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Strategic Leadership in Corporate Social Responsibility

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Strategic Leadership in Corporate Social Responsibility

Abstract

We propose a strategic theory of Corporate Social Responsibility (CSR). Shareholder maximizers commit to a mission statement that extends beyond firm value maximiza- tion. This commitment leads firms (either product market competitors or complementors along the value chain) to change their actions in ways that ultimately favor shareholders. We thus provide a formal analysis of the "doing well by doing good" adage. We also pro- vide conditions such that the mission statement game has the nature of a pure coordination game. Our framework thus provides a natural theory of firm leadership in a CSR context: by selecting a CSR mission statement, a first mover effectively leads the industry to a Pareto optimal equilibrium.

JEL Classification: D24, G32, G34, L20, M14

Keywords: commitment, leadership, Corporate social responsibility, stockholder model, stakeholder model, Externalities, mission statement, clean-energy technology, Supply Chain, Wage setting

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Strategic Leadership in Corporate Social Responsibility

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September 2021

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1. Introduction

Why do corporations, in particular public corporations, adopt corporate social responsibility (CSR) policies? The CSR adage of "doing well by doing good" suggests that a firm can achieve higher financial returns by balancing the goals of different stakeholders. There are various ways in which this can be achieved, including customer awareness (Servaes and Tamayo, 2013; Albuquerque, Koskinen, and Zhang, 2019), a longer-term planning horizon (Bénabou and Tirole, 2010), a more resilient supply chain (Hoepner et al., 2021), or better-addressed employee concerns (Edmans, 2011).

This balancing act, however, is not independent of how other industry participants respond. For example, a firm may invest on the resilience of its supply chain, but that investment may prove of limited value if its suppliers don't do the same. Or a car manufacturer may commit to switch to all-electric vehicle production, but such move may fail, at least in the short run, if its competitors don't act in the same way. In this sense, strategizing over CSR policies is no different than engaging in price and quantity competition in the output market. There is, however, an important difference: CSR is more than a strategic decision variable. To the extent that a firm commits to a certain "mission", CSR effectively changes the firm's objective function, which in turn may have an effect on how it subsequently chooses other strategic variables (e.g. pricing or investment decisions).

In this paper, we follow a stakeholder-model approach to CSR. We assume that firms have the ability to commit to an objective function (it's "mission" or "view") that includes profits as well as other goals, such as employee satisfaction or environmental impact.[1] We develop a series of two-stage meta-games where the first stage corresponds to the choice of an objective function while the second stage corresponds to the choice of some strategic variable.

To fix ideas, consider the first application of our theoretical framework, clean-technology adoption. As in other applications we develop, we note that there is an externality across firms: adoption by one firm in isolation leads to high production marginal costs, whereas adoption by multiple firms leads to all-around lower costs. Examples include (a) non-excludable learning-by-doing cost savings in solar panel manufacturing and (b) network benefits from a collective switch to electric vehicles (due to a dense network of charging stations or improved battery technology).

We provide conditions such that the following is a Nash equilibrium: in the first stage, firms commit to a stakeholder function that places a high weight on the adoption of a clean technology; and in the second stage firms adopt the clean technology. Moreover, we show that equilibrium profits are higher than in the equilibrium of the one-stage game played by straight profit maximizers. We also show that the one-shot game played by profit

1. There exists an economics literature that considers the possibility of committing to a value function different from firm value. In Section 2, we discuss how our paper relates and adds to this literature.

maximizers has the nature of a prisoner's dilemma: sticking to the legacy technology is a dominant strategy but leads to lower profits. Our interpretation of the "doing well by doing good" adage is that CSR helps solve a strategic dilemma, in this case a prisoner's dilemma. In other words, by committing to departing from straight profit maximization, firms are able to effectively increase profits.

Our two-stage meta-game suggests an additional perspective on CSR policies. We provide conditions such that the first stage (the stage corresponding to CSR choices) is a pure coordination game: firms are better off by committing to CSR, but no firm has the incentive to unilaterally choose CSR. This observation provides a natural interpretation of strategic leadership in the CSR context. Specifically, if a firm has the ability to move ahead of its rival in the first stage (the mission-statement stage), then that firm might commit to CSR in the hope of inducing the rival to follow suit and thus break the multiplicity problem of coordination-game equilibria.

We consider two additional applications of our two-stage CSR meta-game, where we change the nature of the second-stage subgame. In our second application, firms set wage rates. As in the first application, we prove the existence of multiple equilibria in the first stage, including one where firms commit to a mission statement that places positive weight on the wage rate and then set high wages in the second stage. Also as in the first application, we show that firms end up earning higher profits than they would when playing the one-shot wage-setting game, where a low wage rate is a dominant strategy.

In our third application, firms make resiliency investments, which we model as an increase in the probability of remaining operational following an industry disruption. Unlike the first two applications, where firms belong to the same industry ("horizontal" firm interaction), our third application considers firms located at different stages of the value chain ("vertical" firm interaction). Unlike the first two applications, we show that opting for a CSR-like mission is a dominant strategy. Intuitively, the complementarities in resilience investments are so significant that, independently of what the other firm does, a firm optimally opts for a mission statement that places weight on resiliency beyond what a profit maximizer would do.

Our analysis is fundamentally dependent on the assumption that firms have the ability to commit to an objective function. One way to commit is via the firm's mission statement. Many skeptics view such statements as pure cheap talk with no effective impact. However, considering the prominence and visibility of these statements, we believe that we are beyond a world of pure babbling equilibria. In a similar vein, Hart and Zingales (2017) suggest that founders can guide current and future managers and boards through the company's mission statement, though they question the fiduciary strength of mission statements in light of the business judgment rule. On the issue of fiduciary strength, we argue that mission statements should be voted by shareholders to help guide management in the pursuit of the desired goals.[2]

Other ways to generate commitment include the hiring of board members and of CEOs with a reputation for CSR, as well as being friendly to outside investors with a preference for CSR. An interesting recent example of matching the firm culture with investor preferences is the filing of a "sustainable" initial public offering by Allbirds, a shoemaker company that advertised to future investors the company's commitment to maintaining a minimum ESG rating. As another example, in June 2021, an Exxon activist investor "successfully waged a battle to install three directors on the board of Exxon with the goal of pushing the energy giant to reduce its carbon footprint" (Phillips, 2021). One may dispute whether this investor is genuinely concerned with ESG beyond financial value or is simply pushing for a strategic move as described in our framework — either way, this and other events suggest that we are in the presence of more than cheap talk.

Recent developments such as the Business Roundtable, the proliferation of "green" statements, and the rise of ESG-monitoring organizations, as well as significant increases in Socially Responsible Investing, all contribute to an environment where commitment is more easily enforced, notwithstanding the existence of companies engaged in "greenwashing." For simplicity, below we describe commitment in the form of a "mission statement". However, as discussed, we view commitment as originating from various complementary sources.

There is an extensive literature on CSR as well as a series of papers developing meta-games similar to the one we propose. This asks for an explanation of the value added by our approach. This we do in the next section. Our basic framework, as well as the three applications mentioned earlier, appear in Sections 3, 4, and 5. Section 6 includes a discussion of our results. Section 7 concludes the paper.

2. Related literature

Our paper relates to an economics and finance literature focused of departures from the neoclassical paradigm of the profit-maximizing firm, a literature developed mostly, though not exclusively, in the context of CSR. Baron (2001) proposes an integrated firm strategy that extends the standard model to include private politics and CSR. Bénabou and Tirole (2010) argue that the "standard definition of CSR is that it is about sacrificing profits in the social interest," adding that CSR emerges in response to a combination of government failure, private interests and other factors. In line with Bénabou and Tirole (2010), Hart and Zingales (2017) revisit the Friedman (1970) doctrine in the case "where shareholders are prosocial and externalities are not perfectly separable from production decisions." Allen, Carletti,

2. In its U.S. Proxy Voting Guidelines, ISS has no comment on mission statements, except perhaps to say somewhat negatively that "[e]ndorsing a set of principles may require a company to take a stand on an issue that is beyond its own control and may limit its flexibility with respect to future developments." (page 57).

and Marquez (2014) take the heterogeneity of corporate forms (shareholder maximizers and stakeholder maximizers) as a given and evaluate their relative merit. Finally, similar to Allen, Carletti, and Marquez (2014), Tirole (2017) discusses the existence (and choice) of multiple organization types in modern economies within the context of CSR, arguing that the shareholder-primacy model is the most likely to succeed in promoting CSR changes. Our contribution to this strand of the literature is two-fold. First, we explore the possibility of strategic *interaction* in a CSR context. Second, we provide an explicit and formal narrative for the transition from a "Friedman firm" (that is, a classic firm value maximizer as in Friedman, 1970) to a socially conscious one. Specifically, whereas in Baron (2001), for example, CSR is a means for an active shareholder to pursue his or her private agenda (which differs from straight value maximization), in our framework a value-maximizing shareholder uses CSR as a means to increase shareholder value.

In parallel with the above (largely theoretical) literature on CSR, there is a series of recent empirical studies on the nature and implications of CSR. For example, Dimson, Karakaş, and Li (2015) show that "success in engagements is more probable if the engaged firm has reputational concerns and higher capacity to implement changes." Starks, Venkat, and Zhu (2020), in turn, provide evidence of sorting between shareholders and firms. Specifically, "longer-horizon investors tilt their portfolios towards firms with high-ESG profiles." Our analysis, while primarily theoretical, has empirical implications. For example, in Section 6, we discuss the possibility of shareholder sorting of as in Starks, Venkat, and Zhu (2020).

Our model is related to the industrial organization literature on strategic delegation, in particular Vickers (1985), Fershtman and Judd (1987) and Sklivas (1987).[3] This literature shows that, in a competitive context, profit-maximizing shareholders pay CEOs to maximize a function that differs from firm profits, the specific nature of this function depending on the nature of product market competition. One limitation of this literature is that shareholders have an incentive to ex-post deviate and ask CEOs to switch to profit maximization. In other words, the results depend on the shareholders' ability to commit to a contract that differs from profit maximization, in particular, the shareholders' inability to secretly renegotiate the contract. Our paper differs from this literature in that we don't model a shareholder-manager agency conflict. More importantly, we believe our assumption that shareholders commit to a vision statement is more reasonable than the type of contracts considered in the delegation literature.

Finally, our paper relates to an extensive economics, strategy and management literature on leadership. In game theory and industrial organization, leadership is normally associated with the order of moves in a sequential-move game, as in, for example, the Stackelberg

3. More recently, Albuquerque, Cabral, and Guedes (2019) also consider the possibility of shareholder-CEO contracts that differ from value maximization, and Morgan and Tumlinson (2019) provide an application to the provision of public goods by corporations motivated by managerial contracts that reflect investor preferences for these public goods.

model (von Stackelberg, 2011). Similar to this literature, in our framework leadership is a commitment modeled by a sequential-move game. Different from this literature, we consider commitment to an objective function rather than commitment to an action (e.g., output or capacity level).

The term leadership is often associated with the ability of a leader (e.g., a CEO) inducing other organization members to follow him or her. Dinh et al. (2014) provide a survey of the organizational behavior, whereas Hermalin (1998) follows an economics and game-theory approach. By contrast, we consider the possibility of a firm leading other industry players, either direct competitors or other firms along the value chain.

3. Clean-energy technology

Throughout the paper, we model CSR as a meta-game: In the first stage, firms choose an objective function (think of a firm committing to a mission statement that corresponds to a stakeholder value function). In the second stage, firms choose some profit-relevant strategic variable. In this section, we consider a specific investment, namely an investment in a clean-energy technology (as opposed to sticking to a legacy technology). Specifically, we assume that the firm's meta-objective function is given by

$$v_i(t_i, t_j; \theta_i) = \pi_i(t_i, t_j) + f(t_i)\,\theta_i \tag{1}$$

The first part of the firm's value function, $\pi_i(t_i, t_j)$, corresponds to financial performance (shareholder value) as a function of each firm's technology choice t_i. We assume this reduced-form profit function results from the subgame equilibrium where firms compete in setting quantities q_i given a linear market demand $Q = 1 - p$ and constant marginal costs c_i. Marginal cost c_i, in turn, depends on the choices t_i *and* t_j. Specifically, for intermediate values of marginal cost, equilibrium profit is given by

$$\widetilde{\pi}_i = \tfrac{1}{9}\,(1 + c_j - 2\,c_i)^2 \tag{2}$$

If, by contrast, firm j's cost is sufficiently high, specifically if $c_j > (1 + c_i)/2$, then firm i is effectively a monopolist, earning equilibrium profits of

$$\widetilde{\pi}_i = \tfrac{1}{4}\,(1 - c_i)^2 \tag{3}$$

The second part of the value function (1), $f(t_i)\,\theta_i$, corresponds to non-profit considerations. Specifically, we assume $f(t_i) = t_i$, where $t_i \in \{0, 1\}$ denotes the technology choice: $t_i = 0$ corresponds to a legacy technology (dirty technology), whereas $t_i = 1$ corresponds to a green technology (clean technology). Finally, θ measures the firm's weight on green technology adoption *beyond its implications for financial performance* (which are including in the first part of v). We interpret θ as the firm's mission statement and assume that $\theta_i \in \{0, \overline{\theta}\}$, that is, the firm's mission statement indicates either that it is a financial value maximizer ($\theta_i = 0$) or instead a firm that is socially responsible ($\theta_i = \overline{\theta}$).

We next specify the relation between technology choice and production marginal cost. We make the important assumption that the clean technology implies a constant marginal cost that depends on the number of adopters of the clean technology. One example that motivates this assumption is given by the adoption of solar panels. To the extent that the technology is subject to steep non-excludable learning by doing, we expect that the production cost of an adopter is lower the greater the number of other firms that make the same choice. Another motivating example is given by electrical vehicles. If General Motors is the only large US car manufacturer switching to electrical vehicles, then the investment in complementary assets such as charging stations or better batteries will be low. If, by contrast many manufacturers commit to EVs, then there will be more complementary investments and as a result the production of EVs will be more efficient.[4]

Specifically, we assume that if only one firm adopts the green technology, then its marginal cost of production is $\overline{c}$, whereas if both firms adopt the clean technology, then each firm's marginal cost of production is $\underline{c} < \overline{c}$. Finally, we assume that the legacy technology has a constant marginal cost c and that

Assumption 1. $\underline{c} < c < 2\,\overline{c} - 1$

The first inequality implies that, if both firms choose the clean technology, then marginal costs are lower than under the legacy technology. In other words, a social planner would choose to adopt the new technology (for simplicity, we assume zero adoption costs). The second inequality implies that, if a firm goes solo in adopting the clean technology, then its cost is so high that effectively it is priced out of the market, that is, it leaves the rival firm as a monopolist.[5] We make additional assumptions regarding $\overline{\theta}$ and the cost parameters:

Assumption 2. $0 < \frac{1}{4}\,(1 - c)^2 - \frac{1}{9}\,(1 - \underline{c})^2 < \overline{\theta} < \frac{1}{9}\,(1 - c)^2$

These inequalities ensure that the solution to the CSR game is interior: First, we ensure that the green technology (when adopted by both firms) has lower cost than the legacy technology, but not so much lower that duopolists with $\underline{c}$ would make more profit than a monopolist with c. Second, we ensure that social responsibility (as measured by the value of θ) is sufficiently high that a firm prefers to be a duopolist with a green technology with

4. A better network of charging stations would primarily affect consumer willingness to pay, not cost. However, the qualitative nature of the results would be similar to the cost reduction case.
5. Note that the second inequality is equivalent to $(1 + c)/2 < \overline{c}$.

respect to a monopolist with the legacy technology; but not so high that a firm would prefer to completely sacrifice its duopoly profits under the legacy technology.[6]

We are now faced with a crucial modeling assumption, namely deciding the payoff function at the time of choosing the payoff function. In other words, what is the firms' payoff function when they choose the values θ_i in the first period. Consistent with historical observation, we assume that $\theta = 0$ at the initial stage. In other words, we consider a game where firms must decide whether to *become* socially responsible, but do so from a financial-value-maximization perspective.

Proposition 1. *There exist three different subgame-perfect equilibria of the* (θ, t) *two-stage game. These equilibria correspond to the following paths:*

(a) $\theta_1 = \theta_2 = 0$*, followed by* $t_1 = t_2 = 0$

(b) $\theta_1 = \theta_2 = \overline{\theta}$*, followed by* $t_1 = t_2 = 1$

(c) $\theta_1 = \theta_2 = \overline{\theta}$*, followed by* $t_1 = t_2 = 0$

Moreover, a profit-maximizing firm prefers equilibrium (b).

(The proof of this and the following resuls can be found in the Appendix.) The three equilibria derived in Proposition 1 have an interesting interpretation in terms of the discussion regarding the nature and the effects of CSR. Equilibrium (a) corresponds to the case when firms do not engage in CSR, which, in broad strokes, might characterize the reality of the corporate world for most of the 20th century. Given that firms remain "Friedman" firms — that is, financial value maximizers — the technology-choice game has a dominant strategy, namely to stick with the legacy technology. Specifically, the technology-choice subgame has the nature of a prisoner's dilemma: together, firms would prefer to switch to a green technology, but individually each firm prefers to stick to the legacy technology.

Equilibrium (b) corresponds, essentially, to the idea that when firms *jointly* embrace CSR, then this choice may have real effects. It is important to stress the qualifier "jointly". In fact, if only one of firms adopts a CSR policy, then it will have no effect on the technology-choice game. The reason is that, for the firm that does not choose CSR, sticking with the legacy technology remains a dominant strategy; and even a firm that chooses CSR optimally responds to a non-adopting rival by not adopting a green technology. By contrast, if *both firms* choose $\theta_i = \overline{\theta}$, then switching to a green technology is a subgame-perfect equilibrium.

It is important to stress that we write "a" subgame-perfect equilibrium, not "the" subgame-perfect equilibrium. If fact, as equilibrium (c) in Proposition 1 suggests, even if both firms choose $\theta_i = \overline{\theta}$, there exists an equilibrium with a subgame leading to no adoption of the green technology. One might refer to this as the failure of CSR, even when CSR corresponds

6. Note that the inequalities in Assumption 2 induce a non-empty set. For example, suppose that $(1-c)^2 = \frac{1}{2}$, $(1-\underline{c})^2 = \frac{3}{4}$ and $\overline{\theta} \in [\frac{1}{24}, \frac{1}{18}]$ satisfy Assumption 2.

to collective action. From a game-theory point of view, one might appeal to Pareto optimality or forward-induction arguments, both at a theoretical and at an experimental level, to exclude this equilibrium (Schelling, 1960; Harsanyi and Selten, 1988; Cooper et al., 1990); but it certainly is a subgame-perfect Nash equilibrium. That notwithstanding, we focus primarily on equilibrium (b), which seems more reasonable.

One way of rephrasing the second equilibrium in Proposition 1 is that the joint adoption of CSR effectively turns a prisoner's dilemma game into a coordination game. Specifically, if both firms operate as "Friedman" firms — that is, with $\theta = 0$ —, then the technology-adoption game has the nature of a prisoner's dilemma: sticking to the legacy technology is the dominant strategy for each firm individually. By adding the initial CSR stage, where firms have the opportunity to commit to $\theta = \overline{\theta}$, we observe that there exist two equilibria (if we exclude the (c) equilibrium). These equilibria, (a) and (b), are Pareto ranked. Effectively, we have a coordination game. Specifically, there is no dominant strategy regarding the choice of CSR, rather each firm's best response is to follow the same choice as the rival firm.

The "transformation" of a prisoner's dilemma into a coordination game also sheds light on the issue of industry leadership. As we have seen, the technology-adoption subgame played by Friedman firms is a prisoner's dilemma. In this context, being a leader is of no help. In fact, a well-intentioned or a strategically-motivated leader who adopts the green technology will only find the disappointment of a rival who is grateful for the opportunity to capture market share by sticking to the legacy technology.[7] By contrast, when playing the CSR coordination game there is clear scope for leadership, as there is in any perfect coordination game. Specifically, sequential choice is the most natural way to induce the "good" equilibrium of a perfect-coordination game. Firm 1 moves first and chooses $\theta = \overline{\theta}$, upon which Firm 2's best response is to choose $\theta = \overline{\theta}$ as well, leading to joint adoption of the green technology — and to higher shareholder value.[8]

4. Wages

Worker conditions, both domestically and in countries hosting suppliers, are an important component of ESG. In this section, we consider a particular dimension of worker conditions: wages. Specifically, we now assume that the firm's meta-objective function is given by

$$v_i(w_i, w_j; \theta_i) = \pi_i(w_i, w_j) + \theta_i \, w_i \tag{4}$$

7. Unilateral signals such as irreversible investment à la Dixit (1980) cannot help in this model since the firm doing the investment would lose the investment and the duopoly profits.
8. The leader, however, will not adopt the clean technology until the follower expresses the same CSR concerns, otherwise the leader will be out of the market in the second stage.

This expression is analogous to (1), with two differences. First, the stage-two variable is now firm i's wage rate. Second, the reduced-form profit function is now different. Specifically, we consider a simple extension of the linear Cournot model of duopoly competition where market demand is given by

$$Q = \min\{w_i, w_j\}\,(1 - p) \tag{5}$$

The $1-p$ term corresponds to a standard linear demand, where by appropriate unit changes we normalize the intercept and the slope to 1. The first term, $\min\{w_i, w_j\}$, requires further explanation. The idea is that, due to consumer awareness (Servaes and Tamayo, 2013), total demand is a function of the industry's reputation for CSR. Our idea is that consumers may have difficulty identifying the specific actions of each firm. Rather, they have a general perception of the industry's CSR performance. The function we consider, $\min\{w_i, w_j\}$, assumes a particularly extreme form: each firm is as bad as the worst firm in the industry. However, we believe our qualitative results follow with less extreme functional forms. It is important, however, that there be some complementarity between the firms' efforts in the eyes of consumers. In particular, it's of little use — in terms of market demand — if one firm unilaterally increases its wage rate.[9] The inverse demand curve corresponding to (5) is given by

$$p = 1 - Q/\min\{w_i, w_j\} = 1 - (q_1 + q_2)/\min\{w_i, w_j\}$$

Firm i's profit, in turn, is given by

$$\pi_i = q_i\left(1 - (q_1 + q_2)/\min\{w_i, w_j\} - w_i\right)$$

Firm i's best-response is given by

$$q_i^* = \tfrac{1}{2}\,\min\{w_i, w_j\}\,(1 - w_i) - \tfrac{1}{2}\,q_j$$

Solving the system of best-responses, we get

$$\begin{aligned} q_i &= \tfrac{1}{3}\,\min\{w_i, w_j\}\,(1 + 2\,w_j - w_i) && (6)\\ p &= \tfrac{1}{3}\,(1 + w_i + w_j) && (7)\\ \pi_i &= \tfrac{1}{9}\,\min\{w_i, w_j\}\,(1 + w_j - 2\,w_i)^2 && (8) \end{aligned}$$

As in the previous section, we assume the game unfolds over two different stages, first the simultaneous choice of a value of $\theta_i \in \{0, \overline{\theta}\}$, and then, having observed (θ_i, θ_j), the simultaneous choice of $w_i \in \{\underline{w}, \overline{w}\}$. Me make a series of assumptions regarding key parameter values:

9. An alternative explanation for this portion of the payoff function is that the industry's successful lobbying efforts require unanimity among all players.

Assumption 3. *The values of* $\underline{w}$, $\overline{w}$, *and* $\overline{\theta}$ *are such that*

$$\underline{w}\,(1+\overline{w}-2\,\underline{w})^2 \geq \overline{w}\,(1-\overline{w})^2 \geq \underline{w}\,(1-\underline{w})^2 \tag{9}$$

$$\overline{w}\,(1-\overline{w})^2 + \overline{\theta}\,\overline{w} \geq \underline{w}\,(1+\overline{w}-2\,\underline{w})^2 + \overline{\theta}\,\underline{w} \tag{10}$$

$$\underline{w}\,(1-\underline{w})^2 + \overline{\theta}\,\underline{w} \geq \underline{w}\,(1+\underline{w}-2\,\overline{w})^2 + \overline{\theta}\,\overline{w} \tag{11}$$

Considering the reduced-form profit function (8), inequalities (9) imply that a Friedman firm prefers to cut wages when its rival sets a high wage but is better off when both firms set a high wage. Considering the reduced-form profit function (8) and the value meta-function (4), inequalities (10) and (11) imply that, by contrast with Friedman firms, a socially responsible firm prefers to set a high wage if and only if its rival sets a high wage as well. Such a profusion of conditions raises the questions of whether the set of values defined by Assumption 3 is non-empty. We answer this question in the affirmative. More generally, we can establish the following result.

Proposition 2. *There exist three different subgame-perfect equilibria of the* (θ, w) *two-stage game. These equilibria correspond to the following paths:*

(a) $\theta_1 = \theta_2 = 0$, *followed by* $w_1 = w_2 = \underline{w}$

(b) $\theta_1 = \theta_2 = \overline{\theta}$, *followed by* $w_1 = w_2 = \overline{w}$

(c) $\theta_1 = \theta_2 = \overline{\theta}$, *followed by* $w_1 = w_2 = \underline{w}$

Moreover, a profit-maximizing firm prefers equilibrium (b). Finally, (9)–(11) defines a positive-measure subset of the $(\overline{\theta}, \underline{w}, \overline{w})$ *space.*

There is a clear parallel between Proposition 2 and Proposition 1. In both cases, we discover three equilibria which have an interesting interpretation in terms of CSR. In both cases, equilibrium (b) is the more interesting (and reasonable) equilibrium. In both cases, CSR effectively turns a prisoners' dilemma into a coordination game. Finally, a strategic leader is a firm that in the first stage chooses a mission statement that commits to a stakeholder model. This leader helps solve the coordination game.

5. Supply chain resiliency

Unlike the first two applications, where firms belong to the same industry ("horizontal" firm interaction), our third application considers firms located at different stages of the value chain ("vertical" firm interaction). Specifically, we model a supply chain composed of two vertically integrated firms, each in its own industry. The focus of our analysis is on the resilience of supply chains. We do so by assuming that industries are subject to disruption, which we model as an exogenous shock that halts the production process (we will later be more specific about this). Moreover, we assume that these shocks can be global or industry specific. Specifically, with probability $1-\alpha$ there is no disruption in either industry; with probability $\alpha\,\phi$, both industries are disrupted; and with probability $\alpha\,(1-\phi)$ exactly one industry is disrupted, each with probability $\alpha\,(1-\phi)/2$.

This modeling approach reflects the view that disruption is sometimes limited to a given stage of the value chain, whereas at other times it extends to the entire chain. For example, the September 2000 Taiwan earthquake affected the world supply of memory chips. In terms of the computer supply chain, this can be seen as a shock to one of the stages of the chain. By contrast, the 2020 pandemic provides an example of a shock that affected entire vertical chains.[10]

Suppose that, by investing $c(x_i)$ dollars, where $x_i \in [0,1]$ and $c(\cdot) > 0$, a firm can guarantee that it will operate with probability x_i in case its industry is disrupted. We refer to this as a resilience investment. An example of a resilience investment might be to build a generator so as not to be dependent on the power grid. Given that firm j makes a x_j investment in resilience, firm i's profit is given by

$$\pi_i(x_i, x_j) \;= \Big(1-\alpha+\tfrac{1}{2}\,\alpha\,(1-\phi)\,(x_i+x_j)+\alpha\,\phi\,x_i\,x_j\Big)\,p-\tfrac{1}{2}\,x_i^2 \tag{12}$$

The expression in large brackets corresponds to the probability that production will take place, an outcome which requires both sectors of the supply chain to operate. If there is no disruption to the process — which happens with probability $1-\alpha$ — then it's business as usual and resilience investments have no effect. If an idiosyncratic shock hits the sector where firm i operates — which happens with probability $\alpha\,(1-\phi)/2$ — then firm i may still operate with conditional probability x_i. If instead an idiosyncratic shock hits the sector where firm j operates — which happens with probability $\alpha\,(1-\phi)/2$ — then firm j may still operate with conditional probability x_j. Following an aggregate shock — which occurs with probability $\alpha\,\phi$ — firms i and j are in operation with conditional probability $x_i\,x_j$, since both firms must remain active. The value obtained from operation is $p > 0$. Finally, for simplicity we assume quadratic costs to investing in supply chain resilience, $c(x_i) = x_i^2/2$.

Let the firm's meta-objective function be

$$v_i(x_i, x_j; \theta_i) = \pi_i(x_i, x_j) + \theta_i\,x_i \tag{13}$$

As before, θ_i measures firm i's weight on outcomes that go beyond straightforward value

10. The above examples refer to physical exogenous shocks. However, disruption may also take the form of information disclosure. For example, the admission that suppliers use child labor would be an example of a shock limited to a stage of the production chain, whereas the finding that the final product requires a chemical such as asbestos that is harmful to health would affect the entire value chain.

maximization (i.e., firm i's concern for the "common good"). In the present context, θ_i measures how much firm i values a well-functioning supply chain (beyond what is valued by a financial optimizer). Specifically, we assume that $\theta_i \in \{0, \overline{\theta}\}$, with $\theta = 0$ corresponding to a Friedman firm (financial value maximizer), and $\theta = \overline{\theta}$ corresponding to a CSR mission statement. The underlying assumption is that a proper operation of the supply chain is beneficial to stakeholders (consumers, workers, and so on) beyond shareholder value.

As before, we assume that firms are originally profit maximizers and choose their mission statement. Subsequently, given the choices of θ_i and θ_j, firms choose the resilience of their production technology, formally firms choose x_i and x_j. We make the following assumption:

Assumption 4. $\alpha \phi p < 1$

This assumption guarantees an interior solution for the optimization problem by Friedman firms. We can then establish the following result.

Proposition 3. *There exists a $\widetilde{\theta} > 0$ such that, if $0 < \overline{\theta} < \widetilde{\theta}$ then $\theta_i = \overline{\theta}$ is a dominant strategy in the CSR metagame. Moreover, financial payoff is greater when $\theta_1 = \theta_2 = \overline{\theta}$ than when $\theta_1 = \theta_2 = 0$.*

From a modeling point of view, our third application differs from the first two in that the second stage corresponds to the choice of a continuous variable $x_i \in [0, 1]$. The second-stage game has the structure of the (inverse) tragedy of the commons. Due to the positive externality of the investment x_i, the Nash equilibrium of the one-shot game has firms investing at level that is lower than the joint optimal level. A CSR mission statement implies that firms have an added reason to increase x_i, which in turn leads the other firm also to increase the value of x_j and ultimately leads to a higher profit.

Another important difference with respect to the first two applications is that, in the present context, the first stage of meta-game can be solved by dominant strategies (whereas in Sections 3 and 4 it corresponds to a pure coordination game). This implies that the order of moves in the first stage is no longer relevant, and thus the remarks about CSR leadership do not apply as in the previous cases.

6. Discussion

In this section, we discuss various aspects of our results, including how to interpret them and what they may imply for public policy.

■ **Relation to reputation literature.** There is an interesting relation between the choice of $\overline{\theta}$ and the game theory literature on reputation (Kreps et al., 1982). In the so-called "gang-of-four" framework, Player 2 is uncertain about another Player 1's type. In certain types of games, a “normal” Player 1 may have an incentive to pool with a “crazy” Player 1 so as to induce a favorable reaction by Player 2. Player 1 does not change its utility function, rather chooses a course of action that induces Player 2 to believe that Player 1 is a “crazy” type.

The correspondence with our framework has Player 1 as firm 1’s shareholder/CEO and Player 2 as firm 2’s shareholder/CEO. A “normal” player is a Friedman shareholder, that is, one whose utility is profit maximization, whereas a “crazy” player is one whose value function includes other stakeholders’ value as well. The difference with respect to the reputation framework is that we do not consider the possibility of asymmetric information. Rather, we assume that players have the ability to change their utility function. To be more specific, players have the ability of choosing a “mission statement,” which effectively influences their future actions as if their utility function had changed.

In spite of this difference, there is an interesting parallel between our framework and the pooling equilibrium (reputation equilibrium) in the Kreps et al.’s (1982) framework. Specifically, our preferred equilibria have a “pooling” flavor. Consider two different shareholders, one who is a profit maximizer and one who is socially conscious. In equilibrium, both take the same course of action. The socially conscious will push for a mission statement that includes CSR because that’s what his or her utility dictates. The Friedman shareholder will push for the same mission statement for a different reason: by doing so, he or she induces more favorable behavior by the rival firm and as such increases financial value.

In other words, empirically there is no way to distinguish the behavior of an “activist” shareholder who is genuinely concerned with CSR from the behavior of a Friedman shareholder who becomes an “activist” shareholder for strategic reasons. This observational equivalence is similar to a pooling equilibrium in the asymmetric information game.

■ **Shareholder utility and the value of θ.** In our basic framework, we assume that a Friedman firm/shareholder (i.e., a financial value maximizer) strategically adopts a CSR utility function. However, it seems reasonable to assume that many firms and shareholders are “genetically” endowed with a $\theta > 0$ utility function. This raises the question of what determines the value of θ (or the $\overline{\theta}$ upper bound) we considered in previous sections.

In terms of our framework, the firm’s social impact (in the shareholder’s eyes) can be measured by $\theta\, x$. A further decomposition of x may be helpful. Let $x \equiv \xi\, \chi$ where χ is the firm’s level of CSR-relevant actions and ξ is the firm’s ability to induce CSR results by its choice of χ. For example, if Google were to increase its minimum wage from \$10 to \$15, this would likely have no real effect, for the simple reason that most of Google’s employees are high-skilled workers. In this sense, we would say that Google’s ξ is close to zero (when it comes to minimum wage, one of many components of a CSR policy). Another example is provided by Volvo. In 2020, the company announced that all new cars would have a factory speed limit of 112 miles per hour. However, speeding ranks only third in car crashes in the U.S., below driving distractions and driving with alcohol and drug impairment (Console, 2020). Again, this would be reflected in a low ξ, this time on account of the low-CSR nature of the activity χ in question.

In sum, in addition to the firm/shareholder's underlying utility from CSR, the product $\theta\, x$ also reflects firm-specific and industry-specific considerations that affect the map from firm actions to actual CSR results.

For simplicity, our analysis only considers two possible values of θ (0 and $\overline{\theta}$). A more general analysis would consider a range of values of θ, with 0 as a lower bound and $\overline{\theta}$ as an upper bound. The lower bound corresponds to a Friedman firm, that is, a financial value maximizer. The upper bound, in turn, corresponds to a value of θ beyond which the firm is not financially viable and thus CSR would be counter-productive (Fairhurst and Greene, 2020). Recent trends suggest that firms worldwide are moving away from the lower bound, but also that the effective values of θ are still relatively low (Bolton and Kacperczyk, 2021).

■ **Mission statement and agency issues.** In the previous sections, we mentioned the firm's mission statement in reference to the firm's meta-utility function (1). As Powers (2012) argues, mission statements communicate the company's purpose to the outside world, bringing clarity as to what the firm is and is not doing. Moreover, mission statements can be an effective means of achieving the commitment we assume in our analysis. In other words, our assumption that each firm chooses a value of θ in the first stage can be interpreted as modeling the firm's choice of a mission statement it commits to.

Consistent with our analysis, Loderer et al. (2010) report that mission statements often go beyond shareholder value as the sole criterion; that is, mission statements feature positive values of θ. Similarly, King, Case, and Premo (2010) document the recent trend of adopting "green statements".[11]

In our analysis, we largely ignore agency problems involving shareholders and CEOs: our focus is on the game-theoretic dimensions of CSR policies. However, agency issues are obviously important, also concerning CSR policies. In this regard, we believe the firm's mission statement can be an effective vehicle to align CEO and shareholders' interests. This alignment works in two ways. First, it helps the process of sorting of shareholders and firms: When a shareholder acquires shares in firm i it effectively buys into a specific value of θ. This is related to Hart and Zingales's (2017) effort to "reconcile" Friedman's (1970) "duty toward shareholders" doctrine with CSR concerns. The idea is that a CEO's duty is to follow the firm's mission statement. To the extent that shareholders are properly sorted across mission statements, by following the firm's mission statement, the CEO is effectively

11. The literature on mission statements (Pearce and David, 1987) has long established a correlation between the existence of a mission statement with firm performance.

maximizing shareholders' interests (which does not necessarily imply maximizing the firm's financial value).[12]

The second direction in the shareholders-mission statement connection pertains to the role of active shareholders. Dimson, Karakaş, and Li (2015) and Flammer (2015) suggest that active shareholders play an important role in changing firm behavior.[13] In terms of our framework, we can think of these active shareholders as a direct determinant of the firm's mission statement (that is, the value of θ).

Related to this, we should mention that a simplifying assumption in our analysis is that firms are symmetric, both in terms of their primitive utility functions and in terms of their actions. Clearly, firm heterogeneity is an important feature of most industries, also in terms of their CSR attitude. For example, Bolton and Kacperczyk (2021) show that commitments to reduce carbon emissions vary across firms. Moreover, "companies that choose to make a commitment are the ones with lower carbon emissions to begin with." Their interpretation of this correlation is that "companies making a commitment are the least problematic ones in terms of carbon emissions." However, an alternative (or additional) interpretation is that of heterogeneity in θ: Some firms have higher values of θ, which in turn leads them to higher values of x (where we interpret a commitment as a choice of a future value of x).

■ **Welfare analysis.** Is CSR good from a social welfare point of view? Answering this question requires a definition of social welfare. A natural definition is to add the surplus from all agents in the economy. Specifically, in the clean-energy technology model, social welfare equals the sum of profits and consumer surplus. Because the equilibrium where both firms choose CSR and adopt the clean-energy technology results in lower cost and higher quantity produced — while requiring no additional investment — both profits and consumer surplus increase relative to the equilibria where both firms choose the legacy technology. It is straightforward to show that

Proposition 4. *In the clean-energy technology game, social welfare is higher in the CSR equilibrium.*

In the wage model, social welfare equals the sum of profits and consumer surplus plus the portion of the wage bill that exceeds the competitive wage. Note that, in the clean-energy technology model, the hypothesis implicit in the definition of social welfare is that the firms' costs are equal to the social cost. However, in the wage-setting model, firms set wages above the competitive level, thus transferring rents to workers. In this context, social welfare must also account for the portion of the wage bill that exceeds the competitive wage. In this context, we can prove the following result:

12. This is our interpretation of Hart and Zingales's (2017) interpretation of Friedman (1970).
13. Schiller (2018) and Dai, Liang, and Ng (2020) focus on other firms in the supply chain.

Proposition 5. *In the wage-setting game, if firm profits are higher when wages are high, social welfare is also higher.*

Finally, in the model of supply-chain resiliency, we do not have an explicit demand curve and and as such cannot calculate the consumer surplus. However, it is reasonable to assume that consumer welfare increases as the supply chain is made more resilient. Since firm profits also increase in the CSR equilibrium, social welfare trivially increases. Overall, these results suggest that the positive role of CSR, in terms of firm profits, also extends to social welfare.

■ **Public policy.** While most of our analysis is focused on firm strategy, our framework and equilibrium results also have implications for public policy. The critical feature that leads to the strategic role played by CSR commitments is the complementarity in the the second-stage game. This suggests that one role for public policy is to introduce complementarities into firm actions. Consider, for example, a tragedy-of-the-commons type subgame such as setting an upper bound on CO_2 emissions. One possible public policy design is to introduce a price subsidy that works only if all the firms in the industry reduce their pollution levels. This would lead to a subgame that shares the main features of our setup. The idea is to use firm interaction as an additional course of incentives for individual players to choose a value of x closer to the socially optimal level.

7. Conclusion

This paper proposes the idea that firms may choose to deviate from profit maximization — by adopting a stakeholder model via a CSR policy — and yet yield higher profits because of strategic complementarities in the industry. We illustrate this idea in three different settings. In the first two, the choice of CSR by all firms in the industry results in an equilibrium that is Pareto optimum. However, there is also an equilibrium where 'Friedman' firms operate. These two equilibria introduce a coordination problem that can be solved if one of the firms assumes the industry leadership to become CSR. In the last setting that we study, the strategic complementarities are so strong that adopting CSR is a dominant strategy for all firms and the question of CSR leader is mute.

We view mission statements as well as the hiring of board members or a CEO with a CSR reputation as ways to assert the intended specific stakeholder model to peer firms and other constituents such as supplier firms. For that reason, we propose that mission statements be voted by shareholders so as to grant them greater fiduciary bite.

One of the many critics of departures from profit maximization writes that

> Purpose cannot solve the problem of shareholder primacy because shareholder capitalism is inherently corrupting of purpose. When purpose and shareholder

> value get into a boxing ring, I will bet on shareholder value every time (Davis, 2021).

Our analysis suggests that the dichotomy between purpose and shareholder value is not clear-cut. Importantly, we move away from the partial equilibrium setting of firm decision making, where traditionally CSR has been studied, and consider the industry equilibrium setting. We point out that the highlighted dichotomy may not exist in the presence of strategic complementarities in an industry.

Our analysis is suitable for problems that arise from positive externalities. When a positive externality exists, a firm that takes the action of the other firms in the industry as a given under-invests in the choice variable relative to what would be socially optimum. This is true in our examples of clean-energy technology choice, wage setting, and supply chain resilience. Changing the firm objective function by adding a component that values the choice variable associated with the externality can move the industry equilibrium closer to the social optimum. In this way, our paper proposes a novel way to use market mechanisms to resolve problems associated with externalities.

Fair trade is a similar application to the wage setting model. If consumers are willing to pay more for the products offered by an industry that collectively engages in fair trade, then strategic complementarities arise that favor the adoption of CSR policies. We leave this and other applications for future research.

Another issue that we leave for future research is the possibility that the choice of θ is continuous rather than discrete. For example, the firm may approach — or be approached — by outside investors that derive different utility over the CSR strategy. How do firms choose between the different outside investors and what is the resulting equilibrium? Presumably, an interior solution would exist to this problem since too much of a concern for CSR can tilt the balance away from profit maximization so as to decrease firm profits.

Appendix

Proof of Proposition 1: As usual, we solve the game backwards, thus ensuring the Nash equilibria we select are subgame perfect. Consider first the case when firm i chooses $\theta_i = 0$, that is, firm i is a financial value maximizer. Suppose that $t_j = 0$. Assumption 1 implies that choosing $t_i = 1$ yields zero profits, whereas choosing $t_i = 0$ yields positive profits. Suppose instead that $t_j = 1$. Assumption 1 implies that choosing $t_i = 0$ leads to monopoly profits. The first inequality in Assumption 2 implies that such monopoly profits are higher than the duopoly profits earned from choosing $t_i = 1$. Together, the above calculations imply that, for a $\theta_i = 0$ firm, $t_i = 0$ is a dominant strategy in the second stage.

Consider now the case when firm i chooses $\theta_i = \overline{\theta}$, that is, firm i maximizes a value function comprising financial value and value from choosing a green technology. The second and third inequalities in Assumption 2 imply that firm i's best response in the second stage is $R_i(t_j) = t_j$, that is, firm i is better off by choosing the same technology as firm j. To see why, suppose that $t_j = 1$. Then $t_i = 1$ is better than $t_i = 0$ if and only if

$$\tfrac{1}{9}\,(1 - \underline{c})^2 + \overline{\theta} > \tfrac{1}{4}\,(1 - c)^2$$

which is equivalent to the second inequality in Assumption 2. Suppose instead that $t_j = 0$. Then $t_i = 0$ is better than $t_i = 1$ if and only if

$$\tfrac{1}{9}\,(1 - c)^2 > \overline{\theta}$$

which is equivalent to the third inequality in Assumption 2.

Finally, we show the three equilibria in the Proposition are indeed Nash equilibria in the meta-game played by financial value maximizers who have the ability to commit to a value of θ. Consider firm equilibrium (a). Along the equilibrium path, firm i obtains (financial) value $\frac{1}{9}\,(1 - c)^2$. By deviating and choosing $\theta = \overline{\theta}$, firm i is unable to induce a different t_j in the second stage, since $t_j = 0$ is a dominant strategy for a $\theta_j = 0$ firm. Since the best response to $t_j = 0$ is $t_i = 0$, regardless of the value of θ_i, we conclude that a change in θ_i does not improve firm i's financial value.

Consider now equilibrium (b). Along the equilibrium path, firm i receives a financial payoff of $\frac{1}{9}\,(1 - \underline{c})^2$. By switching to $\theta_i = 0$, firm i effectively commits to $t_i = 0$, which in term leads firm j to choose $t_j = 0$, which eventually leads to a financial payoff of $\frac{1}{9}\,(1 - c)^2$, which is lower than the equilibrium payoff, by the firt inequality in Assumption 1.

Consider now equilibrium (c). Along the equilibrium path, firm i receives a financial payoff of $\frac{1}{9}\,(1 - c)^2$. By switching to $\theta_i = 0$, firm i effectively commits to $t_i = 0$, which in turn leads firm j to choose $t_j = 0$, which eventually leads to a financial payoff of $\frac{1}{9}\,(1 - c)^2$, the same as the equilibrium payoff.

Finally, since by Assumption 3, $\underline{c} < c$, equilibrium (b) yields the highest financial value of all three equilibria. ■

Proof of Proposition 2: As usual, we solve the game backwards, thus ensuring the Nash equilibria we select are subgame perfect. Consider first the case when $\theta_1 = \theta_2 = 0$, that is, both firms are (or remain) "Friedman" firms, that is, financial value maximizers. This case corresponds to simple Cournot competition (though with a different-than-normal demand curve). Suppose that $w_j = \underline{w}$. Then firm i's payoff function is strictly decreasing in w_i, thus $R_i(\underline{w}) = \underline{w}$, where R_i denotes firm i's best response. Suppose instead that $w_j = \overline{w}$. The first inequality in (9) implies that $R_i(\overline{w}) = \underline{w}$. It follows that $w_i = \underline{w}$ is a dominant strategy, and so the subgame where $\theta_1 = \theta_2 = 0$ leads to $w_1 = w_2 = \underline{w}$.

Consider next the case when $\theta_1 = \theta_2 = \overline{\theta}$, that is, both firms are socially responsible firms that maximize the augmented "stakeholder" value function when choosing w. Inequalities (10) imply that $R_i(w_j) = w_j$, that is, firm i's best response is to set the same wage level as firm j. We thus have two subgame equilibria.

Finally, suppose that $\theta_1 = 0$, whereas $\theta_2 = \overline{\theta}$. Firm 1's best-response is the same as in the $\theta_1 = \theta_2 = 0$ subgame, that is, $w_1 = \underline{w}$ is a dominant strategy. In fact, θ_2 does not enter firm 1's value function, only w_2. Similarly, based on our analysis of the $\theta_1 = \theta_2 = 0$ subgame, we conclude that $R_2(w_1) = w_1$. It follows that the only equilibrium of the subgame is $w_1 = w_2 = \underline{w}$.

The three equilibria in the proposition can be derived from the discussion in the paragraphs.

The statement that firms prefer the equilibrium yielding the path $\theta_i = \overline{\theta}$ and $w_i = \overline{w}$ is equivalent to the second inequaliy in (9). Finally, we prove the claim that the conditions in Assumptin 3 imply a positive-measure subset of $\mathbb{R}^3$. The function $x\,(1-x)^2$ has zeros as $x = 0$ and $x = 1$ and is strictly positive and strictly concave for $x \in (0,1)$. It follows that there exist values $1 > x_1 > x_2 > 0$ such that Condition (9) is satisfied as an equality, that is, $\overline{w}\,(1-\overline{w})^2 = \underline{w}\,(1-\underline{w})^2 = \overline{\pi}$. For these specific values of $\overline{w}, \underline{w}$, Condition (9) is strictly satisfied, for

$$\underline{w}\,(1+\overline{w}-2\,\underline{w})^2 > \underline{w}\,(1+\underline{w}-2\,\underline{w})^2 = \overline{w}\,(1-\overline{w})^2$$

where the inequality follows from $\overline{w} > \underline{w}$ and the equality follows from our choice of $\overline{w}, \underline{w}$, such that $\overline{w}\,(1-\overline{w})^2 = \underline{w}\,(1-\underline{w})^2$. Next we re-write (10) as

$$\overline{\theta}\,(\overline{w}-\underline{w}) \geq \underline{w}\,(1+\overline{w}-2\,\underline{w})^2 - \overline{w}\,(1-\overline{w})^2$$

Notice that the right-hand side is strictly positive:

$$\underline{w}\,(1+\overline{w}-2\,\underline{w})^2 - \overline{w}\,(1-\overline{w})^2 > \underline{w}\,(1+\underline{w}-2\,\underline{w})^2 - \overline{w}\,(1-\overline{w})^2 = 0$$

where the inequality follows from $\overline{w} > \underline{w}$ and the equality follows from our choice of $\overline{w}, \underline{w}$, such that $\overline{w}\,(1-\overline{w})^2 = \underline{w}\,(1-\underline{w})^2$. It follows that we can choose $\overline{\theta}$ such that (10) holds as an equality, that is,

$$\overline{\theta}\,(\overline{w}-\underline{w}) = \underline{w}\,(1+\overline{w}-2\,\underline{w})^2 - \overline{w}\,(1-\overline{w})^2 \tag{14}$$

Condition (11) can be re-written as

$$\overline{\theta}\,(\underline{w}-\overline{w}) > \underline{w}\,(1+\underline{w}-2\,\overline{w})^2 - \underline{w}\,(1-\underline{w})^2$$

Substituting (14) as well as $\overline{w}\,(1-\overline{w})^2 = \underline{w}\,(1-\underline{w})^2$, we get

$$\underline{w}\,(1+\overline{w}-2\,\underline{w})^2 > \underline{w}\,(1+\underline{w}-2\,\overline{w})^2$$

which, considering that $\underline{w}, \overline{w} \in (0,1)$, is equivalent to $\overline{w} > \underline{w}$, which is true by construction.

To summarize, we chose values of $\underline{w}, \overline{w}, \overline{\theta}$ such that two of the conditions hold as equalities and two other ones hold strictly. By slightly increasing the value of $\overline{\theta}$, Condition (10) holds as a strict inequality; and by slightly increasing the value of $\underline{w}$ (or decreasing $\overline{w}$, Condition (9) holds an equality. The result follows. ■

Proof of Proposition 3: In order to focus on sugame-perfect equilibria, we solve the game backwards, beginning with the x stage. Consider first the subgame when $\theta_1 = \theta_2 = 0$. Firm i's best-response (optimal resilience choice x_i given that the firm j chooses x_j) is given by

$$R_i(x_j;0) = \alpha\left(\tfrac{1}{2}\,(1-\phi) + \phi\,x_j\right)p$$

where $R_i(x_j;0)$ denotes the x_i best-response mapping of a firm with $\theta_i = 0$. It follows that the (symmetric) equilibrium of the resilience-investment subgame is given by

$$x^{00} = \tfrac{1}{2}\,\frac{\alpha\,(1-\phi)\,p}{1-\alpha\,\phi\,p}$$

where the 00 superscript denotes that neither firm engages in CSR (that is, neither firm has CSR in their mission statement). Consider next the subgame when $\theta_1 = \theta_2 = \overline{\theta}$. Firm i's best-response mapping is now

$$R_i(x_j;\overline{\theta}) = \left(\tfrac{1}{2}\,\alpha\,(1-\phi) + \alpha\,\phi\,x_j\right)p + \overline{\theta} \tag{15}$$

where $R_i(x_j;\overline{\theta})$ denotes the x_i best-response mapping of a firm with $\theta_i = \overline{\theta}$. The resulting equilibrium of the resilience-investment subgame is given by

$$x^{11} = \frac{\tfrac{1}{2}\,\alpha\,(1-\phi)\,p + \overline{\theta}}{1-\alpha\,\phi\,p}$$

where the 11 superscript denotes that both firms engage in CSR (that is, both firms have CSR in their mission statement). Finally, consider the case when (without loss of generality) $\theta_1 = \overline{\theta}$ and $\theta_2 = 0$. The best-response functions are now given by

$$R(x_2;\overline{\theta}) = \left(\tfrac{1}{2}\,\alpha\,(1-\phi) + \alpha\,\phi\,x_2\right)p + \overline{\theta}$$
$$R(x_1;0) = \left(\tfrac{1}{2}\,\alpha\,(1-\phi) + \alpha\,\phi\,x_1\right)p$$

This results in equilibrium values

$$x^{10} = \frac{(1+\mu)\,\alpha\,(1-\phi)\,p + 2\,\overline{\theta}}{2\,(1-\mu^2)}$$
$$x^{01} = \frac{(1+\mu)\,\alpha\,(1-\phi)\,p + 2\,\mu\,\overline{\theta}}{2\,(1-\mu^2)}$$

where we define

$$\mu \equiv \alpha\,\phi\,p$$

to simplify notation. Finally, the above equilibrium values lead to equilibrium profit values

$$\pi^{00} \equiv \pi(x^{00}, x^{00})$$
$$\pi^{11} \equiv \pi(x^{11}, x^{11})$$
$$\pi^{10} \equiv \pi(x^{10}, x^{01})$$
$$\pi^{01} \equiv \pi(x^{01}, x^{10})$$

We now consider the first stage of the game, the stage when firms choose their mission statement θ_i. Setting a high value of θ is a dominant strategy if and only if $\pi^{11} > \pi^{01}$ and $\pi^{10} > \pi^{00}$. Trivially,

$$\lim_{\theta\to 0} \pi^{11} = \lim_{\theta\to 0} \pi^{01} = \lim_{\theta\to 0} \pi^{00} = \lim_{\theta\to 0} \pi^{10}$$

Computation establishes that

$$\left.\frac{\partial\left(\pi^{11} - \pi^{01}\right)}{\partial\theta}\right|_{\theta\,=\,0} = \frac{\mu\,\alpha\,(1-\phi)\,p}{2\,(1-\mu)^2\,(1+\mu)} > 0$$
$$\left.\frac{\partial\left(\pi^{10} - \pi^{00}\right)}{\partial\theta}\right|_{\theta\,=\,0} = \frac{\mu\,\alpha\,(1-\phi)\,p}{2\,(1-\mu)^2\,(1+\mu)} > 0$$
$$\left.\frac{\partial\left(\pi^{11} - \pi^{00}\right)}{\partial\theta}\right|_{\theta\,=\,0} = \frac{\alpha\,(1-\phi)\,p}{2\,(1-\mu)^2} > 0$$

Finally, the result then follows from Taylor's theorem. ■

Proof of Proposition 4: For marginal cost c, in symmetric equilibria,

$$\begin{aligned}\widehat{p} &= \tfrac{1}{3}\,(1+2\,c)\\ \widehat{Q} &= \tfrac{2}{3}\,(1-c)\\ \widehat{\pi} &= \tfrac{1}{9}\,(1-c)^2\end{aligned}$$

and social welfare equals

$$\begin{aligned}S &= \frac{1}{2}\,(1-\widehat{p})\,\widehat{Q}+(\widehat{p}-c)\,\widehat{Q}\\ &= 2\widehat{\pi}.\end{aligned}$$

The lower marginal cost of the clean-energy technology is unambiguously welfare increasing.
■

Proof of Proposition 5: The proof consists of two parts. First, we show that social welfare increases as w increases from $\underline{w}$ to $\overline{w}$ if and only if $\overline{w}+\underline{w}<1$. Second, we show that, if profits increase, then it must be that $\overline{w}+\underline{w}<1$.

In a symmetric equilibrium — that is, one where both firms choose the same wage rate — market demand, generally given by (5), becomes $Q=w\,(1-p)$, whereas marginal cost is given by w (for both firms). From (6)–(7), we conclude that equilibrium price, total output, and firm profit are given by

$$\begin{aligned}\widehat{p} &= \tfrac{1}{3}\,(1+2\,w)\\ \widehat{Q} &= \tfrac{2}{3}\,w\,(1-w)\\ \widehat{\pi} &= \tfrac{1}{9}\,w\,(1-w)^2\end{aligned}$$

Social welfare is the sum of the consumer surplus, firms' profits, and the excess wage bill relative to the competitive wage

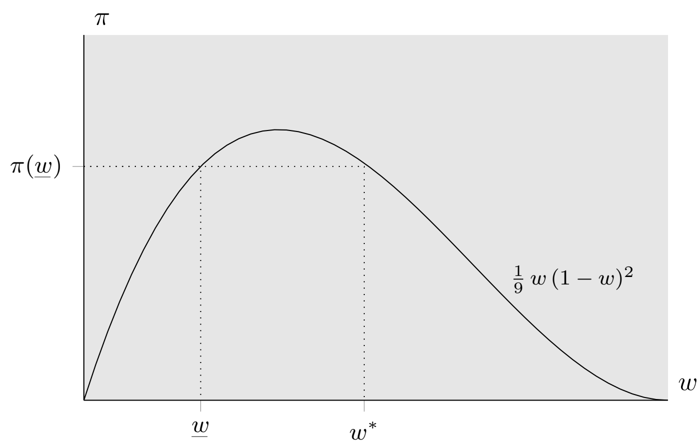
$$\begin{aligned}S &= \frac{1}{2}\,(1-\widehat{p})\,\widehat{Q}+(\widehat{p}-w)\,\widehat{Q}+(w-\underline{w})\,\widehat{Q}\\ &= \widehat{Q}\left(\tfrac{1}{2}\,(1+\widehat{p})-\underline{w}\right).\end{aligned}$$

Substituting $\overline{w}$ and $\underline{w}$ for w in $\widehat{p}$ and $\widehat{Q}$ and simplifying we get

$$\Delta S \equiv S\,\big|_{\,w\,=\,\overline{w}} \;-\; S\,\big|_{\,w\,=\,\underline{w}} \;=\tfrac{4}{9}\,(\overline{w}-\underline{w})\,(1-\overline{w}-\underline{w})\,(1-\underline{w})$$

Since $\overline{w}>\underline{w}$ and $\underline{w}\in(0,1)$, $\Delta S>0$ if and only if $\overline{w}+\underline{w}<1$. This concludes the first part of the proof.

Figure 1
Relation between $\overline{w}$ and $\underline{w}$



The function $\widehat{\pi}$ is quasi-concave in $[0,1]$, as illustrated by Figure 1. It follows that, for a given $\underline{w}$, Condition (9), $\overline{w}\,(1-\overline{w})^2 \geq \underline{w}\,(1-\underline{w})^2$, implies that $\overline{w} \in (\underline{w}, w^*)$. In other words, for a given $\underline{w}$, the value of $\overline{w}$ must be greater than $\underline{w}$ and lower than an upper bound w^* such that $w^* > \overline{w}$ and $\widehat{\pi}$ is declining at w^*.

We next show that $w^* < 1 - \underline{w}$. Consider the function

$$f(x) = \frac{x\,(1-x)^2}{\underline{w}\,(1-\underline{w})^2}$$

By construction, $f(w^*) = 1$. Moreover,

$$f(1-\underline{w}) = \frac{(1-\underline{w})\,\underline{w}^2}{\underline{w}\,(1-\underline{w})^2} = \frac{\underline{w}}{1-\underline{w}} < 1$$

Since $f(\cdot)$ is decreasing in the relevant range, this implies that $w^* < 1 - \underline{w}$. This concludes the second part of the proof. ■

References

Albuquerque, Rui, Luís Cabral, and José Guedes (2019), "Incentive Pay and Systemic Risk," *The Review of Financial Studies*, 32, 4304–4342.

Albuquerque, Rui, Yrjö Koskinen, and Chendi Zhang (2019), "Corporate Social Responsibility and Firm Risk: Theory and Empirical Evidence," *Management Science*, 65, 4451–4949.

Allen, Franklin, Elena Carletti, and Robert Marquez (2014), "Stakeholder Governance, Competition, and Firm Value*," *Review of Finance*, 19, 1315–1346.

Baron, David P. (2001), "Private Politics, Corporate Social Responsibility, and Integrated Strategy," *Journal of Economics & Management Strategy*, 10, 7–45.

Bolton, Patrick and Marcin T. Kacperczyk (2021), "Firm Commitments," SSRN Scholarly Paper ID 3840813, Social Science Research Network, Rochester, NY.

Bénabou, Roland and Jean Tirole (2010), "Individual and Corporate Social Responsibility," *Economica*, 77, 1–19.

Console, Richard P. (2020), "The Most Common Causes of Collision," https://www.natlawreview.com/article/most-common-causes-collision.

Cooper, Russell W., Douglas V. DeJong, Robert Forsythe, and Thomas W. Ross (1990), "Selection Criteria in Coordination Games: Some Experimental Results," *The American Economic Review*, 80, 218–233.

Dai, Rui, Hao Liang, and Lilian Ng (2020), "Socially responsible corporate customers," *Journal of Financial Economics*.

Davis, Gerald F. (2021), "Corporate Purpose Needs Democracy," *Journal of Management Studies*, 58, 902–913.

Dimson, Elroy, Oğuzhan Karakaş, and Xi Li (2015), "Active Ownership," *The Review of Financial Studies*, 28, 3225–3268.

Dinh, Jessica E., Robert G. Lord, William L. Gardner, Jeremy D. Meuser, Robert C. Liden, and Jinyu Hu (2014), "Leadership theory and research in the new millennium: Current theoretical trends and changing perspectives," *The Leadership Quarterly*, 25, 36–62.

Dixit, Avinash (1980), "The Role of Investment in Entry-Deterrence," *The Economic Journal*, 90, 95–106.

Edmans, Alex (2011), "Does the Stock Market Fully Value Intangibles? Employee Satisfaction and Equity Prices," *Journal of Financial Economics*, 101, 621–640.

Fairhurst, Douglas J. and Daniel Greene (2020), "Too Much of a Good Thing? Corporate Social Responsibility and the Takeover Market," SSRN Scholarly Paper ID 3374895, Social Science Research Network, Rochester, NY.

Fershtman, Chaim and Kenneth L. Judd (1987), "Equilibrium Incentives in Oligopoly," *The American Economic Review*, 77, 927–940.

Flammer, Caroline (2015), "Does corporate social responsibility lead to superior financial performance? A regression discontinuity approach," *Management Science*, 61, 2549–2824.

Friedman, Milton (1970), "The Social Responsibility of Business is to Increase Its Profits," *New York Times Magazine*.

Harsanyi, John C. and Reinhard Selten (1988), *A General Theory of Equilibrium Selection in Games*, MIT Press, Cambridge, MA, USA.

Hart, Oliver and Luigi Zingales (2017), "Companies Should Maximize Shareholder Welfare Not Market Value," *Journal of Law, Finance, and Accounting*, 2, 247–274.

Hermalin, Benjamin E. (1998), "Toward an Economic Theory of Leadership: Leading by Example," *The American Economic Review*, 88, 1188–1206.

Hoepner, Andreas G. F., Ioannis Oikonomou, Zacharias Sautner, Laura T. Starks, and Xiaoyan Zhou (2021), "ESG Shareholder Engagement and Downside Risk," SSRN Scholarly Paper ID 2874252, Social Science Research Network, Rochester, NY.

King, D. L., Carl Case, and K. Premo (2010), "Current Mission Statement Emphasis: Be Ethical and Go Global," *Academy of Strategic Management Journal*, 9, 71.

Kreps, David M., Paul Milgrom, John Roberts, and Robert Wilson (1982), "Rational Cooperation in the Finitely Repeated Prisoners' Dilemma," *Journal of Economic Theory*, 27, 245–252.

Loderer, Claudio, Lukas Roth, Urs Waelchli, and Petra Joerg (2010), "Shareholder Value: Principles, Declarations, and Actions," *Financial Management*, 39, 5–32.

Morgan, John and Justin Tumlinson (2019), "Corporate provision of public goods," *Management Science*, 65, 4489–4504.

Pearce, John A. and Fred David (1987), "Corporate Mission Statements: The Bottom Line," *The Academy of Management Executive (1987-1989)*, 1, 109–115.

Phillips, Matt (2021), "Exxon's Board Defeat Signals the Rise of Social-Good Activists," *The New York Times*.

Powers, Edward L. (2012), "Organizational Mission Statement Guidelines Revisited," *International Journal of Management & Information Systems (Online)*, 16, 281–289.

Schelling, Thomas C (1960), *The Strategy of Conflict*, Harvard University Press.

Schiller, Christoph (2018), "Global Supply-Chain Networks and Corporate Social Responsibility," *SSRN Electronic Journal*.

Servaes, H and A Tamayo (2013), "The Impact of Corporate Social Responsibility on Firm Value: The Role of Customer Awareness," *Management Science*, 59, 1045–1061.

Sklivas, Steven D. (1987), "The Strategic Choice of Managerial Incentives," *The RAND Journal of Economics*, 18, 452–458.

Starks, Laura T., Parth Venkat, and Qifei Zhu (2020), "Corporate ESG Profiles and Investor Horizons," *SSRN Electronic Journal*.

Tirole, Jean (2017), *Economics for the common good*, Princeton, NJ: Princeton University Press.

Vickers, John (1985), "Delegation and the Theory of the Firm," *The Economic Journal*, 95, 138–147.

von Stackelberg, Heinrich (2011), *Market Structure and Equilibrium*, Springer-Verlag, Berlin Heidelberg.