can adopt ESG policies. Specifically, before managers make hiring decisions, the board of each firm i may adopt an ESG policy that constrains the firm to pay its workers at least $\omega_i \geq 0$. Hence an ESG policy is fully characterized by ω_i. If firm i adopts policy ω_i, it pays its workers $\max\{\omega_i, W(L)\}$.[5] Firms' ESG policies are public, and in particular observed by competitors. The firm's manager maximizes firm-profits subject to this constraint. That is: The board of directors of the firm adopts an ESG policy that can be monitored and enforced (wages and benefits are observable and verifiable), but the hiring decision is made by executives who have incentives to maximize profit. We emphasize that, in practice, ESG promises to treat workers well often cover multiple dimensions of the employment relation, including non-pecuniary benefits of various kinds, and that ω_i should be understood as the monetary-equivalent of these various promises.

We consider two models of corporate governance throughout the analysis. Under the shareholder primacy model, a firm's board adopts an ESG policy ω_i with the objective of maximizing firm profits, i.e., shareholder value. We label such firms as *shareholder firms*. Under the stakeholder capitalism model, a firm's board instead adopts an ESG policy ω_i with the objective of maximizing a broader measure of a firm's impact, namely total surplus created by the firm—which here equals the sum of firm-profits and worker-surplus. We label such firms as *purposeful firms*. Leading cases in which purposeful firms potentially emerge are if shareholders are socially conscious, if workers gain board representation, or if the firm is incorporated as a Benefit Corporation ("B Corp") with a legal obligation to consider the impact of its policies not only on shareholders but also on other stakeholders such as its employees. Note that purposeful firms are "narrow" consequentialists, and care about the immediate outcomes of their actions, but not the equilibrium implications for other firms.

Last, under both models of corporate governance, we assume that managers maximize profits, subject to the constraints imposed by ESG policies. Effectively, we assume that boards (or investors) are limited in their ability to incentivize managers to directly internalize the

[5]ESG policy ω_i has no effect on firm i's production or revenue. A positive and direct effect on the firm's production function would be analogous to the effect of efficiency wages.

welfare of the firm's employees.

Remark on the framework of competition

Our analysis builds on a standard Cournot model of imperfect competition. This makes transparent the role of the novel aspects of our analysis, namely, firms' ESG policies to treat their stakeholders well. The Cournot model has the specific advantages of allowing for a clear separation between ESG policies (expressed in terms of price) and subsequent actions in the imperfect-competition game (in Cournot, quantities).[6] It also naturally generates the pro- and anti-competitive effects of ESG policies that are central to our analysis.

Related, the assumption of downwards sloping quantity-reaction functions is intuitive and widely-imposed in the literature. It is an important ingredient in our analysis of shareholder firms, but matters less for the case of purposeful firms (see discussion at end of Section 4.3.)[7]

3 Preliminaries

We start by stating several basic results and definitions that we use throughout.

3.1 First-best benchmark

The first-best allocation maximizes industry surplus, which equals total output net of the outside options of workers employed:

$$S(l_1, l_2) \equiv f_1(l_1) + f_2(l_2) - \int_0^{l_1+l_2} W(l)\, dl. \tag{3}$$

[6]Kreps and Scheinkman (1983) show that, under some circumstances, the Cournot outcome arises if firms first choose maximum capacities, and then subsequently engage in price competition. Similarly, we conjecture that equilibria in our setting coincide with the outcomes of a game in which (i) boards of directors set ESG policies; (ii) profit-maximizing managers make capacity decisions; (iii) profit-maximizing managers engage in price competition.

[7]Note that although the distinction between actions as strategic substitutes and complements is sometimes related to quantity versus price competition, the two notions are separate; quantity competition can generate strategic complementarity, while price competition can generate strategic substitutability. Indeed, in models of price competition based on firm "location," this last point is often overlooked because many analyses focus for simplicity on the case in which all consumers buy from at least one firm; see, for example, the discussion in Mas-Colell et al (1995), and especially exercise 12.c.14.

Thus, the first-best allocation is l_i^{**} such that for $i \in \{1, 2\}$

$$f_i'(l_i^{**}) = W^{**} \equiv W(l_1^{**} + l_2^{**}). \tag{4}$$

Note that l_i^{**} would be the equilibrium outcome if both firms were controlled by a single owner whose objective is to maximize surplus rather than profit. It is also immediate that the first-best allocation would arise if the labor market was fully competitive, so that each firm acts as a price-taker. Indeed, let

$$\lambda_i(W_0) \equiv \arg\max_l \; f_i(l) - lW_0 \tag{5}$$

be firm i's profit-maximizing hiring decision if facing a constant wage W_0. Then, $l_i^{**} = \lambda_i(W^{**})$. Notice that $\lambda_i(\cdot)$ is a decreasing function. We use this notation throughout. Since firm 1 is weakly more productive it hires more workers under the first-best allocation, $l_1^{**} \geq l_2^{**}$. Nevertheless, the marginal productivity of both firms is identical, $f_1'(l_1^{**}) = f_2'(l_2^{**})$.

3.2 No-ESG benchmark

Consider a benchmark in which firms don't adopt ESG policies (i.e., $\omega_1 = \omega_2 = 0$). Firm i takes firm $-i$'s hiring l_{-i} as given and maximizes profits, generating firm i's reaction function $r_i(l_{-i}; 0)$. Here, 0 denotes No-ESG policy ($\omega_i = 0$). Formally,

$$r_i(l_{-i}; 0) \equiv \arg\max_l \; f_i(l) - lW(l + l_{-i}). \tag{6}$$

Lemma 1 *The reaction function $r_i(l_{-i}; 0)$ is strictly decreasing in l_{-i} and $r_i(l_{-i}; 0) + l_{-i}$ is strictly increasing in l_{-i}.*

All omitted proofs are in the Appendix. Lemma 1 establishes that if firm $-i$ hires more then firm i hires less, because firm $-i$'s increased hiring raises wages. However, firm i reduces its hiring by less than the increase in firm $-i$'s hiring, so that overall hiring increases. To see the latter point, note that if firm i instead reduces its hiring by the same amount that firm $-i$ increases its, then wages would remain unchanged, while firm i's marginal productivity is higher (since f is concave), implying that firm i isn't optimizing.

Next, we characterize the equilibrium of the No-ESG benchmark.

Lemma 2 *In the unique equilibrium of the No-ESG benchmark, each firm $i = 1, 2$ hires $l_i^B = r_i\left(l_{-i}^B; 0\right)$, i.e.,*

$$f_i'\left(l_i^B\right) = W'\left(l_1^B + l_2^B\right) l_i^B + W\left(l_1^B + l_2^B\right). \tag{7}$$

Moreover, $l_1^B \geq l_2^B$,

$$l_1^B + l_2^B < l_1^{**} + l_2^{**}, \tag{8}$$

and both firms pay their workers

$$W^B \equiv W\left(l_1^B + l_2^B\right) < W^{**}. \tag{9}$$

As in the first-best benchmark, the more productive firm hires more workers, $l_1^B \geq l_2^B$. However, unlike the first-best benchmark, the larger firm has a higher marginal productivity, $f_1'\left(l_1^B\right) \geq f_2'\left(l_2^B\right)$. Intuitively, monopsony power stops firms from fully internalizing the social benefit of increasing employment, and the larger firm fails to internalize it to a larger extent.[8]

Lemma 2 confirms that the usual monopsony distortion arises, so that total employment and wages are below first-best levels. Forcing both firms to hire more and pay higher wages would move the economy closer to efficiency. Regulators who aim to maximize social welfare would be tempted to impose a minimum wage on the industry. However, such an intervention would need to be tailored to industry-specific conditions that are likely to be hard for a regulator to observe. In contrast, firms have a better knowledge of the industry in which they operate, motivating our interest in studying their incentives to self-impose ESG policies.

3.3 An ESG firm's reaction function $r_i(\cdot; \omega_i)$

Suppose that, before hiring, firm i's board adopts the ESG policy ω_i, thereby constraining the firm to pay its workers $\max\{\omega_i, W(L)\}$. Given this constraint, firm i's manager chooses l_i to maximize its profits. Here, we characterize firm i's hiring response l_i to firm $-i$'s hiring l_{-i}, given firm i's ESG policy ω_i—that is, firm i's reaction function.

[8] In the proof of Lemma 2 we show that $l_1^B < l_1^{**}$, i.e., the larger firm is always distorted down. However, in general, $l_2^B < l_2^{**}$ is not guaranteed. Intuitively, if the smaller firm is sufficiently unproductive, it hires very few employees in the first place, and hence, the first order determinant of its hiring decision is the market wage, which is lower in equilibrium (relative to the first-best) due to the incentives of the larger firm to distort down its own employment.

Firm i's profits given employment decisions l_i and l_{-i} and firm i's ESG policy ω_i is

$$\pi_i(l_i, l_{-i}; \omega_i) \equiv f_i(l_i) - \max\{W(l_i + l_{-i}), \omega_i\} l_i. \tag{10}$$

Note that firm i's profits are affected by firm $-i$'s ESG policy only via firm $-i$'s hiring decision l_{-i}. As such, firm i's reaction function is independent of firm $-i$'s ESG policy:

$$r_i(l_{-i}; \omega_i) \equiv \arg\max_l \pi_i(l, l_{-i}; \omega_i). \tag{11}$$

To characterize $r_i(l_{-i}; \omega_i)$, we first define $\Lambda_i(\omega)$ as the solution to

$$\Lambda + r_{-i}(\Lambda; 0) = W^{-1}(\omega). \tag{12}$$

In words, $\Lambda_i(\omega)$ is the level of hiring by firm i such if firm $-i$ is a non-ESG firm and responds optimally then the resulting wage is ω. Define $\Lambda_i(\omega) = 0$ if $W(r_i(0; 0)) > \omega$ and $\Lambda_i(\omega) = \infty$ if $W(\Lambda + r_i(\Lambda; 0)) < \omega$ for all Λ. Note that $\Lambda_i(\omega)$ is well-defined because, by Lemma 1, the left hand side of (12) is strictly increasing in Λ, so at most one solution exists. For use below, note that Lemma 1 also implies that $\Lambda_i(\cdot)$ is strictly increasing.

Lemma 3 *Firm i's reaction function is given by*

$$r_i(l_{-i}; \omega_i) = \begin{cases} \lambda_i(\omega_i) & \text{if } l_{-i} \leq W^{-1}(\omega_i) - \lambda_i(\omega_i) \\ W^{-1}(\omega_i) - l_{-i} & \text{if } l_{-i} \in (W^{-1}(\omega_i) - \lambda_i(\omega_i), \Lambda_{-i}(\omega_i)) \\ r_i(l_{-i}; 0) & \text{if } l_{-i} \geq \Lambda_{-i}(\omega_i) \end{cases} \tag{13}$$

$$= \min\left\{\lambda_i(\omega_i), \max\left\{W^{-1}(\omega_i) - l_{-i}, r_i(l_{-i}; 0)\right\}\right\}. \tag{14}$$

The solid line in Figure 1 graphically illustrates Lemma 3, and in particular shows the three regions of firm i's ESG reaction function. As one would expect, the reaction function is weakly decreasing in l_{-i}. In the first region, where $l_{-i} \leq W^{-1}(\omega_i) - \lambda_i(\omega_i)$, we have $r_i(l_{-i}; \omega_i) = \lambda_i(\omega_i)$ and $W(r_i(l_{-i}; \omega_i) + l_{-i}) \leq \omega_i$. Since demand by firm $-i$ is relatively low, the market wage is below firm $i's$ self-imposed minimum wage ω_i. Hence, firm i pays its employees above the market wage and hires as if it faces a perfectly elastic supply at ω_i.[9] In other words, the ESG policy mutes the monopsony distortion of the manager, who acts as a price taker. We label this as the *competitive* region.

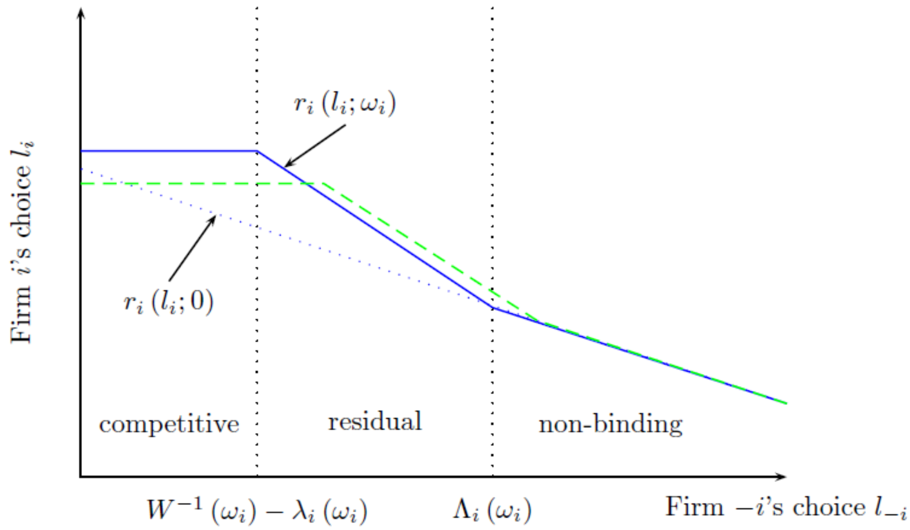

Figure 1 - An ESG firm's labor reaction function.

In the second region, where $l_{-i} \in (W^{-1}(\omega_i) - \lambda_i(\omega_i), \Lambda_{-i}(\omega_i))$, we have $r_i(l_{-i};\omega_i) = W^{-1}(\omega_i) - l_{-i}$, which implies $W(r_i(l_{-i};\omega_i) + l_{-i}) = \omega_i$. That is, the market wage is equal to firm i's self-imposed minimum wage. In this region, demand by firm $-i$ is higher, and if firm i were to hire as if it faces a perfectly elastic supply at ω_i, the resulting market wage would be higher than its self-imposed minimum wage, which in turn would incentivize firm i to hire less, as if it faces no minimum wage constraint. However, since firm $-i$'s demand isn't so high, if firm i were to hire as if it has no constraints, that is $l_i = r_i(l_{-i};0)$, then the resulting market wage would be lower than its self-imposed minimum wage, which in turn, would incentivize it to hire more aggressively, as if it faces perfectly elastic supply at ω_i. Therefore, the best response of the firm is to choose the residual level of demand such that the resulting market wage exactly equals its self-imposed minimum wage. Put differently, the manager of firm i ignores the monopsony distortion as long as there are enough workers who are willing to

[9] If $\omega_i > W(L)$ then firm i may face excess supply. In this case, the employment in firm i is rationed and workers are randomly allocated to firm i until l_i of them are hired.

accept a wage of ω_i. Notice that while firm i is not paying above the market wage, its ESG policy increases the market wage above the level that would have emerged if it were to set $\omega_i = 0$. We label this region as the *residual* region.

In the third region, where $l_{-i} > \Lambda_{-i}(\omega_i)$, firm i's ESG policy isn't binding, i.e., $r_i(l_{-i}; \omega_i) = r_i(l_{-i}; 0)$. To see this, note that $l_{-i} > \Lambda_{-i}(\omega_i)$ is equivalent to $W(l_{-i} + r_i(l_{-i}; 0)) > \omega_i$, which says that firm i's profit maximizing response to l_{-i} pushes the market wage above ω_i even absent any ESG-imposed constraint. We label this as the *non-binding* region.

Figure 1 also shows how firm i's reaction function shifts as its ESG policy grows more aggressive; this is the shift from the solid blue line to the dashed green line. The competitive, residual, and non-binding regions all shift to the right. For intermediate hiring by firm $-i$, roughly the residual region, a more aggressive ESG policy ω_i leads firm i to hire more, and the reaction function shifts up. This is the *pro-competitive* effect of ESG; a more aggressive ESG policy extends the perfectly elastic portion of the supply curve that firm i's manager faces. But for low hiring by firm $-i$, roughly the competitive region, a more aggressive ESG policy ω_i leads firm i to hire less, and the reaction function shifts down. This is the *anti-competitive* effect of ESG; a more ESG policy makes workers more expensive, and the manager hires less.

4 Competition between ESG and non-ESG firms

To develop our first set of results, we start by considering the case in which only firm i adopts the an ESG policy. For example, only firm i is able to credibly constrain its manager to treat workers well; or alternatively, firm i is a "thought leader" and considers a policy that hasn't occurred to firm $-i$. This analysis will also develop key intuitions that will be instrumental in Section 5, where we study competition in ESG policies between the two firms.

4.1 Labor market equilibrium with one ESG firm

As a first step, we characterize the labor market equilibrium that arises when only firm i adopts an (exogenous) ESG policy ω_i.

Proposition 1 *Suppose $\omega_{-i} = 0$. Then, the for any ω_i the unique equilibrium is:*

(i) If $\omega_i \leq W^B$ then the No-ESG benchmark is obtained.

(ii) If $\omega_i > W^B$ *then* $l_i^* = \min\{\Lambda_i(\omega_i), \lambda_i(\omega_i)\}$, $l_{-i}^* = r_{-i}(l_i^*; 0)$, $W_i^* = \omega_i$, *and* $W_{-i}^* = W(l_i^* + r_{-i}(l_i^*; 0))$.

From Proposition 1, the ESG firm's hiring is $l_i^* = \min\{\Lambda_i(\omega_i), \lambda_i(\omega_i)\}$. The two terms in the minimand correspond, respectively, to the equilibrium falling in the residual and competitive regions of firm i's reaction function. As firm i's ESG policy ω_i becomes more aggressive, the first term $\Lambda_i(\omega_i)$ increases, while the second term $\lambda_i(\omega_i)$ decreases, corresponding to the pro- and anti-competitive effects of ESG discussed above. At the No-ESG benchmark W^B we know $\Lambda_i(W^B) = l_i^B$; while the monopsony distortion in the No-ESG benchmark implies $l_i^B < \lambda_i(W^B)$. Consequently, if firm i adopts an ESG policy moderately above W^B then it hires $l_i^* = \Lambda_i(\omega_i) > l_i^B$, which is increasing in the ESG policy ω_i. The left panel of Figure 2 illustrates this pro-competitive effect: Comparing the black dot, which shows the No-ESG benchmark, with the blue dot, which is the equilibrium when firm 2 adopts a moderate ESG policy, shows that a moderate ESG policy increases firm 2's hiring at the expense of firm 1, and in equilibrium, firm 2 operates in the residual region of its reaction function.

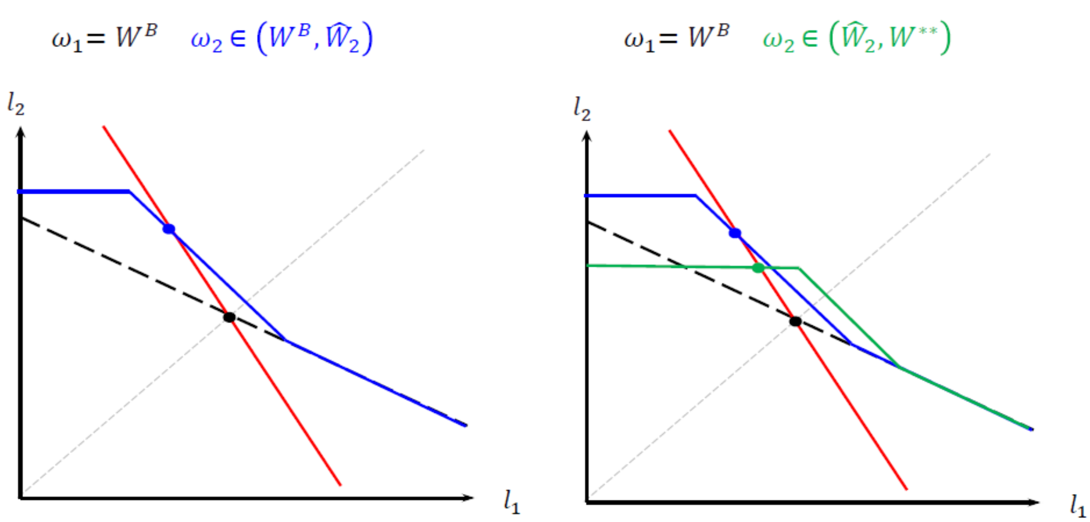

Figure 2 - Reaction functions and equilibrium when only firm 2 adopts an ESG policy.

As firm i continues to increase its ESG policy the anti-competitive effect eventually dominates, and $l_i^* = \lambda_i(\omega_i)$. In particular, we know the anti-competitive effect dominates as ω_i

approaches the first-best wage level W^{**}, because the monopsony distortion and the definition of W^{**} imply

$$\lambda_i(W^{**}) + r_{-i}(\lambda_i(W^{**}); 0) < \lambda_i(W^{**}) + \lambda_{-i}(W^{**}) = W^{-1}(W^{**}), \tag{15}$$

in turn implying (Lemma 1) $\lambda_i(\omega_i) < \Lambda_i(\omega_i)$. The right panel of Figure 2 illustrates this anti-competitive effect: Comparing the blue dot with the green dot, which is the equilibrium when firm 2 adopts an extreme ESG policy, shows that an extreme ESG policy decreases the employment of firm 2 (while increasing the employment of firm 1), and in equilibrium, firm 2 produces in the competitive region of its reaction function.

It follows that the ESG policy that maximizes firm i's employment is $\hat{W}_i \in \left(W^B, W^{**}\right)$, defined as the (unique) intersection of the functions $\Lambda_i(\cdot)$ and $\lambda_i(\cdot)$:

$$\Lambda_i(\hat{W}_i) = \lambda_i(\hat{W}_i). \tag{16}$$

In words, $\hat{W}_i$ is the ESG level at which pro-competitive effects end and anti-competitive effects begin. Figure 3 graphically depicts this point: the ESG firm's reaction function intersects with the non-ESG firm's reaction function exactly at the kink, where the competitive and the residual regions of the reaction function meet.

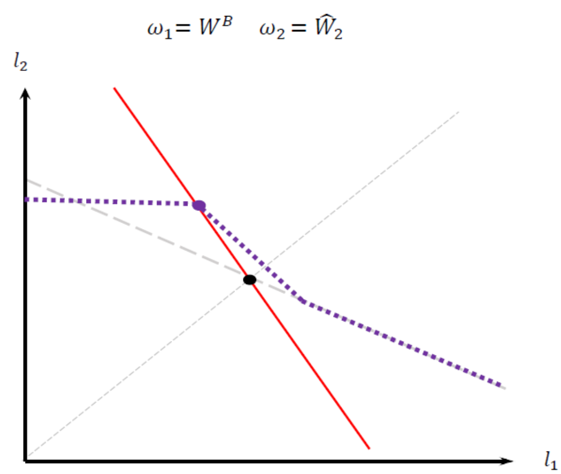

Figure 3 - Reaction functions and equilibrium when only firm 2 adopts the size-maximizing ESG policy.

Below, we consider the optimal choice of ESG policies by firms' boards of directors. We first study the choice of a shareholder firm, and then, in turn, the choice of a purposeful firm.

4.2 Shareholder-value maximizing ESG policies

To analyze a shareholder firm's choice of ESG, we start with the observation that modest ESG policies increase profits for the adopting firm. The reason is that a modest ESG policy effectively commits firm i to compete more aggressively in the labor market. This commitment induces the competitor firm $-i$ to retreat. By definition, if firm i hires l_i^B then the marginal benefits and costs of additional hiring are exactly balanced, conditional on firm $-i$ hiring l_{-i}^B. But if firm i can commit to its hiring choice, the marginal cost of additional hiring is reduced because firm $-i$ retreats and hires less, reducing the wage impact of firm i's additional hiring.

Modest ESG policies are profitable for the same reason that a firm benefits from commitment in Cournot settings. However, the commitment attainable with ESG policies is limited; as discussed above, the maximal employment that firm i can achieve is $\lambda_i(\hat{W}_i)$. But if firm i is adopting ESG policies purely in order to maximize profits, then the limited commitment power they generate is more than enough. Specifically, a shareholder firm i would adopt an ESG policy strictly below $\hat{W}_i$, the size-maximizing ESG policy. This is readily seen from the following expression for firm i's marginal profits from committing to increase hiring l_i:

$$f_i'(l_i) - W(l_i + r_{-i}(l_i;0)) - \left(1 + r_{-i}'(l_i;0)\right) l_i W'(l_i + r_{-i}(l_i;0)). \tag{17}$$

This expression is negative at $l_i = \lambda_i(\hat{W}_i)$. The third term is the monopsony distortion, and is negative. Evaluated at $l_i = \lambda_i(\hat{W}_i)$, the combination of the first two terms is 0, because by definition $f_i'(\lambda_i(\hat{W}_i)) = \hat{W}_i$.

The next result characterizes the ESG policy that maximizes shareholder value, and compares the properties of the equilibrium that unfolds to the No-ESG benchmark. Notationally, let φ_i^* denote the shareholder-value maximizing choice of ESG.[10]

Proposition 2 *Suppose firm i's opponent adopts the No-ESG policy (i.e., $\omega_{-i} = 0$). Then, the shareholder-value maximizing ESG policy of firm i satisfies $\varphi_i^* \in (W^B, \hat{W}_i)$. Under ESG*

[10] For the non-generic cases in which the maximizer is not unique, we focus on the smallest maximizer.

policy φ_i^**,* $l_i^* = \Lambda_i(\varphi_i^*)$*,* $l_{-i}^* = r_{-i}(\Lambda_i(\varphi_i^*);0)$*, and* $W_i^* = W_{-i}^* = \varphi_i^*$*. Relative to the No-ESG benchmark, worker welfare, industry employment, and firm i's employment and profit are higher. In contrast, firm* $-i$*'s employment and profit are lower. Both firms pay the same wage, which is higher than the No-ESG benchmark.*

Figure 4 plots the firm's employment as a function of its own ESG policy, and in particular, the location of the shareholder-value maximizing ESG policy φ_i^*.

The result above has two interesting implications. First, it links the incentives for a shareholder firm to adopt ESG to the competitiveness of the market. In particular, if the labor market were competitive (i.e., labor supply is perfectly elastic) then such a firm wouldn't adopt any ESG policy. Extrapolating from this limiting case, the profit-maximizing ESG policy grows more aggressive as the supply curve becomes more inelastic. In Section E of the Online Appendix, we establish that this implication holds monotonically for the case of symmetric firms, Cobb-Douglas production, and a constant-elasticity of supply of $\epsilon > 0$:

$$f_i(l_i) = \kappa_f l_i^{\alpha} \text{ and } W(L) = \kappa_W L^{\frac{1}{\epsilon}}. \tag{18}$$

Second, a firm's ESG policy increases its profits only if its competitors are aware of the policy. Hence firms benefit from credibly broadcasting their ESG policies; and regulations that facilitate transparency and disclosure of ESG policies contribute to their effectiveness and adoption. In contrast, further below we establish that ESG-transparency matters less if the adopting firm is purposeful.

As noted above, firm i's shareholders benefit from its ESG policy at the expense of firm $-i$'s shareholders. But the employees of both firms gain from firm i's ESG policy. Indeed, in equilibrium, both firms pay their workers $\varphi_i^* > W^B$.[11] Moreover, while employment at firm i increases at the expense of employment at firm $-i$ (i.e., $l_i^* > l_i^B$ and $l_{-i}^* < l_{-i}^B$), total employment increases (i.e., $l_i^* + l_{-i}^* > l_i^B + l_{-i}^B$). That is, firm i increases its employment by more than firm $-i$ reduces it. Therefore, worker welfare always increases relative to the No-ESG benchmark. In this respect, the unintended consequences of a profit-motivated ESG policy are beneficial to workers. Interestingly, since ESG and non-ESG firms' wages coincide in equilibrium, it is empirically challenging to to identify which firm is the ESG-firm based purely on employment

[11] Since $W_{-i}^* = W(\Lambda_i(\varphi_i^*) + r_{-i}(\Lambda_i(\varphi_i^*);0))$, by the definition of $\Lambda_i(\cdot)$, $W_{-i}^* = \varphi_i^*$.

conditions (and in particular, without information on productivity).[12]

Nonetheless, firm i's adoption of ESG never raises industry employment to its first-best level. By Lemma 1, industry employment is maximized by firm i maximizing its own employment, which it does by adopting $\hat{W}_i$ and hiring $l_i = \Lambda_i(\hat{W}_i)$. By the definition of Λ_i, firm $-i$'s best response leads to a market wage $\hat{W}_i$, and industry employment of $W^{-1}(\hat{W}_i)$. Since $\hat{W}_i < W^{**}$, this establishes that industry employment is below its first-best level, as claimed.

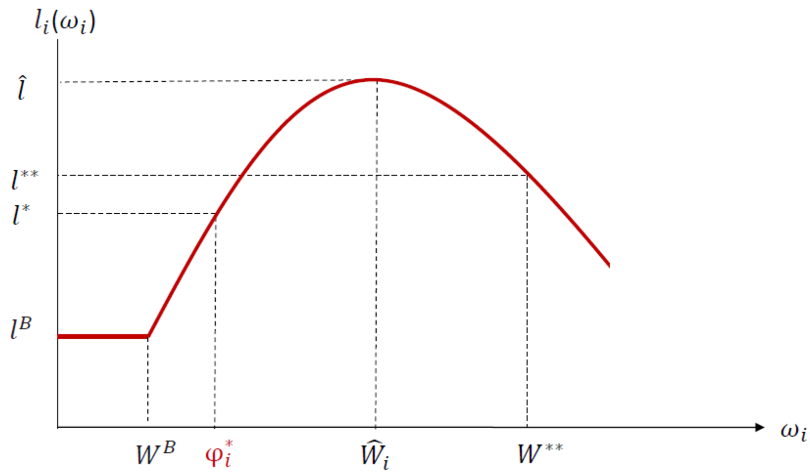

Figure 4 - Firm's employment as a function of its own ESG policy.

The effect of firm i's ESG policy on industry profits and surplus is more nuanced. In the proof of Proposition 2 in the Appendix, we show that if firm i is the (weakly) less-productive firm (i.e., $i = 2$), then total industry profits decrease relative to the No-ESG benchmark. That is, the increase in firm i's profits is lower than the decline firm $-i$'s profits. Intuitively, as firm i increases employment at the expense of its more productive opponent, production is shifted the "wrong" way, toward the firm with the lower marginal productivity and a smaller monopsony distortion in the first place. This force also explains why industry surplus could decline due to firm i's ESG policy, which we illustrate by example in Section C of the Online Appendix. In this respect, when unproductive firms use ESG policies to gain a competitive advantage in real

[12] Notice that if firms were symmetric then the ESG firm would be larger than the non-ESG firm since it employs more workers. However, in general, when firms are asymmetric, it is hard to identify which one is the ESG firm since less productive firms can adopt ESG policy and still hire less.

markets, they create distortions that are beneficial to the firm's shareholders but can be costly from a social perspective. In contrast, if firm i is the more productive firm (i.e., $i = 1$), then it is possible that total industry profits increase relative to the No-ESG benchmark. In this case, the adoption of the ESG policy is a Pareto improvement and industry surplus increases.[13] In fact, industry surplus can increase in those cases in which industry profitability declines. Intuitively, when the more productive firm uses ESG to enhance its competitive advantage, production is shifted the "right" way and toward the firm whose monopsony distortion creates a larger social cost (and hence, increasing production is marginally more valuable).[14]

Under relatively mild conditions (specifically, $W(\cdot)$ log-concave and production functions having the standard log-linear form), Lemma 13 in Section D of the Online Appendix shows that the more productive firm has stronger incentives to adopt ESG, that is, the derivative of profits with respect to ESG is greater for the more productive firm in the neighborhood of the No-ESG benchmark W^B. Intuitively, the more productive firm has more to gain from higher production (since $f_1'(\cdot) > f_2'(\cdot)$). As noted above, industry surplus rises when it is the more productive firm that adopts ESG.

4.3 A purposeful firm's preferred ESG policy

We next characterize and study the implications of a purposeful firm's choice of ESG policy. A purposeful firm's board adopts an ESG policy with the objective of maximizing the surplus created by the firm, which here equals the sum of profits and worker surplus. Worker surplus depends on workers' outside options, which in turn depends on how workers are allocated across different firms. The minimum and maximum values of the combined outside options of firm i's workers are, respectively, $\int_0^{l_i} W(l)\,dl$ and $\int_{l_{-i}}^{l_i+l_{-i}} W(l)\,dl$. We define firm i's surplus using a weighted average of these possibilities, with weight $\mu \in (0,1)$.[15]

$$S_i(l_i, l_{-i}) \equiv f_i(l_i) - \mu \int_0^{l_i} W(l)\,dl - (1-\mu) \int_{l_{-i}}^{l_i+l_{-i}} W(l)\,dl. \tag{19}$$

[13] Recall the shareholder value of the competing firm always declines. Hence a Pareto improvement only arises if shareholders are diversified across the two firms, e.g., common ownership.

[14] Formally, we show in the proof of Proposition 2 in the Appendix that industry surplus is always increasing if the more productive firm chooses an ESG policy in the neighborhood of W^B.

[15] Our results hold for any $\mu \in [0,1]$. If $\mu = \frac{1}{2}$ then $S_i(l_i, l_j) + S_j(l_j, l_i) = S(l_i, l_j)$, that is, the sum of individual firms' surplus equals the industry surplus.

Note that, by maximizing $S_i(l_i, l_{-i})$, a purposeful firm's board cares about the direct actions of the firm but not about equilibrium consequences for competitor-firms and their workers.

The next result characterizes a purposeful firm's most-preferred ESG policy, which we denote as the *optimal purposeful ESG policy.*

Proposition 3 *Suppose firm i's opponent adopts the No-ESG policy (i.e., $\omega_{-i} = 0$). Then, the optimal purposeful ESG policy of firm i is $\hat{W}_i$. Under optimal ESG policy $\hat{W}_i$, $l_i^* = \Lambda_i(\hat{W}_i) = \lambda_i(\hat{W}_i)$, $l_{-i}^* = r_{-i}(\Lambda_i(\hat{W}_i); 0)$, and $W_i^* = W_{-i}^* = \hat{W}_i$. Relative to the No-ESG benchmark, worker welfare, industry employment, and firm i's employment are higher. Firm $-i$'s employment and profit are lower. Both firms pay the same wage, which is higher than the No-ESG benchmark.*

Proposition 3 resembles Proposition 2, with the exception that purposeful firms adopt more aggressive ESG policies than their shareholder-value maximizing counterparts, i.e., $\hat{W}_i > \varphi_i^*$. In particular, a purposeful firm adopts the size-maximizing ESG policy, $\hat{W}_i$. Intuitively, in order to maximize surplus, a purposeful firm wants to be large, even at the expense of profits.

It is worth highlighting that the purposeful firm i would like to be even larger than the size $\lambda_i(\hat{W}_i)$ that it attains under ESG policy $\hat{W}_i$. The reason is that the marginal worker hired produces zero profits, since $f_i'(\lambda_i(\hat{W}_i)) = \hat{W}_i$; but strictly positive worker surplus, since firm i evaluates the marginal worker's outside option as $\mu W(l_i) + (1 - \mu)\hat{W}_i < \hat{W}_i$. Therefore, the board of a purposeful firm would like to have additional tools beyond ESG at its disposal.

This observation has three significant implications. First, and in contrast to a shareholder firm, a purposeful firm wishes it had additional tools at its disposal beyond an ESG promise to treat workers well. But under the assumption that this is the only tool available, increases in ESG ω_i beyond $\hat{W}_i$ backfire, because they reduce firm i's hiring. Second, Lemma 12 in the Online Appendix shows that a purposeful firm adopts policy $\hat{W}_i$ even if its choice is unobserved by its competitor. That is: While a shareholder firm adopts ESG solely because of its strategic impact on competitors, a purposeful firm adopts ESG in order to more-closely align its manager's actions with the wishes of the board and/or shareholders. Consequently, regulations that facilitate transparency and disclosure of ESG policies matter less for purposeful firms than for shareholder firms. Third, the implication that a purposeful firm adopts $\hat{W}_i$ is robust to perturbing the weights placed on shareholder profits and worker welfare.

Returning to Proposition 3, it follows that firm i's hiring and total industry employment are both maximized under the optimal purposeful ESG policy, whereas firm $-i$'s hiring is minimized. Since total employment is higher than under a shareholder firm's preferred ESG policy φ_i^* and the wages paid by both firms also higher, employees of both firms benefit more from the optimal purposeful ESG policy than from φ_i^*.

As in the case of a shareholder firm adopting ESG, the competitor's (firm $-i$) profits are lower under the optimal purposeful ESG policy than in the No-ESG benchmark. However, it is not guaranteed that firm i's profits are higher than in this benchmark. After all, a purposeful firm's ESG policy isn't chosen to maximize profits; and indeed, since the optimal purposeful ESG policy leads the adopting firm to equate marginal productivity with wages, the firm would increase profits by moderating its ESG policy.

Interestingly, the optimal purposeful ESG policy fails to maximize the industry surplus.

Corollary 1 *The optimal purposeful ESG policy of firm i does not maximize industry surplus. The industry-surplus maximizing ESG policy of firm i leads to less employment at firm i and more employment at firm $-i$, relative to the optimal purposeful ESG policy $\hat{W}_i$.*

Intuitively, purposeful firms fail to fully internalize how their ESG policies affect competitor-hiring. In particular, under firm i's optimal purposeful ESG policy $f_i'(l_i^*) = \hat{W}_i < f_{-i}'\left(l_{-i}^*\right)$:[16] that is, marginal productivity is lower at the purposeful ESG firm i than at its non-ESG competitor. So industry surplus would increase if firm i hired less and firm $-i$ hired more. Because firm i adopts an ESG policy with only its own surplus in mind it neglects this potential welfare gain. In this respect, purposeful firm adopts an ESG policy that is too aggressive from a social perspective. Recall that a shareholder firm adopts a less aggressive ESG policy ($\varphi_i^* < \hat{W}_i$). Thus, to maximize industry surplus, a purposeful firm must overweight shareholders relative to its other stakeholders, for example, by giving shareholders greater board-representation. By doing so, the firm adopts a more moderate ESG policy, thereby reducing its hiring—which as shown above is socially beneficial.

The ESG policy adopted by a purposeful firm depends on the elasticity of labor supply, parallel to the case of shareholder firms. If the supply curve is perfectly elastic then all workers have the same outside option, and the No-ESG benchmark outcome maximizes the surplus of each

[16] Firm $-i$'s hiring reflects the monopsony distortion and hence marginal productivity exceeds the wage.

firm. In contrast, Proposition 3 establishes that a purposeful firm hiring from an upwards sloping supply curve benefits from adopting an ESG policy. Extrapolating, the surplus-maximizing ESG policy grows more aggressive as the supply curve becomes more inelastic. In Section E of the Online Appendix, we establish that this implication holds monotonically for the case of symmetric firms and the standard parameterization (18).

Remark on downward-sloping reaction functions

Proposition 2's implication that a moderate ESG policy increases a firm's profits depends on the assumption that reaction functions slope down (see (2)). To see this, we briefly consider the opposite case in which reaction functions slope up, at least locally at the No-ESG benchmark. In this case, adopting a moderate ESG policy ω_i that is slightly more aggressive than the non-ESG wage W^B shifts firm i's reaction function upwards, and effectively commits it to hire more. Thus, the effect of the firm's ESG policy on its manager's hiring decisions (and hence, on workers' welfare) is qualitatively similar to the case of downward-sloping reaction functions. However, different from the baseline model, if reaction functions slope up ($r'_{-i}(l_i; 0) > 0$) then adopting an ESG policy that is slightly more aggressive than W^B reduces the ESG firm's profits, as can be seen directly from (17).

In contrast, the assumption of downward-sloping reaction functions isn't crucial for our results on a purposeful firm's choice of ESG. In particular, Proposition 3's prediction for firm surplus is independent of the slope of reaction functions: A moderate ESG policy increases a firm's hiring, in turn increasing the surplus generated by the firm.

5 Competition in ESG policies

In the analysis above, only firm i has the capacity to adopt ESG policies. In this section, we consider what ESG policies firm $-i$ would optimally adopt in response to firm i's ESG choice, and given the expected reaction of firm $-i$, we analyze firm i's optimal ESG policy. As before, we consider both models of corporate governance, starting with the shareholder primacy model and then turning to the stakeholder capitalism model.

5.1 Labor market equilibrium

As a preliminary step, we characterize the labor market equilibrium arising from an arbitrary pair of ESG policies, thereby generalizing Proposition 1. In equilibrium, $l_i^* = r_i\left(l_{-i}^*; \omega_i\right)$ for $i \in \{1, 2\}$, and firm i pays its workers $W_i^* = \max\left\{W\left(l_1^* + l_2^*\right), \omega_i\right\}$.

Proposition 4 *For a given pair of ESG policies (ω_1, ω_2), a labor market equilibrium exists:*

(i) If $\max_i \omega_i \leq W^B$ then the unique equilibrium coincides with the No-ESG Benchmark.

(ii) If $\min_i \omega_i \geq W^{**}$ then the unique equilibrium is $l_i^* = \lambda_i(\omega_i)$ and $W_i^* = \omega_i$ for $i = 1, 2$.

(iii) If $\omega_i = \omega_{-i} = \omega \in (W^B, W^{**})$ then for any $i = 1, 2$ and

$$l^* \in \left[W^{-1}(\omega) - \min\left\{\Lambda_{-i}(\omega), \lambda_{-i}(\omega)\right\}, \min\left\{\Lambda_i(\omega), \lambda_i(\omega)\right\}\right] \tag{20}$$

there is an equilibrium in which $\left(l_i^*, l_{-i}^*\right) = \left(l^*, W^{-1}(\omega) - l^*\right)$ and $W_i^* = W_{-i}^* = \omega$. No other equilibrium exists.

(iv) If $\omega_i > \omega_{-i}$, $\omega_i > W^B$ and $\omega_{-i} < W^{**}$ then the unique equilibrium is $l_i^* = \min\left\{\Lambda_i(\omega_i), \lambda_i(\omega_i)\right\}$, $l_{-i}^* = r\left(l_i^*; \omega_{-i}\right)$, $W_i^* = \omega_i$ and $W_{-i}^* = \max\left\{\omega_{-i}, W\left(l_i^* + r_{-i}\left(l_i^*; \omega_{-i}\right)\right)\right\}$. If firm i is weakly more productive and $\omega_i < W^{**}$ then $l_i^* > l_{-i}^*$.

Proposition 4 has several important takeaways. First, by part (i), if both firms adopt ESG-policies milder than W^B, then the labor market equilibrium coincides with the No-ESG benchmark. Intuitively, these mild ESG policies are non-binding and have no effect. Second, by part (ii), if both firms adopt ESG-policies that are more aggressive than the first-best wage W^{**}, then each firm pays its self-imposed minimum wage and hires as if facing a perfectly elastic supply at that level. If at least one firm adopts $\omega_i > W^{**}$ then both firms pay wages strictly above the market clearing level.[17] If both firms adopt an ESG policy of W^{**} then the first-best obtains. The left and right panels of Figure 5 depict the reaction functions and labor

[17] If $\omega_i > W^{**}$ then $\lambda_i(\omega_i) < \lambda_i(W^{**})$, and hence, $W\left(\lambda_1(\omega_1) + \lambda_2(\omega_2)\right) < W\left(\lambda_1(W^{**}) + \lambda_2(W^{**})\right) = W^{**} < \omega_i$.

market equilibrium for symmetric firms when $\max_i \omega_i \leq W^B$ and $\omega_1 = \omega_2 = W^{**}$, respectively.

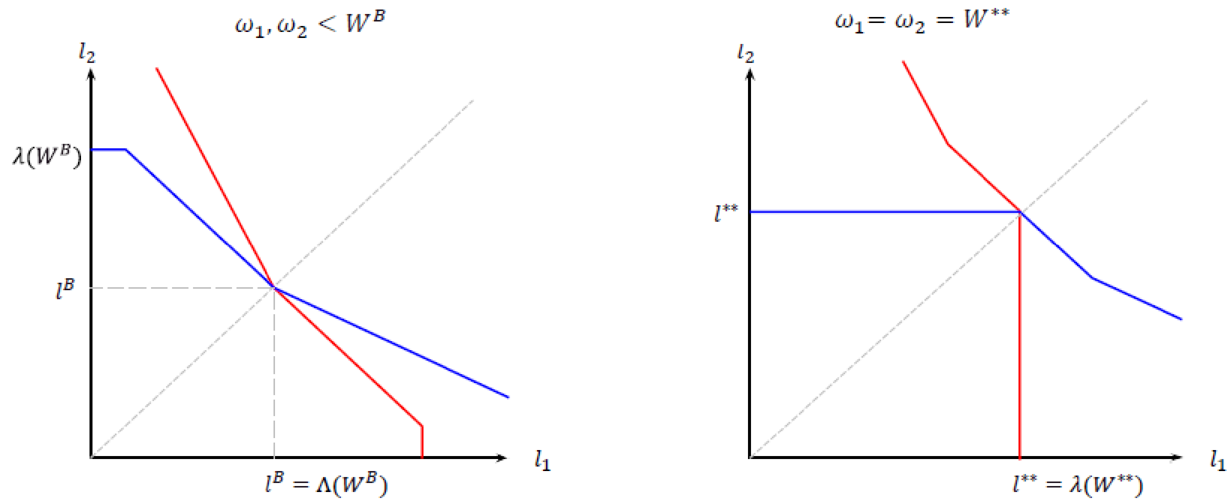

Figure 5 - Labor reaction functions under ESG policies that induce the No-ESG benchmark (left panel) and the first best benchmark (right panel).

Third, by part (iii), if both firms adopt the same ESG policy ω then multiple equilibria exist. In all of these equilibria, both firms pay the market wage, which equals their identical self-imposed minimum wage ω, and total employment is $W^{-1}(\omega)$. Although firms pay the market wage, both this wage and total employment exceed their counterparts in the No-ESG benchmark. Multiple equilibria arise from different splits of the constant employment level across the two firms. The multiplicity stems from the fact that the reaction functions always intersect in the residual-demand region, which has a slope of -1. There, both firms have incentives to hire just enough workers such that the market wage equals the self-imposed minimum wage. Indeed, neither firm has incentives to hire more, since doing so would derive the wage up (the monopsony effect). At the same time, neither firm has an incentives to hire less, since doing so would push the market wage below its self-imposed minimum wage.[18]

[18]It is worth stressing that equilibrium multiplicity arises in the general case of asymmetric firms, and isn't in any way special to the symmetric case; indeed, in the residual-demand region a firm's hiring decision is independent of its production function.

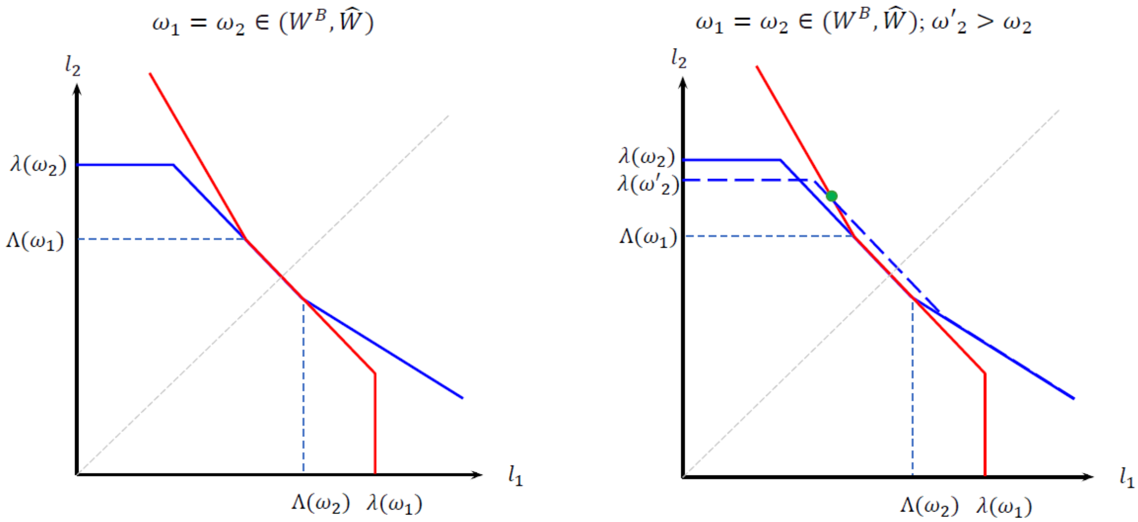

Figure 6 - Labor reaction functions under moderate ESG policies.

Finally, by part (iv), if the competing firms are similar, the firm that adopts a more aggressive ESG-policy hires more workers in equilibrium. Intuitively, an aggressive ESG-policy commits a firm to hire more and consequently pushes its competitor to hire less. If the more productive firm also adopts a more aggressive ESG policy, then it will be more aggressive in the labor market both due to its ESG policy and its inherent higher productivity. If the less productive firm adopts a more aggressive ESG policy, then the two forces operate in opposite directions, and the ranking with respect to the ESG policies is ambiguous.

The left panel of Figure 6 depicts the reaction functions of the symmetric firms when they adopt the same moderate ESG policy. The overlapping 45-degree lines are the graphical representation of equilibrium multiplicity. The right panel shows how the equilibrium set collapses to the green dot if firm 2 increases its ESG policy above its opponent's ($\omega_2' > \omega_2 = \omega_1$). Here, the equilibrium is unique, with firm 2 hiring more but firm 1 hiring less.

Figure 7 is similar to Figure 6 with the exception that the two firms adopt a relatively extreme ESG policy (i.e., $\omega_1, \omega_2 \in (\hat{W}, W^{**})$). The right panel shows how the equilibrium set collapses to the green dot when firm 2 decreases its ESG policy below its opponent's. Here, the equilibrium is unique, with firm 2 hiring less but firm 1 hiring (weakly) more.

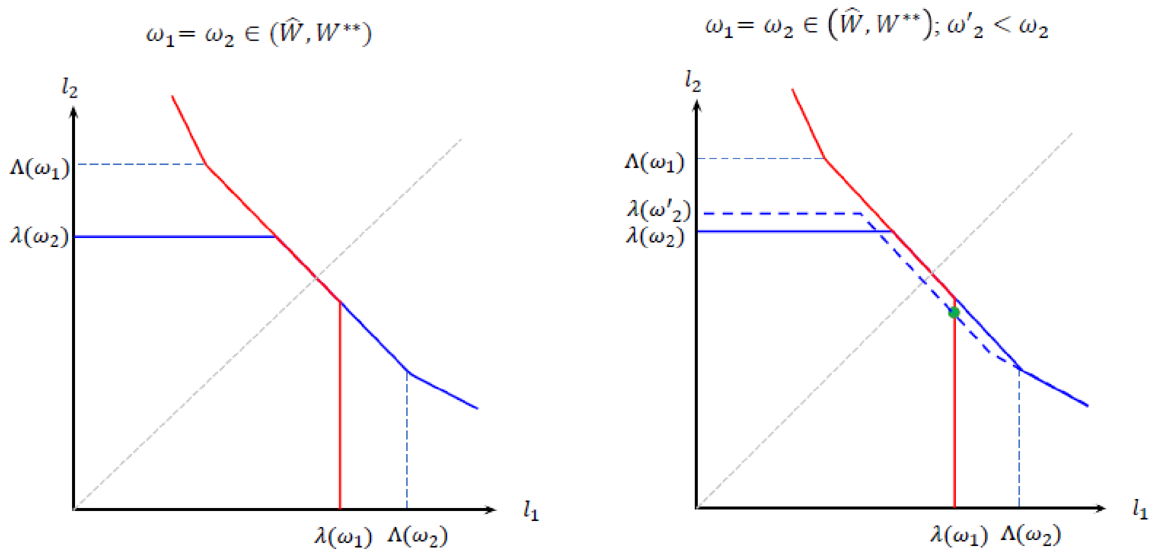

Figure 7 - Labor reaction functions under extreme ESG policies.

5.2 ESG competition between shareholder firms

With Proposition 4's characterization of labor-market outcomes in hand, we turn to the analysis of competition in ESG policies between shareholder firms. As a preliminary observation: For many ESG policies ω_i adopted by firm i, its competitor firm $-i$ would ideally respond by adopting a policy that is infinitesimally more aggressive. Consequently, the characterization of firm $-i$'s response to ω_i faces an open-set problem. Accordingly, we restrict firm $-i$'s policy ω_{-i} to lie in a finite grid of possible choices, with grid size $\epsilon > 0$. We state all results below for the case in which this grid is sufficiently fine, i.e., ϵ sufficiently close to 0.

Lemma 4 *There exists $\check{W}_{-i} \in (\hat{W}_i, W^{**})$ such that the ESG policy that maximizes firm $-i$'s shareholder value in response to firm i adopting ESG policy ω_i has the following properties:*

(i) *If $\omega_i < \check{W}_{-i}$ then firm $-i$ adopts a more aggressive ESG policy than firm i, i.e., $\omega_{-i} > \omega_i$. Moreover, firm $-i$'s policy weakly increases in ω_i in this region.*

(ii) *If $\omega_i \geq \check{W}_{-i}$ then firm $-i$ either adopts the No-ESG policy ($\omega_{-i} = 0$), or else an ESG* *policy that is sufficiently moderate to generate the same outcomes.*

Lemma 4 shows that ESG policies are strategic complements when the policies are moderate and strategic substitutes when they are extreme. If firm i's ESG policy is very moderate ($\omega_i < \varphi^*_{-i}$),[19] then firm $-i$ simply responds by picking $\omega_{-i} = \varphi^*_{-i}$, viz., the ESG policy that it would adopt if firm i hadn't adopted any ESG policy at all. In this case, the "leader" firm i's ESG policy doesn't affect the "follower" firm's choice.

If firm i's ESG policy is intermediate ($\varphi^*_{-i} < \omega_i < \check{W}_{-i}$), then by Proposition 4's characterization of the labor-market equilibrium, firm $-i$ gains nothing from adopting an ESG policy more moderate than its competitor's. So instead, firm $-i$ responds by outdoing firm i's ESG policy. In this case, as firm i's ESG choice becomes more aggressive, firm $-i$ responds by adopting progressively more and more aggressive ESG policies. In all numerical simulations that we've examined firm $-i$ adopts an ESG policy infinitesimally more aggressive than ω_i.

Finally, if firm i's ESG policy is sufficiently aggressive ($\omega_i > \check{W}_{-i}$) then the benefit to firm $-i$ of outdoing ω_i is too small to justify the cost of paying higher wages. This is immediate once ω_i crosses the first-best level W^{**}, since in this case firm $-i$'s hiring shrinks if it outdoes firm i's ESG policy, while its labor costs increase (Proposition 4). By continuity, this conclusion extends to an interval of firm i's ESG policies below W^{**}. Conditional on not outdoing firm i's ESG choice, firm $-i$ is best-off abandoning ESG (or, strictly speaking, picking an ESG policy so moderate that it has no effect on its behavior).

The next result characterizes the equilibrium when shareholder firms compete in ESG policies. Specifically, firm i chooses ω_i and then firm $-i$ responds by choosing ω_{-i}. Given ESG policies (ω_i, ω_{-i}), the firms compete in the labor market. We present our results for ESG competition for cases in which firms are *sufficiently similar* in the sense that the differences between the firms' production functions are relatively small.

Proposition 5 *Suppose firms choose ESG policies to maximize their shareholder values. Then:*

Either *Firm i chooses an ESG policy $\omega_i < \varphi^*_{-i}$ and firm $-i$ chooses $\omega_{-i} = \varphi^*_{-i}$. The equilibrium is payoff equivalent to the equilibrium that emerges when firm i adopts the No-ESG policy (i.e., $\omega^*_i = 0$) and firm $-i$ adopts policy φ^*_{-i}, as characterized by Proposition 2.*

[19] Both in the main text and in the Appendix, for the non-generic case in which there are multiple ESG policies that maximize firm $-i$'s profits when played against the No-ESG policy ω_i, for expositional transparency we let φ^*_{-i} be the least aggressive such policy. We emphasize, moreover, that nothing is at stake with this choice.

Or Firm i chooses the ESG policy $\check{W}_{-i}$ and firm $-i$ chooses a non-binding ESG policy.

In the first part of Proposition 5, firm i adopts an ESG policy that is too moderate to deter firm $-i$, which in turn outdoes firm i's ESG policy and obtains an advantage in the labor market. In contrast, in the second part of Proposition 5, firm i adopts an ESG policy that is aggressive enough to deter firm $-i$ from matching it, and firm i consequently retains its advantage in the labor market. In choosing between the two scenarios firm i faces the following trade-off: in the first scenario firm i faces an aggressive competitor in the labor market, but is itself essentially unconstrained. In the second scenario, firm i instead faces a weak competitor in the labor market, but is constrained by its own aggressive ESG policy to pay high wages.

Regardless of which of these two scenarios prevails in equilibrium, [20] our analysis suggests that several important implications from Proposition 2 extend to cases in which (sufficiently similar) shareholder firms compete in ESG policies.

Proposition 6 *If shareholder firms compete in ESG policies then worker welfare is higher and industry profits are lower than in the No-ESG benchmark.*

Competition in ESG policies between shareholder firms benefits workers; but it reduces profits, and for some parameterizations reduces industry surplus also. As discussed earlier, the misallocation of labor that arises after ESG adoption is socially detrimental. In contrast, below we show that competition in ESG policies between purposeful firms raises industry surplus.

Because competition in ESG policies reduces industry profits, if there is ex-ante uncertainty about which firm is the first-mover in the ESG-game then firms find it mutually beneficial to coordinate on low-impact ESG policies. Ideally firms would agree to abstain from ESG altogether. But in practice this may not be possible, since the gain to deviation would be highest in this case, and firms may instead have to settle on coordinating on mild ESG policies in order to reduce deviation-incentives. This conclusion raises anti-trust concerns for the seemingly benevolent adoption of industry-wide ESG standards, and for moves by large asset managers ("common owners") to promote ESG.

[20] In Section F of the Online Appendix we give examples to illustrate that both scenarios can arise in equilibrium. We show that when firms are symmetric, the first scenario takes place in equilibrium if and only if $\lambda_{-i}(\check{W}_{-i}) > \Lambda_{-i}\left(\varphi^*_{-i}\right)$.

Proposition 5 uses the best-ESG-response characterization of Lemma 4 to characterize a leader-follower game. One can also ask: What happens if firms choose ESG policies independently, without observing each others' choices? Lemma 4 implies that there isn't a pure-strategy equilibrium of this simultaneous-move game. To see the intuition, consider a starting point in which both firms adopt the No-ESG policy. Then, firm i has incentives to adopt policy φ_i^*, and in response, firm $-i$ will adopt a slightly more aggressive ESG policy. From this point on, the firms escalate their policies by small increments until reaching a level against which the best response of one of the firms is to resort back to the No-ESG policy. In turn, this triggers the same chain of responses described above. In other words, our analysis predicts *ESG-cycles* in which periods of moderate ESG policies are followed by periods of aggressive ESG policies, which are in turn followed by periods of moderate ESG policies, and so on.[21]

5.3 ESG competition between purposeful firms

Next, we analyze competition in ESG policies between purposeful firms. We start by characterizing the best-response ESG policy of a purposeful firm:[22]

Lemma 5 *The ESG policy that maximizes the surplus created by purposeful firm $-i$ in response to firm i adopting ESG policy ω_i has the following properties:*

(i) If $\omega_i < W^{**}$ then firm $-i$ adopts a more aggressive ESG policy than firm i, i.e., $\omega_{-i} > \omega_i$.

(ii) If $\omega_i > W^{**}$ then firm $-i$ adopts $\omega_{-i} < W^{**}$.

(iii) If $\omega_i = W^{**}$ then firm $-i$ adopts $\omega_{-i} = W^{**}$.

Part (i) of Lemma 5 parallels part (i) of Lemma 4's analysis of a shareholder firm's choice of ESG. Specifically, if the leader firm i adopts a moderate ESG policy then firm $-i$ responds by outdoing it. The difference between the cases of purposeful and shareholder "follower" firms is that a purposeful follower outdoes the "leader" firm for a wider range of leader-policies.

[21] The notion of ESG-cycles in our framework does not correspond to a solution concept of a static game. A fully dynamic model is needed to establish the ESG-cycles with a standard solution concept, but is outside of the scope of this paper.

[22] Similar to Section 5.2, the characterization of purposeful firm $-i$'s response to ω_i faces an open-set problem, and we follow the same restriction to a finite grid of possible choices.

Specifically, there is a range of ESG policies milder than the first-best level W^{**} that induce a shareholder-value maximizing follower to respond by giving up on its own ESG efforts. In contrast, a purposeful follower outdoes any ESG that its competitor adopts, provided only that it is less than the first-best W^{**}. The difference between the two cases reflects the lower cost of ESG policies for purposeful firms. Specifically, the increase in wages engendered by ESG isn't a cost for a purposeful firm; instead, it is simply a transfer from shareholders to workers.

Similarly, part (ii) of Lemma 5 parallels part (ii) of Lemma 4: once the leader adopts a sufficiently aggressive ESG policy, the follower responds by undercutting rather than outdoing the follower's policy. In the purposeful-firm case, the advantage of undercutting the ESG policy is that it leads to more hiring, which the purposeful firm values.

Part (iii) of Lemma 5 is new to the purposeful-firm case: There is a leader-ESG policy that the follower simply matches. Moreover, this policy is precisely the first-best wage W^{**}. The economics behind part (iii) is that if the follower responds to W^{**} by adopting a more moderate policy then it hires less, because it is the "losing" ESG firm (see Proposition 4), reducing surplus; but if instead it responds with a more aggressive policy it again hires less, in this case because of the anti-competitive effect of aggressive ESG, and again reducing surplus.

Paralleling our earlier discussion, this is another case in which firm $-i$'s board wishes it had more tools at its disposal, since the marginal worker hired produces strictly positive surplus for firm $-i$, and so the firm would ideally like to be larger. However, no choice of ESG policy exists that leads firm $-i$'s manager to actually hire more.

We use Lemma 5 to analyze the result of ESG competition between purposeful firms:

Proposition 7 *In the unique equilibrium, both purposeful firms adopt ESG policy W^{**}, leading to the first-best outcome.*

Proposition 7 is striking: competition in ESG policies between purposeful firms entirely eliminates the monopsony distortion and delivers the first-best industry surplus. This is true even though each individual firm's objective is to maximize only its own surplus, which as Corollary 1 shows can have adverse welfare effects because firms don't internalize the externalities that they inflict on competitors' surplus.

In Proposition 7 firm i anticipates firm $-i$'s best response. Firm i would like to adopt an ESG policy that induces its manager to be more aggressive in the labor market than firm $-i$, but it cannot achieve this because firm $-i$ always responds with a more aggressive policy, $\omega_{-i} > \omega_i$. Thus, the best firm i can do is to adopt an ESG policy that maximizes its employment; it has incentives to grow larger. In principle, since purposeful firms do not internalize the externalities they inflict on their competitors, they have incentives to grow beyond even above the first-best employment level. However, since the hiring decision is made by a profit-maximizing manager and the firm cannot commit to an employment level, the second-best is to choose the highest employment such that marginal productivity is equal to the minimum wage imposed by its ESG policy. This force pushes each firm to adopt the first-best wage as its equilibrium ESG policy. Put differently, the strategic complementarity in ESG policies between competing purposeful firms achieves the first-best outcome. In this respect, ESG is a panacea to market power.

Proposition 7's conclusion that purposeful competition in ESG delivers the first-best outcome is robust to perturbing the weights that a purposeful firm puts on shareholder and worker surplus. Specifically, as long as a purposeful firm puts sufficient weight on worker welfare, then it has incentives to marginally outdo any ESG choice by its competitor that is less than W^{**}. Moreover, as long as a purposeful firm's hiring decision is made by a profit-maximizing manager, a purposeful firm's board never sets an ESG policy more aggressive than W^{**}.

We have established Proposition 7 in the same leader-follower framework that we used to analyze ESG competition between shareholder firms. But exactly the same outcome arises if two purposeful firms select ESG firms independently, as in a simultaneous-move game.

6 Discussion

6.1 Other stakeholders: suppliers and consumers

For concreteness, we have described our analysis in terms of firms adopting policies that constrain their managers to treat workers well. But as emphasized in the introduction, our analysis has parallel implications for similar commitments to suppliers and to customers.

Especially for inputs obtained from lower-income countries, firms face pressures to treat the suppliers of these inputs well, and sometimes respond to such pressures by offering public commitments to do so. Prominent examples include coffee, chocolate, diamonds, and, more recently, rare-earth elements. The outcomes of such policies are exactly the same as those for analogous promises to treat workers well. Moderate promises improve welfare both of an ESG firm's own suppliers, and also of suppliers to competing non-ESG firms. Moreover, moderate policies raise the ESG firm's profits, at the expense of competitors. In contrast, aggressive ESG policies hurt the suppliers to non-ESG firms, and reduce an ESG firm's profits.

Similarly, firms face pressures to treat their customers better than market conditions alone dictate. A prominent example is public pressure on pharmaceutical firms to moderate their prices. In other instances, the public's "demand" is that firms offer higher quality (including higher environmental standards and greater privacy protections) without higher prices. These cases be can analyzed in a dual version of our model in which firms acquire inputs from a competitive market, but compete oligopolistically in the product market. Formally, let P be the inverse demand curve in a given industry, and c_i be firm i's cost function; then firm i chooses output q_i to maximize profits

$$P\left(q_i + q_{-i}\right) q_i - c_i\left(q_i\right). \tag{21}$$

In this context, an ESG policy is a promise to not charge customers "excessive" prices relative to quality, i.e., to set prices no greater than some level ρ_i. Our analysis implies that moderate promises reduce prices and improve welfare for an ESG firm's own customers, and also of customers of competing non-ESG firms. Moreover, moderate policies raise the ESG firm's profits, at the expense of competitors, by effectively committing the ESG to compete more aggressively. In contrast, aggressive ESG policies lead an ESG firm to produce limited quantities, softening competition in the product market and leading to higher prices for its competitors' output.

Finally, the influence of ESG policies extends beyond their immediate application, creating spillover effects in interconnected input and product markets. For example, within the labor market, the adoption of a pro-competitive ESG policy, exemplified by an aggressive hiring strategy leading to increased employment, also leads to an expansion in output. Thus, a pro-competitive hiring policy not only deters rivals in the labor market but also generates a competitive edge in the product market, as competitors anticipate larger production capacities resulting from increased workforce. Conversely, anti-competitive ESG policies have the potential to adversely impact both stakeholders. In essence, ESG policies targeting different stakeholder groups and markets at least partly substitute for one another.

6.2 The evolution of ESG policies

Proposition 2 in particular highlights that even a shareholder firm benefits from adopting ESG policies. This observation in turn begs the question of why ESG policies have achieved such salience in recent years.

One possibility is simply that "ESG" is a new label for an older phenomenon. That is: Firms' promises to treat workers, customers, and suppliers well have a long history, and clearly predate the rise of both ESG and the related concept of "Corporate Social Responsibility." A second possibility is that the increased prominence of ESG in the public consciousness has led some firms to experiment with policies that they had previously and wrongly believed to unprofitable, only to then discover that moderate ESG in fact increases profits. We believe both possibilities have at least some explanatory power.

More interestingly, our model also suggests three further possible drivers for the recent rise in ESG. First, our analysis ties the profitability of ESG policies to oligopolistic conditions. In particular, ESG policies would not be profitable in a competitive market. Considerable evidence suggests concentration has increased in many areas of the US economy (e.g., see Autor et al. (2020) and De Loecker et al. (2020)), with the increase occurring at roughly the same time as the rise of ESG.

Second, and as noted, Lemma 4 identifies an economic force that would generate ESG cycles. That is: firms have an incentive to marginally outdo moderate ESG policies of their competitors, generating "escalation" in ESG; but once competitors adopt sufficiently aggressive ESG policy, a firm does better by abandoning ESG and adopting a policy of driving the hardest bargain with its stakeholders that market conditions permit. Under this interpretation, the economy is currently in an "up" phase in the ESG cycle, reminiscent of previous eras in which firms are perceived to have operated further from market forces. Similarly, eras such the 1980s can be interpreted as the "bust" phase in an ESG cycle, in which firms re-embrace market prices in response to competitors who have moved very far from them.[23]

[23] Rajan et al. (2023) study letters to shareholders from 1960s to 2020s and document time series variation in the stated goals of corporations as reflected in those letters: the focus on other stakeholders of the firm seems to decrease in the 1980s, and then rise to all-time high in the 2020s.

Third, to the extent to which the rise of ESG reflects a real shift in the strength of shareholders' pro-social preferences, our comparison of shareholder and purposeful firms predicts that firms adopt more aggressive ESG policies (Propositions 2 and 3). Two further implications are worth highlighting here. If firms' shareholder bases (or boards) are heterogeneous in the strength of their pro-social preferences, so that only a subset of firms are purposeful in our terminology, Lemma 4 nonetheless implies that shareholder firms also adopt more aggressive ESG policies to keep up with their purposeful rivals. Second, if the shift in shareholder preferences is permanent, Proposition 7 suggests an end to the ESG cycle: all firms converge on the relatively generous ESG policy W^{**}.

6.3 Sensitivity of ESG firms to productivity shocks

Our analysis abstracts from uncertainty, but it nevertheless has some interesting implications for how ESG adopters react to productivity shocks. Specifically, suppose firm i experiences a shock to its productivity before deciding how many workers to hire. Absent ESG policies, the firm naturally hires more (less) workers in response to positive (negative) productivity shocks. Next, consider a firm that has adopted a moderate ESG policy $\omega_i \in (W^B, \hat{W}_i)$ (while firm $-i$ is a non-ESG firm). From Proposition 1, firm i hires $\Lambda_i(\omega)$; this is (locally) independent of firm i's productivity, because the reaction functions intersect in the "residual" region of firm i's reaction function (see Figure 2). Hence a moderate ESG policy reduces firm i's sensitivity to shocks to its productivity.

In contrast, a moderate ESG policy increases firm i's sensitivity to shocks to firm $-i$'s productivity, relative to the case of no-ESG. This again follows from the fact the reaction functions intersect in the residual region of the ESG firm's reaction function.

From Proposition 2, a firm that seeks to maximize shareholder value adopts a moderate ESG policy in the range $(W^B, \hat{W}_i)$ for which the above analysis applies. Moreover, this implication extends to the case the firm anticipates the possibility of productivity shocks.

If a firm adopts an aggressive ESG policy $\omega_i > \hat{W}_i$ then its responsiveness to own- and competitor productivity shocks is reversed. Now, the ESG policy renders the firm *more* responsive to shocks to its own productivity, but unresponsive to shocks to its competitor's productivity. This case is most likely to arise for the case of a purposeful firm; Proposition 3 predicts that such a firm will adopt an ESG policy of $\hat{W}_i$, i.e., exactly on the boundary between the moderate and aggressive cases (see Figure 3). Consequently, a further implication is that purposeful ESG firms respond asymmetrically to shocks, viz., are unresponsive to positive shocks to their own productivity but highly responsive to negative shocks; and are highly responsive to positive shocks to a competitor's productivity, but unresponsive to negative shocks.

6.4 Alternative ESG tools

Our analysis shows that a purposeful firm—in contrast to a shareholder firm—would gain from access to instruments that go beyond promises to ensure the well-being of stakeholders. One such instrument is ESG-linked executive pay structures, which redirect managerial objectives away from pure profit-maximization and toward internalizing stakeholder welfare. As such, our analysis implies that purposeful firms are more inclined to incorporate ESG metrics into compensation contracts compared to shareholder firms. This prediction aligns with empirical findings from Cohen et al (2023), which show a higher prevalence of ESG-linked executive pay in countries with more stringent ESG regulations and greater societal sensitivity toward sustainability. Moreover, given that purposeful firms embrace more aggressive ESG policies than shareholder firms, our analysis further predicts a higher likelihood of ESG-linked executive pay adoption among firms making more aggressive ESG commitments.

Nevertheless, given that purposeful firms already adopt ESG policies that are excessively aggressive from a societal standpoint (see Corollary 1), our analysis suggests that ESG-linked executive pay offers no discernible social value. Specifically, our analysis implies that total social surplus is lowered if firms compensate managers based on ESG-metrics. More broadly, Proposition 7 says that stakeholder capitalism is most effectively implemented by managers focusing on profit-maximization, with boards strategically setting ESG policies to mitigate any adverse impacts this objective may have on the firm's other stakeholders.

6.5 Supply effects of ESG policies

We have assumed that a firm's wages depend only on the combination of its own ESG policy and total labor demand; specifically, each firm pays its workers at least $W(L)$. This represents a minimal departure from the standard Cournot model and it ensures that ESG policies affect other firms entirely through labor demand.[24]

In particular, this assumption rules out the possibility that firm i's ESG policy disproportionately draws workers with the highest outside options, thereby expanding the supply of labor available to firm $-i$. In principle, if "supply effects" of this sort existed, then firm $-i$'s demand would depend on the firm i's ESG policy above and beyond its hiring decision. For example, in this case, if firm $-i$ reduces its hiring to a point at which its competitor i's ESG policy binds, then firm $-i$'s wages would further fall because of the endogenous matching of the lowest-outside-option workers with firm $-i$.

Clearly, if firms can benefit from hiring workers with low outside options (e.g., such workers are easier to retain and motivate), then they will compete for these workers regardless of their ESG policies, and thereby bid the wage up to at least $W(L)$, exactly as our analysis assumes. The equilibrium outcome and the relevance of these intricate supply effects are left for future research.

7 Empirical implications

Our analysis provides a framework to think through how the "S" dimension of ESG policies affects the markets in which firms operate. As such, it produces a large number of empirical implications. Here, we collect some of the main implications, focusing on the case in which just one firm adopts an ESG policy:

1. The profits and market share of an ESG firm, as well as total industry employment, are increasing and then decreasing in the aggressiveness of its ESG policy.

2. The margins of an ESG firm are decreasing in the aggressiveness of its ESG policy.

3. The profits and market share of a non-ESG firm competing with an ESG firm are decreasing and then increasing in the aggressiveness of the ESG firm's policy.

[24] Recall that absent ESG policies, each firm pays workers $W(L)$, and the L workers with lowest outside options are employed. One possible microfoundation is that firms cannot observe workers' outside options, but they have an infinitesimal preference to hire workers with the lowest outside option. Consequently, a situation in which firm i hires the l_i workers with lowest outside options, and pays $W(l_i) < W(L)$, cannot arise, since in this case firm $-i$ would try to poach firm i's workers away.

4. Welfare and wages of workers at the non-ESG firm are increasing and then decreasing in the aggressiveness of the ESG firm's policy.[25] Similarly, in the product market application of our model, consumer welfare at the non-ESG firm is increasing and then decreasing in the aggressiveness of the ESG firm's policy, and product prices of the non-ESG firm are decreasing and then increasing in the aggressiveness of the ESG firm's policy.

5. There is no wage difference between ESG and the non-ESG firms at moderate ESG policies. For extreme ESG policies, the ESG firm offers higher wages than the non-ESG firm, and the difference increases with the aggressiveness of the ESG firm's policy. Similarly, in the product market application of our model, there is no price difference between the ESG and the non-ESG firms at moderate ESG policies. For extreme ESG policies, the ESG firm offers lower prices than the non-ESG firm, and the difference increases with the aggressiveness of the ESG firm's policy.

6. ESG policy and firm size are positively correlated, with causality running in both directions: moderate ESG policies increase a firm's size; while more productive firms are both larger and have greater incentives to adopt ESG.

7. ESG policy's aggressiveness is negatively correlated with the elasticity of supply (for labor and supplier applications) and demand (for customer applications).

8. Relative to a no-ESG firm, a moderate-ESG firm is more responsive to shocks to competitor productivity and less responsive to shocks to own-productivity.

9. Relative to shareholder firms, regulations that facilitate transparency and disclosure of ESG policies have less effect on the adoption of these policies by purposeful firms.

10. When multiple firms adopt ESG, these choices are generally strategic complements (the exception is shareholder-value maximizing firms adopting aggressive ESG policies, in which case policies are strategic substitutes).

[25] Notice that total employment at the non-ESG firm is decreasing at moderate levels of aggressiveness of the ESG firm's policy. However, since industry employment is increasing, all displaced workers can find a job at the ESG firm.

11. Periods in which competing firms adopt moderate ESG policies are followed by periods of aggressive ESG policies, which are then followed again by periods of moderate ESG policies, and so on.

8 Concluding remarks

In this paper we study the equilibrium effects of the "S" dimension of ESG in a model of imperfect competition in labor or product markets. Moderate ESG policies, by which firms promise to treat stakeholders well, are strategically beneficial. "Doing Well by Doing Good" holds for moderate ESG policies; but aggressive ESG policies backfire, both for adopting firms and for many stakeholders. ESG policies of competing firms are strategic complements for moderate policies, but strategic substitutes for aggressive policies. The equilibrium adoption of ESG raises worker welfare but lowers shareholder value. Shareholder-value maximizing firms benefit from coordinating on low impact ESG policies, raising anti-trust concerns. A purposeful firm (led by a socially conscious board) benefits from such ESG policies, and imperfect competition between purposeful firms obtains the first best in equilibrium. Thus, the social purpose of the corporation is a panacea to excessive market power. More broadly, our analysis relates the adoption of ESG policies to the nature of competition between firms and their model of corporate governance.

We have deliberately structured our model to illuminate basic economic forces. While it generates rich and non-obvious implications, it inevitably bypasses various avenues of potential interest, and we hope that subsequent research explores some of these. First, it would be interesting to explore how ESG policies interact with heterogeneous stakeholders; for example, perhaps some employees care more about pro-social policies than others. Second, while our analysis is equally applicable to labor, input, and product markets, it treats each of these three markets in isolation; it would be interesting to explore interactions between these markets, such as the possibility that a promise to treat workers and suppliers better directly raises consumers' valuations in the product market, or alternatively, that promises to produce safe and environmentally friendly products increase a firm's attractiveness as an employer. Third, market power creates a dead weight loss in our framework due to the usual monopsony/monopolistic distortion. However, in some cases market power results from investments in innovation; in these cases, reducing the fruits of market power, as we have argued that ESG policies have the capacity to do, may carry the cost of reducing incentives for innovation. Fourth, our analysis deals with firms engaged in horizontal competition, and leaves open the question of how ESG policies affects firms in vertical relationships, and/or those selling complementary products.

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A Appendix

A.1 Proofs for Section 3

Proof of Lemma 1. It is convenient to rewrite firm i's maximization problem as

$$\max_L f_i\left(L - l_{-i}\right) - W\left(L\right)\left(L - l_{-i}\right).$$

We first note that $W\left(L\right)\left(L - l_{-i}\right)$ is strictly convex. If $W''\left(L\right) \geq 0$ then this is immediate. Otherwise, consider any L such that $W''\left(L\right) < 0$, and note that

$$\frac{\partial^2 W\left(L\right)\left(L - l_{-i}\right)}{\partial L^2} = W''\left(L\right)\left(L - l_{-i}\right) + 2W'\left(L\right) > W''\left(L\right)L + 2W'\left(L\right) > 0,$$

where the final inequality follows from (2). It follows that the firm's objective is strictly concave, and hence has a unique maximizer.

Next, we establish that $r_i\left(l_{-i}, 0\right)$ is decreasing. This follows from the FOC

$$f_i'\left(l_i\right) = W'\left(l_i + l_{-i}\right)l_i + W\left(l_i + l_{-i}\right).$$

The derivative of the RHS with respect to l_{-i} is

$$W''\left(l_i + l_{-i}\right)l_i + W'\left(l_i + l_{-i}\right) = W''\left(L\right)\left(L - l_{-i}\right) + W'\left(L\right),$$

which is strictly positive: this is immediate if $W''\left(L\right) \geq 0$, and follows from (2) if $W''\left(L\right) < 0$. The result follows.

Finally, we establish that $r_i\left(l_{-i}, 0\right) + l_{-i}$ is strictly increasing in l_{-i}. This follows from the single-crossing property applied to firm i profits $f_i\left(L - l_{-i}\right) - W\left(L\right)\left(L - l_{-i}\right)$. Specifically, consider L and $\tilde{L} > L$ such that

$$f_i(\tilde{L} - l_{-i}) - W(\tilde{L})(\tilde{L} - l_{-i}) \geq f_i\left(L - l_{-i}\right) - W\left(L\right)\left(L - l_{-i}\right).$$

Then for any $\widetilde{l}_{-i} > L_{-i}$, we claim

$$f_i(\tilde{L} - \widetilde{l}_{-i}) - W(\tilde{L})(\tilde{L} - \widetilde{l}_{-i}) > f_i(L - \widetilde{l}_{-i}) - W\left(L\right)\left(L - \widetilde{l}_{-i}\right).$$

This holds because

$$\begin{aligned} f_i(\tilde{L}-\widetilde{l}_{-i})-f_i(L-\widetilde{l}_{-i}) &> f_i(\tilde{L}-l_{-i})-f_i\left(L-l_{-i}\right) \\ &\geq W(\tilde{L})(\tilde{L}-l_{-i})-W\left(L\right)\left(L-l_{-i}\right) \\ &> W(\tilde{L})(\tilde{L}-\widetilde{l}_{-i})-W\left(L\right)(L-\widetilde{l}_{-i}), \end{aligned}$$

where the first inequality follows from the concavity of f_i, and the third inequality follows from W being strictly increasing. ■

Proof of Lemma 2. In equilibrium, l_i^B solves $l = r_i\left(r_{-i}\left(l,0\right),0\right)$. Since the slopes of $r_i\left(\cdot,0\right)$ and $r_{-i}\left(\cdot,0\right)$ are strictly below one (Lemma 1), the slope of $r_i\left(r_{-i}\left(\cdot,0\right),0\right)$ is strictly below one as well, and hence l_i^B is unique. Inada conditions ensure existence.

To establish (8), suppose to the contrary that $l_1^B + l_2^B \geq l_1^{**} + l_2^{**}$. Then

$$f_i'\left(l_i^B\right) = W'\left(l_1^B + l_2^B\right)l_i^B + W\left(l_1^B + l_2^B\right) > W\left(l_1^{**} + l_2^{**}\right) = f_i'\left(l_i^{**}\right),$$

which implies $l_i^B < l_i^{**}$, contradicting $l_1^B + l_2^B \geq l_1^{**} + l_2^{**}$.

To establish $l_1^B \geq l_2^B$, note that $f_1' \geq f_2'$ implies $r_1\left(l;0\right) \geq r_2\left(l;0\right)$. Since $r_i\left(l;0\right)$ is a decreasing function,

$$l_1^B = r_1\left(r_2\left(l_1^B;0\right);0\right) \geq r_1\left(r_1\left(l_1^B;0\right);0\right) \geq r_2\left(r_1\left(l_1^B;0\right);0\right) = l_2^B.$$

We next establish that $l_1^B < l_1^{**}$, as noted in footnote 8. Suppose to the contrary that $l_1^B \geq l_1^{**}$. Inequality (8) implies $l_2^{**} > l_2^B$. Hence

$$f_2'\left(l_2^B\right) > f_2'\left(l_2^{**}\right) = f_1'\left(l_1^{**}\right) \geq f_1'\left(l_1^B\right).$$

But $l_1^B \geq l_2^B$ together with (7) directly implies $f_1'\left(l_1^B\right) \geq f_2'\left(l_2^B\right)$, giving a contradiction. ■

Proof of Lemma 3. Let

$$\pi_i^c\left(l_i;\omega_i\right) \equiv f_i\left(l_i\right) - \omega_i l_i.$$

We can write the profit of firm i given ESG policy ω_i as

$$\begin{aligned} \pi_i\left(l_i,l_{-i};\omega_i\right) &= \min\left\{\pi_i\left(l_i,l_{-i};0\right),\pi_i^c\left(l_i;\omega_i\right)\right\} \\ &= \min\left\{f_i\left(l_i\right) - W\left(l_i + l_{-i}\right)l_i, f_i\left(l_i\right) - \omega_i l_i\right\}. \end{aligned}$$

Notice that $\pi_i\left(l_i,l_{-i};\omega_i\right)$ is concave in l_i since it is the lower envelope of two concave functions.

We make two useful observations:

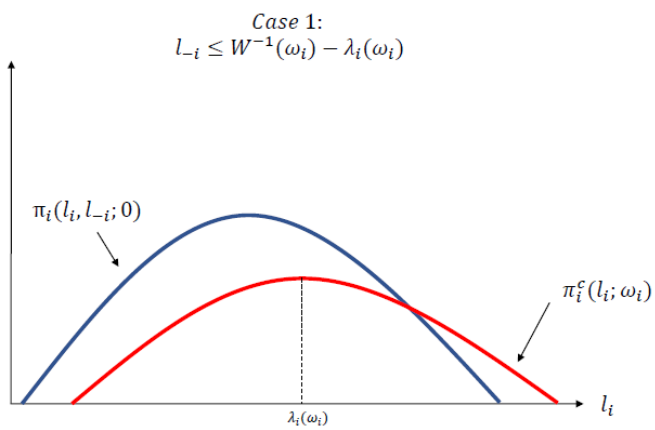
1. Recall $\lambda_i(\omega_i) = \arg\max_{l_i} \pi_i^c(l_i;\omega_i)$ and $r_i(l_{-i};0) = \arg\max_{l_i} \pi_i(l_i, l_{-i};0)$.

2. Note that $\pi_i^c(l_i;\omega_i) > \pi_i(l_i, l_{-i};0) \Leftrightarrow W(l_i + l_{-i}) > \omega_i$. If $W(l_i + l_{-i}) = \omega_i$ then $\pi_i(l_i, l_{-i};0) = \pi_i^c(l_i;\omega_i)$ and at this point,

$$\begin{aligned} \frac{\partial \pi_i(l_i, l_{-i};0)}{\partial l_i} &= f_i'(l_i) - W(l_i + l_{-i}) - W'(l_i + l_{-i}) l_i \\ &< f_i'(l_i) - W(l_i + l_{-i}) = \frac{\partial \pi_i^c(l_i;\omega_i)}{\partial l_i}. \end{aligned}$$

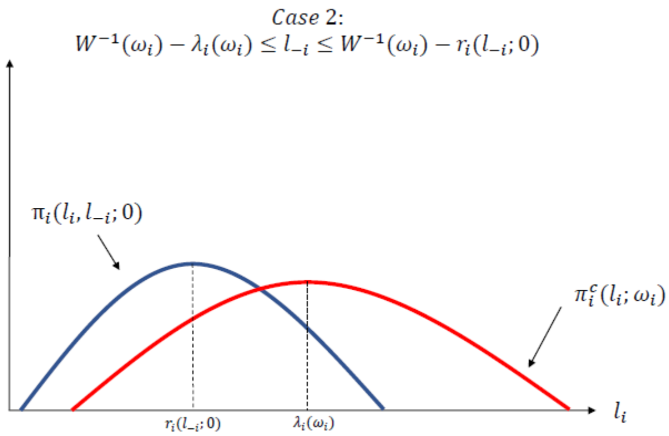
   Hence $\pi_i(l_i, l_{-i};0)$ crosses $\pi_i^c(l_i;\omega_i)$ from above.

There are three cases to consider. **Case 1:** Suppose $W(\lambda_i(\omega_i) + l_{-i}) \leq \omega_i$, which holds if and only if $l_{-i} \leq W^{-1}(\omega_i) - \lambda_i(\omega_i)$. At $l_i = \lambda_i(\omega_i)$, $W(l_i + l_{-i}) \leq \omega_i$ and so $\pi_i^c(l_i;\omega_i) \leq \pi_i(l_i, l_{-i};0)$. So $\pi_i(l_i, l_{-i};0)$ crosses $\pi_i^c(l_i;\omega_i)$ from above to the right of $\lambda_i(\omega_i)$, which is the maximizer of $\pi_i^c(l_i;\omega_i)$. Hence the maximum of $\pi_i(l_i, l_{-i};\omega_i)$ is $l_i = \lambda_i(\omega_i)$.

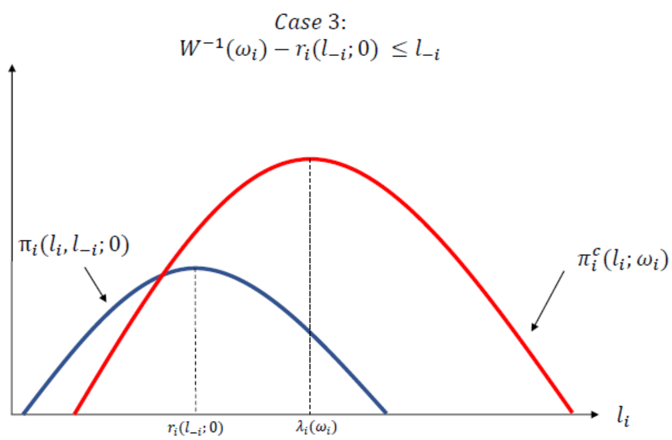


Case 2: Suppose $W(r_i(l_{-i};0) + l_{-i}) \leq \omega_i \leq W(\lambda_i(\omega_i) + l_{-i})$, which holds if and only if $W^{-1}(\omega_i) - \lambda_i(\omega_i) \leq l_{-i} \leq W^{-1}(\omega_i) - r_i(l_{-i};0)$. Note that, in this case, $r(l_{-i};0) \leq \lambda_i(\omega_i)$. At $l_i = r_i(l_{-i};0)$, $W(l_i + l_{-i}) \leq \omega_i$ and so $\pi_i^c(l_i;\omega_i) \leq \pi_i(l_i, l_{-i};0)$. At $l_i = \lambda_i(\omega_i)$, $\omega_i \leq W(\lambda_i(\omega_i) + l_{-i})$, and so $\pi_i(l_i, l_{-i};0) \leq \pi_i^c(l_i;\omega_i)$. Hence the crossing point of the functions $\pi_i^c(l_i;\omega_i)$ and $\pi_i(l_i, l_{-i};0)$ occurs in the interval $[r_i(l_{-i};0), \lambda(\omega_i)]$, with $\pi_i^c(l_i;\omega_i) \leq (\geq) \pi_i(l_i, l_{-i};0)$ to the left (right) of the crossing point. Hence $\min\{\pi_i^c(l_i;\omega_i), \pi_i(l_i, l_{-i};0)\}$ is strictly increasing up to the crossing point, and strictly decreasing after the crossing point, and so is maximized at the crossing point. The crossing point l_i satisfies $W(l_i + l_{-i}) = \omega_i$, i.e.,

$l_i = W^{-1}(\omega_i) - l_{-i}$.



Case 3: Suppose $\omega_i \leq W(r_i(l_{-i};0) + l_{-i})$, which holds if and only if $l_{-i} \geq W^{-1}(\omega_i) - r_i(l_{-i};0)$. At $l_i = r_i(l_{-i};0)$, $\omega_i \leq W(l_i + l_{-i})$, and so $\pi_i(l_i, l_{-i}; 0) \leq \pi_i^c(l_i;\omega_i)$. If $\pi_i(l_i, l_{-i}; 0) \leq \pi_i^c(l_i;\omega_i)$ for all l_i, it is immediate that the maximizer of $\min\{\pi_i^c(l_i;\omega_i), \pi_i(l_i, l_{-i}; 0)\}$ is $r_i(l_{-i};0)$. Otherwise, $\pi_i(l_i, l_{-i}; 0)$ crosses $\pi_i^c(l_i;\omega_i)$ from above at a point to the left of $r_i(l_{-i};0)$. Hence $\pi_i^c(l_i;\omega_i)$ is increasing up to this crossing point, and the maximizer of $\min\{\pi_i^c(l_i;\omega_i), \pi_i(l_i, l_{-i}; 0)\}$ is again $r_i(l_{-i};0)$.



Observe that it cannot be $W(\lambda_i(\omega_i) + l_{-i}) \leq \omega_i \leq W(r_i(l_{-i};0) + l_{-i})$. If it did, then $W(\lambda_i(\omega_i) + l_{-i}) \leq W(r_i(l_{-i};0) + l_{-i})$ implies $\lambda_i(\omega_i) < r_i(l_{-i};0)$, $W(\lambda_i(\omega_i) + l_{-i}) \leq \omega_i$ implies $\pi_i^c(\lambda_i(\omega_i);\omega_i) \leq \pi_i(\lambda_i(\omega_i), l_{-i}; 0)$, and $\omega_i \leq W(r_i(l_{-i};0) + l_{-i})$ implies $\pi_i^c(r_i(l_{-i};0);\omega_i) > \pi_i(r_i(l_{-i};0), l_{-i}; 0)$. Since $\pi_i^c(r_i(l_{-i};0);\omega_i) \leq \pi_i^c(\lambda_i(\omega_i);\omega_i)$, the above implies $\pi_i(r_i(l_{-i};0), l_{-i}; 0) < \pi_i(\lambda_i(\omega_i), l_{-i}; 0)$, which contradicts the observation that $r_i(l_{-i};0)$ is the maximizer of $\pi_i(l_i, l_{-i}; 0)$.

Finally, we rewrite the condition on l_{-i} from Case 2. Note that

$$\pi_i\left(\lambda_i(\omega_i), W^{-1}(\omega_i) - \lambda_i(\omega_i); 0\right) = \pi_i^c(\lambda_i(\omega_i); \omega_i) = \max_{l_i} \pi_i^c(l_i; \omega_i),$$

implying $r_i(W^{-1}(\omega_i) - \lambda_i(\omega_i); 0) < \lambda_i(\omega_i)$. Hence

$$W^{-1}(\omega_i) - \lambda_i(\omega_i) + r_i\left(W^{-1}(\omega_i) - \lambda_i(\omega_i); 0\right) < W^{-1}(\omega_i),$$

i.e., at $l_{-i} = W^{-1}(\omega_i) - \lambda_i(\omega_i)$,

$$l_{-i} + r_i(l_{-i}; 0) < W^{-1}(\omega_i).$$

Hence

$$W^{-1}(\omega_i) - \lambda_i(\omega_i) < \Lambda_{-i}(\omega_i).$$

Hence the condition on l_{-i} is equivalent to

$$l_{-i} \in \left[W^{-1}(\omega_i) - \lambda_i(\omega_i), \Lambda_{-i}(\omega_i)\right].$$

This completes the proof of the first equality in the statement of the result. The second equality follows from the property (Lemma 1) that $r_i(l_{-i}, 0) + l_{-i}$ is strictly increasing. ■

A.2 Proofs for Section 4

Proof of Proposition 1. Proposition 1 is a special case of Proposition 4 when $\omega_{-i} = 0$, which we prove below. ■

Proof of Proposition 2. Proposition 2 follows directly from the arguments that precede its statement in the main text. Here, we establish the results about industry profits and industry surplus that we refer to in the discussion that follows Proposition 2.

First, we prove that if firm i is the (weakly) less-productive firm (i.e., $i = 2$), then total industry profits decrease relative to the No-ESG benchmark. Industry profits are

$$f_i(l_i) + f_{-i}(r_{-i}(l_i; 0)) - (l_i + r_{-i}(l_i; 0)) W(l_i + r_{-i}(l_i; 0)).$$

The derivative of industry profits with respect to l_i is

$$f_i'(l_i) + r_{-i}'(l_i; 0) f_{-i}'(r_{-i}(l_i; 0)) - \left(1 + r_{-i}'(l_i; 0)\right)(W(l_i + r_{-i}(l_i; 0)) + (l_i + r_{-i}(l_i; 0)) W'(l_i + r_{-i}(l_i; 0))).$$

From the FOC for firm $-i$, this simplifies to

$$f_i'(l_i) + r_{-i}'(l_i;0) f_{-i}'(r_{-i}(l_i;0)) - \left(1 + r_{-i}'(l_i;0)\right)\left(f_{-i}'(r_{-i}(l_i;0)) + l_i W'(l_i + r_{-i}(l_i;0))\right)$$

and hence to

$$f_i'(l_i) - f_{-i}'(r_{-i}(l_i;0)) - \left(1 + r_{-i}'(l_i;0)\right) l_i W'(l_i + r_{-i}(l_i;0)). \tag{22}$$

Suppose that firm i is weakly less productive. The facts that $l_i \geq l_i^B$ and $l_{-i}^B \geq l_i^B$ imply

$$f_i'(l_i) \leq f_i'\left(l_i^B\right) \leq f_{-i}'\left(l_{-i}^B\right) \leq f_{-i}'(r_{-i}(l_i;0)).$$

Hence expression (22) is strictly negative, i.e., total profits are decreasing in l_i.

Next, we prove that industry surplus is always increasing if the more productive firm chooses an ESG policy in the neighborhood of W^B. Industry surplus is

$$f_i(l_i) + f_{-i}(r_{-i}(l_i;0)) - \int_0^{l_i + r_{-i}(l_i;0)} W(L)\,dL.$$

The derivative of industry surplus with respect to l_i is

$$f_i'(l_i) + r_{-i}'(l_i;0) f_{-i}'(r_{-i}(l_i;0)) - \left(1 + r_{-i}'(l_i;0)\right) W(l_i + r_{-i}(l_i;0)).$$

From the FOC for firm $-i$, this simplifies to

$$f_i'(l_i) - W(l_i + r_{-i}(l_i;0)) + r_{-i}'(l_i;0)\, r_{-i}(l_i;0)\, W'(l_i + r_{-i}(l_i;0)). \tag{23}$$

Evaluated at l_i^B, expression (23) equals

$$\left(l_i^B + r_{-i}'\left(l_i^B;0\right) r_{-i}\left(l_i^B;0\right)\right) W'\left(l_i^B + r_{-i}\left(l_i^B;0\right)\right).$$

Suppose that firm i is weakly more productive. Then $l_i^B \geq r_{-i}\left(l_i^B;0\right)$, and so the above expression is (using Lemma 1) strictly positive, i.e., total surplus is increasing in l_i in the neighborhood of $l_i = l_i^B$. ■

Proof of Proposition 3. Firm i's surplus is

$$f_i(l_i) - \mu \int_0^{l_i} W(l)\,dl - (1-\mu) \int_{r_{-i}(l_i;0)}^{l_i + r_{-i}(l_i;0)} W(l)\,dl, \tag{24}$$

The derivative of (24) with respect to l_i is

$$\begin{aligned}
& f_i'(l_i) - \mu W(l_i) - (1-\mu)\left[\begin{array}{c} \left(1 + r_{-i}'(l_i;0)\right) W\left(l_i + r_{-i}(l_i;0)\right) \\ -r_{-i}'(l_i;0)\, W\left(r_{-i}(l_i;0)\right) \end{array}\right] \\
= \;& f_i'(l_i) - \mu W(l_i) - (1-\mu) W\left(l_i + r_{-i}(l_i;0)\right) \\
& -(1-\mu) r_{-i}'(l_i;0)\left[W\left(l_i + r_{-i}(l_i;0)\right) - W\left(r_{-i}(l_i;0)\right)\right] \\
> \;& f_i'(l_i) - W\left(l_i + r_{-i}(l_i;0)\right),
\end{aligned} \tag{25}$$

where the inequality follows because $r_{-i}'(l_i;0) < 0$ and $W\left(l_i + r_{-i}(l_i;0)\right) > W(l_i)$.

There are two cases to consider. First, suppose $\omega_i \in [W^B, \hat{W}_i)$. Increasing ω_i corresponds to increasing l_i. In this case, $l_i = \Lambda_i(\omega_i) < \lambda_i(\omega_i)$, or equivalently, $f_i'(l_i) > \omega_i$; and $\omega_i = W\left(l_i + r_{-i}(l_i;0)\right)$. Hence (25) is strictly positive. It follows that $\omega_i = \hat{W}_i$ delivers higher firm surplus than any choice in $[W^B, \hat{W}_i)$.

Second, consider $\omega_i > \hat{W}_i$. Decreasing ω_i corresponds to increasing l_i. In this case, $l_i = \lambda_i(\omega_i)$, or equivalently, $f_i'(l_i) = \omega_i$; and $\omega_i > W\left(l_i + r_{-i}(l_i;0)\right)$. Hence (25) is strictly positive. It follows that $\omega_i = \hat{W}_i$ delivers higher firm surplus than any choice in $\omega_i > \hat{W}_i$.

As in the proof of Proposition 2, firm $i's$ employment, total employment, wages, and workers' surplus, are all higher in equilibrium relative to the No-ESG benchmark. Moreover, firm's $-i's$ employment and profitability are lower, and if $i = 1$ then total profitability is also lower. ■

Proof of Corollary 1. Industry surplus is

$$f_i(l_i) + f_{-i}\left(r_{-i}(l_i;0)\right) - \int_0^{l_i + r_{-i}(l_i;0)} W(l)\, dl, \tag{26}$$

The derivative of (26) with respect to l_i is

$$\begin{aligned}
& f_i'(l_i) - W\left(l_i + r_{-i}(l_i;0)\right) + r_{-i}'(l_i;0)\left[f_{-i}'\left(r_{-i}(l_i;0)\right) - W\left(l_i + r_{-i}(l_i;0)\right)\right] \\
< \;& f_i'(l_i) - W\left(l_i + r_{-i}(l_i;0)\right).
\end{aligned}$$

where the inequality follows from the monopsony distortion in non-ESG firm's hiring decisions, $f_{-i}'\left(r_{-i}(l_i;0)\right) > W\left(l_i + r_{-i}(l_i;0)\right)$, along with the fact that $r_{-i}'(l_i;0) < 0$.

From Proposition 3, the ESG policy that maximizes firm i's surplus is $\hat{W}_i$, and the associated employment level is such that $f_i'(l_i) = \hat{W}_i = W\left(l_i + r_{-i}(l_i;0)\right)$. Hence the derivative of (26) with respect to l_i is strictly negative at this point, implying that the ESG policy that maximizes industry surplus must induce strictly lower employment at firm i. (No ESG policy can induce strictly more employment.) ■

A.3 Proofs for Section 5.1

The next sequence of auxiliary results will be used for the proof of Proposition 4. The proofs of these results can be found in Section A of the Online Appendix.

Lemma 6 *If $\omega_1 \neq \omega_2$ then there is at most one labor market equilibrium.*

Lemma 7 *If $\max_i \omega_i \leq W^B$ then in any equilibrium, $l_i^* = l_i^B$ and $W_1^* = W_2^* = W^B$.*

Lemma 8 *If $\omega_i \geq W^{**}$ then $l_i = \lambda_i(\omega_i)$.*

Lemma 9 *If $\omega_i \in (W^B, \hat{W}_i]$ and $\omega_{-i} \leq \omega_i$ then $l_i^* = \Lambda_i(\omega_i)$, $l_{-i}^* = W^{-1}(\omega_i) - \Lambda_i(\omega_i)$, and $W_1^* = W_2^* = \omega_i$ is an equilibrium; and is the unique equilibrium if $\omega_{-i} < \omega_i$.*

Lemma 10 *Suppose $\omega_i \in (\hat{W}_i, W^{**}]$ and $\omega_{-i} \leq \omega_i$. Then,*

(i) There is an equilibrium in which, $l_i^* = \lambda_i(\omega_i)$, $l_{-i}^* = r_{-i}(\lambda_i(\omega_i); \omega_{-i}) \leq W^{-1}(\omega_i) - \lambda_i(\omega_i)$, and $W_i^* = \omega_i$.

(ii) If $\omega_{-i} < \omega_i$ then the equilibrium in part (i) is the unique equilibrium and $l_{-i}^* < W^{-1}(\omega_i) - \lambda_i(\omega_i)$. Moreover:

(a) If $W^{-1}(\omega_{-i}) - \lambda_i(\omega_i) \geq r_{-i}(\lambda_i(\omega_i); 0)$ then $l_{-i}^* = W^{-1}(\omega_{-i}) - \lambda_i(\omega_i)$ and $W_{-i}^* = \omega_{-i}$.

(b) If $W^{-1}(\omega_{-i}) - \lambda_i(\omega_i) < r_{-i}(\lambda_i(\omega_i); 0)$ then $l_{-i}^* = r_{-i}(\lambda_i(\omega_i); 0)$ and $W_{-i}^* = W(\lambda_i(\omega_i) + r_{-i}(\lambda_i(\omega_i); 0))$.

(iii) If $\omega_{-i} = \omega_i$ then $l_{-i}^* = r_{-i}(\lambda_i(\omega_i); \omega_{-i}) = W^{-1}(\omega_i) - \lambda_i(\omega_i)$ and $W_{-i}^* = \omega_i$.

Proof of Proposition 4. Part (i) follows from Lemma 7. Part (ii) follows from Lemma 8. Consider part (iii). Suppose $\omega_2 = \omega_1 = \omega \in (W^B, W^{**})$. As we show in the proof of Lemma 9, inequality (48) holds, that is

$$r_{-i}(\Lambda_i(\omega); 0) < \lambda_{-i}(\omega). \tag{27}$$

Since $\Lambda_i(\omega) + r_{-i}(\Lambda_i(\omega); 0) = W^{-1}(\omega)$, then (48) implies

$$W^{-1}(\omega) < \Lambda_i(\omega) + \lambda_{-i}(\omega).$$

Since $\omega > W^B$, repeating the arguments in the proof of Lemma 9 that shows (49), for $i = 1, 2$ we have

$$W^{-1}(\omega) < \Lambda_i(\omega) + \Lambda_{-i}(\omega).$$

Since $\omega < W^{**}$, we have

$$W^{-1}(\omega) < W^{-1}(W^{**}) = \lambda_i(\omega) + \lambda_{-i}(\omega).$$

Combined, these three inequalities establish the interval in (20) is not empty.

Let l^* be an element in interval (20). Then,

$$l^* \in \left[W^{-1}(\omega) - \lambda_{-i}(\omega), \Lambda_i(\omega)\right].$$

Notice $l^* \leq \Lambda_i(\omega)$ implies $W^{-1}(\omega) - l^* \geq r_{-i}(l^*; 0)$ and $W^{-1}(\omega) - \lambda_{-i}(\omega) \leq l^*$ implies $\lambda_{-i}(\omega) \leq W^{-1}(\omega) - l^*$. Thus, from Lemma 3, $r_{-i}(l^*; \omega) = W^{-1}(\omega) - l^*$. Moreover

$$l^* \in \left[W^{-1}(\omega) - \Lambda_{-i}(\omega), \lambda_i(\omega)\right]$$

and so

$$r_{-i}(l^*; \omega) = W^{-1}(\omega) - l^* \in \left[W^{-1}(\omega) - \lambda_i(\omega), \Lambda_{-i}(\omega)\right].$$

Thus, from Lemma 3

$$r_i(r_{-i}(l^*; \omega); \omega) = W^{-1}(\omega) - r_{-i}(l^*; \omega) = l^*,$$

establishing that $(l^*, W^{-1}(\omega) - l^*)$ is an equilibrium. The fact that both firms pay ω is immediate.

Finally, we show that there are no other equilibria. We have just shown that the function $r_i(r_{-i}(\cdot; \omega); \omega)$ has an interval of fixed points, and that over this interval the function has slope 1. From the proof of Lemma 6, it follows that the set of fixed points of $r_i(r_{-i}(\cdot; \omega); \omega)$ coincides with with the interval over which the function has slope 1. From the proof of Lemma 6, and from Lemma 3, this interval is defined by the pair of conditions

$$\begin{aligned} l_i &\in \left[W^{-1}(\omega) - \lambda_{-i}(\omega), \Lambda_i(\omega)\right] \\ W^{-1}(\omega) - l_i &\in \left[W^{-1}(\omega) - \lambda_i(\omega), \Lambda_{-i}(\omega)\right] \end{aligned}$$

which together is exactly the interval in (20). This completes part (iii).

Consider part (iv). If $\omega_{-i} < \omega_i$ then the equilibrium is unique based on Lemma 6. Based on Lemma 9, if $\omega_i \in (W^B, \hat{W}_i]$ then $l_i = \Lambda_i(\omega_i)$ and $W_i^* = \omega_i$. Based on Lemma 10 part (i), if

$\omega_i \in (\hat{W}_i, W^{**}]$ then $l_i^* = \lambda_i(\omega_i)$ and $W_i^* = \omega_i$. Since $\omega_i \le \hat{W}_i \Leftrightarrow \Lambda_i(\omega_i) \le \lambda_i(\omega_i)$, this can be written as $l_i^* = \min\{\Lambda_i(\omega_i), \lambda_i(\omega_i)\}$ and $W_i^* = \omega_i$ as required. Notice l_{-i}^* and W_{-i}^* follow from the definition of equilibrium, and their explicit characterization is given in Lemmas 9 and 10.

Finally, we prove that if firms i are symmetric (i.e., have the same production functions) or $i = 1$ (the larger firm adopts a more aggressive ESG policy), then $l_i^* > l_{-i}^*$. If $\omega_i \in (W^B, \hat{W}_i]$ then based on Lemma 9, $l_i^* > l_{-i}^* \Leftrightarrow \Lambda_i(\omega_i) > W^{-1}(\omega_i) - \Lambda_i(\omega_i)$. Inequality (49) from the proof of Lemma 9 implies $\Lambda_i(\omega) + \Lambda_{-i}(\omega) > W^{-1}(\omega)$. Thus, $\Lambda_i(\omega_i) > W^{-1}(\omega_i) - \Lambda_i(\omega_i)$ must hold. If $\omega_i \in (\hat{W}_i, W^{**}]$ then based on Lemma 10 $l_i^* = \lambda_i(\omega_i)$ and $l_{-i}^* < W^{-1}(\omega_i) - \lambda_i(\omega_i)$. Recall $\lambda_i(W^{**}) + \lambda_{-i}(W^{**}) = W^{-1}(W^{**})$. If $\omega_i < W^{**}$ and firms are symmetric or $\lambda_i(\cdot) > \lambda_{-i}(\cdot)$ then $\lambda_i(\omega_i) > W^{-1}(\omega_i) - \lambda_i(\omega_i)$. ■

A.4 Proofs for Section 5.2

Proof of Lemma 4. We consider separately upwards and downwards responses by firm $-i$ to firm i's policy ω_i. Let $\pi_{-i}^{down}(\omega_i)$ and $\pi_{-i}^{up}(\omega_i)$ respectively denote the maximal profits that firm $-i$ can obtain if restricted to policies $\omega_{-i} < \omega_i$ and $\omega_{-i} \ge \omega_i$. From Lemmas 7–10, both these functions are continuous in ω_i. Further, for $j = i, -i$ define

$$L_j(\omega) = \begin{cases} \min\{\Lambda_j(\omega), \lambda_j(\omega)\} & \text{if } \omega \ge W^B \\ l_j^B & \text{if } \omega \le W^B. \end{cases}$$

Consider first downwards responses $\omega_{-i} < \omega_i$. From Lemmas 7–10, $l_i^* = L_i(\omega_i)$ regardless of the specific value of ω_{-i}. So firm $-i$'s profits are maximized by playing the unconstrained best response to $L_i(\omega_i)$, which can be achieved by choosing $\omega_{-i} = 0$. Hence

$$\pi_{-i}^{down}(\omega_i) = \max_{l_{-i}} f_{-i}(l_{-i}) - l_{-i} W(L_i(\omega_i) + l_{-i}).$$

Consequently, $\pi_{-i}^{down}(\omega_i)$ is constant for $\omega_i \le W^B$; strictly decreasing over $\omega_i \in [W^B, \hat{W}_i]$; and strictly increasing for $\omega_i \ge \hat{W}_i$. Moreover, note that $W(\lambda_i(W^{**}) + \lambda_{-i}(W^{**})) = W^{**} = f'_{-i}(\lambda_i(W^{**}))$, which implies the monopsony distortion, namely:

$$\begin{aligned} \pi_{-i}^{down}(W^{**}) &> f_{-i}(\lambda_{-i}(W^{**})) - \lambda_{-i}(W^{**}) W(\lambda_i(W^{**}) + \lambda_{-i}(W^{**})) \\ &= \max_{l_{-i}} f_{-i}(l_{-i}) - l_{-i} W^{**}. \end{aligned} \tag{28}$$

We next consider upwards responses $\omega_{-i} \ge \omega_i$. For $\omega_i \le W^B$ is is immediate from Lemma 7 and Proposition 2 that firm $-i$ adopts φ_{-i}^*. For $\omega_i \ge W^B$, Lemmas 8–10 imply that firm $-i$'s profits from any policy $\tilde{\omega}_{-i} > \omega_i$ are $f_{-i}(L_{-i}(\tilde{\omega}_{-i})) - L_{-i}(\tilde{\omega}_{-i})\tilde{\omega}_{-i}$, and in particular, are independent of firm i's policy ω_i. Hence an increase in ω_i affects firm $-i$ solely by shrinking the set of upwards responses available, implying both that the profit function $\pi_{-i}^{up}(\omega_i)$ is weakly decreasing in ω_i and that firm $-i$'s policy is weakly increasing in ω_i (conditional on firm $-i$ adopting $\omega_{-i} \geq \omega_i$).

Moreover, from Lemma 8, if $\omega_i = W^{**}$ then any upwards response ω_{-i} yields profits

$$f_{-i}\left(\lambda_{-i}\left(\omega_{-i}\right)\right) - \lambda_{-i}\left(\omega_{-i}\right)\omega_{-i} = \max_{l_{-i}} f_{-i}\left(l_{-i}\right) - l_{-i}\omega_{-i},$$

which combined with (28) implies that

$$\pi_{-i}^{down}\left(W^{**}\right) > \lim_{\epsilon \to 0} \pi_{-i}^{up}\left(W^{**}\right). \tag{29}$$

($\epsilon \to 0$ means $\omega_{-i} \searrow \omega_i = W^{**}$).

Below, we establish that

$$\lim_{\epsilon \to 0} \pi_{-i}^{up}\left(\omega_i\right) > \pi_{-i}^{down}\left(\omega_i\right) \text{ if } \omega_i \leq \hat{W}_i. \tag{30}$$

Continuity of $\pi_{-i}^{down}(\omega_i)$ and $\pi_{-i}^{up}(\omega_i)$, combined with the observations that the former functions is increasing for $\omega_i \geq \hat{W}_i$ while the latter is weakly decreasing, along with (29), implies that there exists a unique $\check{W}_{-i} \in (\hat{W}_i, W^{**})$ such that $\lim_{\epsilon \to 0} \pi_{-i}^{up}(\omega_i) > \pi_{-i}^{down}(\omega_i)$ if $\omega_i < \check{W}_{-i}$ and $\lim_{\epsilon \to 0} \pi_{-i}^{up}(\omega_i) < \pi_{-i}^{down}(\omega_i)$ if $\omega_i > \check{W}_{-i}$.

Proof of (30): There are three subcases. First, if $\omega_i < \varphi_{-i}^*$ then if firm $-i$ adopts φ_{-i}^* it hires $\Lambda_{-i}(\varphi_{-i}^*)$ at wage φ_{-i}^* (see Lemma 9). By Proposition 2, firm $-i$'s profits strictly exceed those in the No-ESG benchmark, which equal $\pi_{-i}^{down}\left(W^B\right)$, and which in turn exceeds $\pi_{-i}^{down}(\omega_i)$ provided $\omega_i \leq \hat{W}_i$. Hence

$$\pi_{-i}^{up}\left(\omega_i\right) > \pi_{-i}^{down}\left(\omega_i\right) \text{ if } \omega_i < \min\{\varphi_{-i}^*, \hat{W}_i\}. \tag{31}$$

Second, if $\min\{\varphi_{-i}^*, \hat{W}_i\} \leq \omega_i < \min\{\hat{W}_i, \hat{W}_{-i}\}$ then if firm $-i$ adopts $\omega_{-i} = \omega_i + \epsilon$ it hires $\Lambda_{-i}(\omega_{-i})$ at wage ω_{-i} (see Lemma 9). Moreover, because $W^B < \min\{\varphi_{-i}^*, \hat{W}_i\} \leq \omega_i$,

$$\Lambda_{-i}\left(\omega_i\right) > \Lambda_{-i}\left(W^B\right) = l_{-i}^B = r_{-i}\left(l_i^B; 0\right) = r_{-i}\left(\Lambda_i\left(W^B\right); 0\right) > r_{-i}\left(\Lambda_i\left(\omega_i\right); 0\right). \tag{32}$$

The function $f_{-i}(l) - l\omega_i$ is concave with a unique maximizer at $\lambda_{-i}(\omega_i)$. Note that $\omega_i < \hat{W}_{-i}$ implies $\Lambda_{-i}(\omega_i) < \lambda_{-i}(\omega_i)$; and $r_{-i}(\Lambda_i(\omega_i); 0) < \Lambda_{-i}(\omega_i)$ from (32); and hiring levels $l_i = \Lambda_i(\omega_i)$ and $l_{-i} = r_{-i}(\Lambda_i(\omega_i); 0)$ result in wage ω_i. It follows that, for ϵ sufficiently small, firm

$-i$'s profits from ω_{-i} strictly exceed

$$f_{-i}\left(r_{-i}\left(\Lambda_i\left(\omega_i\right);0\right)\right)-r_{-i}\left(\Lambda_i\left(\omega_i\right);0\right)\omega_i=\pi_{-i}^{down}\left(\omega_i\right).$$

Consequently (and regardless of whether $\omega_{-i}=\omega_i+\epsilon$ is the best upwards response to ω_i for firm $-i$),

$$\lim_{\epsilon\to 0}\pi_{-i}^{up}\left(\omega_i\right)>\pi_{-i}^{down}\left(\omega_i\right)\text{ if }\min\{\varphi_{-i}^*,\hat{W}_i\}\leq\omega_i<\min\{\hat{W}_i,\hat{W}_{-i}\}.\tag{33}$$

Third, if $\min\{\hat{W}_i,\hat{W}_{-i}\}\leq\omega_i<\hat{W}_i$ then $\hat{W}_{-i}\leq\omega_i<\hat{W}_i$. Because $\omega_i<\hat{W}_i$,

$$\pi_{-i}^{down}\left(\omega_i\right)=\max_{l_{-i}}f_{-i}\left(l_{-i}\right)-l_{-i}W\left(\Lambda_i\left(\omega_i\right)+l_{-i}\right).\tag{34}$$

Note that the wage $W\left(\Lambda_i\left(\omega_i\right)+l_{-i}\right)$ at the profit-maximizing choice of l_{-i} in (34) equals ω_i. Because $\omega_i\geq\hat{W}_{-i}$, if firm $-i$ adopts $\omega_{-i}=\omega_i+\epsilon$ it hires $\lambda_{-i}\left(\omega_{-i}\right)$ at wage ω_{-i}, and so $\pi_{-i}^{up}\left(\omega_i\right)$ weakly exceeds the profits from this policy. Hence

$$\lim_{\epsilon\to 0}\pi_{-i}^{up}\left(\omega_i\right)\geq\max_{l_{-i}}f_{-i}\left(l_{-i}\right)-l_{-i}\omega_i>\pi_{-i}^{down}\left(\omega_i\right)\text{ if }\min\{\hat{W}_i,\hat{W}_{-i}\}\leq\omega_i<\hat{W}_i.\tag{35}$$

Combined, (31), (33), and (35) establish (30), completing the proof. ■

Proof of Proposition 5. To avoid excessive mathematical complication we assume that the grid determining firm $-i$'s policy choices includes $\check{W}_{-i}$.

We show that, for the leader firm i: (A) any policy choice $\omega_i\in[\varphi_{-i}^*,\min\{\hat{W}_{-i},\check{W}_{-i}\})$ is dominated by $\omega_i<\varphi_{-i}^*$; (B) any policy choice $\omega_i\geq\min\{\hat{W}_{-i},\check{W}_{-i}\}$ with $\omega_i\neq\check{W}_{-i}$ is dominated by $\omega_i=\check{W}_{-i}$.

Proof of (A): This case only arises if $\varphi_{-i}^*<\check{W}_{-i}$. On the one hand, if firm i adopts $\omega_i<\varphi_{-i}^*$ then, by Lemma 4, Lemma 9, and Proposition 2, firm $-i$ responds by adopting policy φ_{-i}^*. By Lemma 9, the labor market outcome is that firm i hires $l_i=W^{-1}(\varphi_{-i}^*)-\Lambda_{-i}(\varphi_{-i}^*)=r_i(\Lambda_{-i}(\varphi_{-i}^*);0)$ at wage φ_{-i}^*, for firm i profits of

$$\max_{l_i}f_i\left(l_i\right)-l_iW(\Lambda_{-i}(\varphi_{-i}^*)+l_i).\tag{36}$$

On the other hand, if firm i adopts $\omega_i\in[\varphi_{-i}^*,\min\{\hat{W}_{-i},\check{W}_{-i}\})$ then by Lemma 4, firm $-i$ responds by adopting $\omega_{-i}>\omega_i$. From Lemma 10, it follows straightforwardly that any $\omega_{-i}\geq\hat{W}_{-i}$ is a strictly worse response for firm $-i$ than $\omega_{-i}=\hat{W}_{-i}$. Hence firm $-i$'s response satisfies $\omega_{-i}\in(\omega_i,\hat{W}_{-i}]$, and by Lemma 9 the labor market outcome is that firm i hires

$l_i = W^{-1}(\omega_{-i}) - \Lambda_{-i}(\omega_{-i}) = r_i(\Lambda_{-i}(\omega_{-i});0)$ at wage ω_{-i}, for firm i profits of

$$\max_{l_i} f_i(l_i) - l_i W(\Lambda_{-i}(\omega_{-i}) + l_i). \tag{37}$$

Since $\Lambda_{-i}(\omega_{-i}) > \Lambda_{-i}(\omega_i) \geq \Lambda_{-i}(\varphi^*_{-i})$ it follows that profits (36) exceed profits (37), completing the proof of (A).

Proof of (B): First note that, by Lemma 4, if firm i adopts $\omega_i \geq \check{W}_{-i}$ then firm $-i$ adopts a non-binding policy. From Lemma 10, firm i hires $\lambda_i(\omega_i)$ at wage ω_i. The resulting profits for firm i are strictly decreasing in ω_i. Hence any policy $\omega_i > \check{W}_{-i}$ is dominated from firm i's perspective by $\omega_i = \check{W}_{-i}$.

Next, we consider the case in which firm i adopts $\omega_i \in [\hat{W}_{-i}, \check{W}_{-i})$. From Lemma 4, firm $-i$ responds by adopting $\omega_{-i} > \omega_i$. Moreover, because $\omega_i \geq \hat{W}_{-i}$, it follows from the same argument as directly above that firm $-i$'s unique best response ω_{-i} is the smallest value on the grid that strictly exceeds ω_i. From Lemma 10, firm i's profits are

$$f_i(r_i(\lambda_{-i}(\omega_{-i});\omega_i)) - r_i(\lambda_{-i}(\omega_{-i});\omega_i) W(\lambda_{-i}(\omega_{-i}) + r_i(\lambda_{-i}(\omega_{-i});\omega_i)). \tag{38}$$

Note that these profits are weakly below what firm i would get under the No-ESG policy $\omega_i = 0$ if firm $-i$ continues to hire $\lambda_{-i}(\omega_{-i})$,

$$\begin{aligned} & f_i(r_i(\lambda_{-i}(\omega_{-i});0)) - r_i(\lambda_{-i}(\omega_{-i});0) W(\lambda_{-i}(\omega_{-i}) + r_i(\lambda_{-i}(\omega_{-i});0)) \\ = \; & \max_{l_i} f_i(l_i) - l_i W(\lambda_{-i}(\omega_{-i}) + l_i). \end{aligned} \tag{39}$$

Because $\omega_{-i} \leq \check{W}_{-i}$ for ϵ sufficiently small, $\lambda_{-i}(\check{W}_{-i}) \leq \lambda_{-i}(\omega_{-i})$, and profits (39) are in turn weakly below

$$\max_{l_i} f_i(l_i) - l_i W(\lambda_{-i}(\check{W}_{-i}) + l_i). \tag{40}$$

Moreover, there exists some $\delta > 0$ such that profits (40) exceed (38) by at least δ, regardless of $\omega_i \in [\hat{W}_{-i}, \check{W}_{-i})$, as follows. For ω_i and hence ω_{-i} bounded away from $\hat{W}_{-i}$, firm $-i$'s hiring $\lambda_{-i}(\omega_{-i})$ is bounded below $\Lambda_{-i}(\omega_{-i})$, which by Lemma 10 implies that $r_i(\lambda_{-i}(\omega_{-i});\omega_i)$ is bounded away from $r_i(\lambda_{-i}(\omega_{-i});0)$ and hence that (38) is bounded away from (39). If instead ω_i and hence ω_{-i} is bounded away from $\check{W}_{-i}$ then (39) is bounded away from (40).

By the definition of $\check{W}_{-i}$, and the fact that we are in the case with $\check{W}_{-i} > \hat{W}_{-i}$, firm $-i$'s profits from adopting a policy $\check{W}_{-i}$ against ω_i just below $\check{W}_{-i}$ are the same as from adopting $\omega_{-i} = 0$ against $\omega_i = \check{W}_{-i}$, i.e.,

$$f_{-i}(\lambda_{-i}(\check{W}_{-i})) - \lambda_{-i}(\check{W}_{-i})\check{W}_{-i} = \max_{l_{-i}} f_{-i}(l_{-i}) - l_{-i} W(\lambda_i(\check{W}_{-i}) + l_{-i}). \tag{41}$$

If firm i adopts $\omega_i = \check{W}_{-i}$ its profits equal $f_i(\lambda_i(\check{W}_{-i})) - \lambda_i(\check{W}_{-i})\check{W}_{-i}$. For the case of symmetric firms ($f_i \equiv f_{-i}$), equality (41) implies that these profits equal (40), which strictly exceeds the profits from $\omega_i \in [\hat{W}_{-i}, \check{W}_{-i})$, given by (38). That is, any policy $\omega_i = [\hat{W}_{-i}, \check{W}_{-i})$ is dominated by $\omega_i = \check{W}_{-i}$.

Because of the bound δ between profits (38) and (40), the same conclusion holds whenever the two firms' production functions are sufficiently similar. This completes the proof. ■

Proof of Proposition 6. From Lemma 4 and Proposition 5, the labor market equilibrium that follows the equilibrium choice of ESG policies is either (A), $\left(l_i^*, l_{-i}^*\right) = (r_i(\Lambda_{-i}(\varphi_{-i}^*), 0), \Lambda_{-i}(\varphi_{-i}^*))$, or (B) $\left(l_i^*, l_{-i}^*\right) = (\lambda_i(\check{W}_{-i}), r_{-i}(\lambda_i(\check{W}_{-i}), 0))$. In both cases, firms pay wages of at least $W\left(l_i^* + l_{-i}^*\right)$. So the worker welfare conclusion follows provided that

$$l_i^* + l_{-i}^* > l_1^B + l_2^B. \tag{42}$$

In case (A), this follows immediately from Lemma 1 and $\Lambda_{-i}(\varphi_{-i}^*) > \Lambda_{-i}\left(W^B\right)$. In case (B), it follows from Lemma 1 and

$$\lambda_i(\check{W}_{-i}) > \lambda_i\left(W^{**}\right) = l_i^{**} \geq l_i^B,$$

where the final inequality holds strictly for symmetric firms ($f_i \equiv f_{-i}$) and hence holds for sufficiently similar firms also.

Regardless of whether case (A) or (B) holds, the industry profit conclusion follows from the same argument as in the proof of Proposition 2, combined with the observation that the conclusion straightforwardly extends to sufficiently similar firms (regardless of which one is more productive). ■

A.5 Proofs for Section 5.3

The next auxiliary lemma is used in the proof of Lemma 5. Its proof is given in Section A of the Online Appendix.

Lemma 11 *If $\omega_i = \omega_{-i} \in \left(W^B, W^{**}\right)$ then at least one firm can profitably deviate to some $\omega > \omega_i = \omega_{-i}$.*

Proof of Lemma 5. As an initial step we establish:

Claim: If $\omega_i < \hat{W}_{-i}$ then firm $-i$ hires $l_{-i} \leq \lambda_{-i}(\hat{W}_{-i})$, with equality if and only if $\omega_{-i} = \hat{W}_{-i}$.

Proof of claim: Immediate if $\omega_{-i} \geq \omega_i$. Suppose instead that $\omega_{-i} < \omega_i$. The result is immediate if $\omega_i \leq W^B$. If $\omega_i \in (W^B, \hat{W}_i]$ then $l_{-i} = W^{-1}(\omega_i) - \Lambda_i(\omega_i) < \Lambda_{-i}(\omega_i) \leq \Lambda_{-i}(\hat{W}_{-i})$. If $\omega_i > \hat{W}_i$ then $l_{-i} < W^{-1}(\omega_i) - \lambda_i(\omega_i) < W^{-1}(\hat{W}_{-i}) - \lambda_i(\hat{W}_{-i}) < \lambda_{-i}(\hat{W}_{-i})$.

We next consider, sequentially, the cases $\omega_i < \hat{W}_{-i}$, $\omega_i \in [\hat{W}_{-i}, W^{**})$, $\omega_i \geq W^{**}$.

Case 1 : $\omega_i < \hat{W}_{-i}$. If firm $-i$ adopts $\omega_{-i} = \hat{W}_{-i}$ then (Lemma 9) the firms hire $l_{-i} = \lambda_{-i}(\hat{W}_{-i}) = \Lambda_{-i}(\hat{W}_{-i})$ and $l_i = r_i(\lambda_{-i}(\hat{W}_{-i}); \omega_i) = r_i(\lambda_{-i}(\hat{W}_{-i}); 0)$. Note that

$$W(l_{-i} + r_i(l_{-i}; 0)) = \hat{W}_{-i} = f'_{-i}(l_{-i}).$$

Hence for any $\tilde{l}_{-i} < \lambda_{-i}(\hat{W}_{-i})$,

$$S_{-i}(\tilde{l}_{-i}, r_i(\lambda_{-i}(\hat{W}_{-i}); \omega_i)) < S_{-i}(\lambda_{-i}(\hat{W}_{-i}), r_i(\lambda_{-i}(\hat{W}_{-i}); \omega_i)).$$

Since $r_i(\lambda_{-i}(\hat{W}_{-i}); \omega_i) \leq r_i(\tilde{l}_{-i}; \omega_i)$ and firm $-i$'s surplus S_{-i} is strictly decreasing in firm i's hiring,

$$S_{-i}(\tilde{l}_{-i}, r_i(\tilde{l}_{-i}; \omega_i)) \leq S_{-i}(\tilde{l}_{-i}, r_i(\lambda_{-i}(\hat{W}_{-i}); \omega_i)).$$

So from the claim, firm $-i$'s strict best response to $\omega_i < \hat{W}_{-i}$ is to adopt $\omega_{-i} = \hat{W}_{-i}$.

Case 2: $\omega_i \in [\hat{W}_{-i}, W^{**})$. Suppose that $\omega_{-i} < \omega_i$. If $\omega_i > \hat{W}_i$ then (Lemma 10) the firms hire $l_i = \lambda_i(\omega_i)$ and $l_{-i} < W^{-1}(\omega_i) - \lambda_i(\omega_i) < \lambda_{-i}(\omega_i)$. If instead $\omega_i \leq \hat{W}_i$ then (Lemma 9) the firms hire $l_i = \Lambda_i(\omega_i)$ and $l_{-i} = W^{-1}(\omega_i) - \Lambda_i(\omega_i) < \Lambda_{-i}(\omega_i) \leq \lambda_{-i}(\omega_i)$. In both cases, $W(l_i + l_{-i}) \leq \omega_i < f'_{-i}(l_{-i})$. Hence firm $-i$'s surplus from ω_{-i} is weakly below the surplus it obtains from adopting $\omega_{-i} = \omega_i - \epsilon$. From Lemma 11 it then follows that firm $-i$'s surplus is maximized by some $\omega_{-i} \in (\omega_i, W^{**})$.

Case 3: $\omega_i \geq W^{**}$. By Lemma 8, $l_i = \lambda_i(\omega_i) \leq \lambda_{-i}(W^{**})$. If firm $-i$ adopts $\omega_{-i} \geq W^{**}$ then (Lemma 8 again) $l_{-i} = \lambda_{-i}(\omega_{-i}) \leq \lambda_{-i}(W^{**})$. Since

$$f'_{-i}(\lambda_{-i}(W^{**})) = W^{**} = W(\lambda_i(W^{**}) + \lambda_{-i}(W^{**})) \geq W(\lambda_i(\omega_i) + \lambda_{-i}(W^{**})), \tag{43}$$

it follows that adopting $\omega_{-i} = W^{**}$ gives firm $-i$ strictly greater surplus than any $\omega_{-i} > W^{**}$.

Subcase: $\omega_i = W^{**}$. If firm $-i$ adopts $\omega_{-i} < W^{**}$ then

$$l_{-i} \leq \max\left\{W^{-1}(\omega_{-i}) - \lambda_i(W^{**}), r_{-i}(\lambda_i(W^{**}); 0)\right\}.$$

Note that

$$W^{-1}(\omega_{-i}) - \lambda_i(W^{**}) < W^{-1}(W^{**}) - \lambda_i(W^{**}) = \lambda_{-i}(W^{**})$$

while certainly $r_{-i}(\lambda_i(W^{**});0) < \lambda_{-i}(W^{**})$, and so $l_{-i} < \lambda_{-i}(W^{**})$. By (43), it follows that adopting $\omega_{-i} = W^{**}$ gives firm $-i$ strictly greater surplus than any $\omega_{-i} < W^{**}$.

Subcase: $\omega_i > W^{**}$. Note that $\lambda_{-i}(W^{**}) < W^{-1}(W^{**}) - \lambda_{-i}(\omega_i)$. Hence for all ω_{-i} in an open neighborhood around W^{**}, $\lambda_{-i}(\omega_{-i}) < W^{-1}(\omega_{-i}) - \lambda_{-i}(\omega_i)$, implying that if firm $-i$ adopts ω_{-i} in a neighborhood below W^{**} it hires $l_{-i} = \lambda_{-i}(\omega_{-i})$. So firm $-i$'s hiring strictly decreases in ω_{-i} in the neighborhood below W^{**}. Since $\omega_i > W^{**}$, the inequality in (43) holds strictly. Hence firm $-i$'s surplus is strictly raised by reducing ω_{-i} below W^{**}. Moreover, note for use in the proof of Proposition 7 that firm $-i$'s surplus-maximizing choice of ω_{-i} must lead to hiring $l_i > \lambda_{-i}(W^{**})$. ∎

Proof of Proposition 7. If the leader adopts $\omega_i = W^{**}$ then by Lemma 5 the follower likewise adopts $\omega_{-i} = W^{**}$, and the firms hire $l_i^{**} = \lambda_i(W^{**})$ and $l_{-i}^{**} = \lambda_{-i}(W^{**})$.

If the leader adopts $\omega_i < W^{**}$ then by Lemma 5 the follower adopts $\omega_{-i} > \omega_i$, where from the proof of Lemma 5, $\omega_{-i} \in [\hat{W}_i, W^{**})$. By Lemma 10, firm $-i$ hires $l_{-i} = \lambda_{-i}(\omega_{-i}) > \lambda_{-i}(W^{**})$. Note that $W^{-1}(\omega_i) - \lambda_{-i}(\omega_{-i}) < W^{-1}(W^{**}) - \lambda_{-i}(W^{**}) = \lambda_i(W^{**})$ and $r_i(\lambda_{-i}(\omega_{-i});0) < r_i(\lambda_{-i}(W^{**});0) < \lambda_i(W^{**})$. Hence firm i hires $l_i < \lambda_i(W^{**}) = l_i^{**}$. Combined with $l_{-i} > l_{-i}^{**}$ and $f_i'(l_i^{**}) = W\left(l_i^{**} + l_{-i}^{**}\right)$, it follows that firm $i's$ surplus is strictly higher from adopting $\omega_i = W^{**}$ then any $\omega_i < W^{**}$.

Finally, if the leader adopts $\omega_i > W^{**}$ then by Lemma 8 it hires $l_i = \lambda_i(\omega_i) < \lambda_i(W^{**}) = l_i^{**}$. By Lemma 5, firm $-i$ adopts $\omega_{-i} < W^{**}$, and as noted in the proof of Lemma 5, hires $l_{-i} > \lambda_{-i}(W^{**}) = l_{-i}^{**}$. It again follows that firm $i's$ surplus is strictly higher from adopting $\omega_i = W^{**}$ than any $\omega_i > W^{**}$. ∎

Online Appendix for "ESG: A Panacea for Market Power?"

by Philip Bond[26] and Doron Levit[27]

In this Online Appendix we provide supplemental results to the analysis in the main text.

A Proofs of auxiliary lemmas from Sections 5.1 and 5.3

Proof of Lemma 6. Note that (l_1, l_2) is a labor market equilibrium if and only if l_2 is a solution to

$$r_2\left(r_1\left(l_2;\omega_1\right);\omega_2\right) = l_2.$$

and $l_1 = r_1\left(l_2;\omega_1\right)$. From Lemma 3, it is immediate that the function $r_2\left(r_1\left(\cdot;\omega_1\right);\omega_2\right)$ has the following properties: It is continuous and weakly increasing. It is differentiable at all but at most four points. The set of points at which the function has slope 1 is an interval. Everywhere outside this interval the slope is strictly less than 1. And finally, if the slope is 1 then

$$\begin{aligned} r_1\left(l_2;\omega_1\right) &= W^{-1}\left(\omega_1\right) - l_2 \\ r_2\left(r_1\left(l_2;\omega_1\right);\omega_2\right) &= W^{-1}\left(\omega_2\right) - r_1\left(l_2;\omega_1\right). \end{aligned}$$

From these properties, equilibrium multiplicity occurs only if

$$W^{-1}\left(\omega_2\right) - \left(W^{-1}\left(\omega_1\right) - l_2\right) = l_2,$$

has more than one solution, i.e., only if $\omega_1 = \omega_2$. ■

Proof of Lemma 7. To show that $l_i^* = l_i^B$ is an equilibrium, notice $\lambda_i\left(W^B\right) > l_i^B = W^{-1}\left(W^B\right) - l_{-i}^B = r_i\left(l_{-i}^B;0\right)$. Notice $\omega_i \leq W^B \Rightarrow \lambda_i\left(\omega_i\right) \geq r_i\left(l_{-i}^B;0\right)$. Also notice $\omega_i \leq W^B$ and $W^{-1}\left(W^B\right) - l_{-i}^B = r_i\left(l_{-i}^B;0\right)$ imply $W^{-1}\left(\omega_i\right) - l_{-i}^B < r_i\left(l_{-i}^B;0\right)$. Based on Lemma 3, $r_i\left(l_{-i}^B;\omega_i\right) = r_i\left(l_{-i}^B;0\right)$. Thus, if firm $-i$ picks $l_{-i} = l_{-i}^B$ then firm i's best response is $r_i\left(l_{-i}^B;\omega_i\right) = l_i^B$.

It remains to show that this is the unique equilibrium. Suppose to the contrary there is a second equilibrium $(\tilde{l}_1, \tilde{l}_2)$. By Lemma 6 it must be $\omega_2 = \omega_1 = \omega$ for some $\omega \leq W^B$, and by its proof, it must be $\tilde{l}_1 + \tilde{l}_2 = W^{-1}\left(\omega\right)$.

Since $r_i\left(\cdot;\omega\right)$ is weakly decreasing, if $\tilde{l}_i \leq l_i^B$ then $\tilde{l}_{-i} = r_{-i}(\tilde{l}_i,\omega) \geq r_{-i}(l_i^B,\omega) = l_{-i}^B$ (the last equality follows from the observation above that $l_i^* = l_i^B$ is an equilibrium). Hence for some

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$i \in \{1, 2\}$, $\tilde{l}_i \geq l_i^B$. Moreover, $\tilde{l}_i > l_i^B$, since if instead $\tilde{l}_i = l_i^B$ then $\tilde{l}_{-i} = l_{-i}^B$, a contradiction for the existence of a second equilibrium.

Observe

$$W^{-1}(\omega) = \tilde{l}_1 + \tilde{l}_2 = \tilde{l}_i + r_{-i}(\tilde{l}_i; \omega) \geq l_i^B + r_{-i}\left(l_i^B; \omega\right) = W^{-1}\left(W^B\right).$$

Indeed, the second equality follows from the definition of equilibrium, the first inequality follows from the observation that $l + r(l; \omega)$ is a weakly increasing function of l, and the third equality follows from the observation that $\left(l_i^B, l_{-i}^B\right)$ is an equilibrium when $\omega \leq W^B$. Therefore, it must be $\omega = W^B$. But notice that $l_i^B = \Lambda_i\left(W^B\right)$. And thus, $\tilde{l}_i > l_i^B$ implies $\tilde{l}_i > \Lambda_i\left(W^B\right) = \Lambda_i(\omega)$, and hence, $r_{-i}(\tilde{l}_i; \omega) = r_{-i}(\tilde{l}_i; 0)$ by Lemma 3. Therefore, and since $\omega = W^B$,

$$W^{-1}(\omega) = \tilde{l}_i + r_{-i}(\tilde{l}_i; \omega) = \tilde{l}_i + r_{-i}(\tilde{l}_i; 0) > l_i^B + r\left(l_i^B; 0\right) = W^{-1}\left(W^B\right),$$

where the strict inequality follows from Lemma 1, a contradiction. ■

Proof of Lemma 8. For specificity, set $i = 2$. Suppose $\omega_2 \geq W^{**}$. For use at various points in the proof, note that

$$\lambda_1(\omega_2) + \lambda_2(\omega_2) \leq \lambda_1(W^{**}) + \lambda_2(W^{**}) = W^{-1}(W^{**}) \leq W^{-1}(\omega_2) \tag{44}$$

and that, if $l_i \leq \lambda_i(\omega_i)$ and $\omega_i \geq W^{**}$ then by Lemma 1,

$$\begin{aligned} l_i + r_{-i}(l_i; 0) &\leq \lambda_i(\omega_i) + r_{-i}(\lambda_i(\omega_i); 0) \\ &\leq \lambda_i(W^{**}) + r_{-i}(\lambda_i(W^{**}); 0) \\ &\leq \lambda_i(W^{**}) + \lambda_{-i}(W^{**}) = W^{-1}(W^{**}) \leq W^{-1}(\omega_i), \end{aligned}$$

i.e., if $l_i \leq \lambda_i(\omega_i)$ and $\omega_i \geq W^{**}$ then

$$r_{-i}(l_i; 0) \leq W^{-1}(\omega_i) - l_i. \tag{45}$$

Notice we used $r_{-i}(\lambda_i(W^{**}); 0) \leq \lambda_{-i}(W^{**})$. Indeed since $r_{-i}(\lambda_i(W^{**}); 0)$ satisfies

$$f'_{-i}(r) = W'(r + \lambda_i(W^{**}))\, r + W(r + \lambda_i(W^{**})),$$

using $f'_{-i}(\lambda_{-i}(W^{**})) = W^{**}$, we have

$$\begin{aligned} & W'(\lambda_{-i}(W^{**}) + \lambda_i(W^{**}))\,\lambda_{-i}(W^{**}) + W(\lambda_{-i}(W^{**}) + \lambda_i(W^{**})) \\ = \;& W'(\lambda_{-i}(W^{**}) + \lambda_i(W^{**}))\,\lambda_{-i}(W^{**}) + W^{**} \\ = \;& W'(\lambda_{-i}(W^{**}) + \lambda_i(W^{**}))\,\lambda_{-i}(W^{**}) + f'_{-i}(\lambda_{-i}(W^{**})) \\ > \;& f'_{-i}(\lambda_{-i}(W^{**})), \end{aligned}$$

and hence, $r_{-i}(\lambda_i(W^{**});0) \leq \lambda_{-i}(W^{**})$.

First, we show that in any equilibrium $l_2 = \lambda(\omega_2)$. It suffices to show that

$$r_1(\lambda_2(\omega_2);\omega_1) \leq W^{-1}(\omega_2) - \lambda_2(\omega_2), \tag{46}$$

because in this case,

$$\begin{aligned} \lambda_2(\omega_2) &\leq W^{-1}(\omega_2) - r_1(\lambda_2(\omega_2);\omega_1) \\ &\leq \max\left\{W^{-1}(\omega_2) - r_1(\lambda_2(\omega_2);\omega_1), r_2(r_1(\lambda_2(\omega_2);\omega_1);0)\right\} \end{aligned}$$

thereby implying that $r_2(r_1(\lambda_2(\omega_2);\omega_1);\omega_2) = \lambda_2(\omega_2)$. To establish (46): If $\omega_1 \geq \omega_2$ then the inequality is immediate from the combination of $r_1(\cdot;\omega_1) \leq \lambda_1(\omega_1) \leq \lambda_1(\omega_2)$ and (44). If instead $\omega_1 < \omega_2$ then note that it is sufficient to establish

$$\max\left\{W^{-1}(\omega_1) - \lambda_2(\omega_2), r_1(\lambda_2(\omega_2);0)\right\} \leq W^{-1}(\omega_2) - \lambda_2(\omega_2). \tag{47}$$

This inequality indeed holds by the combination of $\omega_1 < \omega_2$ and (45).

Next, if $\omega_1 \neq \omega_2$ then the equilibrium is unique by Lemma 6, and the proof is complete. For $\omega_1 = \omega_2 = \omega \geq W^{**}$, simply note that $l_i \leq \lambda_i(\omega)$ for both firms and so:

$$\begin{aligned} r_i(l_{-i};\omega) &= \min\left\{\lambda_i(\omega), \max\left\{W^{-1}(\omega) - l_{-i}, r(l_{-i};0)\right\}\right\} \\ &= \min\left\{\lambda_i(\omega), W^{-1}(\omega) - l_{-i}\right\} \\ &= \lambda_i(\omega), \end{aligned}$$

where the first and second equalities follow from (45) and (44), respectively. Hence the unique equilibrium in this case is $l_i = \lambda_i(\omega)$. ■

Proof of Lemma 9. For concreteness, we prove the lemma for $i = 1$; the same proof follows for $i = 2$. We start by arguing that the best response of firm 2 to $l_1 = \Lambda_1(\omega_1)$ is $l_2 = W^{-1}(\omega_1) - \Lambda_1(\omega_1)$. Firm 2's best response is

$$r_2(\Lambda_1(\omega_1);\omega_2) = \min\left\{\lambda_2(\omega_2), \max\left\{W^{-1}(\omega_2) - \Lambda_1(\omega_1), r_2(\Lambda_1(\omega_1);0)\right\}\right\}.$$

Observe that

$$r_2(\Lambda_1(\omega_1);0) < \lambda_2(\omega_1). \tag{48}$$

This follows because, by definition of $\Lambda_1(\omega_1)$, at $(l_1, l_2) = (\Lambda_1(\omega_1), r_2(\Lambda_1(\omega_1);0))$ the market wage is ω_1, and so the marginal effect of changing l_2 on firm 2's profits is

$$f_2'(l_2) - \omega_1 - W'(l_1 + l_2).$$

Since $f_2'(\lambda_2(\omega_1)) = \omega_1$, this expression is strictly negative for any $l_2 \geq \lambda_2(\omega_1)$, implying the optimal response of firm 2 to $l_1 = \Lambda_1(\omega_1)$ is strictly smaller than $\lambda_2(\omega_1)$, i.e., inequality (48).

Again using the definition of $\Lambda_1(\omega_1)$, $\omega_2 \leq \omega_1$, and inequality (48) implies

$$W^{-1}(\omega_2) - \Lambda_1(\omega_1) \leq W^{-1}(\omega_1) - \Lambda_1(\omega_1) = r_2(\Lambda_1(\omega_1);0) < \lambda_2(\omega_1) < \lambda_2(\omega_2).$$

Recalling

$$r_2(l_1;\omega_2) = \min\left\{\lambda_2(\omega_2), \max\left\{W^{-1}(\omega_2) - l_1, r_2(l_1;0)\right\}\right\},$$

we established $r_2(\Lambda_1(\omega_1);\omega_2) = W^{-1}(\omega_1) - \Lambda_1(\omega_1)$ as claimed.

Next, we argue that the best response of firm 1 to $l_2 = W^{-1}(\omega_1) - \Lambda_1(\omega_1)$ is $l_1 = \Lambda_1(\omega_1)$. Firm 1's best response is

$$r_1\left(W^{-1}(\omega_1) - \Lambda_1(\omega_1);\omega_1\right) = \min\left\{\lambda_1(\omega_1), \max\left\{\Lambda_1(\omega_1), r_1\left(W^{-1}(\omega_1) - \Lambda_1(\omega_1);0\right)\right\}\right\},$$

As an intermediate step, we establish that for any $\omega > W^B$,

$$W^{-1}(\omega) < \Lambda_1(\omega) + \Lambda_2(\omega). \tag{49}$$

To see why, observe that for $i = 1, 2$, $\Lambda_i(\omega) > \Lambda_i\left(W^B\right) = l_i^B$, and hence,

$$W^{-1}(\omega) = \Lambda_i(\omega) + r_{-i}(\Lambda_i(\omega);0) < \Lambda_i(\omega) + r_{-i}\left(l_i^B;0\right) = \Lambda_i(\omega) + l_{-i}^B.$$

Summing over $i = 1, 2$ implies

$$2W^{-1}(\omega) < \Lambda_1(\omega) + \Lambda_2(\omega) + l_1^B + l_2^B = \Lambda_1(\omega) + \Lambda_2(\omega) + W^{-1}\left(W^B\right).$$

Inequality (49) then follows from the fact that $W^{-1}(\omega) > W^{-1}\left(W^B\right)$.

Combining Lemma 1 and (49) implies

$$W^{-1}(\omega_1) - \Lambda_1(\omega_1) + r_1\left(W^{-1}(\omega_1) - \Lambda_1(\omega_1);0\right) < \Lambda_2(\omega_1) + r_1(\Lambda_2(\omega_1);0) = W^{-1}(\omega_1),$$

and so,

$$r_1\left(W^{-1}(\omega_1) - \Lambda_1(\omega_1);0\right) < \Lambda_1(\omega_1) \leq \lambda_1(\omega_1),$$

where the final weak inequality follows from $\omega_1 \leq \hat{W}_1$ and that fact that $\omega_1 \leq \hat{W}_1 \Leftrightarrow \Lambda_1(\omega_1) \leq \lambda_1(\omega_1)$. Therefore,

$$r_1\left(W^{-1}(\omega_1) - \Lambda_1(\omega_1); \omega_1\right) = \Lambda_1(\omega_1)$$

as claimed. Hence, $(l_1^*, l_2^*) = (\Lambda_1(\omega_1), W^{-1}(\omega_1) - \Lambda_1(\omega_1))$ is an equilibrium. Uniqueness when $\omega_1 > \omega_2$ follows from Lemma 6.

Finally, notice that

$$W(l_1^* + l_2^*) = W\left(\Lambda_1(\omega_1) + W^{-1}(\omega_1) - \Lambda_1(\omega_1)\right) = \omega_1 \geq \omega_2,$$

and hence $W_1^* = W_2^* = \omega_1$, completing the proof. ■

Proof of Lemma 10. For concreteness, we prove the lemma for $i = 1$; the same proof follows for $i = 2$.

First, we show that if $l_2 \leq W^{-1}(\omega_1) - \lambda_1(\omega_1)$ then firm 1's best response is $r_1(l_2; \omega_1) = \lambda_1(\omega_1)$. This follows directly from $\lambda_1(\omega_1) \leq W^{-1}(\omega_1) - l_2 \leq \max\{W^{-1}(\omega_1) - l_2, r_1(l_2; 0)\}$.

Second, we show firm 2's best response to firm 1 picking $\lambda_1(\omega_1)$ is $r_2(\lambda_1(\omega_1); \omega_2) \leq W^{-1}(\omega_1) - \lambda_1(\omega_1)$. It is sufficient to establish that $\max\{W^{-1}(\omega_2) - \lambda_1(\omega_1), r_2(\lambda_1(\omega_1); 0)\} \leq W^{-1}(\omega_1) - \lambda_1(\omega_1)$. This is indeed the case since $\omega_2 \leq \omega_1$ implies $W^{-1}(\omega_2) - \lambda_1(\omega_1) \leq W^{-1}(\omega_1) - \lambda_1(\omega_1)$ and by $\lambda_1(\omega_1) < \Lambda_1(\omega_1)$ (from $\omega_1 > \hat{W}_1$) and Lemma 1,

$$\lambda_1(\omega_1) + r_2(\lambda_1(\omega_1); 0) < \Lambda_1(\omega_1) + r_2(\Lambda_1(\omega_1); 0) = W^{-1}(\omega_1),$$

and so

$$r_2(\lambda_1(\omega_1); 0) < W^{-1}(\omega_1) - \lambda_1(\omega_1).$$

Therefore, $r_2(\lambda_1(\omega_1); \omega_2) \leq W^{-1}(\omega_1) - \lambda_1(\omega_1)$ as claimed.

Third, we show that

$$r_2(\lambda_1(\omega_1); \omega_2) = \max\left\{W^{-1}(\omega_2) - \lambda_1(\omega_1), r_2(\lambda_1(\omega_1); 0)\right\}.$$

Since $\omega_2 \leq \omega_1 \leq W^{**}$, we have

$$W^{-1}(\omega_1) \leq W^{-1}(W^{**}) = \lambda_1(W^{**}) + \lambda_2(W^{**}) \leq \lambda_1(\omega_1) + \lambda_2(\omega_2),$$

and so

$$W^{-1}(\omega_1) - \lambda_1(\omega_1) \leq \lambda_2(\omega_1). \tag{50}$$

The result follows from the combination of step 2, (50), and $\omega_2 \leq \omega_1$.

Fourth, from Steps 1 and 2, there is an equilibrium in which $l_1^* = \lambda_1(\omega_1)$ and $l_2 = r_2(\lambda_1(\omega_1); \omega_2) \leq W^{-1}(\omega_1) - \lambda_1(\omega_1)$ and hence $W_1^* = \omega_1$. This completes part (i). If $\omega_2 < \omega_1$ then based on Lemma 6 this is the unique equilibrium, and the characterization follows from

Steps 2 and 3. This completes part (ii). Similarly, if $\omega_2 = \omega_1$ then the characterization again follows from Steps 2 and 3, completing part (iii) and the proof. ■

Proof of Lemma 11. Suppose $\omega_j = \omega_k = \omega \in \left(W^B, W^{**}\right)$. Based on Proposition 4 part (iii), for any $i = j, k$ and

$$l^* \in \left[W^{-1}(\omega) - \min\left\{\Lambda_{-i}(\omega), \lambda_{-i}(\omega)\right\}, \min\left\{\Lambda_i(\omega), \lambda_i(\omega)\right\}\right] \tag{51}$$

there is an equilibrium in which $(l_j^*, l_k^*) = (l^*, W^{-1}(\omega) - l^*)$ and $W_j^* = W_k^* = \omega$. For all members of the equilibrium set, the equilibrium wage is ω. Because both firms $i = k, j$ hire strictly less than $\lambda_i(\omega)$, at any equilibrium in the interior of the equilibrium set, firm i's profits and own surplus are strictly increasing in l_i. Take any equilibrium (l_k, l_j). At least one firm i has $l_i < \min\left\{\Lambda_i(\omega), \lambda_i(\omega)\right\}$. By choosing $\omega_i \in (\omega, W^{**})$ this firm i ensures the labor market equilibrium has $l_i = \min\left\{\Lambda_i(\omega), \lambda_i(\omega)\right\}$, and that it pays ω. By choosing ω_i sufficiently close to ω, firm i can achieve profits arbitrarily close to that which it would receive from hiring $l_i = \min\left\{\Lambda_i(\omega), \lambda_i(\omega)\right\}$ and paying ω, which in turn strictly exceed its equilibrium profits. ■

B Nontransparent ESG policy

Lemma 12 *Suppose the ESG policy of purposeful firm i is unobserved by firm $-i$, who adopts the No-ESG policy. Then, the equilibrium is unique, and in equilibrium firm i adopts ESG policy $\hat{W}_i$ and the labor market outcome is $l_i^* = \Lambda_i(\hat{W}_i)$ and $l_{-i}^* = r_{-i}(\Lambda_i(\hat{W}_i); 0)$, and both firms pay wages $\hat{W}_i$.*

Proof. We prove that in any equilibrium, firm i chooses $\omega_i = \hat{W}_i$. Let firm $-i's$ employment in a candidate equilibrium be l_{-i}^*. Notice l_{-i}^* is invariant to the actual choice if ω_i. Let $l_i(\omega_i) = r_i\left(l_{-i}^*; \omega_i\right)$ be the employment of firm i given policy ω_i and the expected employment of firm $-i's$. Then, firm $i's$ surplus is

$$S(\omega_i) = f_i(l_i(\omega_i)) - \mu \int_0^{l_i(\omega_i)} W(l)\, dl - (1-\mu) \int_{l_{-i}^*}^{l_i(\omega_i)+l_{-i}^*} W(l)\, dl.$$

Notice

$$S'(\omega_i) = l_i'(\omega_i)\left[f_i'(l_i(\omega_i)) - \mu W(l_i(\omega_i)) - (1-\mu) W\left(l_i(\omega_i) + l_{-i}^*\right)\right]$$

There are three cases:

- If $l_{-i}^* \geq \Lambda_{-i}(\omega_i)$ then $l_i(\omega_i) = r_i\left(l_{-i}^*; 0\right)$ and $l_i'(\omega_i) = 0$. Therefore, $S'(\omega_i) = 0$ in this range.

- If $W^{-1}(\omega_i) - \lambda_i(\omega_i) < l^*_{-i} < \Lambda_{-i}(\omega_i)$ then $l_i(\omega_i) = W^{-1}(\omega_i) - l^*_{-i}$ and $l'_i(\omega_i) > 0$. Notice

$$W^{-1}(\omega_i) - \lambda_i(\omega_i) < l^*_{-i} \Rightarrow l_i(\omega_i) = W^{-1}(\omega_i) - l^*_{-i} < \lambda_i(\omega_i).$$

  Since $l_i(\omega_i) < \lambda_i(\omega_i)$ we have $f'_i(l_i(\omega_i)) \geq \omega_i$, and hence

$$S'(\omega_i) = l'_i(\omega_i)\left[f'_i(l_i(\omega_i)) - \mu W(l_i(\omega_i)) - (1-\mu)\omega_i\right] > 0.$$

- If $l^*_{-i} \leq W^{-1}(\omega_i) - \lambda_i(\omega_i)$ then $l_i(\omega_i) = \lambda_i(\omega_i)$ and $l'_i(\omega_i) = \lambda'_i(\omega_i) < 0$. Notice $f'_i(l_i(\omega_i)) = \omega_i$ and $W(l_i(\omega_i)) < W\left(l_i(\omega_i) + l^*_{-i}\right) < \omega_i$. Therefore,

$$\omega_i - \mu W(\lambda_i(\omega_i)) - (1-\mu) W\left(l_i(\omega_i) + l^*_{-i}\right) > 0$$

  and

$$S'(\omega_i) = \lambda'_i(\omega_i)\left[\omega_i - \mu W(\lambda_i(\omega_i)) - (1-\mu) W\left(l_i(\omega_i) + l^*_{-i}\right)\right] < 0$$

We conclude, the optimal ω_i is $\hat{W}_i$. In other words, the only ESG policy from which the board of firm i would not deviate given the expected choice of firm i, is $\hat{W}_i$. Therefore, in equilibrium it must be $\omega_i = \hat{W}_i$. The played outcome in the labor market in equilibrium is $l^*_i = \Lambda_i(\hat{W}_i)$ and $l^*_{-i} = r_{-i}(\Lambda_i(\hat{W}_i); 0)$, and by the arguments above, the board of firm i has no incentives to change ω_i from $\hat{W}_i$ to any $\hat{\omega}_i \neq \hat{W}_i$. Therefore, $\hat{W}_i$ is the unique equilibrium also without commitment ■

C Linear example

We consider an example to illustrate several effects of ESG policies that we discuss in the main text. Suppose

$$\begin{aligned} f_i &= A_i l - 0.5 l^2;\ A_1 \geq A_2 > 0 \\ W(L) &= \omega L;\ \omega > 0 \end{aligned}$$

The best response function is

$$r_i(l_{-i}; 0) = \frac{A_i - \omega l_{-i}}{2\omega + 1}$$

The No-ESG benchmark requires

$$l^B_i = r_i\left(r_{-i}\left(l^B_i; 0\right); 0\right) \Leftrightarrow l^B_i = \frac{A_i(2\omega+1) - \omega A_{-i}}{3\omega^2 + 4\omega + 1}.$$

To ensure $l^B_i > 0$, we assume $\frac{2\omega+1}{\omega} > \frac{A_i}{A_{-i}} > \frac{\omega}{2\omega+1}$ (this condition substitutes the Inada conditions we impose in the main text).

The profit-maximizing ESG policy (when the other firm chooses no ESG policy) requires employment l_i^* that satisfies

$$\begin{aligned} f_i'(l_i) - W(l_i + r_{-i}(l_i;0)) - \left(1 + r_{-i}'(l_i;0)\right) l_i W'(l_i + r_{-i}(l_i;0)) &= 0 \Leftrightarrow \\ A_i - l_i^* - \omega \left(l_i^* + \frac{A_{-i} - \omega l_i^*}{2\omega + 1} \right) - \frac{1+\omega}{2\omega+1} l_i \omega &= 0 \Leftrightarrow \\ l_i^* &= \frac{A_i (2\omega + 1) - \omega A_{-i}}{2\omega^2 + 4\omega + 1}. \end{aligned}$$

Notice $l_i^B < l_i^*$. Moreover, $l_i^* > l_{-i}^* \Leftrightarrow A_i > A_{-i}$, thus the more productive firm chooses a more aggressive ESG policy.

Industry surplus given employment $(l_i, r_{-i}(l_i;0))$ is

$$\begin{aligned} S(l_i) &= A_i l_i - 0.5 l_i^2 + A_{-i} \frac{A_{-i} - \omega l_i}{2\omega + 1} - 0.5 \left(\frac{A_{-i} - \omega l_i}{2\omega + 1} \right)^2 - \omega \int_0^{l_i + \frac{A_{-i} - \omega l_i}{2\omega + 1}} L dL \\ &= A_i l_i - 0.5 l_i^2 + A_{-i} \frac{A_{-i} - \omega l_i}{2\omega + 1} - 0.5 \left(\frac{A_{-i} - \omega l_i}{2\omega + 1} \right)^2 - \frac{1}{2} \omega \left(l_i + \frac{A_{-i} - \omega l_i}{2\omega + 1} \right)^2 \end{aligned}$$

Notice

$$S'(l_i) = A_i - A_{-i} \frac{(3\omega + 1)\omega}{(2\omega + 1)^2} - l_i \frac{(2\omega + 1)^2 + \omega (1 + \omega)^2 + \omega^2}{(2\omega + 1)^2}$$

Thus, $S''(l_i) < 0$ and $S(l_i)$ obtains its maximum at

$$l_{\max S} \equiv \frac{(2\omega + 1)^2 A_i - (3\omega + 1)\omega A_{-i}}{(2\omega + 1)^2 + \omega (1 + \omega)^2 + \omega^2}.$$

We show two results:

1. Suppose $\frac{A_i}{A_{-i}} \to \frac{\omega}{\omega + 1}$. In this case $l_{\max S} < l_i^B \Leftrightarrow \omega^2 < 2\omega + 1$, which holds for $\omega > 0$ sufficiently small. If $l_{\max S} < l_i^B$ then $S'' < 0$ and $l_i^B < l_i^*$ imply $S\left(l_i^B\right) > S(l_i^*)$, that is, relative to the No-ESG benchmark, industry surplus is lower in the ESG equilibrium when the ESG firm is the less productive firm (i.e., $\frac{A_i}{A_{-i}} < 1$). Since a purposeful firm hires $\hat{l}_i > l_i^*$ workers under its optimal policy, $S(l_i^*) > S(\hat{l}_i)$, that is, the industry surplus created by a shareholder-value maximizing firm can even be higher than the one created by a purposeful firm.

2. Notice
$$l_{\max S} > l_i^* \Leftrightarrow \frac{A_i}{A_{-i}} > \frac{5\omega^3 + 7\omega^2 + 2\omega}{6\omega^3 + 9\omega^2 + 5\omega + 1}$$

   Since the RHS is smaller than one, if $\frac{A_i}{A_{-i}} > 1$ then $l_{\max S} > l_i^*$. In this case, $S'' < 0$ and $l_i^B < l_i^*$ imply $S\left(l_i^B\right) < S(l_i^*)$, that is, relative to the No-ESG benchmark, industry surplus is higher in the ESG equilibrium when the ESG firm is the more productive firm (i.e., $\frac{A_i}{A_{-i}} > 1$).

Industry profitability given employment $(l_i, r_{-i}(l_i; 0))$ is

$$\begin{aligned}\Pi(l_i) &= A_i l_i - 0.5 l_i^2 - l_i \omega \left(l_i + \frac{A_{-i} - \omega l_i}{2\omega+1}\right) \\ &\quad + A_{-i}\frac{A_{-i} - \omega l_i}{2\omega+1} - 0.5\left(\frac{A_{-i} - \omega l_i}{2\omega+1}\right)^2 - \frac{A_{-i} - \omega l_i}{2\omega+1}\omega\left(l_i + \frac{A_{-i} - \omega l_i}{2\omega+1}\right) \\ &= A_i l_i + (A_{-i} + l_i)\frac{A_{-i} - \omega l_i}{2\omega+1} - \left(\omega + \frac{1}{2}\right)\left(l_i + \frac{A_{-i} - \omega l_i}{2\omega+1}\right)^2\end{aligned}$$

Notice

$$\Pi'(l_i) = A_i - A_{-i}\frac{2\omega}{2\omega+1} - \frac{2\omega + (1+\omega)^2}{2\omega+1} l_i.$$

Thus, $\Pi''(l_i) < 0$ and $\Pi(l_i)$ obtains its maximum at

$$l_{\max \Pi} \equiv \frac{(2\omega+1) A_i - 2\omega A_{-i}}{\omega^2 + 4\omega + 1}.$$

We show two results:

1. Notice

$$l_{\max \Pi} < l_i^B \Leftrightarrow \frac{A_i}{A_{-i}} < \frac{5\omega^2 + 4\omega + 1}{5\omega^2 + 4\omega + \omega^2 - (\omega^2 + 2\omega)}.$$

   Since the RHS is larger than one, if $\frac{A_i}{A_{-i}} < 1$ then $l_{\max \Pi} < l_i^B$. In this case, $\Pi'' < 0$ and $l_i^B < l_i^*$ imply $\Pi\left(l_i^B\right) > \Pi(l_i^*)$, that is, relative to the No-ESG benchmark, industry profitability is lower in the ESG equilibrium when the ESG firm is the less productive firm (i.e., $\frac{A_i}{A_{-i}} < 1$).

2. Notice

$$l_{\max \Pi} > l_i^* \Leftrightarrow \frac{A_i}{A_{-i}} > \frac{3\omega^2 + 4\omega + 1}{(2\omega+1)\omega}$$

   where $\frac{3\omega^2+4\omega+1}{(2\omega+1)\omega} \in \left(1, \frac{2\omega+1}{\omega}\right)$. Thus, if $\frac{A_i}{A_{-i}} > \frac{3\omega^2+4\omega+1}{(2\omega+1)\omega}$, then $\Pi'' < 0$ and $l_i^B < l_i^*$ imply $\Pi\left(l_i^B\right) < \Pi(l_i^*)$, that is, relative to the No-ESG benchmark, industry profitability is higher in the ESG equilibrium when the ESG firm is sufficiently more productive than its competitor (i.e., $\frac{A_i}{A_{-i}} > \frac{3\omega^2+4\omega+1}{(2\omega+1)\omega} > 1$).

3. Notice that if $\frac{A_i}{A_{-i}} \in \left(1, \min\left\{\frac{5\omega^2+4\omega+1}{5\omega^2+4\omega+\omega^2-(\omega^2+2\omega)}, \frac{3\omega^2+4\omega+1}{(2\omega+1)\omega}\right\}\right)$ then $S\left(l_i^B\right) < S(l_i^*)$ but $\Pi\left(l_i^B\right) > \Pi(l_i^*)$. Therefore, industry surplus can increase even if industry profitability decreases.

D The effect of productivity on the firm's ESG policy

In this section we give conditions under which more productive (and hence larger) firms have a greater incentive to adopt ESG policies. Assume a production function $f_i(l_i) = A_i l_i^{\alpha}$, where $\alpha \in (0,1)$ and $A_1 \geq A_2$, so firm 1 is the larger firm.[28] Assume that labor supply $W(L)$ is log-concave, as well $W''(L) L + W'(L) > 0$ (already assumed). The constant-elasticity labor supply $W(L) = KL^{\frac{1}{\epsilon}}$ is trivially log-concave.

Recall ESG by one firm effectively turns that firm into a Stackelberg leader. Also recall that $l_{-i} + r_i(l_{-i}; 0)$ increases in l_{-i}. So we can write the non-ESG firm's choice of l_i as a function of L, i.e., $l_i(L)$ solves

$$f_i'(l_i) = W(L) + W'(L) l_i.$$

By the implicit function theorem,

$$\begin{aligned} l_i'(L) &= \frac{W''(L) l_i(L) + W'(L)}{f_i''(l_i) - W'(L)} \\ &= \frac{W''(L) l_i(L) + W'(L)}{\frac{l_i(L) f_i''(l_i(L))}{f'(l_i(L))} \frac{W(L)+W'(L) l_i}{l_i(L)} - W'(L)} \\ &= \frac{(W''(L) l_i(L) + W'(L)) l_i(L)}{\frac{l_i(L) f_i''(l_i(L))}{f'(l_i(L))} (W(L) + W'(L) l_i(L)) - W'(L) l_i(L)} \\ &= \frac{\left(\frac{W''(L)}{W'(L)} l_i(L) + 1\right) l_i(L)}{\frac{l_i(L) f_i''(l_i(L))}{f'(l_i(L))} \left(\frac{W(L)}{W'(L)} + l_i(L)\right) - l_i(L)}. \end{aligned}$$

Substituting in for the functional form of the production function,

$$l_i'(L) = \frac{\left(\frac{W''(L)}{W'(L)} l_i(L) + 1\right) l_i(L)}{(\alpha - 1)\left(\frac{W(L)}{W'(L)} + l_i(L)\right) - l_i(L)}.$$

Note that $l_i'(L) < 0$. (Existing assumption that $W''(L) L + W'(L) > 0$ used here.)

Let j be the ESG firm. We can think of this firm as selecting L, to maximize profits

$$\pi_j(L) = f_j(L - l_i(L)) - (L - l_i(L)) W(L).$$

Note that selecting L is equivalent to setting an ESG policy $W(L)$.

[28]Note that this production is consistent with firm-asymmetry stemming from mergers between identical firms. That is: If n identical firms each with a production function $\tilde{A}\tilde{l}^{\alpha}$ merge, the resulting conglomerate has output $n\tilde{A}\tilde{l}^{\alpha} = n^{1-\alpha}\tilde{A}\left(n\tilde{l}\right)^{\alpha}$. Defining $A_c = n^{1-\alpha}\tilde{A} > \tilde{A}$ and $l_c = n\tilde{l}$, the conglomerate has output $A_c l_c^{\alpha}$.

Lemma 13 $\pi_1'\left(L^B\right) > \pi_2'\left(L^B\right)$. *That is: The more productive firm benefits more from a small increase in an ESG policy relative to the No-ESG benchmark.*

Proof. The derivative of the ESG firm's profits with respect to L is

$$\begin{aligned}
\pi_j'(L) &= (1 - l_i'(L))\left[f_j'(L - l_i(L)) - W(L)\right] - (L - l_i(L))\,W'(L) \\
&= (1 - l_i'(L))\left[f_j'(L - l_i(L)) - W(L) - (L - l_i(L))\,W'(L)\right] - (L - l_i(L))\,W'(L) \\
&\quad + (1 - l_i'(L))\,(L - l_i(L))\,W'(L) \\
&\quad (1 - l_i'(L))\left[f_j'(L - l_i(L)) - W(L) - (L - l_i(L))\,W'(L)\right] - l_i'(L)\,(L - l_i(L))\,W'(L)
\end{aligned}$$

As $L = L^B$, we know $L - l_i(L) = l_j(L)$. From the first-order condition determining $l_j(L)$ it follows that

$$\pi_j'(L) = -l_i'(L)\,(L - l_i(L))\,W'(L)\,.$$

Hence we must show

$$-l_2'(L)\,(L - l_2(L)) > -l_1'(L)\,(L - l_1(L))\,,$$

or equivalently (after substitution for $l_i'(L)$)

$$\frac{\left(\frac{W''(L)}{W'(L)}l_2(L) + 1\right) l_2(L)\,(L - l_2(L))}{(1-\alpha)\left(\frac{W(L)}{W'(L)} + l_2(L)\right) + l_2(L)} > \frac{\left(\frac{W''(L)}{W'(L)}l_1(L) + 1\right) l_1(L)\,(L - l_1(L))}{(1-\alpha)\left(\frac{W(L)}{W'(L)} + l_1(L)\right) + l_1(L)}.$$

Using $L - l_1\left(L^B\right) = l_2\left(L^B\right)$, at $L = L^B$ this inequality is in turn equivalent to

$$\frac{\frac{LW''(L)}{W'(L)}\frac{l_2(L)}{L} + 1}{(1-\alpha)\left(\frac{W(L)}{LW'(L)} + \frac{l_2(L)}{L}\right) + \frac{l_2(L)}{L}} > \frac{\frac{LW''(L)}{W'(L)}\frac{L-l_2(L)}{L} + 1}{(1-\alpha)\left(\frac{W(L)}{LW'(L)} + \frac{L-l_2(L)}{L}\right) + \frac{L-l_2(L)}{L}}.$$

To complete the proof we establish that this inequality is implied by $l_1\left(L^B\right) > l_2\left(L^B\right)$. We show that

$$\frac{\frac{LW''(L)}{W'(L)}x + 1}{(1-\alpha)\left(\frac{W(L)}{LW'(L)} + x\right) + x} > \frac{\frac{LW''(L)}{W'(L)}(1-x) + 1}{(1-\alpha)\left(\frac{W(L)}{LW'(L)} + 1 - x\right) + 1 - x}.$$

It suffices to show that the function

$$\frac{\frac{LW''(L)}{W'(L)}x + 1}{(1-\alpha)\left(\frac{W(L)}{LW'(L)} + x\right) + x}$$

is decreasing in $x \in [0,1]$, or equivalently (given monotonicity of any function of this form),

$$\frac{1}{(1-\alpha)\frac{W(L)}{LW'(L)}} > \frac{\frac{LW''(L)}{W'(L)}}{2-\alpha},$$

i.e.,

$$\frac{2-\alpha}{1-\alpha} > \frac{W''(L)\,W(L)}{W'(L)^2},$$

which indeed holds since W is log-concave. ■

E Comparative statics with respect to supply elasticity

In this section we derive comparative statics of the firm's ESG policy with respect to supply elasticity. We assume symmetric firms, constant elasticity of labor supply $W(L) = \kappa_W L^{\frac{1}{\epsilon}}$, and power production function $f(l) = \kappa_f l^{\alpha}$. We let $\eta \equiv \frac{1}{\epsilon}$. Recall φ^* is the profit maximizing ESG policy. We derive the following result:

Lemma 14 *The ratio $\frac{\varphi^*}{W^B}$ is greater than one and decreasing in η.*

Proof. Given total hiring L, the optimal hiring r of the non-ESG firm is given by the solution of the FOC

$$f'(r) = W(L) + rW'(L).$$

Given the above functional forms,

$$\begin{aligned} \alpha\kappa_f r^{\alpha-1} &= \left(1+\eta\frac{r}{L}\right)\kappa_W L^{\eta} \Leftrightarrow \\ L^{1-\alpha+\eta} &= \frac{\alpha\kappa_f}{\kappa_W}\frac{\left(\frac{r}{L}\right)^{\alpha-1}}{1+\eta\frac{r}{L}}. \end{aligned}$$

Let L^B denote total hiring at the No-ESG benchmark, and L^* and r^* respectively denote total hiring and the hiring of the non-ESG firm's when the ESG firm adopts the profit-maximizing policy. Recalling that in the No-ESG benchmark each firm hires $\frac{L^B}{2}$ workers, we have

$$\left(\frac{L^*}{L^B}\right)^{1-\alpha+\eta} = \frac{\frac{\left(\frac{r^*}{L^*}\right)^{\alpha-1}}{\left(1+\eta\frac{r^*}{L^*}\right)}}{\frac{\left(\frac{1}{2}\right)^{\alpha-1}}{\left(1+\frac{\eta}{2}\right)}}.$$

The ESG-policy that delivers L^* is simply $\varphi^* = W(L^*)$. Hence the ratio φ^* to the non-ESG benchmark wage is

$$\frac{\varphi^*}{W^B} = \left(\frac{L^*}{L^B}\right)^\eta = \left(\frac{\frac{\left(\frac{r^*}{L^*}\right)^{\alpha-1}}{\left(1+\eta\frac{r^*}{L^*}\right)}}{\frac{\left(\frac{1}{2}\right)^{\alpha-1}}{\left(1+\frac{\eta}{2}\right)}}\right)^{\frac{\eta}{1-\alpha+\eta}}. \tag{52}$$

Note that

$$\ln\frac{\varphi^*}{W^B} = \frac{\eta}{1-\alpha+\eta}\left(\ln\frac{1+\frac{\eta}{2}}{1+\eta\frac{r^*}{L^*}} - (1-\alpha)\ln\left(2\frac{r^*}{L^*}\right)\right).$$

Since $\frac{r^*}{L^*} < \frac{1}{2}$, the term in parentheses is positive. Notice

$$\begin{aligned}\frac{\partial}{\partial\eta}\frac{1+\frac{\eta}{2}}{1+\eta\frac{r^*}{L^*}} &= \frac{\frac{1}{2}\left(1+\eta\frac{r^*}{L^*}\right) - \frac{r^*}{L^*}\left(1+\frac{\eta}{2}\right) - \eta\frac{\partial}{\partial\eta}\left(\frac{r^*}{L^*}\right)\left(1+\frac{\eta}{2}\right)}{\left(1+\eta\frac{r^*}{L^*}\right)^2} \\ &= \frac{\frac{1}{2} - \frac{r^*}{L^*} - \eta\left(1+\frac{\eta}{2}\right)\frac{\partial}{\partial\eta}\left(\frac{r^*}{L^*}\right)}{\left(1+\eta\frac{r^*}{L^*}\right)^2}.\end{aligned}$$

It follows that if $\frac{\partial}{\partial\eta}\left(\frac{r^*}{L^*}\right) < 0$ then the ratio $\frac{\varphi^*}{W^B}$ is increasing in η.

We prove $\frac{\partial}{\partial\eta}\left(\frac{r^*}{L^*}\right) < 0$ in several steps.

1. *Deriving* $1 + \frac{\partial r^*}{\partial l^*}$. Let l^* be the ESG firm's labor choice associated with φ^*. Then, the FOC of the non-ESG firm implies

$$f'(r^*) = W(l^* + r^*) + W'(l^* + r^*)\, r^*,$$

and by the implicit function theorem,

$$\frac{\partial r^*}{\partial l^*} = \frac{W'(l^*+r^*) + r^* W''(l^*+r^*)}{f_i''(r^*) - 2W'(l^*+r^*) - r^* W''(l^*+r^*)}.$$

Given the functional form assumptions, and letting $L^* = r^* + l^*$, this specializes to

$$\frac{\partial r^*}{\partial l^*} = \frac{\frac{\eta}{L^*} + \frac{\eta(\eta-1)}{(L^*)^2} r}{\frac{\alpha-1}{r^*} f'(r^*) - 2\frac{\eta}{L^*} W(L^*) - \frac{\eta(\eta-1)}{(L^*)^2} r^* W(L^*)} W(L^*).$$

Substituting in for

$$f'(r^*) = W(L^*) + r^* W'(L^*) = \left(1 + \eta\frac{r^*}{L^*}\right) W(L^*),$$

the reaction function's slope becomes

$$\begin{aligned}\frac{\partial r^*}{\partial l^*} &= \frac{\frac{\eta}{L^*}+\frac{\eta(\eta-1)}{(L^*)^2}r^*}{\frac{\alpha-1}{r^*}\left(1+\eta\frac{r^*}{L^*}\right)-2\frac{\eta}{L^*}-\frac{\eta(\eta-1)}{(L^*)^2}r^*}\\ &= -\frac{\eta\frac{r^*}{L^*}+\eta\left(\eta-1\right)\left(\frac{r^*}{L^*}\right)^2}{\left(1-\alpha\right)\left(1+\eta\frac{r^*}{L^*}\right)+2\eta\frac{r^*}{L^*}+\eta\left(\eta-1\right)\left(\frac{r^*}{L^*}\right)^2}.\end{aligned}$$

Hence

$$1+\frac{\partial r^*}{\partial l^*}=\frac{\left(1-\alpha\right)\left(1+\eta\frac{r^*}{L^*}\right)+\eta\frac{r^*}{L^*}}{\left(1-\alpha\right)\left(1+\eta\frac{r^*}{L^*}\right)+2\eta\frac{r^*}{L^*}+\eta\left(\eta-1\right)\left(\frac{r^*}{L^*}\right)^2}.$$

2. *Showing* $1+\frac{\partial r^*}{\partial l^*}$ *is decreasing in* η. Letting $z\equiv\frac{r^*}{L^*}$,

$$1+\frac{\partial r^*}{\partial l^*}=\frac{1}{1+z\frac{\eta+\eta(\eta-1)z}{\eta z+(1-\alpha)(1+\eta z)}}$$

We establish that $1+\frac{\partial r^*}{\partial l^*}$ is decreasing in η for any $z\in(0,1)$. This is equivalent to showing that $\frac{\eta+\eta(\eta-1)z}{\eta z+(1-\alpha)(1+\eta z)}$ is increasing in η, or equivalently that

$$\left[1+\left(2\eta-1\right)z\right]\left[\eta z+\left(1-\alpha\right)\left(1+\eta z\right)\right]-\left[\eta+\eta\left(\eta-1\right)z\right]\left[z+\left(1-\alpha\right)z\right]>0.$$

Expanding, this inequality is equivalent to

$$\begin{aligned} & \eta z+\left(\eta-1\right)\eta z^2+\left(\eta z\right)^2+\left(1-\alpha\right)\left(1+\eta z\right)+\left(1-\alpha\right)\left(1+\eta z\right)\left(\eta-1\right)z+\left(1-\alpha\right)\left(1+\eta z\right)\eta z\\ - & \ \eta z-\left(\eta-1\right)\eta z^2-\left(1-\alpha\right)\eta z-\left(1-\alpha\right)\eta\left(\eta-1\right)z^2\\ = & \left(\eta z\right)^2+\left(1-\alpha\right)\left(1+\eta z\right)+\left(1-\alpha\right)\left(1+\eta z\right)\left(\eta-1\right)z+\left(1-\alpha\right)\left(1+\eta z\right)\eta z-\left(1-\alpha\right)\eta z\\ & -\left(1-\alpha\right)\eta\left(\eta-1\right)z^2\\ = & \left(\eta z\right)^2+\left(1-\alpha\right)\left(1+\eta z\right)+\left(1-\alpha\right)\left(\eta-1\right)z+\left(1-\alpha\right)\left(1+\eta z\right)\eta z-\left(1-\alpha\right)\eta z\\ = & \left(\eta z\right)^2+\left(1-\alpha\right)\left(1+\left(\eta-1\right)z+\left(1+\eta z\right)\eta z\right),\end{aligned}$$

which is indeed strictly positive for $z\in(0,1)$.

3. *Solving for* $\frac{r^*}{L^*}$. Given constant elasticity of supply, the FOC for r^* and l^* are

$$\begin{aligned} f'\left(r^*\right) &= \left(1+\eta\frac{r^*}{L^*}\right)W\left(L^*\right)\\ f'\left(l^*\right) &= \left(1+\eta\frac{l^*}{L^*}\left(1+\frac{\partial r^*}{\partial l^*}\right)\right)W\left(L^*\right).\end{aligned}$$

Given the power production function, it follows that

$$\left(\frac{r^*}{l^*}\right)^{\alpha-1} = \left(\frac{\frac{r^*}{L^*}}{1-\frac{r^*}{L^*}}\right)^{\alpha-1} = \frac{1+\eta\frac{r^*}{L^*}}{1+\eta\left(1-\frac{r^*}{L^*}\right)\left(1+\frac{\partial r^*}{\partial l^*}\right)}.$$

Given the characterization of the slope of the reaction, note that this equation is entirely in terms of the ratio $\frac{r^*}{L^*}$. Letting $z \equiv \frac{r^*}{L^*}$, and substituting in for $1+\frac{\partial r^*}{\partial l^*}$,

$$\left(\frac{1-z}{z}\right)^{1-\alpha} = \frac{1+\eta z}{1+\eta(1-z)\frac{(1-\alpha)(1+\eta z)+\eta z}{(1-\alpha)(1+\eta z)+2\eta z+\eta(\eta-1)z^2}}. \quad (53)$$

Note that as z increases from 0 to $\frac{1}{2}$, the LHS is decreasing from ∞ to 1 while the RHS at $z=\frac{1}{2}$ exceeds 1. So at least one solution exists. We also know that the equilibrium is unique (see main text), and hence the solution to (53) is unique, and in the interval $z \in \left(0, \frac{1}{2}\right)$.

4. *$\frac{r^*}{L^*}$ is decreasing in η.* It suffices to show that the RHS of (53) is locally increasing in η in the neighborhood of its solution. That is: It suffices to show that

$$z\left(1+\eta(1-z)\left(1+\frac{\partial r^*}{\partial l^*}\right)\right) - (1+\eta z)\left((1-z)\left(1+\frac{\partial r^*}{\partial l^*}\right)+\eta(1-z)\frac{\partial}{\partial \eta}\left(1+\frac{\partial r^*}{\partial l^*}\right)\right) > 0$$

in the neighborhood of the solution of (53). Since $\frac{\partial}{\partial \eta}\left(1+\frac{\partial r^*}{\partial l^*}\right) < 0$, it suffices to show that

$$z\left(1+\eta(1-z)\left(1+\frac{\partial r^*}{\partial l^*}\right)\right) - (1+\eta z)(1-z)\left(1+\frac{\partial r^*}{\partial l^*}\right) > 0,$$

or equivalently,

$$z-(1-z)\left(1+\frac{\partial r^*}{\partial l^*}\right) > 0.$$

Notice that since the LHS of (53) is greater than one, the RHS of (53) is also greater than one in the neighborhood of the solution of (53), that is

$$\frac{1+\eta z}{1+\eta(1-z)\left(1+\frac{\partial r^*}{\partial l^*}\right)} > 1 \Leftrightarrow z > (1-z)\left(1+\frac{\partial r^*}{\partial l^*}\right).$$

■

Next, we derive comparative statics of the firm's ESG policy with respect to supply elasticity, only now for a purposeful firm. Recall $\hat{W}$ is the optimal purposeful ESG policy. We derive the following result:

Lemma 15 *The ratio $\frac{\hat{W}}{W^B}$ is greater than one and decreasing in η.*

Proof. Let $\hat{l}$ be the employment of the purposeful firm under ESG policy $\hat{W}$. By definition:

$$f'(\hat{l}) = W(\hat{l} + \hat{r})$$

and notice that the non-ESG optimal response, $\hat{r}$, satisfies

$$f'(\hat{r}) = W(\hat{l} + \hat{r}) + \hat{r}W'(\hat{l} + \hat{r}).$$

Combining these conditions, and making use of the constant elasticity of supply, gives

$$f'(\hat{r}) = f'(\hat{l})\left(1 + \eta\frac{\hat{r}}{\hat{L}}\right),$$

where $\hat{L} = \hat{l} + \hat{r}$. Using the power production function,

$$\begin{aligned} \left(\frac{\hat{r}}{\hat{l}}\right)^{\alpha-1} &= 1 + \eta\frac{\hat{r}}{\hat{L}} \Leftrightarrow \\ \left(\frac{1 - \frac{\hat{r}}{\hat{L}}}{\frac{\hat{r}}{\hat{L}}}\right)^{1-\alpha} &= 1 + \eta\frac{\hat{r}}{\hat{L}}. \end{aligned}$$

Notice that a solution exists and is unique. Since the LHS is decreasing in $\frac{\hat{r}}{\hat{L}}$, and the RHS is increasing in $\frac{\hat{r}}{\hat{L}}$ and η, the solution $\frac{\hat{r}}{\hat{L}}$ is decreasing in η.

Parallel to the profit-maximizing case

$$\frac{\hat{W}}{W^B} = \left(\frac{\hat{L}}{L^B}\right)^{\eta} = \left(\frac{\frac{\left(\frac{\hat{r}}{\hat{L}}\right)^{\alpha-1}}{\left(1+\eta\frac{\hat{r}}{\hat{L}}\right)}}{\frac{\left(\frac{1}{2}\right)^{\alpha-1}}{\left(1+\frac{\eta}{2}\right)}}\right)^{\frac{\eta}{1-\alpha+\eta}}.$$

As in the profit-maximizing case, it follows that $\frac{\hat{W}}{W^B}$ is increasing in η, i.e., increasing in the elasticity of supply. ■

F Example of deterrence in ESG competition

In this section we give an example in which the equilibrium when shareholder firms compete in ESG is characterized by part (ii) of Proposition 5, that is, firm i chooses the ESG policy $\check{W}_{-i}$ and firm $-i$ chooses a non-binding ESG policy.

For this purpose, we assume symmetric firms. Let l^* by ESG hiring level associated with profit-maximizing ESG φ^*, and let $r^* = r(l^*; 0)$, $L^* = l^* + r^*$ and $W^* = W(L^*)$. Also, let $\check{l}$ be the labor choice associated with the preemption ESG policy $\check{W}$. We proceed in several steps.

An equivalent no-preemption condition

Define

$$\begin{aligned} H(l) &= \max_{\tilde{l}} f(\tilde{l}) - f'(l)\,\tilde{l} = f(l) - f'(l)\,l \\ J(l) &= \max_{\tilde{l}} f(\tilde{l}) - W(l+\tilde{l})\tilde{l} = f(r(l;0)) - r(l;0)\,W(l + r(l;0)). \end{aligned}$$

Observe that H is strictly increasing, and J is strictly decreasing:

$$\begin{aligned} H'(l) &= -f''(l)\,l > 0 \\ J'(l) &= r'(l;0)\,[f'(r(l;0)) - W(l + r(l;0)) - W'(l + r(l;0))\,r(l;0)] - W'(l + r(l;0))\,r(l;0) \\ &= -W'(l + r(l;0))\,r(l;0) < 0. \end{aligned}$$

By definition, at $\check{l}$,

$$J\left(\check{l}\right) = H\left(\check{l}\right).$$

Preemption is unprofitable if and only if

$$J(l^*) > H\left(\check{l}\right).$$

Claim: The condition $J(l^*) > H\left(\check{l}\right)$ holds if and only if $J(l^*) > H(l^*)$.

Proof of Claim: First, suppose $J(l^*) > H(l^*)$. Then $\check{l} > l^*$. Hence $J(l^*) > J\left(\check{l}\right) = H(\hat{l})$. Second, suppose $H(l^*) > J(l^*)$. Then $l^* > \check{l}$. Hence $H(\hat{l}) = J\left(\check{l}\right) > J(l^*)$.

No preemption condition

Preemption is unprofitable iff

$$f(r^*) - r^* W^* > f(l^*) - f'(l^*)\,l^*.$$

Rewriting, the no-preemption condition is

$$l^*\left(f'(l^*) - W^*\right) > f(l^*) - f(r^*) - (l^* - r^*)\,W^*.$$

By the definition of l^*, this is in turn equivalent to

$$l^* l^* \left(1 + r'(l^*)\right) W'(L^*) > f(l^*) - f(r^*) - (l^* - r^*)\,W^*, \tag{54}$$

which in turn is equivalent to

$$l^* l^* \left(1 + r'(l^*)\right) W'(L^*) > \frac{f(l^*)}{l^* f'(l^*)} l^* f'(l^*) - \frac{f(r^*)}{r^* f'(r^*)} r^* f'(r^*) - (l^* - r^*)\,W^*,$$

i.e.,

$$\begin{aligned} l^* l^* \left(1 + r'\left(l^*\right)\right) W'\left(L^*\right) &> \frac{f\left(l^*\right)}{l^* f'\left(l^*\right)} l^* \left(W^* + l^* \left(1 + r'\left(l^*\right)\right) W'\left(L^*\right)\right) \\ &- \frac{f\left(r^*\right)}{r^* f'\left(r^*\right)} r^* \left(W^* + r^* W'\left(L^*\right)\right) - \left(l^* - r^*\right) W^*, \end{aligned}$$

i.e.,

$$\begin{aligned} &\frac{f\left(r^*\right)}{r^* f'\left(r^*\right)} \frac{r^*}{l^*} \frac{r^*}{L^*} \frac{L^* W'\left(L^*\right)}{W^*} + \left(\frac{f\left(r^*\right)}{r^* f'\left(r^*\right)} - 1\right) \frac{r^*}{l^*} - \left(\frac{f\left(l^*\right)}{l^* f'\left(l^*\right)} - 1\right) \\ \geq \ &\left(\frac{f\left(l^*\right)}{l^* f'\left(l^*\right)} - 1\right) \frac{l^*}{L^*} \left(1 + r'\left(l^*\right)\right) \frac{L^* W'\left(L^*\right)}{W^*}. \end{aligned}$$

Specializing the production and labor supply functions

Consider

$$\begin{aligned} W(L) &= \kappa_W L^{\frac{1}{\epsilon}} = \kappa_W L^{\eta} \\ f(l) &= \kappa_f l^{\alpha}. \end{aligned}$$

Hence

$$\begin{aligned} W'(L) &= \frac{\eta W(L)}{L} \\ W''(L) &= \frac{\eta (\eta - 1) W(L)}{L^2} \\ f'(l) &= \frac{\alpha f(l)}{l} \\ f''(l) &= \frac{\alpha (\alpha - 1) f(l)}{l^2}. \end{aligned}$$

The reaction function $r(l)$ is defined by

$$f'(r(l)) = W(l + r(l)) + r(l) W'(l + r(l)).$$

and it can be shown that

$$r'(l) = \frac{W'(l + r(l)) + r(l) W''(l + r(l))}{f''(r(l)) - 2W'(l + r(l)) - r(l) W''(l + r(l))}.$$

Hence the reaction function's slope is

$$r' = \frac{\frac{\eta}{L} + \frac{\eta(\eta-1)}{L^2} r}{\frac{\alpha-1}{r} f' - 2\frac{\eta}{L} W - \frac{\eta(\eta-1)}{L^2} r W} W.$$

Substituting in for

$$f' = W + rW' = \left(1 + \eta \frac{r}{L}\right) W,$$

the reaction function's slope

$$\begin{aligned} r' &= -\frac{\frac{\eta}{L} + \frac{\eta(\eta-1)}{L^2} r}{\frac{1-\alpha}{r}\left(1 + \eta\frac{r}{L}\right) + 2\frac{\eta}{L} + \frac{\eta(\eta-1)}{L^2} r} \\ &= -\frac{\eta\frac{r}{L} + \eta(\eta-1)\left(\frac{r}{L}\right)^2}{(1-\alpha)\left(1 + \eta\frac{r}{L}\right) + 2\eta\frac{r}{L} + \eta(\eta-1)\left(\frac{r}{L}\right)^2}. \end{aligned}$$

Hence

$$1 + r' = \frac{(1-\alpha)\left(1 + \eta\frac{r}{L}\right) + \eta\frac{r}{L}}{(1-\alpha)\left(1 + \eta\frac{r}{L}\right) + 2\eta\frac{r}{L} + \eta(\eta-1)\left(\frac{r}{L}\right)^2}.$$

The no-preemption condition specializes to

$$\frac{r^*}{l^*}\frac{r^*}{L^*}\eta + (1-\alpha)\frac{r^*}{l^*} - (1-\alpha) \geq (1-\alpha)\frac{l^*}{L^*}\left(1 + r'(l^*)\right)\eta.$$

To express everything in terms of $\frac{r}{L}$, note that

$$\begin{aligned} \frac{r}{l} &= \frac{\frac{r}{L}}{1 - \frac{r}{L}} \\ 1 - \frac{r}{l} &= \frac{1 - 2\frac{r}{L}}{1 - \frac{r}{L}}. \end{aligned}$$

So the no-preemption condition is

$$\left(1 + \eta\frac{r^*}{L^*}\right)\frac{\frac{r^*}{L^*}}{1 - \frac{r^*}{L^*}} + \alpha\frac{1 - 2\frac{r^*}{L^*}}{1 - \frac{r^*}{L^*}} - 1 > (1-\alpha)\left(1 - \frac{r^*}{L^*}\right)\eta\left(1 + r'(l^*)\right),$$

i.e.,

$$\left(1 + \eta\frac{r^*}{L^*}\right)\frac{r^*}{L^*} + \alpha\left(1 - 2\frac{r^*}{L^*}\right) - \left(1 - \frac{r^*}{L^*}\right) > (1-\alpha)\left(1 - \frac{r^*}{L^*}\right)^2\eta\left(1 + r'(l^*)\right).$$

To solve explicitly for $\frac{r^*}{L^*}$:

$$f'(r^*) = \left(1+\eta\frac{r^*}{L^*}\right)W^*$$
$$f'(l^*) = \left(1+\eta\frac{l^*}{L^*}\left(1+r'(l^*)\right)\right)W^*.$$

Hence
$$\left(\frac{r^*}{l^*}\right)^{\alpha-1} = \left(\frac{\frac{r^*}{L^*}}{1-\frac{r^*}{L^*}}\right)^{\alpha-1} = \frac{1+\eta\frac{r^*}{L^*}}{1+\eta\left(1-\frac{r^*}{L^*}\right)\left(1+r'(l^*)\right)}.$$

Writing the ratio $\frac{r}{L}$ as z, and substituting in for $1+r'$,

$$\left(\frac{z}{1-z}\right)^{\alpha-1} = \frac{1+\eta z}{1+\eta(1-z)\frac{(1-\alpha)(1+\eta z)+\eta z}{(1-\alpha)(1+\eta z)+2\eta z+\eta(\eta-1)z^2}}.$$

Based on numerics, it appears that ηz^2 grows slowly, something like $\log\eta$. Specifically, numerics show that if labor supply has constant elasticity, and this elasticity approaches 0, then no-preemption condition is violated, i.e., preemption occurs. As labor supply elasticity approaches 0, $W(L)$ approaches: flat and equal to 0 over $(0,1)$, then vertical and infinite at 1. That is: labor is free up to 1, then infinitely expensive. This labor supply curve implies that, away from $l=1$, the reaction function slope is close to -1. That is: if ESG firm hires more, non-ESG firm hires less by almost the same amount. This makes the RHS of the no-preemption condition (54) large, i.e., the different between ESG and non-ESG profits is large. Ceteris paribus, it makes the LHS small, since $1+r'$ approaches 0. The non-obvious gap in this argument is that W' explodes, so the limiting behavior of $\left(1+r'(l^*)\right)W'(L^*)$ is unclear. Numerically, $\left(1+r'(l^*)\right)\frac{L^*W'(L^*)}{W^*}$ converges to 0, however.

G Multiple firms: $N>2$

In this section we show that our results in Section 4 can be generalized to competition between one ESG firm and $N-1$ non-ESG firms, where $N>2$ and all firms are otherwise symmetric. Specifically, we reproduce Propositions 2 and 3 for $N>2$. For this purpose, we let $L\equiv\sum_i l_i$ and $L_{-i}\equiv\sum_{j\neq i} l_j$. Firm $i's$ profit and surplus are defined as

$$\pi_i(l_i,L_{-i}) = f(l_i) - l_iW(l_i+L_{-i})$$

and
$$S_i(l_i,L_{-i}) = f(l_i) - \mu\int_0^{l_i}W(l)\,dl - (1-\mu)\int_{L_{-i}}^{l_i+L_{-i}}W(l)\,dl,$$

respectively.

The results in Section 3 are identical, with the following exceptions: (i) l_{-i} is replaced everywhere by L_{-i}; (ii) industry surplus is defined by $S(l_1, \ldots, l_N) \equiv \sum_i f(l_i) - \int_0^{\sum_i l_i} W(l)\, dl$; (iii) the first best allocation l^{**} solves $f'(l^{**}) = W(Nl^{**})$; and (iv) the No-ESG benchmark hiring l^B solves, $l^B = r\left((N-1)\, l^B; 0\right)$.

Suppose firm N adopts ESG policy ω_N, while $\omega_i = 0$ for all $i < N$. We focus on subgame equilibria in which all other (non-ESG) firms make the same labor market choice. So an equilibrium is a pair (l_N, l_{-N}).

Lemma 16 *The equilibrium is unique.*

Proof. An equilibrium is (l_N, l_{-N}) such that $l_N = r((N-1)\, l_{-N}; \omega_N)$ and $l_{-N} = r(l_N + (N-2)\, l_{-N}; 0)$, or equivalently,

$$l_{-N} = r\left(r\left((N-1)\, l_{-N}; \omega_N\right) + (N-2)\, l_{-N}; 0\right) \tag{55}$$

$$l_N = r\left((N-1)\, l_{-N}; \omega_N\right). \tag{56}$$

Suppose that, contrary to the claimed result, there exist two distinct equilibria, (l_N, l_{-N}) and $(\tilde{l}_N, \tilde{l}_{-N})$, where without loss $\tilde{l}_{-N} > l_{-N}$. (The case $\tilde{l}_{-N} = l_{-N}$ cannot arise because it implies $\tilde{l}_N = l_N$, in which case the two equilibria aren't distinct.)

By (55), $\tilde{l}_{-N} > l_{-N}$ implies that

$$r(r((N-1)\, \tilde{l}_{-N}; \omega_N) + (N-2)\, \tilde{l}_{-N}; 0) > r\left(r\left((N-1)\, l_{-N}; \omega_N\right) + (N-2)\, l_{-N}; 0\right)$$

Recall that by Lemma 1 $r(\cdot; 0)$ is a decreasing function. This implies that

$$r((N-1)\, \tilde{l}_{-N}; \omega_N) + (N-2)\, \tilde{l}_{-N} < r\left((N-1)\, l_{-N}; \omega_N\right) + (N-2)\, l_{-N}.$$

Also from Lemma 1, $r(L_{-N}; 0) + L_{-N}$ is an increasing function of L_{-N}. It then follows that

$$\begin{aligned} & r((N-1)\, \tilde{l}_{-N}; \omega_N) + (N-2)\, \tilde{l}_{-N} + r(r((N-1)\, \tilde{l}_{-N}; \omega_N) + (N-2)\, \tilde{l}_{-N}; 0) \\ < \; & r\left((N-1)\, l_{-N}; \omega_N\right) + (N-2)\, l_{-N} + r\left(r\left((N-1)\, l_{-N}; \omega_N\right) + (N-2)\, l_{-N}; 0\right). \end{aligned}$$

Substituting in (55), this inequality is equivalent to

$$r((N-1)\, \tilde{l}_{-N}; \omega_N) + (N-1)\, \tilde{l}_{-N} < r\left((N-1)\, l_{-N}; \omega_N\right) + (N-1)\, l_{-N}.$$

But, since $\tilde{l}_{-N} > l_{-N}$, this contradicts the combination of Lemmas 1 and 3 that $r(L_{-N}; \omega_N) + L_{-N}$ is a weakly increasing function. ■

To characterize equilibrium outcomes, first define $\rho(l_N)$ by

$$\rho(l_N) = r(l_N + (N-2)\rho(l_N); 0). \tag{57}$$

That is: if firm N hires l_N in equilibrium, then $\rho(l_N)$ is the equilibrium hiring of firms $1, \ldots, N-1$. Note that since $r(\cdot; 0)$ is strictly decreasing (Lemma 1) it follows that $\rho(l_N)$ is well-defined, and moreover is strictly decreasing in l_N.[29] Moreover:

Lemma 17 *$l_N + (N-1)\rho(l_N)$ is strictly increasing in l_N.*

Proof. Consider l_N and $\tilde{l}_N > l_N$. Since $\rho(\tilde{l}_N) < \rho(l_N)$ it follows that

$$\tilde{l}_N + (N-2)\rho(\tilde{l}_N) > l_N + (N-2)\rho(l_N).$$

Hence by Lemma 1,

$$\begin{aligned} & \tilde{l}_N + (N-2)\rho(\tilde{l}_N) + r(\tilde{l}_N + (N-2)\rho(\tilde{l}_N); 0) \\ > \; & l_N + (N-2)\rho(l_N) + r(l_N + (N-2)\rho(l_N); 0), \end{aligned}$$

or equivalently,

$$\tilde{l}_N + (N-2)\rho(\tilde{l}_N) + \rho(\tilde{l}_N) > l_N + (N-2)\rho(l_N) + \rho(l_N),$$

establishing the result. ■

Lemma 18 *Define $\hat{W}$ by*

$$\hat{W} = W(\lambda(\hat{W}) + (N-1)\rho(\lambda(\hat{W}))). \tag{58}$$

Then, $\hat{W}$ is well-defined, and lies in the interval $\left(W^B, W^{**}\right)$. Moreover, $\lambda(\hat{W}) > l^{**} > l^B$

Proof. Observe $\hat{W}$ is well-defined since by Lemma 17, $W(\lambda(\cdot) + (N-1)\rho(\lambda(\cdot)))$ is a decreasing function. Note that $\rho\left(l^B\right) = l^B < \lambda\left(W^B\right)$, so by Lemma 17,

$$l^B + (N-1)l^B < \lambda(W_B^*) + (N-1)\rho\left(\lambda\left(W^B\right)\right),$$

and so

$$W^B < W\left(\lambda\left(W^B\right) + (N-1)\rho\left(\lambda\left(W^B\right)\right)\right),$$

implying $\hat{W} > W^B$. Moreover, $\lambda(\hat{W}) > l^B$, since if instead $\lambda(\hat{W}) \leq l^B$ then (58) and Lemma 17 imply $\hat{W} \leq W\left(l^B + (N-1)\rho\left(l^B\right)\right) = W\left(Nl^B\right) = W^B$, contradicting $\hat{W} > W^B$.

[29] It can be shown that $[l_N + (N-1)\rho(l_N)]' \in (0,1)$. Indeed, $\rho'(l_N) = \frac{r'(l_N+(N-2)\rho;0)}{1-(N-2)r'(l_N+(N-2)\rho;0)}$ and $[l_N + (N-1)\rho(l_N)]' = \frac{1+r'(l_N+(N-2)\rho;0)}{1-(N-2)r'(l_N+(N-2)\rho;0)} \in (0,1)$

Notice $\lambda(W^{**}) = l^{**}$ and $\rho(l^{**}) < l^{**}$. Indeed, if on the contrary $\rho(l^{**}) \geq l^{**}$ then $r(l^{**} + (N-2)\rho(l^{**}); 0) = \rho(l^{**}) \geq l^{**}$ and $L_{-N} \equiv l^{**} + (N-2)\rho(l^{**}) \geq (N-1)l^{**}$. Notice $r(L_{-N}, 0)$ uniquely solves

$$f'(r) - W(r + L_{-N}) - rW'(r + L_{-N}) = 0.$$

However,

$$\begin{aligned} f'(l^{**}) - W(l^{**} + L_{-N}) - l^{**}W'(l^{**} + L_{-N}) &= W(Nl^{**}) - W(l^{**} + L_{-N}) - l^{**}W'(l^{**} + L_{-N}) \\ &< W(Nl^{**}) - W(Nl^{**}) - l^{**}W'(l^{**} + L_{-N}) \\ &= -l^{**}W'(l^{**} + L_{-N}) < 0. \end{aligned}$$

Therefore, $r(L_{-N}, 0) < l^{**}$, a contradiction. Since $\lambda(W^{**}) = l^{**}$ and $\rho(l^{**}) < l^{**}$, we have $\lambda(W^{**}) + (N-1)\rho(\lambda(W^{**})) = l^{**} + (N-1)\rho(l^{**}) < Nl^{**}$ and

$$W^{**} > W(\lambda(W^{**}) + (N-1)\rho(\lambda(W^{**})))$$

implying $\hat{W} < W^{**}$. Notice $\lambda(\hat{W}) > \lambda(W^{**}) = l^{**}$. ∎

Lemma 19 *If $\omega_N \leq W^B$ then firm N's ESG policy has no effect, and the equilibrium coincides with the No-ESG benchmark, $(l_N, l_{-N}) = (l^B, l^B)$. If $W^B < \omega_N \leq \hat{W}$ then the equilibrium l_N is determined by the solution to $W(l_N + (N-1)\rho(l_N)) = \omega_N$, while if $\omega_N \geq \hat{W}$ the equilibrium $l_N = \lambda(\omega_N)$. In all cases, $l_{-N} = \rho(l_N)$.*

Proof. There are three cases:

1. $\omega_N \leq W^B$: Intuitively, this is a non-binding ESG policy, and has no effect, i.e., the equilibrium is $(l_N, l_{-N}) = (l^B, l^B)$. Formally: $\Lambda(\omega_N) \leq \Lambda(W^B) = (N-1)l^B$. Hence $r((N-1)l^B; \omega_N) = r((N-1)l^B; 0) = l^B$, establishing that (l^B, l^B) is the (unique) equilibrium.

2. $W^B < \omega_N \leq \hat{W}$: In this case, the equilibrium is determined by the solution to

$$W(l_N + (N-1)\rho(l_N)) = \omega_N$$

along with $l_{-N} = \rho(l_N)$. To establish that this is indeed the equilibrium, we must show $r((N-1)\rho(l_N); \omega_N) = l_N$, i.e.,

$$r((N-1)\rho(l_N); \omega_N) = W^{-1}(\omega_N) - (N-1)\rho(l_N).$$

From Lemma 3, this is equivalent to showing

$$\lambda(\omega_N) \geq W^{-1}(\omega_N) - (N-1)\rho(l_N) \geq r((N-1)\rho(l_N); 0).$$

We first show that

$$l_N \in (l^B, \lambda(\omega_N)].$$

To establish the upper bound, suppose to the contrary that $l_N > \lambda(\omega_N)$. By Lemma 17,

$$\omega_N = W(l_N + (N-1)\rho(l_N)) > W(\lambda(\omega_N) + (N-1)\rho(\lambda(\omega_N))),$$

implying $\hat{W} > W(\lambda(\hat{W}) + (N-1)\rho(\lambda(\hat{W})))$, contradicting the definition of $\hat{W}$. To establish the lower bound, simply note that

$$W\left(l^B + (N-1)\rho\left(l^B\right)\right) = W\left(Nl^B\right) = W^B < \omega_N,$$

so by Lemma 17 it follows that $l_N > l^B$.

To establish the required pair of inequalities: From the definition of $\hat{W}$,

$$W^{-1}(\hat{W}) = \lambda(\hat{W}) + (N-1)\rho(\lambda(\hat{W})),$$

and hence

$$\begin{aligned} W^{-1}(\omega_N) &\leq \lambda(\omega_N) + (N-1)\rho(\lambda(\omega_N)) \\ &\leq \lambda(\omega_N) + (N-1)\rho(l_N). \end{aligned}$$

Finally, $l_N > l^B$ implies $\rho(l_N) < \rho\big(l^B\big) = l^B$ and so

$$\begin{aligned} (N-1)\rho(l_N) + r((N-1)\rho(l_N);0) &< (N-1)l^B + r\left((N-1)l^B;0\right) \\ &= Nl^B = W^{-1}\left(W^B\right) < W^{-1}(\omega_N). \end{aligned}$$

3. $\omega_N \geq \hat{W}$: In this case, the equilibrium is $l_N = \lambda(\omega_N)$ along with $l_{-N} = \rho(l_N)$. To establish that this is indeed the equilibrium, we must show $r((N-1)\rho(\lambda(\omega_N));\omega_N) = \lambda(\omega_N)$, for which it in turn suffices to show that

$$\lambda(\omega_N) \leq W^{-1}(\omega_N) - (N-1)\rho(\lambda(\omega_N)).$$

This inequality indeed follows from $\omega_N \geq \hat{W}$ and the definition of $\hat{W}$.

■

Proof of Proposition 2. For $\omega_N \in [W^B, \hat{W}]$, firm N's profits are

$$f(l_N) - l_N W(l_N + (N-1)\rho(l_N)), \tag{59}$$

where l_N is as characterized in Lemma 19. In this range, l_N is strictly increasing in ω_N. The derivative of (59) with respect to l_N is

$$f'(l_N) - W(l_N + (N-1)\rho(l_N)) - (1 + (N-1)\rho'(l_N))W'(l_N + (N-1)\rho(l_N)). \tag{60}$$

At $\omega_N = W^B$ we know $l_N = \rho(l_N) = l^B$, and so (60) reduces to

$$f'\left(l^B\right) - W\left(Nl^B\right) - \left(1 + (N-1)\rho'\left(l^B\right)\right)W'\left(Nl^B\right) = -(N-1)\rho'\left(l^B\right)W'\left(Nl^B\right),$$

where the equality follows from the firm N's optimality condition in the non-ESG benchmark. Since ρ is strictly decreasing, it follows that firm N's profits are strictly increasing in the ESG policy ω_N in the neighborhood to above W^B.

At $\omega_N = \hat{W}$ we know $l_N = \lambda(\omega_N)$, or equivalently, $f'(l_N) = W(l_N + (N-1)\rho(l_N))$. Hence (60) reduces to

$$-(1 + (N-1)\rho'(l_N))W'(l_N + (N-1)\rho(l_N)),$$

which is strictly negative by Lemma 17. So firm N's profits are strictly decreasing in the ESG policy ω_N in the neighborhood below $\hat{W}$.

For $\omega_N \geq \hat{W}$, firm N hires $l_N = \lambda(\omega_N)$, or equivalently, firm N's profits are $\max_{\tilde{l}_N} f(\tilde{l}_N) - \omega_N \tilde{l}_N$, and so are strictly decreasing in ω_N, completing the proof. ■

Proof of Proposition 3. Firm N's surplus is

$$f(l_N) - \mu \int_0^{l_N} W(l)\,dl - (1-\mu)\int_{(N-1)\rho(l_N)}^{l_N + (N-1)\rho(l_N)} W(l)\,dl, \tag{61}$$

where l_N is as characterized in Lemma 19. The derivative of (61) with respect to l_N is

$$\begin{aligned} & f'(l_N) - \mu W(l_N) - (1-\mu)W(l_N + (N-1)\rho(l_N)) \\ - \ & (1-\mu)(N-1)\rho'(l_N)\left(W(l_N + (N-1)\rho(l_N)) - W((N-1)\rho(l_N))\right) \\ \geq \ & f'(l_N) - W(l_N + (N-1)\rho(l_N)), \end{aligned} \tag{62}$$

where the inequality follows because ρ is decreasing.

First, consider $\omega_N \in [W^B, \hat{W})$. Increasing ω_N corresponds to increasing l_1. In this case, $l_N < \lambda(\omega_N)$, or equivalently, $f'(l_N) > \omega_N$; and $\omega_N = W(l_N + (N-1)\rho(l_N))$. Hence (62) is strictly positive. It follows that $\omega_N = \hat{W}$ delivers higher firm surplus than any choice in $[W^B, \hat{W})$.

Second, consider $\omega_N > \hat{W}$. Decreasing ω_N corresponds to increasing l_N. In this case, $l_N = \lambda(\omega_N)$, or equivalently, $f'(l_N) = \omega_N$; and $\omega_N > W(l_N + (N-1)\rho(l_N))$. Hence (62) is strictly positive. It follows that $\omega_N = \hat{W}$ delivers higher firm surplus than any choice in $\omega_N > \hat{W}$. ■

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