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Managerial Compensation and Firm Value in the Presence of Socially Responsible Investors

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Abstract Shareholders with standard monetary preferences will give a manager incentives to increase firm profits, which can be achieved with equity grants. When shareholders are socially responsible, in the sense that they also value corporate social performance, it is not clear which incentives the manager should receive. Yet, in a standard principal–agent model, we show that the optimal contract is surprisingly simple: it consists in giving equity holdings to the manager. This is notably because the stock price will incorporate expected profits as well as the social performance of the firm, to the extent that it is valued by shareholders. Consequently, equity holdings give the manager incentives to jointly maximize the profits and the social performance of the firm according to shareholders' preferences. To facilitate alignment of interests, more socially responsible firms will optimally hire more socially responsible managers. We conclude that neither the shareholder primacy model nor equity-based managerial compensation is necessarily inconsistent with the attainment of social objectives.

Keywords Corporate social performance (CSP) · Corporate social responsibility (CSR) · Executive compensation · Fiduciary duty · Incentive contracts · Principal–agent model · Socially responsible investment (SRI)

JEL Classification D21 · D64 · G34 · K20

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Introduction

It is increasingly common for shareholders to have "social" as well as monetary preferences. A 2014 survey by US Trust cited in the *Financial Times*[1] found that 75 percent of investors under 35 "consider the social and environmental impact" when making financial investments. In the US alone, certified socially responsible assets amount to $2 trillion (Kitzmueller and Shimshack 2012). The presence of socially responsible shareholders has implications for firm governance and incentives alignment within the firm. In this paper, we study the compensation contract offered by socially responsible shareholders to the firm's manager.

In the neo-classical framework, investors have preferences for profits, and the objective of the firm consists in maximizing profits subject to a set of constraints imposed by law and the markets. Corporate decisions are guided by the principle of shareholder value maximization. The agency problem which emanates from the separation between ownership and control can then be solved by giving the manager a stake in the firm's profits—for example in the form of a fraction of the firm's equity—which will encourage the manager to increase profits.

When investors are also socially responsible, their objective function becomes bidimensional: indeed, they now jointly maximize firm profits and corporate social performance (CSP). They may then also want to encourage some corporate actions that increase CSP, even at the expense of profits. Given the evidence that a substantial number of investors and investment funds do have this type of preference (Sparkes and Cowton 2004), it would make

[1] The generational split that threatens to reform finance, *Financial Times* July 5–6, 2014, p. 6.

sense to give firm managers incentives to increase both firm profits and CSP, as emphasized by Baron (2008). However, in practice managerial incentives typically take the form of stocks and stock options (Frydman and Jenter 2010), and the structure of CEO compensation in socially responsible firms is not significantly different than in other similar firms (Frye et al. 2006). This might be considered puzzling: why not also incentivize managers to increase CSP? This paper will provide an answer to this apparent inconsistency: in the presence of socially responsible investors, equity-based compensation will lead a manager to jointly maximize profits and CSP according to investors' preferences.

We use a stylized principal–agent model in which socially responsible shareholders design the contract of a manager who must then determine the allocation of firm resources toward profit maximization and CSP enhancement. Following this managerial decision, the shareholders set the stock price of the firm according to their preferences on a competitive market for the firm's shares. Crucially, the stock price reflects both expected firm profits and CSP: socially responsible shareholders are willing to pay more for shares in a socially responsible firm, ceteris paribus. We show that the provision of managerial incentives is then surprisingly simple, and reflects current practices: it is optimal to give short-term and long-term equity holdings to the manager. As a result, the manager is concerned with the consequences of his allocation of firm resources for the value of the firm's equity. Given that the stock price aggregates the preferences of shareholders on profits and CSP, giving equity-based incentives to a manager ensures that he will jointly maximize profits and CSP according to shareholders' preferences. That is, even though the objective function of shareholders is bidimensional, it is sufficient to give managerial incentives along one dimension only, namely the market value of the firm's equity. Contrary to the neo-classical framework, maximizing the market value of the firm's equity is not equivalent to maximizing profits when shareholders value CSP.

This framework allows to derive a number of related results. First of all, we show that a decrease in social responsibility requires an increase in equity holdings: if managers derive less utility from "doing good," the sensitivity of their pay to their performance must be increased for incentive purposes. In addition, when social preferences are heterogeneous, we show that a firm will hire a manager whose social preferences matches its average shareholder's. Indeed, a congruence on this dimension facilitates the provision of incentives, and any discrepancy will result in inefficiencies. This suggests that firms should screen managers based on their personal preference for social responsibility (see also Besley and Ghatak 2005; Brekke and Nyborg 2008). Overall, our results suggest that socially responsible firms will offer compensation packages similar (although not identical) to other firms,' but that they will hire more socially responsible managers.

The model also shows that more socially responsible firms will tend to have a higher valuation but lower subsequent stock returns, ceteris paribus. This distinction helps reconcile some apparently contradictory empirical findings, as reviewed for example in Margolis et al. (2007). It also emphasizes that more socially responsible firms have a lower cost of equity capital.

These results have important implications for the debate on CSR and managerial incentives. The debate on CSR was largely framed by the view of Friedman (1970) that it would be illegitimate for managers to pursue any objective other than profit maximization, because managers are the agents of shareholders. On the other side, some proponents of CSR argue that firms should not be run exclusively in the interests of shareholders, because in some instances it is desirable to depart from profit maximization (e.g., Kolstad 2007). By contrast with these two perspectives, our model shows that a firm managed in the interests of its socially responsible shareholders will maximize not only its profits but also its CSP. In addition, compensating managers based on the firm's equity value will lead them to devote resources both to profit-enhancing activities and to CSP-enhancing activities. This result contrasts with the view summarized in Tirole (2001) that equity-based compensation "encourage[s] management to devote most of its effort to enhancing profitability and favor this objective when trading off the costs and benefits of alternative decisions." Because of this multitask problem, Tirole (2001) then argues that social responsibility is likely to be best promoted with flat compensation rather than performance-based incentives, in contrast with the results presented in this paper. In case a measure of CSP is available, the literature argues that compensation should be contingent both on profits and on this CSP measure (e.g., Baron 2008), for example via CSP audits contingent on observing high profitability as in Sinclair-Desgagné (1999). By contrast, we show that equity-based compensation can play a useful role in fostering CSP, to the extent that shareholders are socially responsible.

Finally, the paper provides a legal basis for Corporate Social Responsibility (CSR) in the US and the UK,[2] where managers and directors have a fiduciary duty to act in the best interests of shareholders. Indeed, the model emphasizes that shareholders will optimally write contracts that induce the manager to allocate firm resources to CSP,

[2] According to Reinhardt et al. (2008), it is unclear whether CSR is legal in the US and the UK, given the fiduciary duty of managers and directors to shareholders.

which benefits shareholders and is consistent with the maximization of shareholder wealth.

The emerging literature on CSR is reviewed in Kitzmueller and Shimshack (2012). Our contribution to this literature is to study the incentives alignment problem in the presence of socially responsible investors. A closely related paper is Graff Zivin and Small (2005). In their model, shareholders with preferences for consumption and for charitable giving can choose between investing in a socially responsible firm, or making donations directly. With these shareholder preferences, a share in a socially responsible firm is a bundle that delivers both financial and social benefits. Graff Zivin and Small (2005) study when investments in CSP by firms or direct charitable donations are substitutes, but they do not study incentive alignment between managers and shareholders, which is the focus of this paper. Another closely related paper is Baron (2008), who builds a very rich model which relates CSP incentives to the social preferences of the firm's consumers and shareholders. One crucial difference is that managerial compensation can be contingent on profits and CSP in Baron (2008), whereas it can be contingent on the (endogenously determined) stock price in this paper.

The rest of the paper is organized as follows. The next section presents the model. The following two sections present the main results of the paper, and revisit the model under the assumption that preferences for CSP are heterogeneous across shareholders. The last section discusses the results and concludes. The Appendix includes the proofs of the main results and provides additional technical details.

A Model of Corporate Social Responsibility

This section develops a model to study the provision of equity-based incentives to managers when shareholders value CSP. As managerial incentives can depend on the stock price, which is determined by investors, it is important to complement a model of managerial contracting by a model of portfolio choice. We rely on the existing literature to develop a stylized model which combines these two features, and which also takes into account the fact that agents do not only derive utility from wealth, but also have social preferences. We make a number of simplifying assumptions to keep a model that combines all these elements as tractable and simple as possible.

We consider a publicly listed firm run by a manager and initially owned by n shareholders. Thus, we focus on firms for which a stock price is available, and in which there is a separation between ownership and control. At $t = 0$, the manager can exert effort or not: $e \in \{0, 1\}$. A manager who exerts effort incurs a private cost worth $C > 0$ in monetary terms. Without effort ($e = 0$), profits at $t = 2$ are $\tilde{\epsilon}$, where $\tilde{\epsilon}$ is a normally distributed random variable with zero mean and variance σ^2 realized at $t = 2$, and CSP at $t = 2$ is 0. A manager who exerts effort ($e = 1$) "unlocks" the firm's potential, and must then at $t = 0$ choose the allocation $a \in [0, 1]$ of firm resources given that profits at $t = 2$ are $\sqrt{1 - a} + \tilde{\epsilon}$, and CSP at $t = 2$ is $\phi\sqrt{a}$. For the moral hazard problem to be realistic and nontrivial, we assume that neither effort e nor the resource allocation a is contractible. This is a multitasking problem in the spirit of Holmström and Milgrom (1991). As is standard in the literature, "CSR manifests itself in some observable and measurable behavior or output" (Kitzmueller and Shimshack 2012), which we define as CSP. There are decreasing returns to increasing either profits or CSP, so that it is generically socially optimal to allocate resources to both.

The parameter $\phi \geq 0$ captures the differences in firms' technologies and opportunities which are such that CSP is relatively more valuable in some firms and some industries than in others. This captures the notion that the capacity to undertake socially beneficial actions varies across firms and industries, for example because some firms have developed a particular expertise which is relevant for CSP while others have not. The level of ϕ thus determines the "bang (in terms of CSP) for the buck" for investments in CSP. For example, a typical high ϕ firm may be able to substantially reduce its polluting emissions at a very low cost; in this case, a dollar invested in CSP will generate of lot of "social good," i.e., ϕ is high. A typical medium ϕ firm is able to improve its CSP by undertaking activities unrelated to its business, such as making donations. In a typical low ϕ firm, resources allocated to CSP are often wasted, for example because they are used inefficiently or because they tend to be diverted (think about funds allocated to support local green entrepreneurship which are actually used to fund the ailing high-tech venture of an employee's relative, say). With $\phi = 0$ (respectively $\phi \to \infty$), it is worthless to allocate any resource to CSP (resp. to profit maximization).

The important assumption that managerial "effort" is privately costly captures the divergent interests between the manager and shareholders. As in standard principal–agent models, it justifies the use of explicit monetary incentives (as will be clear in the next section, with $C \to 0$ the contract would simply serve a risk-sharing purpose). The assumption that profits are normally distributed helps keep the portfolio choice problem tractable, but is otherwise not crucial.

At $t = 1$, shareholders observe a and ϕ, and the stock price p is established on a market for the firm shares. (We show in the "Unobservable actions" section in the

Appendix that the main results of the paper are unchanged if instead shareholders observe noisy signals which are informative about expected profits and CSP but do not reveal the manager's action.) That shareholders observe both a and ϕ (or signals about firm profits and firm CSP) is crucial, because otherwise the stock price would not reflect either the financial or the social performance of the firm. At $t = 1$, each shareholder must then (re)allocate his wealth ω to a portfolio that includes z shares in the firm and an investment of $\omega - zp$ at the risk-free rate r_f—which is for simplicity normalized to zero: $r_f = 0$.[3] Given shareholders' optimal demands for the firm stock at $t = 1$, the stock price is determined by the standard market clearing constraint. To simplify and alleviate calculations, we normalize the number of shares outstanding to 1, so that the equity holdings of a shareholder may also be viewed as the fraction of the firm that he owns, and firm value at $t = 1$ is simply equal to the stock price.

The agents (the manager and the shareholders) are risk-averse expected utility maximizers, with preferences defined over money and CSP as in Graff Zivin and Small (2005). This important assumption is consistent with the results of Andreoni and Miller (2002), who demonstrate that "altruism is rational," in the sense that observed altruistic behavior can be generated by a standard utility function. The risk aversion assumption is essential for the portfolio choice problem and for the derivation of the stock price. For tractability, we assume that the agents have preferences with Constant Absolute Risk Aversion (CARA), with an absolute risk aversion of ρ, so that their utility writes as $U(X) = -\exp\{-\rho X\}$ (the assumption of CARA utility combined with normally distributed profits allows to derive a simple expression for the stock price). Crucially, the argument X of the utility function is a function of financial and social returns: for an agent who from $t = 1$ to $t = 2$ owns z shares in the firm with resource allocation a in which the manager exerts effort, the argument $X(z, a)$ is the following function of $t = 2$ profits and CSP:

$$X(z,a) = z\left(\sqrt{1-a} + \tilde{\epsilon} + u_s\phi\sqrt{a}\right) + W(z) \tag{1}$$

where $W(z)$ is the non-firm wealth of the agent (as a function of z), for example the investment at the risk-free rate minus the payment to the manager for shareholders, or the fixed wage minus the effort cost for the manager. It is important to note that u_s is the weight that agents place on CSP relative to profits. This parameter essentially captures the intensity of the preference for CSP. With $u_s = 0$, agents only care about "money." In this paper, it is critical that shareholders value both the financial performance and the social performance of the firm. The empirical evidence suggests that shareholders are "socially responsible" and value CSP, at least to some extent (e.g., Sparkes and Cowton 2004), which is captured by assuming $u_s > 0$. This is also in line with the view of Reinhardt et al. (2008) that "some shareholders may gain utility from the knowledge that their profits have been invested in socially responsible projects." (we allow for heterogeneous preferences in that regard in a subsequent section).

The actions that contribute to CSP in this model are activities and practices that contribute to social goods at the expense of firm profits, as in Graff Zivin and Small (2005). For example, Tirole (2001) mentions that the firm could refrain from "bribing officials in less developed countries" or from "polluting when pollution taxes or permits are not yet put in place." In Baron (2008), "the expenditures could represent redistribution through corporate philanthropy, human rights policies, or paying a living wage." Other examples include transferring technologies and skills to a charity, or educating people in the local community. There is anecdotal evidence that some firms allocate resources for these purposes rather than exclusively to increase profits. It is important to note that, in this model, CSP represents actions that, while socially desirable, reduce firm profits. These actions have been referred to as "altruistic CSR" by Lyon and Maxwell (2008). Thus, we consider only the subset of CSR policies for which there is a nontrivial tradeoff between improving the firm's social performance and its financial performance (actions that improve both the firm's social and financial performance, such as "strategic CSR," should be undertaken in any case). This paper will study this tradeoff, and in particular how it affects the stock price, resource allocation, and managerial incentives.

There are n ex-ante identical shareholders, each of whom owns the same fraction of the firm at $t = 0$ (it follows that shareholders have the same preferences at this stage). At $t = 0$, shareholders optimally design the manager's contract, which must be such that it is accepted by the manager and that it induces effort. The contract will have consequences for the resource allocation chosen by the manager, which shareholders also take into consideration. The manager has a reservation utility of $\bar{U}$, which means that he will not accept the contract offered by shareholders if it is associated with a level of expected utility less than $\bar{U}$. For the problem to be nontrivial, we assume that the cost of effort C is sufficiently small for effort to be optimal, which notably necessitates $C < \sqrt{1-a} + u_s\phi\sqrt{a}$.

[3] Considering only these two types of investments is standard in the literature, and it is sufficient to establish the firm's stock price. Considering more than one firm's stock would impose that we consider the strategic interactions between the CSR policies of different firms, which is an interesting question and a natural extension of the model, but is beyond the scope of this paper.

We begin the analysis by studying the outcome in the absence of agency problems, i.e., with no separation between ownership and control, by assuming for simplicity that there is only one shareholder ($n = 1$) who also manages the firm (this analysis and in particular Claim 1 remain valid if we consider the same problem with n shareholders—for a formal proof we refer to the "First-best with heterogeneous preferences" section in the Appendix with $u_s^i = u_s$ for any shareholder i). Given that effort is optimal, the allocation of firm resources that maximizes the shareholder's expected utility is the value of a that maximizes

$$\mathbb{E}\left[U\left(\sqrt{1-a}+\tilde{\epsilon}+u_s\phi\sqrt{a}-C\right).\right] \tag{2}$$

In this setting, this is equivalent to maximizing the certainty equivalent of $X(z, a)$, which writes as $\sqrt{1-a}+u_s\phi\sqrt{a}-\frac{\rho}{2}\sigma^2-C$.[4] The resource allocation that maximizes this criterion is the allocation in the absence of agency problems, i.e., the "first-best" allocation, denoted by a^{FB}. Consequently, we have:

Claim 1 *The first-best optimal resource allocation is*

$$a^{\mathrm{FB}} = \frac{u_s^2\phi^2}{1+u_s^2\phi^2} \tag{3}$$

The proof immediately follows from the maximization of the shareholder's certainty equivalent with respect to a (as the certainty equivalent is concave in a, the optimum is given by the first-order condition). In particular, this result implies that it is optimal to devote more resources to CSP than to profit maximization if and only if $u_s\phi > 1$. This first-best resource allocation a^{FB} will be our benchmark in the subsequent analysis.

In an economy populated by n agents, say, this first-best optimal resource allocation a^{FB} is implicitly based on the preferences of all agents in the model: without an agency problem, the equilibrium portfolio choices are such that any agent in the economy holds the same fraction of the firm (see the "Portfolio choice" section in the Appendix), which implies that it is sufficient to consider the preferences of the firm's shareholders in an analysis of the first-best (with $C \to 0$, which can be interpreted as the limit case in which there is no agency problem, we show in (11) below that the manager has the same equity holdings as any other shareholder). With incomplete markets and imperfect risk sharing, an analysis of the first-best would also need to consider the preferences of agents in the economy who are not shareholders of the firm.

Corporate Social Performance in Equilibrium

In this section, we analyze the agency relationship between the shareholders and the manager. We derive the optimal managerial contract designed by shareholders at $t = 0$, the resource allocation optimally chosen by the manager, and the stock price established on the market for the firm's stocks at $t = 1$.

Stock Price

We solve the model by backward induction, starting with the portfolio choice problem at $t = 1$. Shareholders choose their portfolio by allocating their wealth to the firm stock and to a risk-free investment to maximize their expected utility. As shown in the Appendix (see the "Portfolio choice" section for more details), the resulting stock price p established at $t = 1$ as a function of the long-term equity holdings z_m^{LT} of the manager and of the resource allocation a is

$$p = \sqrt{1-a}+u_s\phi\sqrt{a}-\frac{1-z_m^{\mathrm{LT}}}{n}\rho\sigma^2 \tag{4}$$

The stock price is increasing in expected profits, in the utility associated with owning shares in a socially responsible firm, and decreasing in the variance of profits.

Proposition 1 *The resource allocation $a^\star$ that maximizes the stock price corresponds to the first-best optimal allocation: $a^\star = a^{\mathrm{FB}}$.*

The proof of this important result is in the Appendix. The resource allocation that maximizes the expected utility of shareholders, which is by definition the first-best resource allocation a^{FB}, is also the one that maximizes the stock price. This is because the stock price reflects the valuation of the firm by shareholders, and this valuation is maximized by taking actions preferred by shareholders. In this model, socially responsible shareholders derive utility from CSP, and will therefore be willing to pay more to hold shares in a socially responsible firm, all else equal.

Managerial Incentives

We now derive the managerial contract, as designed optimally by the shareholders at $t = 0$. We consider contracts which consist of a fixed wage w, z_m^{ST} shares in the firm that

[4] By definition, for an agent with utility function u, the certainty equivalent CE of random wealth $\tilde{w}$ writes as $\mathbb{E}[u(\tilde{w})] \equiv u(CE)$. Given that u is increasing, maximizing the expected utility of wealth is equivalent to maximizing the certainty equivalent. In addition, with CARA utility with coefficient of absolute risk aversion ρ and normally distributed wealth with variance σ^2, the certainty equivalent of $\tilde{w}$ is equal to $\mathbb{E}[\tilde{w}]-\frac{\rho}{2}\sigma^2$ (e.g., Gollier 2001 p. 57, or Grossman and Stiglitz 1980).

the manager must sell at the $t = 1$ stock price, and z_m^{LT} shares that the manager must hold until $t = 2$. We refer to these two latter components as "short-term equity holdings" and "long-term equity holdings." This is a major difference with respect to Baron (2008), who assumes that managerial compensation can only depend on profits and social expenditures. Thus, the contract ξ in this model can be described by $\{w, z_m^{\mathrm{ST}}, z_m^{\mathrm{LT}}\}$. Denoting by $Y(\xi, a)$ the argument in the manager's utility function, a manager who exerts effort $(e = 1)$ chooses the resource allocation a to maximize

$$\mathbb{E}[U(Y(\xi,a))|e=1] = \mathbb{E}\Big[U\Big(w + z_m^{\mathrm{ST}} p + z_m^{\mathrm{LT}}\left(\sqrt{1-a} + \tilde{\epsilon} + u_s\phi\sqrt{a}\right) - C\Big)\Big] \tag{5}$$

At the time of contracting ($t = 0$), there are n shareholders, each of whom owns the same fraction of the firm. Any shareholder will accordingly bear a fraction 1 / n of the cost of managerial compensation, which consists in the fixed wage w and the liquidation value $z_m^{\mathrm{ST}} p$ of short-term equity holdings at $t = 1$. In addition, each shareholder will own the same fraction $\frac{1-z_m^{\mathrm{LT}}}{n}$ of the firm from $t = 1$ to $t = 2$ (see (20)), given that the manager will own a fraction z_m^{LT} of the shares. Shareholders choose the managerial contract to maximize their expected utility:

$$\max_{w, z_m^{\mathrm{ST}}, z_m^{\mathrm{LT}}, a_m} \mathbb{E}\left[U\left(\frac{1-z_m^{\mathrm{LT}}}{n}\left(\sqrt{1-a_m} + \tilde{\epsilon} + u_s\phi\sqrt{a_m}\right) - \frac{1}{n}\left(w + z_m^{\mathrm{ST}} p\right)\right)\right], \tag{6}$$

subject to the following constraints:

$$\mathbb{E}[U(Y(\xi,a_m))|e=1] \geq \mathbb{E}[U(Y(\xi,a))|e=0] \tag{7}$$

$$\mathbb{E}[U(Y(\xi,a_m))|e=1] \geq \mathbb{E}[U(Y(\xi,a))|e=1] \qquad \forall a \in [0,1] \tag{8}$$

$$\mathbb{E}[U(Y(\xi,a_m))|e=1] \geq \bar{U}\,. \tag{9}$$

The following Proposition describes the equilibrium contract and the associated resource allocation:

Proposition 2 *In equilibrium, the manager receives the following short-term and long-term equity holdings:*

$$z_m^{\mathrm{ST}} = \max\left\{\frac{C}{\sqrt{1-a^{\mathrm{FB}}} + u_s\phi\sqrt{a^{\mathrm{FB}}}} - \frac{1}{1+n}, 0\right\} \quad \text{and} \quad z_m^{\mathrm{LT}} = \frac{1}{1+n} \tag{10}$$

In addition, the fixed wage w *is set so that the expected utility of the manager is equal to his reservation utility. For any set of parameter values, the resource allocation optimally chosen by the manager is the first-best allocation* a$^{\mathrm{FB}}$.

In this setting, short-term and long-term equity holdings are perfect substitutes in terms of incentives. This is because maximizing the stock price is achieved by choosing the resource allocation preferred by shareholders, while a manager with long-term equity holdings only would choose the resource allocation that he prefers as a shareholder (given that he is also socially responsible). Since shareholders and the manager have the same social preferences u_s (an assumption which is relaxed in the next section), these two allocations of resources are identical and equal to the first-best resource allocation a^{FB}.

However, short-term and long-term equity holdings have different implications for risk sharing. At the optimum, long-term equity holdings are set at the level which ensures first-best optimal risk sharing. As the manager and shareholders are risk averse with CARA utility, it is well known that it is optimal to allocate the same fraction of the risk $\tilde{\epsilon}$ to each agent, even absent any moral hazard problem (e.g., Demange and Laroque 2006). In particular, with $z_m^{\mathrm{ST}} = 0$ (which is the case with $C \to 0$), we have $z_m^{\mathrm{LT}} = \frac{1}{1+n}$ according to Proposition 2. Using (20), each shareholder then owns the following fraction of the firm:

$$z = \frac{1 - z_m^{\mathrm{LT}}}{n} = \frac{1 - \frac{1}{1+n}}{n} = \frac{1}{1+n} \tag{11}$$

In this case, the manager and each shareholder hold the same fraction of the firm. By contrast, Baron (2008) assumes universal risk neutrality, so the managerial contract has no risk-sharing purpose in his model.

In addition, when the cost of effort C is sufficiently high, short-term equity holdings adjust upward as needed to provide enough effort incentives (the equilibrium level of z_m^{ST} is increasing in the cost of effort C). Given that the stock price is set prior to the realization of uncertainty, exposing the manager to the short-term stock price does not expose him to any risk. Finally, the level of pay adjusts so that the manager accepts the contract (the equilibrium fixed wage is increasing in the manager's reservation utility $\bar{U}$). The fixed wage w is earned in any circumstances, so that it does not have any effect on incentives, but it adjusts so that the manager is at his reservation level of utility.

The degree of social responsibility u_s affects not only the resource allocation, but also the short-term equity holdings of the manager:

Claim 2 *The short-term equity holdings of the manager* $\left(z_m^{\mathrm{ST}}\right)$ *are decreasing in the preference for CSP, as measured by* u_s.

This result is due to the combination of two effects. First, the direct effect of a higher social responsibility u_s is a greater intrinsic motivation of the manager to exert effort, for a given resource allocation. This in turn reduces the need for explicit incentives. Second, a higher u_s also increases the equilibrium resource allocation a, which results in a higher firm value conditional on the manager exerting effort (relative to the case with a lower u_s). It is then possible to preserve effort incentives while reducing the sensitivity of managerial compensation to firm value, because there is now a larger wedge between firm value when the manager exerts effort and firm value when he does not. Thus, the model predicts that short-term equity-based incentives will be lower when social responsibility is stronger.

The "standard" principal–agent model in which shareholders must simply induce a manager to maximize profits corresponds to the special case of $\phi = 0$:

Corollary 1 *For $\phi = 0$, the efficient resource allocation is $a^{\mathrm{FB}} = 0$, and the managerial equity holdings are*

$$z_m^{\mathrm{ST}} = \max\left\{C - \frac{1}{1+n}, 0\right\} \qquad \text{and} \qquad z_m^{\mathrm{LT}} = \frac{1}{1+n} \tag{12}$$

This result directly follows from Claim 1 and from Proposition 2 with $\phi = 0$.

The contract could in principle also depend on firm profits and on CSP. However, the contract described in Proposition 2 elicits the first-best resource allocation, does not give any rent to the manager, and is associated with first-best optimal risk sharing. That is, there is no need to use any measure besides the stock price for incentives provision. Thus, even if CSP were contractible, making managerial incentives directly contingent on CSP (in addition to other variables) would not improve efficiency. Furthermore, in practice, making incentives contingent upon CSP is difficult and could result in distortions, as discussed further in Sect. 4.

Alternative incentive schemes could be feasible in theory, but none would improve efficiency in a strict sense, and most would suffer from a number of flaws. For example, the manager's effort could be monitored by a designated monitor, but Tirole (2001) notes that these schemes are rarely observed in practice. He attributes this to the fact that it would often be in the interests of the manager and the monitor to collude. By contrast, "A market has more integrity. (...) with a market (cum insider trading rules) it becomes much harder for the entrepreneur to capture the passive monitoring process." (Tirole 2001). The manager and the shareholders could also report the manager's actions to a court of law, as discussed in Laffont and Martimort (2001). However, this mechanism faces problems of equilibrium selection (Laffont and Martimort 2001, p.251), and it may be costly to implement due to the existence of legal costs or communication costs. It may even be infeasible in practice due to the impossibility to measure effort on a clear scale, or because of restrictions on the ability to impose punishments in case of deviation—either due to limited liability or to imperfections in the judicial system (Laffont and Martimort 2001, Chap. 9).

Valuation and Returns

The model predicts that firms with different capacities for CSP, as captured by the parameter ϕ in our model, will systematically differ in terms of valuation and stock returns (where the stock return from $t = 1$ to $t = 2$ is the financial return from buying the stock at $t = 1$ and receiving the firm profits at $t = 2$). Indeed, assuming that parameters are such that the stock price and the expected stock return are positive,[5] we have:

Proposition 3 *In equilibrium, firm valuation at $t = 1$ is increasing in the firm's capacity for CSP, as measured by ϕ, and the expected stock return from $t = 1$ to $t = 2$ is decreasing in ϕ.*

Note that firms with a greater capacity ϕ for CSP also invest more in CSP: a^{FB} is increasing in ϕ (see Claim 1), so that firms with a higher ϕ are also more "socially responsible."

The first part of Proposition 3 is less obvious than it seems: all else equal, it is clear from Eq. (4) that a higher capacity for CSP (ϕ) translates into a higher stock price. However, Proposition 3 states that firm valuation is increasing in the firm's capacity for CSP (ϕ) *in equilibrium*, once the effect of ϕ on the resource allocation a is taken into consideration. The second part of Proposition 3 is also less obvious than it seems. Indeed, even though allocating more resources to CSP decreases firm profits at $t = 2$, the stock price at $t = 1$ is determined endogenously by shareholders who already take this into account. Instead, stock returns from $t = 1$ to $t = 2$ are decreasing in the firm's capacity for CSP (ϕ) because shareholders derive utility from CSP, so that they drive the stock price over and

[5] With a negative stock price or a negative expected stock return, the net effect of ϕ on the expected stock return would be ambiguous and even questionable (note that we do not impose any restriction on the *realized* stock return, which can be negative). First, it is not clear how to interpret stock returns, or changes in stock returns, when stock prices are negative. Second, a higher stock price due to a higher ϕ reduces the absolute value of the expected stock return, but if the expected stock return is negative, then this effect actually *increases* the expected stock return—hence the potentially ambiguous net effect. In the model, the expected stock return will be positive if $u_s\phi$ is not too large, i.e., if the preference for CSP does not outweigh the risk premium. This is the empirically relevant case, as studies do *not* report negative average stock returns for socially responsible firms (e.g., Galema et al. 2008).

above what they would be willing to pay for expected firm profits, hence the lower expected (future) return. In other words, socially responsible investors value a socially responsible firm more, and are willing to sacrifice monetary returns to enhance CSP.

This result has two important implications. First of all, Proposition 3 emphasizes that devoting some firm resources to CSP rather than profit maximization can increase the market value of the firm's equity. Indeed, socially conscious shareholders are willing to invest more money into socially responsible firms per unit of expected profit generated, or equivalently the expected return on equity is lower for firms that invest more in CSP, as established in Proposition 3. This in turn gives these firms an advantage, namely a lower cost of equity capital and a higher equity value, which notably enhances their ability to raise external funding via equity issues. This advantage could compensate for the greater profitability of other firms (with a lower ϕ). An important implication is that the lower profitability of firms that invest more in CSP does not necessarily threaten their survival.

Proposition 3 also shows that the relation between CSP and financial performance will be different if the latter is measured with valuation metrics or with return metrics. This result is all the more important that recent research on the relation between CSP and financial performance often does not distinguish between stock returns and firm valuation—for example, the review of Margolis et al. (2007) lumps these two types of financial performance together. Although most studies establish correlations rather than causation, the extant empirical evidence is mostly consistent with these predictions of the model. On the one hand, the event studies referenced in Kitzmueller and Shimshack (2012) find a positive stock price reaction to "positive social news," and the studies referenced in Margolis et al. (2007) generally find that CSP and firm value are positively related. On the other hand, Margolis et al. (2007) acknowledge that this effect becomes weaker once the effect of CSP on subsequent financial performance is examined, and Brammer et al. (2006) find that CSP is negatively related to subsequent stock returns. While these findings may at first glance seem paradoxical or even contradictory, our framework rationalizes them and emphasizes the importance of distinguishing between the valuation and stock return effects of CSP. This should facilitate studies of the relation between CSP and corporate financial performance, thereby responding to Ruf et al. (2001) and van Beurden and Gössling (2008), who argue that inconsistencies across empirical studies may be due to a lack of theoretical foundations.

Finally, we argue that the results in Proposition 3 continue to hold in a model with several investment periods. In a multiperiod model in which consecutive generations of investors are socially responsible in every period, the stock price will be high not only when investors purchase the stock, but also when they sell it afterwards. It is then unclear whether the expected (monetary) return of more socially responsible firms (with a higher ϕ) is still lower. To address this concern, in the "Stock returns over time" section of the Appendix, we sketch a simple model with several periods and overlapping generations of socially responsible investors, and we show that Proposition 3 still holds. The intuition is that, for markets to clear at the beginning of every period, the stock of a more socially responsible firm must have a lower expected (monetary) return, otherwise it would be in excess demand. This principle continues to hold if the stock has a resale value which is increasing in ϕ.

Heterogeneous Preferences

We now extend the model by considering heterogeneous preferences for CSP across the population. Andreoni and Miller (2002) find that a quarter of subjects in their experiments are "selfish money-maximizers," while others display varying degrees of altruism. Thus, social preferences are not uniform in the population. In this section, we study the consequences of this heterogeneity for contracting, the matching between managers and firms, the stock market equilibrium, and the efficient resource allocation, which notably enables us to establish the robustness of the main results of the previous section.

The preference for CSP of shareholder i (respectively manager j) is denoted by u_s^i (resp. u_s^j)—instead of u_s for every agent in the baseline model. We assume that the population of potential managers is sufficiently diverse that shareholders can hire a manager of any type, i.e., they can choose the level of u_s^j (in de Bettignies and Robinson 2013, the firm can also choose the level of social responsibility of its manager). To keep the model tractable and simple, we assume that managers only differ on this dimension. Thus, this extension of the model enables us to address a new issue, namely to determine the type of manager that each type of firm will attract.

We consider the case where the shareholder structure does not change over time, by assuming that the shareholder structure—considering the set of shares held by shareholders—at $t = 0$ is the same as at $t = 1$ (we would otherwise need to consider the implications of shareholders having different investment horizons, which would considerably complexify the model and is not the focus of the paper).[6] Note that due to optimal risk sharing across risk-

[6] Specifically, the shareholders who are least socially conscious would liquidate part of their stake at $t = 1$, so that they would be ex-ante more concerned about the $t = 1$ stock price (i.e., they would be more "short-termist") than other shareholders who would optimally retain or even increase their stake in the firm at $t = 1$. This would lead to potentially interesting implications related to the divergence of investment horizons across shareholders, but it would also

averse shareholders, a firm will typically be owned by several shareholders. At $t = 0$, the shareholders design the compensation contract to maximize their collective surplus. Specifically, we use the criterion proposed in Grossman and Hart (1979), who show that when side-payments between shareholders are allowed, "the firm's objective function is a weighted sum of shareholders' private valuations of the firm's future production stream." This assumption is natural if a compensation contract is to satisfy the Pareto criterion. It also has the advantage of approximating each shareholder group's bargaining power.

At $t = 1$, the stock price $\bar{p}$ as a function of the resource allocation a, of the contract $\xi \equiv \{\bar{w}, \bar{z}_m^{ST}, \bar{z}_m^{LT}\}$, and of the set $\{u_s^i\}$ of shareholder preferences (cf. the "Portfolio choice with heterogeneous preferences" section in the Appendix) is

$$\bar{p} = \sqrt{1-a} + \frac{\sum_{i=1}^n u_s^i}{n}\phi\sqrt{a} - \frac{1-\bar{z}_m^{LT}}{n}\rho\sigma^2 \tag{13}$$

The stock price aggregates the (heterogeneous) preferences of shareholders across the profits and CSP dimensions. As in the baseline model, the resource allocation $\bar{a}^\star$ that maximizes the stock price is the same as the first-best allocation: $\bar{a}^\star = \bar{a}^{FB}$ (technical details are in the "First-best with heterogeneous preferences" section in the Appendix). In what follows, we consider two cases.

First, suppose that the firm hires a manager j such that $u_s^j = \frac{1}{n}\sum_{i=1}^n u_s^i$, i.e., the preference for CSP of the manager is the same as the average shareholder preference for CSP. Then the optimal contract is similar to the one described in Proposition 2—the only difference is that the preference for CSP u_s is "replaced" by the average shareholder preference for CSP, $\frac{1}{n}\sum_{i=1}^n u_s^i$:

Proposition 4 *A manager with same preference for CSP as the average shareholder receives the following short-term and long-term equity holdings:*

$$\bar{z}_m^{ST} = \max\left\{\frac{C}{\sqrt{1-\bar{a}^{FB}} + \frac{\sum_{i=1}^n u_s^i}{n}\phi\sqrt{\bar{a}^{FB}}} - \frac{1}{1+n}, 0\right\}$$
$$\text{and} \qquad \bar{z}_m^{LT} = \frac{1}{1+n} \tag{14}$$

In addition, the fixed wage $\bar{w}$ is set so that the expected utility of the manager is equal to his reservation utility. For any set of parameter values, the resource allocation optimally chosen by the manager is the first-best allocation $\bar{a}^{FB}$.

In this case, as in the previous section, risk sharing is socially optimal, and the manager is at his reservation level of utility (i.e., he does not derive any rent). That is, hiring a manager with the same preference for CSP as the average shareholder allows to obtain the first-best optimal resource allocation, to achieve socially optimal risk sharing, and to maintain the manager at his reservation level of utility (cf. Proposition 4). On the contrary, if the firm does not hire a manager j whose preference for CSP matches the average shareholder's, then inefficiencies are unavoidable. This leads us to this new result:

Proposition 5 *It is optimal for a firm to hire a manager with the same preference for CSP u_s^j as the average shareholder's: $u_s^j = \frac{1}{n}\sum_{i=1}^n u_s^i$.*

Thus, the model predicts assortative matching along the preference for CSP dimension between shareholders and managers: shareholders will if possible hire managers whose preference for CSP corresponds to their own average preference. For example, firms in which shareholders only care about financial returns will hire a purely self-interested manager, whereas firms in which shareholders are extremely (respectively moderately) socially responsible will hire an extremely (resp. moderately) socially responsible manager. This matching may be facilitated by the fact that job seekers prefer to work for organizations with "values similar to their own," as indicated by the survey-based evidence reported in Kitzmueller and Shimshack (2012).

This result differs from previous justifications for matching intrinsically motivated agents with similar firms. In Brekke and Nyborg (2008), firms practice CSR to screen intrinsically motivated agents, which then allows them to offer less explicit incentives. In Besley and Ghatak (2005), extrinsic incentives and intrinsic motivation are substitutes, so that matching socially conscious agents and principals allows to reduce bonus payments. In our model, if the firm hires a manager whose social preferences differ from those of shareholders, then either there is no risk sharing between the manager and the shareholders (if $\bar{z}_m^{LT} = 0$), or the manager chooses an allocation of firm resources that differs from the first-best allocation.

The determination of the shareholder structure is not the focus of this paper, but the model nevertheless gives interesting insights. Indeed, the ownership of a given shareholder is increasing in the difference between the preference for CSP of this shareholder and the preference for CSP of the average shareholder, and it is increasing in the CSP of the firm if this difference is positive (cf. equation (68)). In addition, we established that a firm

Footnote 6 continued
considerably complexify the model (indeed, shareholders would have heterogeneous preferences not only on the CSP dimension, but also on the investment horizon dimension), and it is not the focus of this paper. Furthermore, it would be questionable to assume an ex-ante ($t == 0$) shareholder structure which is not ex-post ($t = 1$) optimal.

whose shareholders have a strong preference for CSP will invest relatively more in CSP, in the sense that $\bar{a}^{FB}$ is higher. That is, the ownership structure of a firm not only affects but is also affected by the firm's CSR policy.

Discussion and Conclusion

The main message of the paper is that, in the presence of socially responsible investors, the market mechanism and equity-based compensation are not necessarily inconsistent with social objectives, and can even be instrumental in driving the firm toward these objectives. This result, however, relies on some crucial assumptions. In particular, it is important that shareholders are socially responsible, in the sense that they derive additional utility from owning shares in a socially responsible firm. This in turn implies that they are willing to pay more to own shares in a socially responsible firm, ceteris paribus. Should shareholders not be socially responsible, or should their preferences on this dimension not translate into a higher willingness to pay, equity-based compensation would then not fully play its role. More generally, the level of the parameter u_s, which represents the sensitivity of shareholders' certainty equivalent utility to CSP, must be sufficiently high for the stock price to adequately reflect CSP. Existing empirical studies suggest that u_s is positive, but it is still unclear to what extent shareholders are willing to sacrifice financial returns for social returns.

In that regard, it is important to underline that we defined CSP as the extent to which the firm sacrifices profits in the social interest. This perspective on CSP is in line with the definition of CSR in McWilliams (2000): "Actions of firms that contribute to social welfare, beyond what is required for profit maximization, are classified as Corporate Social Responsibility (CSR)." Likewise, McWilliams and Siegel (2001) characterize corporate social responsibility as "actions that appear to further some social good, beyond the interests of the firm and that which is required by law." Our approach could arguably be categorized as an "integrative theory" of CSR according to the typology of Garriga and Melé (2004), although in this case the corporation integrates the (social) preferences of its shareholders.

The analysis developed in this paper challenges the view that a firm can either benefit shareholders by maximizing profits or deliberately not act in the best interests of its shareholders. For example, according to Kitzmueller and Shimshack (2012) "Within this narrow neoclassical firm paradigm, CSR expenditures could only be a manifestation of moral hazard towards shareholders." Likewise, Margolis et al. (2007) assert that the firm can either maximize shareholder wealth or pursue social objectives. By contrast, with socially responsible investors, we have shown that the market value of a firm is (up to a point) increasing in the amount of resources invested to improve its CSP rather than its profits. This is because the market value of a company measures not only its ability to generate cash flows (i.e., its financial performance) but also its social performance, so that the firm can benefit shareholders by jointly maximizing profits and CSP. This distinction is important, especially regarding the legal basis for allocating firm resources to CSP, which is at best unclear in the US and UK according to Reinhardt et al. (2008), where directors and managers have a fiduciary duty to shareholders (in other countries such as France, management and directors must also take into consideration the "social interest," as specified for example in Rapport Viénot (1995)). In addition, with socially responsible investors, we have shown in Claim 1 that a firm managed in the interests of its shareholders will invest some resources to improve its CSP rather than its profits. This establishes that devoting resources to CSP can still be consistent with the fiduciary duty of managers and directors if shareholders are socially responsible (see Reinhardt et al. (2008) for a discussion of the legality of CSR in different countries).

The main result that equity holdings give the manager incentives to jointly maximize firm profits and CSP according to shareholders' preferences is especially important in light of the fact that providing specific CSP incentives is notoriously difficult. This is both because of measurement and aggregation problems. While it is straightforward to measure firm profits, it is often harder to measure firm CSP, even on only one dimension. Firm spending on socially responsible activities could be measured in some instances, but measuring inputs rather than outputs may not fully solve the moral hazard problem. In addition, while aggregating monetary sums is simple, it is more arduous to aggregate measures of CSP across different dimensions. As is already well known from the agency literature, providing incentives based on an imperfect measure of performance may have undesirable side effects, notably because it might encourage agents to game the system or to manipulate this performance measure. For example, rewarding time spent at the office rather than achievements could encourage a manager to spend a lot of unproductive time at the office; likewise, rewarding the money spent on CSP rather than actual CSP could encourage the manager to simply give money to badly managed charities rather than carefully study the opportunities available to the firm.

The purpose of this paper was to study the provision of managerial incentives when a firm can invest to enhance its financial performance (profits) and its social performance

(CSP), and when shareholders value both aspects of the firm's performance. The analysis relied on a number of critical assumptions, which we now discuss. First, there is a separation of ownership and control: aligning interests between the owner(s) and the manager of a firm would be irrelevant if the owner of the firm were also its manager. Second, to have a meaningful agency problem, the manager must exert "costly effort," as already discussed in Sect. 1 of the paper. Third, the manager must decide the allocation of firm resources toward the improvement of its financial or social performance, and this resource allocation is observable but uncontractible. The uncontractability of actions reflects their complex nature, and the ability of agents to game attempts at measuring and rewarding actions or inputs rather than outcomes or outputs, as already discussed in the previous paragraph. That actions are uncontractible is thus a common assumption in the moral hazard literature. That either the resource allocation or informative signals about the firm's profits and CSP (cf. the "Unobservable actions" section in the Appendix) are observable is crucial: if neither were observable, then the firm's CSP would not be reflected in the stock price. In practice, it seems likely that investors receive some information about the firm's CSP and profits, i.e., they receive signals about these two dimensions of firm performance. Fourth, the assumption that shareholders are risk averse is realistic and important for portfolio choice and the resulting stock price. (Risk-neutral shareholders would buy or sell infinite numbers of shares as long as the stock price differs from their valuation of the stock, which would be a problem when shareholders have heterogeneous preferences for CSP.) This said, the level of shareholder risk aversion is not restricted in the model, and it could be arbitrarily low. Fifth, there must be a market for firm shares on which the stock price is established, i.e., the firm must be publicly listed. The use of a stock market-based mechanism for incentive provision is obviously impossible if firm shares are not traded and valued on a stock market. Sixth, shareholders must value the social performance of the firm. This assumption relies on some aforementioned empirical evidence. As already noted, this is crucial for the stock price to reflect firm profits and firm CSP, which is in turn necessary for equity-based incentives to encourage the manager to improve both the financial and the social performance of the firm.

In addition to the crucial assumptions enumerated in the preceding paragraph, the analysis in this paper also relies on a number of simplifying assumptions made for tractability. In this paragraph, we discuss the results' robustness to different assumptions. First, the effort by the firm's manager is binary. This allows us to consider only one incentive constraint in the analysis, and to focus on the allocation of firm resources to profit maximization and CSP rather than on the level of managerial "effort." This also means that the level of effort to be induced by the manager is fixed (at $e = 1$), i.e., it does not depend on other parameters. As argued by Edmans et al. (2009), if the benefits of effort are multiplicative in firm size, then the highest level of effort will be optimal for sufficiently large firms (this is the "maximum effort principle"), i.e., the level of effort to be implemented is fixed, as is the case in our model. In future research, it would be interesting to study the optimal level of managerial effort that the optimal contract should induce, and in particular the interaction between the preference for CSP and the optimal level of effort—this would be especially relevant for smaller firms. Second, by considering normally distributed firm profits, we do not study the impact of the asymmetry of the distribution or the fatness of its tails on the optimal contract. In our model, the shape of the distribution of firm profits can potentially affect the level of the stock price (for example, prudent investors would be willing to pay more to hold a stock with a positive skewness), and the optimal risk-sharing rule (i.e., the allocation of long-term equity holdings across agents). A change in the level of the stock price would affect the manager's fixed wage, which does not play a crucial role in the analysis. Moreover, with CARA utility, the optimal risk-sharing rule is for each agent to bear the same fraction of the risk, independently of the shape of its distribution (Gollier 2001, p. 58). The main results of the paper would thus be qualitatively robust to alternative distributional assumptions. Third, to derive the stock price, we assumed a simplified portfolio choice problem in which investors allocate their wealth to the firm stock and a risk-free asset. As long as shareholders have monetary and social preferences, the stock price would still reflect firm profits and firm CSP even if the set of assets were expanded, so this assumption is not crucial. Fourth, by postulating CARA utility, we take into account the risk aversion of the manager and investors, but we do not let their level of absolute risk aversion be decreasing in wealth ("DARA"). With DARA, the optimal risk-sharing rule would depend on the level of wealth of the different agents, with more wealthy agents bearing a higher fraction of firm risk. For example, a manager who is more wealthy than investors would hold more long-term equity holdings than a single investor for risk-sharing purposes. In turn, higher managerial long-term equity holdings could decrease the managerial short-term equity holdings necessary for incentive purposes, because short-term and long-term equity holdings are substitutes in incentive provision, as in Proposition 2. In sum, the optimal contract described in Proposition 2 would keep similar features, but the relative importance of short-term and long-term managerial equity holdings would depend on the distribution of wealth across agents in the economy. Fifth, to focus on the heterogeneity of preferences for CSP across agents, we assumed for simplicity that all agents in the model have the same degree of risk aversion. If agents were also heterogeneous in terms of risk aversion, the optimal risk-sharing rule would be altered, with less risk-averse agents bearing a higher fraction of firm risk (as discussed above). The analysis could thus be extended in several directions.

Finally, this paper should be viewed as a starting point for further research in this emerging area. A modified version of this model could be used to address a number of important related questions. For example, it would be interesting to study the dynamics of a firm's shareholder structure and its interaction with contracting. Indeed, a more socially responsible firm would likely attract more socially responsible shareholders, who would in turn elicit a higher level of CSP (the diversification motive would admittedly mitigate the tendency of shareholders with different preferences for CSP to hold different portfolios). Note that the notion that shareholders adjust their financial investments according to their preference for CSP is consistent with the existence of indices and mutual funds that apply CSR screenings, thus allowing investors to invest in CSP-strong companies (investors with no preference for CSP can on the contrary invest in mutual funds that hold "sin stocks"). A careful analysis of these mechanisms could presumably contribute to explain the diversity of CSR strategies across firms, the diversity of their ownership structures, and the diversity of their managers.

Appendix

Portfolio Choice

Denote by $X(z, a)$ the argument of the utility function of any given shareholder as a function of the number of shares z purchased at $t = 1$ and the allocation a of firm resources. In this case, denote by $W(z) = \omega - zp$ the amount invested at $t = 1$ at the risk-free rate by the shareholder, which is a function of z, as determined optimally by the shareholder at $t = 1$. Using Eq. (1),

$$X(z,a) = z\left(\sqrt{1-a} + \tilde{\epsilon} + u_s\phi\sqrt{a}\right) + \omega - zp \tag{15}$$

With CARA preferences with absolute risk aversion ρ and a normally distributed risk $\tilde{\epsilon}$, we know (e.g., Grossman and Stiglitz 1980) that maximizing expected utility is equivalent to maximizing the following certainty equivalent with respect to z:

$$\begin{aligned} CE(z,a) &= \mathbb{E}[X(z,a)] - \frac{\rho}{2}\mathrm{var}[X(z,a)] \\ &= z\sqrt{1-a} + \omega - zp + zu_s\phi\sqrt{a} - \frac{\rho}{2}z^2\sigma^2. \end{aligned} \tag{16}$$

The solution to this optimization problem is given by the first-order condition, which after some rearranging yields

$$z = \frac{\sqrt{1-a} + u_s\phi\sqrt{a} - p}{\rho\sigma^2} \tag{17}$$

Note that the optimal investment in firm stock by any given shareholder is independent from his wealth ω, due to assumption of CARA utility. Given this set of optimal demands from n ex-ante identical shareholders, the stock price is given by the market clearing equation which equates the supply $1 - z_m^{\mathrm{LT}}$ of shares and the demand $n \times z$ of shares:

$$n\frac{\sqrt{1-a} + u_s\phi\sqrt{a} - p}{\rho\sigma^2} = 1 - z_m^{\mathrm{LT}} \tag{18}$$

Solving this equation for p gives the $t = 1$ equilibrium stock price:

$$p = \sqrt{1-a} + u_s\phi\sqrt{a} - \frac{1 - z_m^{\mathrm{LT}}}{n}\rho\sigma^2 \tag{19}$$

The stock price is simply equal to expected firm profits $\sqrt{1-a}$, plus the utility $u_s\phi\sqrt{a}$ of owning shares in a socially responsible firm, minus the risk premium due to the variability of firm profits (σ^2) and shareholder risk aversion ρ. This risk premium is calculated based on $\frac{1-z_m^{\mathrm{LT}}}{n}$, which is the fraction of the firm held by each shareholder in equilibrium. Indeed, substituting the stock price p from (19) in (17) gives

$$z = \frac{1 - z_m^{\mathrm{LT}}}{n} \tag{20}$$

Proof of Proposition 1

Given that the stock price is concave in a, the resource allocation $a^\star$ that maximizes the stock price is the one that solves $\frac{\mathrm{d}p}{\mathrm{d}a} = 0$. With the value of p derived in (4), this implies

$$\frac{\mathrm{d}p}{\mathrm{d}a} = -\frac{1}{2}\frac{1}{\sqrt{1-a^\star}} + u_s\phi\frac{1}{2}\frac{1}{\sqrt{a^\star}} = 0 \tag{21}$$

Rearranging,

$$a^\star = \frac{u_s^2\phi^2}{1 + u_s^2\phi^2}. \tag{22}$$

Comparing with (3) proves Proposition 1.

Proof of Proposition 2

With a contract consisting in a fixed wage w, z_m^{ST} short-term equity holdings and z_m^{LT} long-term equity holdings, and denoting $\xi = \{w, z_m^{\mathrm{ST}}, z_m^{\mathrm{LT}}\}$, the argument in the utility function of a manager who exerts effort is

$$Y(\xi, a) = w + z_m^{\mathrm{ST}} p + z_m^{\mathrm{LT}} \left(\sqrt{1-a} + \tilde{\epsilon} + u_s \phi \sqrt{a} \right) - C. \tag{23}$$

Substituting the stock price p from (4) gives

$$\begin{aligned} Y(\xi, a) &= w + z_m^{\mathrm{ST}} \left[\sqrt{1-a} + u_s \phi \sqrt{a} - \frac{1 - z_m^{\mathrm{LT}}}{n} \rho \sigma^2 \right] \\ &\quad + z_m^{\mathrm{LT}} \left(\sqrt{1-a} + \tilde{\epsilon} + u_s \phi \sqrt{a} \right) - C \\ &= w + \left(\sqrt{1-a} + u_s \phi \sqrt{a} \right) \left[z_m^{\mathrm{ST}} + z_m^{\mathrm{LT}} \right] \\ &\quad - z_m^{\mathrm{ST}} \frac{1 - z_m^{\mathrm{LT}}}{n} \rho \sigma^2 + z_m^{\mathrm{LT}} \tilde{\epsilon} - C. \end{aligned} \tag{24}$$

The optimization problem of a manager who exerts effort is to choose a to maximize $\mathbb{E}[U(Y(\xi, a))|e = 1]$. Given that the problem is concave in a for $z_m^{\mathrm{ST}} + z_m^{\mathrm{LT}} > 0$, the optimal value a_m of a optimally chosen by the manager is described by the first-order condition of the manager's expected utility with respect to a, which after some rearranging yields

$$a_m = \frac{u_s^2 \phi^2}{1 + u_s^2 \phi^2} \tag{25}$$

Note that a_m is independent from the fixed wage w or from the equity holdings z_m^{ST} and z_m^{LT}, as long as $z_m^{\mathrm{ST}} + z_m^{\mathrm{LT}} > 0$. In addition, $a_m = a^\star = a^{\mathrm{FB}}$: for any contract of the type $\xi = \{w, z_m^{\mathrm{ST}}, z_m^{\mathrm{LT}}\}$, the resource allocation optimally chosen by the manager maximizes the stock price and is the first-best resource allocation.

Given that $a_m = a^{\mathrm{FB}}$ for $z_m^{\mathrm{ST}} + z_m^{\mathrm{LT}} > 0$, we now derive the optimal values of w, z_m^{ST}, and z_m^{LT} such that the manager accepts the contract and exerts effort. At the time of contracting ($t = 0$), there are n shareholders, each of whom owns the same fraction of the firm. Any shareholder will accordingly bear a fraction 1 / n of the cost of managerial compensation, which consists in the fixed wage w and the liquidation value $z_m^{\mathrm{ST}} p$ of short-term equity holdings at $t = 1$. In addition, each shareholder will own the same fraction $\frac{1 - z_m^{\mathrm{LT}}}{n}$ of the firm from $t = 1$ to $t = 2$ (see (20)), given that the manager will own a fraction z_m^{LT} of the shares. Using the certainty equivalent approach, the optimization problem of any shareholder at $t = 0$ is[7]

$$\begin{aligned} \max_{w, z_m^{\mathrm{ST}}, z_m^{\mathrm{LT}}} & \frac{1 - z_m^{\mathrm{LT}}}{n} \left(\sqrt{1-a} + u_s \phi \sqrt{a} \right) - \frac{1}{n} \left(w + z_m^{\mathrm{ST}} p \right) \\ & - \frac{\rho}{2} \frac{\left(1 - z_m^{\mathrm{LT}}\right)^2}{n^2} \sigma^2 \end{aligned} \tag{26}$$

given $a = a^{\mathrm{FB}}$, subject to the following constraints:

$$\mathbb{E}\left[U\left(Y\left(\xi, a^{\mathrm{FB}}\right)\right)|e = 1\right] \geq \mathbb{E}[U(Y(\xi, a))|e = 0] \tag{27}$$

$$\mathbb{E}\left[U\left(Y\left(\xi, a^{\mathrm{FB}}\right)\right)|e = 1\right] \geq \bar{U}, \tag{28}$$

where $Y(\xi, a)$ conditional on $e = 1$ is given in (24), and $Y(\xi, a)$ conditional on $e = 0$ is $w + z_m^{\mathrm{ST}} \left[-\frac{1 - z_m^{\mathrm{LT}}}{n} \rho \sigma^2 \right] + z_m^{\mathrm{LT}} \tilde{\epsilon}$. The incentive constraint (27) ensures that the expected utility of a manager who exerts effort is larger than the expected utility of a manager who does not exert effort, thus ensuring that the contract elicits effort. There is a continuum of contracts which achieve incentive compatibility and have the same implications for resource allocation, cost of compensation, and managerial expected utility (indeed, as will be further explained below notably in footnote 7, z_m^{ST} can be set above the level which satisfies (27) as an equality, and the fixed wage correspondingly lowered to leave expected pay unchanged); as in Edmans et al. (2009), we choose the maximum between the level of z_m^{ST} which satisfies (27) as an equality and zero (so that $z_m^{\mathrm{ST}} \geq 0$). The participation constraint (28) ensures that the expected utility of a manager who accepts the contract is in equilibrium (conditional on $e = 1$ and $a = a_m$) is larger than his reservation level of utility $\bar{U}$.

Using the certainty equivalent approach, the incentive constraint (27) may be rewritten as

$$\begin{aligned} & w + z_m^{\mathrm{ST}} \left[\sqrt{1 - a^{\mathrm{FB}}} + u_s \phi \sqrt{a^{\mathrm{FB}}} - \frac{1 - z_m^{\mathrm{LT}}}{n} \rho \sigma^2 \right] \\ & \quad + z_m^{\mathrm{LT}} \left(\sqrt{1 - a^{\mathrm{FB}}} + u_s \phi \sqrt{a^{\mathrm{FB}}} \right) - C - \frac{\rho}{2} z_m^{\mathrm{LT}2} \sigma^2 \\ & \quad \geq w + z_m^{\mathrm{ST}} \left[-\frac{1 - z_m^{\mathrm{LT}}}{n} \rho \sigma^2 \right] - \frac{\rho}{2} z_m^{\mathrm{LT}2} \sigma^2. \end{aligned} \tag{29}$$

Removing offsetting terms and rearranging yields

$$z_m^{\mathrm{ST}} + z_m^{\mathrm{LT}} \geq \frac{C}{\sqrt{1 - a^{\mathrm{FB}}} + u_s \phi \sqrt{a^{\mathrm{FB}}}}. \tag{30}$$

Denoting by $\bar{W}$ the reservation wage which is implicitly defined by $U(\bar{W}) \equiv \bar{U}$, and given that the equity holdings are such that the manager exerts effort, the participation constraint (28) may be rewritten with the certainty equivalent approach as

[7] In equilibrium, given the shareholder structures at $t = 0$ and $t = 1$ (see (20)), the only transactions at $t = 1$ consist in each shareholder buying the same number z_m^{ST}/n of shares from the manager at a price

Footnote 7 continued
p. This is captured by the $z_m^{\mathrm{ST}} p/n$ term in (26). In addition, each shareholder will own a fraction $\frac{1 - z_m^{\mathrm{LT}}}{n}$ of the firm from $t = 1$ to $t = 2$, hence the other terms in (26).

$$w+z_m^{\mathrm{ST}}\left[\sqrt{1-a^{\mathrm{FB}}}+u_s\phi\sqrt{a^{\mathrm{FB}}}-\frac{1-z_m^{\mathrm{LT}}}{n}\rho\sigma^2\right] + z_m^{\mathrm{LT}}\left(\sqrt{1-a^{\mathrm{FB}}}+u_s\phi\sqrt{a^{\mathrm{FB}}}\right) - C-\frac{\rho}{2}z_m^{\mathrm{LT}2}\sigma^2\geq\bar{W}. \tag{31}$$

We denote by μ and λ the Lagrange multipliers associated with the constraints (30) and (31), respectively.

The first-order conditions of the optimization problem in (26)–(28) with respect to w, z_m^{ST}, and z_m^{LT} are then, respectively,

$$-1+\lambda=0 \tag{32}$$

$$-\left[\sqrt{1-a^{\mathrm{FB}}}+u_s\phi\sqrt{a^{\mathrm{FB}}}-\frac{1-z_m^{\mathrm{LT}}}{n}\rho\sigma^2\right] + \lambda\left[\sqrt{1-a^{\mathrm{FB}}}+u_s\phi\sqrt{a^{\mathrm{FB}}}-\frac{1-z_m^{\mathrm{LT}}}{n}\rho\sigma^2\right]+\mu=0 \tag{33}$$

$$-\left(\sqrt{1-a^{\mathrm{FB}}}+u_s\phi\sqrt{a^{\mathrm{FB}}}\right)-z_m^{\mathrm{ST}}\frac{\rho\sigma^2}{n}+\rho\frac{1-z_m^{\mathrm{LT}}}{n}\sigma^2 + \lambda\left(\sqrt{1-a^{\mathrm{FB}}}+u_s\phi\sqrt{a^{\mathrm{FB}}}+z_m^{\mathrm{ST}}\frac{\rho\sigma^2}{n}-\rho z_m^{\mathrm{LT}}\sigma^2\right) +\mu=0 \tag{34}$$

Equation (32) gives $\lambda=1$, which used in (33) implies $\mu=0$.[8] With $\lambda=1$ and $\mu=0$, the first-order condition (34) can be rewritten as

$$z_m^{\mathrm{LT}}=\frac{1}{1+n} \tag{35}$$

Plugging this value of z_m^{LT} in (30), equating both sides, and using $z_m^{\mathrm{ST}}\geq 0$ gives

$$z_m^{\mathrm{ST}}=\max\left\{\frac{C}{\sqrt{1-a^{\mathrm{FB}}}+u_s\phi\sqrt{a^{\mathrm{FB}}}}-\frac{1}{1+n},0\right\} \tag{36}$$

Finally, substituting for z_m^{ST} and z_m^{LT} in (31) gives the fixed wage w, which satisfies the participation constraint as an equality ($\lambda=1$ implies that the participation constraint is binding due to the complementary slackness condition):

$$w=\bar{W}-\max\left\{\frac{C}{\sqrt{1-a^{\mathrm{FB}}}+u_s\phi\sqrt{a^{\mathrm{FB}}}}-\frac{1}{1+n},0\right\} \left[\sqrt{1-a^{\mathrm{FB}}}+u_s\phi\sqrt{a^{\mathrm{FB}}}-\frac{1-\frac{1}{1+n}}{n}\rho\sigma^2\right] -\frac{1}{1+n}\left(\sqrt{1-a^{\mathrm{FB}}}+u_s\phi\sqrt{a^{\mathrm{FB}}}\right)+C+\frac{\rho}{2}\frac{1}{(1+n)^2}\sigma^2 \tag{37}$$

Proof of Claim 2

Using the value of z_m^{ST} in (10) with $a=a^{\mathrm{FB}}$ (cf. Claim 1 and Proposition 2), we have

$$\frac{\mathrm{d}z_m^{\mathrm{ST}}}{\mathrm{d}u_s}=\frac{\mathrm{d}}{\mathrm{d}u_s}\left\{\frac{C}{\sqrt{1-\frac{u_s^2\phi^2}{1+u_s^2\phi^2}}+u_s\phi\sqrt{\frac{u_s^2\phi^2}{1+u_s^2\phi^2}}}-\frac{1}{1+n}\right\}$$
$$=-C\frac{-\frac{1}{2}\frac{2u_s\phi^2}{(1+u_s^2\phi^2)^2}\left(\frac{1}{1+u_s^2\phi^2}\right)^{-0.5}+\frac{2u_s\phi^2\sqrt{1+u_s^2\phi^2}-u_s^3\phi^4(1+u_s^2\phi^2)^{-0.5}}{1+u_s^2\phi^2}}{\left(\sqrt{1-\frac{u_s^2\phi^2}{1+u_s^2\phi^2}}+u_s\phi\sqrt{\frac{u_s^2\phi^2}{1+u_s^2\phi^2}}\right)^2}$$
$$=-C\frac{u_s\phi^2}{(1+u_s^2\phi^2)^{3/2}}\frac{-1+2(1+u_s^2\phi^2)-u_s^2\phi^2}{\left(\sqrt{1-\frac{u_s^2\phi^2}{1+u_s^2\phi^2}}+u_s\phi\sqrt{\frac{u_s^2\phi^2}{1+u_s^2\phi^2}}\right)^2}<0 \tag{38}$$

Unobservable Actions

This section revisits the model under the assumption that the resource allocation a is unobservable by shareholders. We now assume that profits at $t=2$ are equal to $e\sqrt{1-a}+\tilde{\theta}_\pi+\tilde{\epsilon}$, and CSP is equal to $e\phi\sqrt{a}+\tilde{\theta}_\phi$, where as in the baseline model $e\in\{0,1\}$ and $a\in[0,1]$ are optimally chosen by the manager at $t=0$. The random variables $\tilde{\theta}_\pi$ and $\tilde{\theta}_\phi$ are normally distributed with mean zero and respective variance σ_π^2 and σ_ϕ^2. Both $\tilde{\theta}_\pi$ and $\tilde{\theta}_\phi$ are realized at $t=1$. We assume that $\tilde{\theta}_\phi$ is independent from other random variables. Since both $\tilde{\epsilon}$ and $\tilde{\theta}_\pi$ affect firm profits, we assume that they are correlated, with $\mathrm{cov}(\tilde{\epsilon},\tilde{\theta}_\pi)\equiv\varrho$, and for simplicity we also assume that the variance of $\tilde{\epsilon}$ does not depend on the realization of $\tilde{\theta}_\pi$ at $t=1$, i.e., $\mathrm{var}(\tilde{\epsilon}|\theta_\pi)=\mathrm{var}(\tilde{\epsilon})==\sigma^2$.

At $t=1$, before making portfolio choices, shareholders observe two signals, namely $s_\pi=e\sqrt{1-a}+\theta_\pi$ and

[8] This implies that the participation constraint is binding, whereas the incentive constraint is not. Intuitively, if the participation constraint were not satisfied as an equality, then it would be possible to lower w by a small enough amount that the participation constraint remains satisfied. This would increase the objective function in (26) without affecting any of the other constraints, which shows that the participation constraint must be binding at the optimum. However, the fact that the incentive constraint is not binding is due to the fact that z_m^{ST} could be increased over the level such that the incentive constraint in (30) is satisfied as an equality given the optimal level of z_m^{LT}. Indeed, to the extent that this increase is offset in terms of expected pay by a decrease in the fixed wage w (which occurs automatically given that the participation constraint is binding), it does not have any effect on expected pay or on the risk allocation, and it remains optimal for the manager to exert effort. That is, all constraints remain satisfied and the objective function in (26) is unchanged.

$s_\phi = e\phi\sqrt{a} + \theta_\phi$, where θ_π and θ_ϕ denote the realizations of $\tilde{\theta}_\pi$ and $\tilde{\theta}_\phi$, respectively. As in the baseline model, $\tilde{\epsilon}$ is realized at $t == 2$.

These assumptions capture the notions that the effect of investments in business operations and in CSP have effects on profits and the provision of social goods which are uncertain, and that managerial actions are unobservable. For example, shareholders only observe the polluting emissions of the firm, but pollution-reducing efforts may fail. More generally, a number of factors beyond the manager's control may affect the profits and CSP of a firm.

We now establish that the main results of the paper remain unchanged under these assumptions that shareholders observe signals which are imperfectly informative about the manager's effort e and resource allocation a if $\varrho = 0$, and we characterized the manager's contract when $\varrho \neq 0$.

As in the Portfolio choice section, denoting by $X(z, a)$ the argument of the utility function of any given shareholder as a function of the number of shares z purchased at $t == 1$ and the allocation a of firm resources, in equilibrium we have

$$X(z,a) = z\left(\sqrt{1-a} + \theta_\pi + \tilde{\epsilon} + u_s(\phi\sqrt{a} + \theta_\phi)\right) + \omega - zp \tag{39}$$

The solution z of this optimization problem is

$$z = \frac{\sqrt{1-a} + \theta_\pi + +u_s(\phi\sqrt{a} + \theta_\phi) - p}{\rho\sigma^2} \tag{40}$$

The $t = 1$ equilibrium stock price is

$$p = \sqrt{1-a} + \theta_\pi + u_s\left(\phi\sqrt{a} + \theta_\phi\right) - \frac{1 - z_m^{\mathrm{LT}}}{n}\rho\sigma^2 \tag{41}$$

Substituting the stock price p from (19) in (17) gives the optimal portfolio allocation:

$$z = \frac{1 - z_m^{\mathrm{LT}}}{n} \tag{42}$$

It immediately follows from (41) that the stock price maximizing resource allocation $a^\star$, as defined in (22), is unchanged. Moreover, the first-best optimal resource allocation maximizes

$$\mathbb{E}\left[U\left(\sqrt{1-a} + \tilde{\theta}_\pi + \tilde{\epsilon} + u_s(\phi\sqrt{a} + \tilde{\theta}_\phi) - C\right)\right]. \tag{43}$$

That is, it maximizes the certainty equivalent $\sqrt{1-a} + u_s\phi\sqrt{a} - \frac{\varrho}{2}\left[\sigma^2 + \sigma_\pi^2 + \sigma_\phi^2 + 2\varrho\right] - C$, which yields the same value of a^{FB} as in Claim (1). With $a^\star$ and a^{FB} both as in the baseline model, it immediately follows that Proposition 1 still holds in this setting.

A manager who exerts effort now chooses the resource allocation a to maximize

$$\begin{aligned}
&\mathbb{E}[U(Y(\xi,a))|e=1] \\
&\quad \equiv \mathbb{E}\Big[U\Big(w + z_m^{\mathrm{ST}}p + z_m^{\mathrm{LT}}\Big(\sqrt{1-a} + \tilde{\theta}_\pi + \tilde{\epsilon} \\
&\qquad + u_s\Big(\phi\sqrt{a} + \tilde{\theta}_\phi\Big)\Big) - C)\Big].
\end{aligned} \tag{44}$$

For $z_m^{\mathrm{ST}} + z_m^{\mathrm{LT}} > 0$, the action a_m that maximizes this expression is the same as in the baseline model (defined in (25)), and we have $a_m = a^{\mathrm{FB}}$.

Using the certainty equivalent approach, the optimization problem of shareholders at $t = 0$ is

$$\begin{aligned}
&\max_{w,z_m^{\mathrm{ST}},z_m^{\mathrm{LT}}} \mathbb{E}\Big[U\Big(\frac{1-z_m^{\mathrm{LT}}}{n}\Big(\sqrt{1-a} + \tilde{\theta}_\pi + \tilde{\epsilon} \\
&\quad + u_s\Big(\phi\sqrt{a} + \tilde{\theta}_\phi\Big)\Big).. \\
&\quad - \frac{1}{n}\left(w + z_m^{\mathrm{ST}}p\right)\Big)\Big] \\
&\Leftrightarrow \max_{w,z_m^{\mathrm{ST}},z_m^{\mathrm{LT}}} \frac{1-z_m^{\mathrm{LT}}}{n}\left(\sqrt{1-a} + u_s\phi\sqrt{a}\right) \\
&\quad - \frac{1}{n}\left(w + z_m^{\mathrm{ST}}\mathbb{E}[p]\right) \\
&\quad - \frac{\rho}{2}\Bigg[\frac{\left(1-z_m^{\mathrm{LT}}\right)^2}{n^2}\sigma^2 + \frac{\left(1-z_m^{\mathrm{LT}}-z_m^{\mathrm{ST}}\right)^2}{n^2}\left(\sigma_\pi^2 + u_s^2\sigma_\phi^2\right) \\
&\quad + 2\frac{\left(1-z_m^{\mathrm{LT}}\right)\left(1-z_m^{\mathrm{LT}}-z_m^{\mathrm{ST}}\right)}{n^2}\varrho\Bigg]
\end{aligned} \tag{45}$$

given $a = a^{\mathrm{FB}}$, subject to the following constraints at $t = 0$ (note that the stock price p, which is realized at $t = 1$, is a random variable at $t = 0$):

$$\mathbb{E}\left[U\left(Y\left(\xi, a^{\mathrm{FB}}\right)\right)|e=1\right] \geq \mathbb{E}[U(Y(\xi,a))|e=0] \tag{46}$$

$$\mathbb{E}\left[U\left(Y\left(\xi, a^{\mathrm{FB}}\right)\right)|e=1\right] \geq \bar{U}\,. \tag{47}$$

Using the certainty equivalent approach, the incentive constraint (46) may be rewritten as

$$\begin{aligned}
&w + z_m^{\mathrm{ST}}\left[\sqrt{1-a^{\mathrm{FB}}} + u_s\phi\sqrt{a^{\mathrm{FB}}} - \frac{1-z_m^{\mathrm{LT}}}{n}\rho\sigma^2\right] \\
&\quad + z_m^{\mathrm{LT}}\left(\sqrt{1-a^{\mathrm{FB}}} + u_s\phi\sqrt{a^{\mathrm{FB}}}\right) - C \\
&\quad - \frac{\rho}{2}\left[z_m^{\mathrm{LT}^2}\sigma^2 + \left(z_m^{\mathrm{LT}} + z_m^{\mathrm{ST}}\right)^2\left(\sigma_\pi^2 + u_s^2\sigma_\phi^2\right)\right. \\
&\quad \left. + 2z_m^{\mathrm{LT}}\left(z_m^{\mathrm{LT}} + z_m^{\mathrm{ST}}\right)\varrho\right] \\
&\quad \geq w + z_m^{\mathrm{ST}}\left[-\frac{1-z_m^{\mathrm{LT}}}{n}\rho\sigma^2\right] - \frac{\rho}{2}\left[z_m^{\mathrm{LT}^2}\sigma^2\right. \\
&\quad + \left(z_m^{\mathrm{LT}} + z_m^{\mathrm{ST}}\right)^2\left(\sigma_\pi^2 + u_s^2\sigma_\phi^2\right). \\
&\quad \left. + 2z_m^{\mathrm{LT}}\left(z_m^{\mathrm{LT}} + z_m^{\mathrm{ST}}\right)\varrho\right].
\end{aligned} \tag{48}$$

Removing offsetting terms and rearranging yields

$$z_m^{\mathrm{ST}} + z_m^{\mathrm{LT}} \geq \frac{C}{\sqrt{1-a^{\mathrm{FB}}} + u_s \phi \sqrt{a^{\mathrm{FB}}}}, \tag{49}$$

which is the same inequality as in the baseline model (cf. (30)). Denoting by $\bar{W}$ the reservation wage which is implicitly defined by $U(\bar{W}) \equiv \bar{U}$, and given that the equity holdings are such that the manager exerts effort, the participation constraint (47) may be rewritten with the certainty equivalent approach as

$$\begin{aligned} & w + z_m^{\mathrm{ST}} \left[\sqrt{1-a^{\mathrm{FB}}} + u_s \phi \sqrt{a^{\mathrm{FB}}} - \frac{1 - z_m^{\mathrm{LT}}}{n} \rho \sigma^2 \right] \\ & \quad + z_m^{\mathrm{LT}} \left(\sqrt{1-a^{\mathrm{FB}}} + u_s \phi \sqrt{a^{\mathrm{FB}}} \right) - C \\ & - \frac{\rho}{2} \left[z_m^{\mathrm{LT}2} \sigma^2 + \left(z_m^{\mathrm{LT}} + z_m^{\mathrm{ST}} \right)^2 \left(\sigma_\pi^2 + u_s^2 \sigma_\phi^2 \right) \right. \\ & \quad \left. + 2 z_m^{\mathrm{LT}} \left(z_m^{\mathrm{LT}} + z_m^{\mathrm{ST}} \right) \varrho \right] \geq \bar{W}. \end{aligned} \tag{50}$$

We denote by μ and λ the Lagrange multipliers associated with the constraints (49) and (50), respectively.

The first-order conditions of the optimization problem in (45)–(47) with respect to w, z_m^{ST}, and z_m^{LT} are then, respectively,

$$-1 + \lambda = 0 \tag{51}$$

$$\begin{aligned} & - \left[\sqrt{1-a^{\mathrm{FB}}} + u_s \phi \sqrt{a^{\mathrm{FB}}} - \frac{1 - z_m^{\mathrm{LT}}}{n} \rho \sigma^2 \right] \\ & + \rho \left[\frac{1 - z_m^{\mathrm{LT}} - z_m^{\mathrm{ST}}}{n} \left(\sigma_\pi^2 + u_s^2 \sigma_\phi^2 \right) + \frac{\left(1 - z_m^{\mathrm{LT}}\right)}{n} \varrho \right] \\ & + \lambda \left[\sqrt{1-a^{\mathrm{FB}}} + u_s \phi \sqrt{a^{\mathrm{FB}}} - \frac{1 - z_m^{\mathrm{LT}}}{n} \rho \sigma^2 \right. \\ & \left. - \rho \left(\left(z_m^{\mathrm{LT}} + z_m^{\mathrm{ST}} \right) \left(\sigma_\pi^2 + u_s^2 \sigma_\phi^2 \right) + z_m^{\mathrm{LT}} \varrho \right) \right] + \mu = 0 \end{aligned} \tag{52}$$

$$\begin{aligned} & - \left(\sqrt{1-a^{\mathrm{FB}}} + u_s \phi \sqrt{a^{\mathrm{FB}}} \right) - z_m^{\mathrm{ST}} \frac{\rho \sigma^2}{n} + \rho \left[\frac{1 - z_m^{\mathrm{LT}}}{n} \sigma^2 \right. \\ & \left. + \frac{1 - z_m^{\mathrm{LT}} - z_m^{\mathrm{ST}}}{n} \left(\sigma_\pi^2 + u_s^2 \sigma_\phi^2 \right) + \frac{2 - 2 z_m^{\mathrm{LT}} - z_m^{\mathrm{ST}}}{n} \varrho \right] \\ & + \lambda \left[\sqrt{1-a^{\mathrm{FB}}} + u_s \phi \sqrt{a^{\mathrm{FB}}} + z_m^{\mathrm{ST}} \frac{\rho \sigma^2}{n} \right. \\ & \quad \left. - \rho \left(z_m^{\mathrm{LT}} \sigma^2 + \left(z_m^{\mathrm{LT}} + z_m^{\mathrm{ST}} \right) \left(\sigma_\pi^2 + u_s^2 \sigma_\phi^2 \right) + \left(2 z_m^{\mathrm{LT}} + z_m^{\mathrm{ST}} \right) \varrho \right) \right] \\ & \quad + \mu \\ & \quad = 0 \end{aligned} \tag{53}$$

Equation (51) gives $\lambda = 1$, which allows to rewrite (52) as

$$\begin{aligned} & \rho \left[\frac{1 - z_m^{\mathrm{LT}} - z_m^{\mathrm{ST}}}{n} \left(\sigma_\pi^2 + u_s^2 \sigma_\phi^2 \right) + \frac{\left(1 - z_m^{\mathrm{LT}}\right)}{n} \varrho \right] \\ & \quad - \rho \left(\left(z_m^{\mathrm{LT}} + z_m^{\mathrm{ST}} \right) \left(\sigma_\pi^2 + \sigma_\phi^2 \right) + z_m^{\mathrm{LT}} \varrho \right) + \mu = 0 \\ & \Leftrightarrow \quad \rho \left[\frac{1 - (n+1) \left(z_m^{\mathrm{LT}} - z_m^{\mathrm{ST}} \right)}{n} \left(\sigma_\pi^2 + u_s^2 \sigma_\phi^2 \right) \right. \\ & \left. + \frac{\left(1 - (n+1) z_m^{\mathrm{LT}}\right)}{n} \varrho \right] + \mu = 0 \end{aligned} \tag{54}$$

Likewise, (53) can be rewritten as follows:

$$\begin{aligned} & \rho \left[\frac{1 - z_m^{\mathrm{LT}}}{n} \sigma^2 + \frac{1 - z_m^{\mathrm{LT}} - z_m^{\mathrm{ST}}}{n} \left(\sigma_\pi^2 + u_s^2 \sigma_\phi^2 \right) \right. \\ & \left. + \frac{2 - 2 z_m^{\mathrm{LT}} - z_m^{\mathrm{ST}}}{n} \varrho \right] \\ & \quad - \rho \left[z_m^{\mathrm{LT}} \sigma^2 + \left(z_m^{\mathrm{LT}} + z_m^{\mathrm{ST}} \right) \left(\sigma_\pi^2 + u_s^2 \sigma_\phi^2 \right) \right. \\ & \quad \left. + \left(2 z_m^{\mathrm{LT}} + z_m^{\mathrm{ST}} \right) \varrho \right] + \mu = 0 \Leftrightarrow \rho \left[\frac{1 - (n+1) z_m^{\mathrm{LT}}}{n} \sigma^2 \right. \\ & + \frac{1 - (n+1) \left(z_m^{\mathrm{LT}} - z_m^{\mathrm{ST}} \right)}{n} \left(\sigma_\pi^2 + u_s^2 \sigma_\phi^2 \right). \\ & \quad \left. + \frac{2 - (n+1) \left(2 z_m^{\mathrm{LT}} + z_m^{\mathrm{ST}} \right)}{n} \varrho \right] + \mu = 0 \end{aligned}$$

Plugging μ from (54), this gives

$$\begin{aligned} & \rho \left[\frac{1 - (n+1) z_m^{\mathrm{LT}}}{n} \sigma^2 + \frac{1 - (n+1) \left(z_m^{\mathrm{LT}} + z_m^{\mathrm{ST}} \right)}{n} \varrho \right] = 0 \\ & \Leftrightarrow \quad z_m^{\mathrm{LT}} = \frac{\frac{1}{n+1} \sigma^2 + \left[\frac{1}{n+1} - z_m^{\mathrm{ST}} \right] \varrho}{\sigma^2 + \varrho} \end{aligned} \tag{55}$$

Note that, if either $z_m^{\mathrm{ST}} = 0$ or $\varrho = 0$, then $z_m^{\mathrm{LT}} = \frac{1}{n+1}$.

There are then two cases to consider. First, if

$$\frac{1}{n+1} \geq \frac{C}{\sqrt{1-a^{\mathrm{FB}}} + u_s \phi \sqrt{a^{\mathrm{FB}}}}, \tag{56}$$

then the incentive constraint in (49) is nonbinding with $z_m^{\mathrm{ST}} = 0$ and the implied value of z_m^{LT} in (55). Standard cost minimization arguments then show that the optimal contract is such that $z_m^{\mathrm{ST}} = 0$ and $z_m^{\mathrm{LT}} = \frac{1}{n+1}$, as in Proposition 2. Second, if (56) does not hold, then the incentive constraint in (49) is binding, so using (49) and the value of z_m^{LT} in (55), we have

$$z_m^{\mathrm{ST}} = \left(\frac{C}{\sqrt{1-a^{\mathrm{FB}}} + u_s \phi \sqrt{a^{\mathrm{FB}}}} - \frac{1}{n+1} \right) \Big/ \left(1 - \frac{\varrho}{\sigma^2 + \varrho} \right) > 0. \tag{57}$$

That is, with $\varrho = 0$ or when (56) holds, the optimal short-term and long-term equity holdings, z_m^{ST} and z_m^{LT}, are still as in Proposition 2.

With $\varrho \neq 0$ *and* when (56) does not hold, the optimal values of z_m^{LT} and z_m^{ST}, in equations (55) and (57), respectively, are not exactly as in Proposition 2. Intuitively, optimal risk sharing is different when the two shocks on firm profits realized at $t = 1$ and $t = 2$, $\tilde{\theta}_\pi$ and $\tilde{\epsilon}$, are correlated. Indeed, the manager is exposed to the $t = 1$ shock $\tilde{\theta}_\pi$ because of his short-term and long-term equity holdings $\left(z_m^{\mathrm{ST}} \text{ and } z_m^{\mathrm{LT}} \right)$, whereas he is only exposed to the t = 2 shock $\tilde{\epsilon}$ because of his long-term equity holdings $\left(z_m^{\mathrm{LT}}\right)$. In the absence of correlation between these two shocks ($\varrho = 0$), the optimal risk-sharing rule is simply for the manager to bear a fraction $\frac{1}{n+1}$ of each shock, which is achieved with $z_m^{\mathrm{LT}} = \frac{1}{n+1}$ and $z_m^{\mathrm{ST}} = 0$; if these equity holdings are insufficient to elicit effort, then short-term equity holdings will increase, because they do not increase the manager's risk exposure as much as long-term equity holdings, but they provide just as much effort incentives. However, with $\varrho > 0$ (respectively $\varrho < 0$), this increase in short-term equity holdings will expose the manager to the risk common to $\tilde{\theta}_\pi$ and $\tilde{\epsilon}$ over and above (resp. below) the optimal risk-sharing rule. To decrease (resp. increase) the manager's risk exposure to this "common risk" while maintaining adequate effort incentives, the less risky short-term equity holdings will be increased (resp. decreased) relative to the case with $\varrho = 0$, while the more risky long-term equity holdings will be decreased (resp. increased).

Proof of Proposition 3

First, substituting the value of $a = a^{\mathrm{FB}}$ (cf. Claim 1 and Proposition 2) in the stock price p from (4), firm value at t = 1 is

$$p = \sqrt{1 - \frac{u_s^2\phi^2}{1 + u_s^2\phi^2}} + u_s\phi\sqrt{\frac{u_s^2\phi^2}{1 + u_s^2\phi^2}} - \frac{1 - z_m^{\mathrm{LT}}}{n}\rho\sigma^2.$$

So

$$\begin{aligned}\frac{\mathrm{d}p}{\mathrm{d}\phi} &= \sqrt{1 - \frac{u_s^2\phi^2}{1 + u_s^2\phi^2}} + u_s\phi\sqrt{\frac{u_s^2\phi^2}{1 + u_s^2\phi^2}} \\ &= -\frac{1}{2}\frac{2u_s^2\phi}{(1 + u_s^2\phi^2)^2}\left(1 - \frac{u_s^2\phi^2}{1 + u_s^2\phi^2}\right)^{-0.5} \\ &\quad + u_s\sqrt{\frac{u_s^2\phi^2}{1 + u_s^2\phi^2}} + \frac{1}{2}u_s\phi\frac{2u_s^2\phi}{(1 + u_s^2\phi^2)^2}\left(\frac{u_s^2\phi^2}{1 + u_s^2\phi^2}\right)^{-0.5} \\ &= -\frac{1}{2}\frac{2u_s^2\phi}{(1 + u_s^2\phi^2)^2}\frac{1}{\left(1 + u_s^2\phi^2\right)^{-0.5}} \\ &\quad + u_s\sqrt{\frac{u_s^2\phi^2}{1 + u_s^2\phi^2}} + \frac{1}{2}\frac{2u_s^2\phi}{(1 + u_s^2\phi^2)^2}\frac{1}{\left(1 + u_s^2\phi^2\right)^{-0.5}} > 0.\end{aligned} \tag{58}$$

The first part of the Proposition is proven.

Second, denoting by $\mathbb{E}[\cdot]$ the mathematical expectation operator, in equilibrium (with $a = a^{\mathrm{FB}}$), the expected stock return $\mathbb{E}[r(a,p)]$ from t = 1 to t = 2 is

$$\begin{aligned}\mathbb{E}[r(a^{\mathrm{FB}},p)] &\equiv \mathbb{E}\left[\frac{\sqrt{1 - a^{\mathrm{FB}}} + \tilde{\epsilon} - p}{p}\right] \\ &= \frac{\sqrt{1 - \frac{u_s^2\phi^2}{1+u_s^2\phi^2}} - \left(\sqrt{1 - \frac{u_s^2\phi^2}{1+u_s^2\phi^2}} + u_s\phi\sqrt{\frac{u_s^2\phi^2}{1+u_s^2\phi^2}} - \frac{1-z_m^{\mathrm{LT}}}{n}\rho\sigma^2\right)}{\sqrt{1 - \frac{u_s^2\phi^2}{1+u_s^2\phi^2}} + u_s\phi\sqrt{\frac{u_s^2\phi^2}{1+u_s^2\phi^2}} - \frac{1-z_m^{\mathrm{LT}}}{n}\rho\sigma^2} \\ &= \frac{-u_s\phi\sqrt{\frac{u_s^2\phi^2}{1+u_s^2\phi^2}} + \frac{1-z_m^{\mathrm{LT}}}{n}\rho\sigma^2}{p}.\end{aligned} \tag{59}$$

It follows that

$$\begin{aligned}\frac{\mathrm{d}\mathbb{E}[r(a^{\mathrm{FB}},p)]}{\mathrm{d}\phi} &= \frac{\mathrm{d}}{\mathrm{d}\phi}\left\{\frac{-u_s\phi\sqrt{\frac{u_s^2\phi^2}{1+u_s^2\phi^2}} + \frac{1-z_m^{\mathrm{LT}}}{n}\rho\sigma^2}{p}\right\} \\ &= \frac{-\left(u_s\sqrt{\frac{u_s^2\phi^2}{1+u_s^2\phi^2}} + \frac{1}{2}u_s\phi\frac{2u_s^2\phi}{(1+u_s^2\phi^2)^2}\left(\frac{u_s^2\phi^2}{1+u_s^2\phi^2}\right)^{0.5}\right)p - \left(-u_s\phi\sqrt{\frac{u_s^2\phi^2}{1+u_s^2\phi^2}} + \frac{1-z_m^{\mathrm{LT}}}{n}\rho\sigma^2\right)\frac{\mathrm{d}p}{\mathrm{d}\phi}}{p^2} < 0\end{aligned}$$

where the inequality follows from the assumption that the stock price p and the expected stock return are positive, i.e., $-u_s\phi\sqrt{\frac{u_s^2\phi^2}{1+u_s^2\phi^2}}+\frac{1-z_m^{\mathrm{LT}}}{n}\rho\sigma^2 \geq 0$ (using (59)), and the fact that $\frac{\mathrm{d}p}{\mathrm{d}\phi}>0$ (cf. (58)). The second part of the Proposition is proven.

Stock Returns over Time

In this section, we extend the model to let the firm produce and its stock price be established over multiple periods. To this end, we make a number of simplifying assumptions. The purpose is to establish the robustness of the results stated in Proposition 3.

Suppose that a firm with capacity for CSP ϕ lives for T periods, with $T \geq 2$. For simplicity, in every period the firm produces the same expected profits $\sqrt{1-a}$ and has the same CSP $\phi\sqrt{a}$. We consider a standard model of portfolio choice with overlapping generations of investors. Every period, a new generation of n shareholders is born who lives for two periods. As in the baseline model, each generation of investors values CSP at rate u_s. At the beginning of the first period of their lives, say period t, they invest at the risk-free rate and in the firm stock at price p_t. CSP is realized in every period, while profits are realized at the end of each period and fully paid off to investors at the end of each period. At the beginning of the second period of their lives, period $t+1$, this generation of investors sells firm stocks at price p_{t+1}, and the new generation of investors invests at this price. As in the baseline model, in any period t, the price p_t adjusts so that there is adequate demand by "young" investors ("old" investors are forced sellers). Portfolio choices and price formation are thus as in the baseline model, except that, in every period apart from the last, investors now receive an additional payoff in the form of the resale value of their stocks, as valued at the next period stock price.

At the beginning of the last period (T), the stock price is as in the baseline model:

$$p_T = \sqrt{1-a}+u_s\phi\sqrt{a}-\frac{1-z_m^{\mathrm{LT}}}{n}\rho\sigma^2. \tag{60}$$

In addition, for $t \leq T-1$, we have

$$p_t = \sqrt{1-a}+u_s\phi\sqrt{a}+p_{t+1}-\frac{1-z_m^{\mathrm{LT}}}{n}\rho\sigma^2. \tag{61}$$

Setting $t=T-1$ in (61) and substituting from (60),

$$p_{T-1} = \sqrt{1-a}+u_s\phi\sqrt{a}+p_T-\frac{1-z_m^{\mathrm{LT}}}{n}\rho\sigma^2 = 2p_T. \tag{62}$$

Iterating, for any integer $\tau \leq T-1$, we have $p_{T-\tau}=(\tau+1)p_T$. At any point in time, the stock price (or firm value) is strictly increasing in ϕ, as in Proposition 3.

As in the proof of Proposition 3, we calculate the expected return in period $T-\tau$:

$$\begin{aligned}\mathbb{E}[r(a,p_{T-\tau})] &= \frac{\sqrt{1-a}+p_{T-\tau+1}-p_{T-\tau}}{p_{T-\tau}} \\ &= \frac{-u_s\phi\sqrt{a}+\frac{1-z_m^{\mathrm{LT}}}{n}\rho\sigma^2}{(\tau+1)\left[\sqrt{1-a}+u_s\phi\sqrt{a}-\frac{1-z_m^{\mathrm{LT}}}{n}\rho\sigma^2\right]}.\end{aligned} \tag{63}$$

Note that the expression for the (expected) return is standard: it is based on the (expected) profit paid off to investors as dividends during the period, and on the stock prices at times t and $t+1$ (or in this case $T-\tau$ and $T-\tau+1$). Assuming that stock prices are positive, the expected return in (63) is strictly decreasing in ϕ, as in Proposition 3.

Portfolio Choice with Heterogeneous Preferences

This section follows the same lines as the "Portfolio choice" section, and is therefore abbreviated. For a shareholder with preferences u_s^i for CSP, maximizing $\mathbb{E}[U(X(\bar{z}_i,a))]$ is equivalent to maximizing the following certainty equivalent with respect to $\bar{z}_i$:

$$CE(\bar{z}_i,a) = \bar{z}_i\sqrt{1-a}+\omega-\bar{z}_i\bar{p}+\bar{z}_i u_s^i\phi\sqrt{a}-\frac{\rho}{2}\bar{z}_i^2\sigma^2. \tag{64}$$

The solution to this optimization problem is given by the first-order condition, which after some rearranging yields

$$\bar{z}_i = \frac{\sqrt{1-a}+u_s^i\phi\sqrt{a}-\bar{p}}{\rho\sigma^2}. \tag{65}$$

Given this set of optimal demands from n ex-ante identical shareholders, the stock price is given by the market clearing equation which equates the supply $1-\bar{z}_m^{\mathrm{LT}}$ of shares and the demand $\sum_{i=1}^n \bar{z}_i$ of shares:

$$\sum_{i=1}^n \frac{\sqrt{1-a}+u_s^i\phi\sqrt{a}-\bar{p}}{\rho\sigma^2} = 1-\bar{z}_m^{\mathrm{LT}}. \tag{66}$$

Solving this equation for $\bar{p}$ gives the $t = 1$ equilibrium stock price:

$$\bar{p} = \sqrt{1-a}+\frac{\sum_{i=1}^n u_s^i}{n}\phi\sqrt{a}-\frac{1-\bar{z}_m^{\mathrm{LT}}}{n}\rho\sigma^2. \tag{67}$$

Substituting the stock price $\bar{p}$ from (67) in (65) gives the fraction of the firm held by shareholder i in equilibrium:

$$\bar{z}_i = \frac{\left(u_s^i - \frac{\sum_{h=1}^n u_s^h}{n}\right)\phi\sqrt{a}}{\rho\sigma^2} + \frac{1-\bar{z}_m^{\mathrm{LT}}}{n}. \tag{68}$$

With heterogeneous preferences, a shareholder who values CSP more will hold a larger fraction of a socially responsible firm in equilibrium.

First-Best with Heterogeneous Preferences

We redefine the first-best, i.e., the outcome in the absence of agency problems, in the setting with heterogeneous shareholder preferences.

Denote by z_i^{FB} the fraction of shares held by shareholder i at $t = 1$ at the first-best. It is the outcome of the optimal portfolio allocation when shareholders directly manage the firm, and is therefore given by (68) with $\bar{z}_m^{\mathrm{LT}} = 0$, where the value of a is taken as given at this stage:

$$z_i^{\mathrm{FB}} = \frac{\left(u_s^i - \frac{\sum_{h=1}^n u_s^h}{n}\right)\phi\sqrt{a}}{\rho\sigma^2} + \frac{1}{n}. \tag{69}$$

With $\bar{z}_m^{\mathrm{ST}} = \bar{z}_m^{\mathrm{LT}} = 0$, the stake of shareholder i at $t = 0$ is the same.

In accordance with the criterion proposed by Grossman and Hart (1979), the first-best resource allocation in which shareholders directly manage the firm, $\bar{a}^{\mathrm{FB}}$, is the value of a that maximizes

$$\sum_{i=1}^n \left\{ z_i^{\mathrm{FB}}\left(\sqrt{1-a} + u_s^i\phi\sqrt{a}\right) - \frac{\rho}{2} z_i^{\mathrm{FB}^2}\sigma^2 \right\} - C. \tag{70}$$

Denoting $\sigma_{u_s}^2 \equiv \sum_{i=1}^n \frac{1}{n}\left(u_s^i - \frac{\sum_{h=1}^n u_s^h}{n}\right)^2$, the first-order condition with respect to a is

$$-\frac{1}{2}\frac{1}{\sqrt{1-a}} + \frac{n\sigma_{u_s}^2\phi^2}{\rho\sigma^2} + \frac{1}{2}\frac{\sum_{i=1}^n u_s^i}{n}\phi\frac{1}{\sqrt{a}} - \frac{n\sigma_{u_s}^2\phi^2}{2\rho\sigma^2} = 0. \tag{71}$$

As the expression in (70) is concave in a, the optimum $\bar{a}^{\mathrm{FB}}$ is given by the first-order condition in (71), which after some rearranging gives

$$\bar{a}^{\mathrm{FB}} = \frac{\left(\frac{\sum_{i=1}^n u_s^i}{n}\right)^2\phi^2}{1 + \left(\frac{\sum_{i=1}^n u_s^i}{n}\right)^2\phi^2}. \tag{72}$$

Likewise, the stock price $\bar{p}$ in (67) is concave in a, so that the value of a that maximizes $\bar{p}$ is given by the first-order condition. Simple calculations show that the value of a that maximizes the stock price is equal to $\bar{a}^{\mathrm{FB}}$.

Proof of Proposition 4

This proof follows the same lines as the proof of Proposition 2 and is therefore abbreviated. With a contract $\xi = \{\bar{w}, \bar{z}_m^{\mathrm{ST}}, \bar{z}_m^{\mathrm{LT}}\}$, the argument in the utility function of a manager who exerts effort is

$$Y(\xi, a) = \bar{w} + \bar{z}_m^{\mathrm{ST}}\bar{p} + \bar{z}_m^{\mathrm{LT}}\left(\sqrt{1-a} + \tilde{\epsilon} + u_s^i\phi\sqrt{a}\right) - C. \tag{73}$$

Substituting the stock price $\bar{p}$ from (13) gives

$$\begin{aligned} Y(\xi, a) = &\bar{w} + \bar{z}_m^{\mathrm{ST}}\left[\sqrt{1-a} + \frac{\sum_{i=1}^n u_s^i}{n}\phi\sqrt{a} - \frac{1-\bar{z}_m^{\mathrm{LT}}}{n}\rho\sigma^2\right] \\ &+ \bar{z}_m^{\mathrm{LT}}\left(\sqrt{1-a} + \tilde{\epsilon} + u_s^j\phi\sqrt{a}\right) - C. \end{aligned} \tag{74}$$

The optimization problem of a manager who exerts effort is to choose a to maximize $\mathbb{E}[U(Y(\xi, a))|e = 1]$. Given that the problem is concave in a for $\bar{z}_m^{\mathrm{ST}} \geq 0$ and $\bar{z}_m^{\mathrm{LT}} > 0$, the optimal value $\bar{a}_m$ of a optimally chosen by the manager is described by the first-order condition of the manager's expected utility with respect to a, which after some rearranging yields $\bar{a}_m = \bar{a}^{\mathrm{FB}}$ (here it is crucial that $u_s^j = \frac{1}{n}\sum_{i=1}^n u_s^i$).

We now derive the optimal values of $\bar{w}$, $\bar{z}_m^{\mathrm{ST}}$, and $\bar{z}_m^{\mathrm{LT}}$ such that the manager accepts the contract and exerts effort. Using the certainty equivalent approach and the Grossman and Hart (1979) criterion, the optimization problem of shareholders at $t = 0$ is[9]

$$\begin{aligned} \max_{\bar{w}, \bar{z}_m^{\mathrm{ST}}, \bar{z}_m^{\mathrm{LT}}} \sum_{i=1}^n &\left[\bar{z}_i\left(\sqrt{1-a} + u_s^i\phi\sqrt{a}\right)\right. \\ &\left. - \left(\bar{z}_i + \frac{\bar{z}_m^{\mathrm{LT}}}{n}\right)\left(\bar{w} + \bar{z}_m^{\mathrm{ST}}\bar{p}\right) - \frac{\rho}{2}\bar{z}_i^2\sigma^2\right] \end{aligned} \tag{75}$$

$$\begin{aligned} &= \left(1 - \bar{z}_m^{\mathrm{LT}}\right)\left(\sqrt{1-a} + \frac{\sum_{i=1}^n u_s^i}{n}\phi\sqrt{a}\right) \\ &\quad + \frac{n\sigma_{u_s}^2\phi^2 a}{\rho\sigma^2} - \left(\bar{w} + \bar{z}_m^{\mathrm{ST}}\bar{p}\right) \\ &\quad - \frac{\rho}{2}\left(\frac{n\sigma_{u_s}^2\phi^2 a}{\rho^2\sigma^4} + \frac{\left(1-\bar{z}_m^{\mathrm{LT}}\right)^2}{n}\right)\sigma^2 \end{aligned} \tag{76}$$

[9] In equilibrium, given the shareholder structures at $t = 0$ and $t = 1$ (see (68)), the only transactions at $t = 1$ consist in each shareholder i buying $\left(\bar{z}_i + \frac{\bar{z}_m^{\mathrm{LT}}}{n}\right)\bar{z}_m^{\mathrm{ST}}$ shares from the manager at price $\bar{p}$ (this is proportional to the stake of each shareholder in the firm, and $\sum_{i=1}^n\left(\bar{z}_i + \frac{\bar{z}_m^{\mathrm{LT}}}{n}\right) = 1$ because of the market clearing equation). This is captured by the $\left(\bar{z}_i + \frac{\bar{z}_m^{\mathrm{LT}}}{n}\right)\bar{z}_m^{\mathrm{ST}}\bar{p}$ term in (75). Likewise, each shareholder i will pay a fraction of the manager's fixed wage $\bar{w}$ according to his stake in the firm. Finally, each shareholder will own a fraction $\bar{z}_i$ of the firm from $t = 1$ to $t = 2$, hence the other terms in (75).

given $a = \bar{a}^{\text{FB}}$, where we denoted $\sigma^2_{u_s} \equiv \sum_{i=1}^n \frac{1}{n}\left(u_s^i - \frac{\sum_{h=1}^n u_s^h}{n}\right)^2$, and we used (68) and $\sum_{i=1}^n\left(u_s^i - \frac{\sum_{h=1}^n u_s^h}{n}\right) = 0$. The objective function in (76) is maximized subject to the following constraints:

$$\mathbb{E}[U(Y(\xi,\bar{a}^{\text{FB}}))|e=1] \geq \mathbb{E}[U(Y(\xi,a))|e=0] \tag{77}$$

$$\mathbb{E}[U(Y(\xi,\bar{a}^{\text{FB}}))|e=1] \geq \bar{U}, \tag{78}$$

where $Y(\xi,a)$ conditional on $e=0$ is given in (74), and $Y(\xi,a)$ conditional on $e=0$ is $\bar{w} + \bar{z}_m^{\text{ST}}\left[-\frac{1-\bar{z}_m^{\text{LT}}}{n}\rho\sigma^2\right] + \bar{z}_m^{\text{LT}}\tilde{\epsilon}$. As before, there is a continuum of contracts that achieve incentive compatibility; as in Edmans et al. (2009), we choose the maximum between the level of $\bar{z}_m^{\text{ST}}$ which satisfies (77) as an equality and zero (so that $\bar{z}_m^{\text{ST}} \geq 0$).

Using the certainty equivalent approach, the incentive constraint (77) may be rewritten as

$$\begin{aligned}&\bar{w} + \bar{z}_m^{\text{ST}}\left[\sqrt{1-\bar{a}^{\text{FB}}} + \frac{\sum_{i=1}^n u_s^i}{n}\phi\sqrt{\bar{a}^{\text{FB}}} - \frac{1-\bar{z}_m^{\text{LT}}}{n}\rho\sigma^2\right]\\ &\quad + \bar{z}_m^{\text{LT}}\left(\sqrt{1-\bar{a}^{\text{FB}}} + u_s^j\phi\sqrt{\bar{a}^{\text{FB}}}\right) - C - \frac{\rho}{2}\left(\bar{z}_m{}^{\text{LT}}\right)^2\sigma^2\\ &\geq \bar{w} + \bar{z}_m^{\text{ST}}\left[-\frac{1-\bar{z}_m^{\text{LT}}}{n}\rho\sigma^2\right] - \frac{\rho}{2}\left(\bar{z}_m^{\text{LT}}\right)^2\sigma^2.\end{aligned} \tag{79}$$

Removing offsetting terms, using $u_s^j = \frac{\sum_{i=1}^n u_s^i}{n}$, and rearranging yields

$$\left(\bar{z}_m^{\text{ST}} + \bar{z}_m^{\text{LT}}\right)\left(\sqrt{1-\bar{a}^{\text{FB}}} + \frac{\sum_{i=1}^n u_s^i}{n}\phi\sqrt{\bar{a}^{\text{FB}}}\right) \geq C. \tag{80}$$

Denoting by $\bar{W}$ the reservation wage which is implicitly defined by $U(\bar{W}) \equiv \bar{U}$, and given that the equity holdings are such that the manager exerts effort, the participation constraint (78) may be rewritten with the certainty equivalent approach as

$$\begin{aligned}&\bar{w} + \bar{z}_m^{\text{ST}}\left[\sqrt{1-\bar{a}^{\text{FB}}} + \frac{\sum_{i=1}^n u_s^i}{n}\phi\sqrt{\bar{a}^{\text{FB}}} - \frac{1-\bar{z}_m^{\text{LT}}}{n}\rho\sigma^2\right]\\ &\quad + \bar{z}_m^{\text{LT}}\left(\sqrt{1-\bar{a}^{\text{FB}}} + u_s^j\phi\sqrt{\bar{a}^{\text{FB}}}\right) - C - \frac{\rho}{2}(\bar{z}_m^{\text{LT}})^2\sigma^2 \geq \bar{W}.\end{aligned} \tag{81}$$

We denote by μ and λ the Lagrange multipliers associated with the constraints (80) and (81), respectively.

The first-order conditions of the optimization problem in (76)–(78) with respect to $\bar{w}$, $\bar{z}_m^{\text{ST}}$, and $\bar{z}_m^{\text{LT}}$ are then, respectively,

$$-1 + \lambda = 0 \tag{82}$$

$$\begin{aligned}&-\left[\sqrt{1-\bar{a}^{\text{FB}}} + \frac{\sum_{i=1}^n u_s^i}{n}\phi\sqrt{\bar{a}^{\text{FB}}} - \frac{1-\bar{z}_m^{\text{LT}}}{n}\rho\sigma^2\right]\\ &+\lambda\left[\sqrt{1-\bar{a}^{\text{FB}}} + \frac{\sum_{i=1}^n u_s^i}{n}\phi\sqrt{\bar{a}^{\text{FB}}} - \frac{1-\bar{z}_m^{\text{LT}}}{n}\rho\sigma^2\right] + \mu = 0\end{aligned} \tag{83}$$

$$\begin{aligned}&-\left(\sqrt{1-\bar{a}^{\text{FB}}} + \frac{\sum_{i=1}^n u_s^i}{n}\phi\sqrt{\bar{a}^{\text{FB}}}\right)\\ &-\bar{z}_m^{\text{ST}}\frac{\rho\sigma^2}{n} + \rho\frac{1-\bar{z}_m^{\text{LT}}}{n}\sigma^2\\ &+\lambda\left(\sqrt{1-\bar{a}^{\text{FB}}} + u_s^j\phi\sqrt{\bar{a}^{\text{FB}}} + \bar{z}_m^{\text{ST}}\frac{\rho\sigma^2}{n} - \rho\bar{z}_m^{\text{LT}}\sigma^2\right)\\ &+\mu = 0.\end{aligned} \tag{84}$$

Equation (82) gives $\lambda = 1$, which used in (83) implies $\mu = 0$. With $\lambda = 1$ and $\mu = 0$, the first-order condition (84) can be rewritten as

$$\bar{z}_m^{\text{LT}} = \frac{1}{1+n}. \tag{85}$$

Plugging in (80) and equating both sides, and using $\bar{z}_m^{\text{ST}} \geq 0$ gives

$$\bar{z}_m^{\text{ST}} = \max\left\{\frac{C}{\sqrt{1-\bar{a}^{\text{FB}}} + \frac{\sum_{i=1}^n u_s^i}{n}\phi\sqrt{\bar{a}^{\text{FB}}}} - \frac{1}{1+n}, 0\right\}. \tag{86}$$

Finally, substituting for $\bar{z}_m^{\text{ST}}$ and $\bar{z}_m^{\text{LT}}$ in (81) gives the fixed wage, which satisfies the participation constraint as an equality ($\lambda = 1$ implies that the participation constraint is binding due to the complementary slackness condition):

$$\begin{aligned}\bar{w} = &\bar{W} - \max\left\{\frac{C}{\sqrt{1-\bar{a}^{\text{FB}}} + \frac{\sum_{i=1}^n u_s^i}{n}\phi\sqrt{\bar{a}^{\text{FB}}}} - \frac{1}{1+n}, 0\right\}\\ &\left[\sqrt{1-\bar{a}^{\text{FB}}} + \frac{\sum_{i=1}^n u_s^i}{n}\phi\sqrt{\bar{a}^{\text{FB}}} - \frac{1-\frac{1}{1+n}}{n}\rho\sigma^2\right]\\ &-\frac{1}{1+n}\left(\sqrt{1-\bar{a}^{\text{FB}}} + u_s^j\phi\sqrt{\bar{a}^{\text{FB}}}\right) + C + \frac{\rho}{2}\frac{1}{(1+n)^2}\sigma^2\end{aligned}. \tag{87}$$

Proof of Proposition 5

Let the manager have u_s^j such that $u_s^j \neq \frac{1}{n}\sum_{i=1}^n u_s^i$. We will show that this results in inefficiencies relative to the case studied in Proposition 4.

First, suppose that $\bar{z}_m^{\text{LT}} = 0$. Then risk sharing is not socially optimal, an inefficiency.

Second, suppose that $\bar{z}_m^{\mathrm{LT}} > 0$. Consider the case $u_s^j > \frac{1}{n}\sum_{i=1}^n u_s^i$ (respectively $u_s^j < \frac{1}{n}\sum_{i=1}^n u_s^i$). Then the first-best optimal resource allocation coincides with the allocation that maximizes the stock price, but a manager with long-term equity holdings $\left(\bar{z}_m^{\mathrm{LT}} > 0\right)$ will optimally choose a resource allocation strictly higher (resp. lower) than at the first-best, given that the argument in the utility function of a manager who exerts effort is

$$\begin{aligned} Y(\xi, a) = & \bar{w} + \bar{z}_m^{\mathrm{ST}}\left[\sqrt{1-a} + \frac{\sum_{i=1}^n u_s^i}{n}\phi\sqrt{a} - \frac{1-\bar{z}_m^{\mathrm{LT}}}{n}\rho\sigma^2\right] \\ & + \bar{z}_m^{\mathrm{LT}}\left(\sqrt{1-a} + \tilde{\epsilon} + u_s^j\phi\sqrt{a}\right) - C \end{aligned} \tag{88}$$

The certainty equivalent of $\mathbb{E}[U(Y(\xi,a))|e=1]$ is therefore

$$\begin{aligned} \mathrm{CE}(\xi, a) = & \bar{w} + \bar{z}_m^{\mathrm{ST}}\left[\sqrt{1-a} + \frac{\sum_{i=1}^n u_s^i}{n}\phi\sqrt{a} - \frac{1-\bar{z}_m^{\mathrm{LT}}}{n}\rho\sigma^2\right] \\ & + \bar{z}_m^{\mathrm{LT}}\left(\sqrt{1-a} + u_s^j\phi\sqrt{a}\right) - C - \frac{\rho}{2}\bar{z}_m^{\mathrm{LT}\,2}\sigma^2 \end{aligned} \tag{89}$$

The certainty equivalent is concave in a, so that the value of a optimally chosen by the manager is given by the following first-order condition:

$$\begin{aligned} & \bar{z}_m^{\mathrm{ST}}\left[-\frac{1}{2}(1-a)^{-1/2} + \frac{\sum_{i=1}^n u_s^i}{n}\phi\frac{1}{2}a^{-1/2}\right] \\ & + \bar{z}_m^{\mathrm{LT}}\left(-\frac{1}{2}(1-a)^{-1/2} + u_s^j\phi\frac{1}{2}a^{-1/2}\right) \\ & = 0 \end{aligned} \tag{90}$$

$$\Leftrightarrow \frac{(1-a)^{-1/2}}{a^{-1/2}} = \phi\frac{\bar{z}_m^{\mathrm{ST}}\frac{\sum_{i=1}^n u_s^i}{n} + \bar{z}_m^{\mathrm{LT}}u_s^j}{\bar{z}_m^{\mathrm{ST}} + \bar{z}_m^{\mathrm{LT}}} \tag{91}$$

$$\Leftrightarrow a = \frac{\phi^2\left(\bar{z}_m^{\mathrm{ST}}\frac{\sum_{i=1}^n u_s^i}{n} + \bar{z}_m^{\mathrm{LT}}u_s^j\right)^2}{\left(\bar{z}_m^{\mathrm{ST}} + \bar{z}_m^{\mathrm{LT}}\right)^2 + \phi^2\left(\bar{z}_m^{\mathrm{ST}}\frac{\sum_{i=1}^n u_s^i}{n} + \bar{z}_m^{\mathrm{LT}}u_s^j\right)^2}. \tag{92}$$

With $\bar{z}_m^{\mathrm{LT}} > 0$ and $u_s^j \neq \frac{1}{n}\sum_{i=1}^n u_s^i$, the value of a as derived in (92) is different from the first-best resource allocation $\bar{a}^{\mathrm{FB}}$ derived in (72), an inefficiency.[10]

[10] The manager chooses a to maximize a weighted sum of two terms. First, his short-term stock price-based compensation, with weight $\bar{z}_m^{\mathrm{ST}}$, which is maximized by choosing $a = \bar{a}^{\mathrm{FB}}$. Second, his own objective function as a shareholder with social preference u_s^j, with weight $\bar{z}_m^{\mathrm{LT}}$, which is maximized by choosing $a = \frac{u_s^{j\,2}\phi^2}{1+u_s^{j\,2}\phi^2}$, which is larger (resp. smaller) than $\bar{a}^{\mathrm{FB}}$. The allocation optimally chosen by manager j is therefore a convex combination of $\bar{a}^{\mathrm{FB}}$ and $\frac{u_s^{j\,2}\phi^2}{1+u_s^{j\,2}\phi^2} \neq \bar{a}^{\mathrm{FB}}$, where the weight on the latter is strictly positive due to $\bar{z}_m^{\mathrm{LT}} > 0$.

References

Andreoni, J., & Miller, J. (2002). Giving according to GARP: An experimental test of the consistency of preferences for altruism. *Econometrica*, *70*(2), 737–753.

Baron, D. P. (2008). Managerial contracting and corporate social responsibility. *Journal of Public Economics*, *92*(1–2), 268–288.

Besley, T., & Ghatak, M. (2005). Competition and incentives with motivated agents. *American Economic Review*, *95*(3), 616–636.

Brammer, S., Brooks, C., & Pavelin, S. (2006). Corporate social performance and stock returns: UK evidence from disaggregate measures. *Financial Management*, *35*(3), 97–116.

Brekke, K. A., & Nyborg, K. (2008). Attracting responsible employees: Green production as labor market screening. *Resource and Energy Economics*, *30*(4), 509–526.

de Bettignies, J.-E., & Robinson, D. T. (2013). *When is social responsibility socially desirable*? Working paper, Queen's University.

Demange, G., & Laroque, G. (2006). *Finance and the economics of uncertainty*. Cambridge, MA: Wiley-Blackwell.

Edmans, A., Gabaix, X., & Landier, A. (2009). A multiplicative model of optimal CEO incentives in market equilibrium. *Review of Financial Studies*, *22*(12), 4881–4917.

Friedman, M. (1970, September 13). The social responsibility of business is to increase its profits. *New York Times Magazine*.

Frydman, C., & Jenter, D. (2010). CEO compensation. *Annual Review of Financial Economics*, *2*, 75–102.

Frye, M. B., Nelling, E., & Webb, E. (2006). Executive compensation in socially responsible firms. *Corporate Governance: An International Review*, *14*(5), 446–455.

Galema, R., Plantinga, A., & Scholtens, B. (2008). The stocks at stake: Return and risk in socially responsible investment. *Journal of Banking and Finance*, *32*(12), 2646–2654.

Garriga, E., & Melé, D. (2004). Corporate social responsibility theories: Mapping the territory. *Journal of Business Ethics*, *53*(1–2), 51–71.

Gollier, C. (2001). *The economics of risk and time*. Cambridge, MA: MIT Press.

Graff Zivin, J., & Small, A. (2005). A Modigliani-Miller theory of altruistic corporate social responsibility. *Topics in Economic Analysis & Policy*, *5*(1), Article 10.

Grossman, S. J., & Hart, O. D. (1979). A theory of competitive equilibrium in stock market economies. *Econometrica*, *47*(2), 293–329.

Grossman, S. J., & Stiglitz, J. E. (1980). On the impossibility of informationally efficient markets. *American Economic Review*, *70*(3), 393–408.

Holmström, B., & Milgrom, P. (1991). Multitask Principal–Agent analyses: Incentive contracts, asset ownership, and job design. *Journal of Law, Economics, and Organization*, *7*, 24–52.

Kitzmueller, M., & Shimshack, J. (2012). Economic perspectives on corporate social responsibility. *Journal of Economic Literature*, *50*(1), 51–84.

Kolstad, I. (2007). Why firms should not always maximize profits. *Journal of Business Ethics*, *76*(2), 137–145.

Laffont, J.-J., & Martimort, D. (2001). *The theory of incentives*. Princeton, NJ: Princeton University Press.

Lyon, T. P., & Maxwell, J. W. (2008). Corporate social responsibility and the environment: A theoretical perspective. *Review of Environmental Economics and Policy*, *2*(2), 240–260.

Margolis, J. D., Elfenbein, H. A., & Walsh, J. P. (2007). *Does it pay to be good? A meta-analysis and redirection of research on the relationship between corporate social and financial performance*. Working Paper, Harvard University.

McWilliams, A. (2000). Corporate social responsibility. *Wiley Encyclopedia of Management*, *12*, 1–4.

McWilliams, A., & Siegel, D. (2001). Corporate social responsibility: A theory of the firm perspective. *Academy of Management Review*, *26*(1), 117–127.

Reinhardt, F. L., Stavins, R. N., & Vietor, R. H. K. (2008). Corporate social responsibility through an economic lens. *Review of Environmental Economics and Policy*, *2*(2), 219–239.

Ruf, B. M., Muralidhar, K., Brown, R. M., Janney, J. J., & Paul, K. (2001). An empirical investigation of the relationship between change in corporate social performance and financial performance: A stakeholder theory perspective. *Journal of Business Ethics*, *32*(2), 143–156.

Sinclair-Desgagné, B. (1999). How to restore higher-powered incentives in multi-task agencies. *Journal of Law, Economics, and Organization*, *15*(2), 418–433.

Sparkes, R., & Cowton, C. J. (2004). The maturing of socially responsible investment: A review of the developing link with corporate social responsibility. *Journal of Business Ethics*, *52*(1), 45–57.

Tirole, J. (2001). Corporate governance. *Econometrica*, *69*(1), 1–35.

van Beurden, P., & Gössling, T. (2008). The worth of values: A literature review on the relation between corporate social and financial performance. *Journal of Business Ethics*, *82*(2), 407–424.

Viénot, M. (1995). Le conseil d'administration des sociétés cotées.