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Public Thrift, Private Perks: Signaling Board Independence with Executive Pay

PABLO RUIZ-VERDÚ and RAVI SINGH*

ABSTRACT

We analyze how boards’ reputational concerns influence executive compensation and the use of hidden pay. Independent boards reduce disclosed pay to signal their independence, but are more likely than manager-friendly boards to use hidden pay or to distort incentive contracts. Stronger reputational pressures lead to lower disclosed pay, weaker managerial incentives, and higher hidden pay, whereas greater transparency of executive compensation has the opposite effects. Although reputational concerns can induce boards to choose compensation contracts more favorable to shareholders, we show that there is a threshold beyond which stronger reputational concerns harm shareholders. Similarly, excessive pay transparency can harm shareholders.

*Pablo Ruiz-Verdú is with the Department of Business Administration, Universidad Carlos III de Madrid. Ravi Singh is with Higher Moment Capital, LP. A previous version of this paper was circulated under the title “Board Independence, CEO Pay, and Camouflaged Compensation.” The authors are grateful to Philip Bond (the Editor), an anonymous Associate Editor, and two anonymous referees for their valuable feedback and suggestions. Pablo Ruiz-Verdú acknowledges the financial support of Spain’s Ministry of Science, Innovation and Universities, the State Research Agency, and FEDER (through grant PGC2018-097187-B-I00), Madrid’s Autonomous Community (through grant EARLYFIN-CM, #S2015/HUM-3353), and Spain’s Ministry of Economy and Competitiveness (through grant ECO2015-69615-R). We have read The Journal of Finance disclosure policy and have no conflicts of interest to disclose.

Correspondence: Pablo Ruiz-Verdú, Universidad Carlos III de Madrid, Department of Business Administration, Calle Madrid, 126, Getafe 28903, Madrid, Spain; e-mail:pablo.ruiz@uc3m.es
Boards of directors set CEO pay. Understanding how directors’ incentives affect compensation contracts is therefore essential for understanding executive pay. In this paper, we model CEO pay explicitly as a board decision determined by the extent of director independence and by directors’ reputational concerns. We show that a key consequence of directors’ reputational concerns is the use of camouflaged or hidden forms of pay, which are otherwise difficult to rationalize in optimal contracting models.\(^1\)

In our model, directors account for the effect of their compensation decisions on their reputation for independence. Boards signal their independence to investors by reducing the level of compensation that is disclosed to investors. However, boards offset part of this reduction by compensating CEOs in camouflaged ways. Moreover, while the reduction in disclosed pay in and of itself is beneficial to shareholders, this signaling is potentially inefficient because the reduction in CEO pay can lead to suboptimal managerial incentives and because hidden pay is more costly to the firm than disclosed pay (i.e., hidden forms of pay result in a deadweight loss). A key result is that independent boards are more likely to distort incentives and use hidden pay than are manager-friendly boards. Our analysis thus explains the use of hidden forms of pay as a by-product of independent boards’ effort to signal their independence to investors.

Reputational concerns are widely regarded as a key determinant of director incentives and play a central role in our analysis.\(^2\) In our model reputational concerns arise because we assume that shareholders do not observe directors’ true independence from management and must infer the degree of independence from directors’ actions. Of course, shareholders observe formal measures of director independence (such as, for example, whether a director is a former employee of the firm). However, shareholders may be unaware of undisclosed ties between directors and the firm or the CEO, or of other attributes, such as personality traits that influence the willingness of a director to confront the CEO.\(^3\)

\(^1\)Indeed, recent reviews of the literature on CEO compensation argue that “the widespread use of “stealth” compensation is difficult to explain if compensation were simply the efficient outcome of an optimal contract” (Frydman and Jenter (2010), p. 91), and that “The use of “stealth” compensation is a challenge for the shareholder value view” (Edmans, Gabaix, and Jenter (2017), p. 468).

\(^2\)The optimal contracting view of executive compensation builds on the implicit assumption that directors’ reputational concerns align their incentives with those of shareholders (see, for example, Fama and Jensen (1983)), so that boards choose compensation contracts that maximize shareholder value. At the other extreme, the rent extraction view of executive compensation holds that reputational concerns induce directors to camouflage managerial rent extraction (Bertrand and Mullainathan (2000), Bebchuk and Fried (2004)).

\(^3\)The NYSE’s Listed Company Manual states that “It is not possible to anticipate, or explicitly to provide
Compensation decisions are a particularly important indicator of director independence as there is a clear conflict between shareholder and management interests when it comes to the appropriate level of executive pay. Indeed, compensation decisions are commonly viewed as the “acid test” of corporate governance. It is for this reason that we focus on the signaling role of compensation decisions.

In addition to the pay that is disclosed to shareholders, we assume that the board can pay the manager in hidden ways. We further assume that hiding compensation is costly for two reasons. First, resources are diverted to camouflage pay. Second, the value to the manager of hidden forms of compensation is likely to be lower than their cost to the firm. For example, a manager is likely to prefer 100,000 dollars in cash over a perk that costs 100,000 dollars to the firm.

Our motivation for incorporating hidden pay into the model is the prevalence of camouflaged forms of executive pay such as perks that are difficult to observe, projects that yield private benefits for managers, poorly disclosed pension plans, backdated options, strategically timed option grants, or manipulated performance measures. The fact that boards appear to hide pay suggests that they care about the information that their compensation decisions convey to shareholders. The reputational concerns of directors are thus likely the primary motivation for boards adopting hidden forms of pay, as in our model.

As outlined above, the model yields several novel results. We show that independent boards signal their independence to investors by reducing CEO pay. Lower CEO pay is a credible signal of director independence because reducing CEO pay has a greater private cost for manager-friendly boards. Therefore, the benefit to shareholders of directors’ reputational concerns is that they generally lead to lower managerial pay. However, reputational concerns also have a dark side: independent boards may compensate the manager in costly undisclosed ways to make up for the reduction in disclosed pay that is necessary to signal their independence. In addition, reputational concerns can lead independent boards to choose inefficiently structured incentive compensation contracts. In particular, when reducing the

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4 Warren Buffett, Chairman and CEO of Berkshire Hathaway, famously described executive compensation as the acid test of corporate governance (see, for example, Buffet (2002)).
CEO’s base pay is not sufficient to signal independence, independent boards may also reduce incentive pay, leading to weaker managerial incentives.\(^5\)

Although the use of hidden pay or inefficient compensation structures is often attributed to a lack of independence, we show that independent boards are more likely than manager-friendly boards to engage in these practices. Hidden pay or other inefficient compensation structures are not a vehicle used by manager-friendly boards to deceive shareholders, but rather are a consequence of independent boards attempting to signal their independence to investors. Thus, the model suggests caution is due when interpreting the compensation structures of boards perceived to be independent as defining standards of good practice.

Another key result of the paper is that the availability of hidden pay exacerbates the effects of reputational concerns by making it less costly for manager-friendly boards to imitate independent boards, thus forcing independent boards to distort compensation contracts to an even greater extent to signal their independence. The availability of hidden pay can thus lead to inefficiencies, even if boards do not use hidden pay in equilibrium, by inducing independent boards to choose inefficient disclosed contracts. In fact, the availability of hidden pay can lead to a significant deadweight loss precisely when the cost of hiding pay is negligible because independent boards are forced to distort incentives the most when the low cost of hiding pay makes it cheap for manager-friendly boards to imitate independent boards.

We derive several empirical implications from the model that shed light on the potential impact of recent regulatory changes and corporate governance trends towards greater transparency and board accountability.\(^6\) Disclosure requirements that aim to make executive compensation more transparent or greater scrutiny of compensation packages by external monitors will generally have the intended effect of discouraging the use of hidden pay. However, by making it more costly for manager-friendly boards to imitate the pay policies of independent boards, greater transparency reduces the pressure on independent boards to reduce CEO pay to signal their independence and thus can lead to higher managerial pay and lower profits. Indeed, we show that transparency is likely to be beneficial only up to a certain threshold, beyond which the increase in disclosed pay outweighs the benefit of

\(^5\)These results are in line with Jensen and Murphy’s (1990) conjecture that “political forces” together with disclosure requirements create distortions in the structure of compensation schemes.

\(^6\)For example, the SEC strengthened the disclosure requirements for executive compensation in rules introduced in 2006, 2009, and 2015.
reducing hidden pay and inefficient contract distortions, so that some pay opacity is optimal for shareholders. Our model thus shows that although stricter disclosure requirements may have beneficial effects, there is a limit to how far mandated disclosure can go before it is value-decreasing.\footnote{Hermalin and Weisbach (2012) also reach this conclusion, but they analyze different mechanisms through which disclosure may affect CEO pay. We discuss the relation between our results and theirs in Section IV.B.}

We also show that corporate governance changes that increase the value of a reputation for independence, such as an increase in institutional ownership, the adoption of voting rules that increase investor influence over the election of directors, or an increase in the influence of proxy advisory firms, will generally lead to lower executive compensation but may also have the unintended effects of increasing the use of inefficient hidden pay or inefficiently reducing the strength of CEOs’ incentives. As in the case of transparency, there is generally a threshold level beyond which the distortions created by increased reputational pressure outweigh the benefit for shareholders of lower CEO pay.

Despite the emphasis on camouflaged compensation by rent extraction explanations of executive pay (Bebchuk and Fried (2004)), hidden compensation is absent from formal models of executive compensation. An exception is the model proposed by Kuhnen and Zwiebel (2008). However, in their model the CEO effectively sets his own compensation, so the model cannot shed light on the role played by the board in determining executive pay.

The theoretical literature on executive compensation abstracts from the role of boards, with a few notable exceptions. Hermalin and Weisbach (1998) propose a model in which the board decides whether to retain the CEO, and bargains with the CEO over the CEO’s pay and the board’s composition. Almazan and Suarez (2003) develop a model in which the CEO’s incentives are determined by both a compensation contract designed by the board and the board’s bargaining power when negotiating the CEO’s replacement. Hermalin (2005) analyzes a model in which the board decides whether to replace a CEO of unknown ability. He shows that more diligent monitoring by boards may lead to higher CEO pay by inducing higher CEO effort, which must be compensated. Kumar and Sivaramakrishnan (2008) propose a model in which the board acquires information about the firm and selects a compensation contract for the CEO. They find that the equilibrium relationship between independence and equity compensation is ambiguous. None of these papers considers the impact of directors’ reputational concerns on their choice of CEO compensation.
Several other papers model the board as a monitor or adviser of the manager (see Adams, Hermelin, and Weisbach (2010), for a review). However, none of these models investigates the role of the board in determining CEO compensation contracts. Further, only Song and Thakor (2006), Fisman et al. (2014), and Levit and Malenko (2016) explicitly analyze board reputation. In Song and Thakor’s model, boards consider whether to accept a project proposed by the CEO based on the potential impact of their decision on their reputation as experts. Fisman et al. (2014) consider a model in which the board decides whether to replace the CEO and bears a cost for taking a decision contrary to shareholders’ desires. Levit and Malenko (2016) propose a model in which director independence is private information, and directors can signal their independence through governance decisions that affect the allocation of control between shareholders and managers. In their model, the type of reputation that is valued by the labor market for directors is determined in equilibrium, and multiple equilibria can exist, with a reputation for independence being valued in some equilibria and a reputation for manager-friendliness being valued in others.

To our knowledge, only Dasgupta and Noe (2019) provide a model in which boards’ reputational concerns affect their compensation decisions. Dasgupta and Noe (2019) consider a setting in which offering the manager a bonus if the firm invests in a project is optimal only under certain circumstances, which are known to the board but not to shareholders, and analyze how the threat of shareholder outrage affects the bonus policy of both shareholder and manager-oriented boards. We discuss how their results relate to ours in Section III.

The remainder of the paper is organized as follows. In Section I we describe the setup of the model. To analyze the impact of the board’s reputational concerns on the levels of disclosed and hidden pay, in Section II we present a baseline model in which the manager’s disclosed compensation is assumed to consist solely of a fixed salary. Section III extends the baseline model to analyze how the board’s reputational concerns affect the design of compensation contracts and managerial incentives. In Section IV we discuss the model’s predictions regarding CEO pay, we analyze the impact of changes in pay transparency and the strength of boards’ reputational concerns on shareholder wealth, and we contrast hidden versus public perks and show that the ability of the board to hide pay plays a critical role in our analysis. Section V concludes. All proofs are in the Appendix. We provide a table summarizing the notation used in the paper at the end of the Appendix.
I. Setup

We consider a model of a firm’s board of directors with the following timeline. The board of directors designs the disclosed compensation contract for the firm’s risk-neutral manager and decides whether to pay the manager an additional amount of hidden pay. The labor market for directors, which we treat as a single player, observes the disclosed compensation contract, but not the hidden pay, and allocates board seats to the firm’s directors. Finally, profits net of hidden pay and total compensation are realized.

A. Board Preferences, Independence, and Reputational Concerns

We treat the board as a single decision maker with preferences defined over the manager’s expected utility ($w$), the firm’s expected profits ($\pi$), and the labor market’s belief that the board is independent ($\mu \in [0, 1]$).

We assume that the board’s utility is increasing in expected profits because directors’ pay is tied to firm performance or because they derive utility from fulfilling their fiduciary duty towards the firm’s risk-neutral shareholders. Importantly, whereas most previous models of boards (e.g., Hermalin and Weisbach (1998), Raheja (2005)) incorporate reputational concerns through a preference for higher profits, we model those reputational concerns explicitly through the impact of the board’s decisions on the labor market’s belief $\mu$.

We also assume that the board’s utility is increasing in the manager’s utility. Directors are likely to care about the manager because pleasing the manager makes the manager more likely to favor the board. For example, increasing CEO pay may make the CEO more likely to support increases in director compensation or to channel the firm’s donations to directors’ preferred charities. Directors may also want to favor the manager if they are averse to boardroom conflict (preferring a “quiet life”) and higher pay makes the relationship with the manager less adversarial, if they develop a friendship with the CEO, or if they feel the need to reciprocate if the CEO helped them get elected to the board.

The factors determining directors’ independence are likely to vary across directors, making some boards more manager-friendly than others. For example, some directors may have an undisclosed stake in firms that conduct business with the firm or in nonprofit organizations that could benefit from the firm’s charitable giving. Such directors will have a stronger incentive to favor the manager in order to influence the manager’s choices to their advantage.
Directors may also differ in personality traits or may have a preexisting relationship with the CEO. We assume that there are two types of boards: manager-friendly boards (M boards) and independent boards (I boards), which differ in their willingness to favor the manager at the expense of profits. The probability that a board is I is common knowledge and equal to \( q \in (0, 1) \).

Since M boards favor the manager at the expense of shareholders, we assume that the labor market for directors values director independence.\(^8\) However, since the labor market cannot observe the board’s true independence, its allocation of board seats depends on its belief \( \mu \) that the board is type I. Instead of explicitly modeling the labor market for directors, we assume that directors’ expected utility from future board appointments is an increasing function of \( \mu \). For simplicity, we assume that the board’s utility has the form\(^9\)

\[
U(w, \pi, \mu, t; \eta) = \pi + tv(w) + \eta \mu. \tag{1}
\]

The parameter \( t \) is the board’s type, which is equal to \( M > 0 \) if the board is type M and to \( I \in (0, M) \) if the board is type I. To capture the board’s preference for higher manager utility, we assume that \( v' > 0 \). We also assume that \( v'' < 0 \) and that \( Mv'(w) < 1 \) for \( w \) sufficiently large, so that boards do not want to increase the manager’s utility without bound. Finally, \( \eta > 0 \) represents the strength of directors’ reputational concerns. The term \( \eta \mu \) can thus be interpreted as the board’s discounted expected utility if the labor market believes that the board is I with probability \( \mu \) and acts according to that belief. We assume that directors prefer any feasible \((w, \pi, \mu)\) to leaving the firm, so we can disregard the board’s participation constraint.

\(^8\)While Levit and Malenko (2016) show that there can exist equilibria in which directors benefit from a reputation for being manager-friendly, the evidence generally indicates that directors benefit from a reputation for independence. Excessive pay is penalized in the director labor market (Morgan, Poulsen, and Wolf (2006), Cai, Garner, and Walkling (2009), Fischer et al. (2009), Yermack (2010), Ertimur, Ferri, and Muslu (2011)) and CEO turnover-performance sensitivity is higher when directors are close to reelection (Fos, Li, and Tsoutsoura (2018)). Directors that retain antitakeover provisions (Coles and Hoi (2003)) or block takeover bids (Harford (2003)) are appointed to fewer additional boards. The opinion of proxy-advisory firms and activist institutional investors, which strongly endorse director independence, is important for directors’ careers (Alexander et al. (2009), Cai, Garner, and Walkling (2009)). Jiang, Wan, and Zhao (2016) find that dissenting from management is rewarded by the market and that directors with stronger reputational concerns dissent more, although Marshall (2015) does not find significant effects of dissent.

\(^9\)We omit arguments placed after the semicolon whenever clarity is not compromised.
B. Hidden Pay

The board offers the manager a disclosed compensation contract and hidden pay, which is not observed by the labor market for directors. In this section, we describe our assumptions concerning hidden pay. We postpone the description of the disclosed compensation contracts to Sections II and III.

To provide $y \geq 0$ dollars of hidden pay to the manager, the firm incurs a cost $z(y; \kappa)$, where $\kappa \geq 0$ is a parameter that determines the marginal cost of hidden pay. We assume that (i) $z(0; \kappa) = 0$ for all $\kappa$, $z_y(y; 0) = 1$ and $z_{yy}(y; \kappa) > 0$ for $\kappa > 0$, and (ii) $z_{\kappa\kappa}(y; \kappa) > 0$, so the marginal cost of hiding pay is increasing in the parameter $\kappa$. These assumptions imply that for any $\kappa > 0$, $z_y(y; \kappa) > 1$ for any $y \geq 0$ and $z(y; \kappa) > y$ for any $y > 0$, so $y$ dollars of hidden pay cost more than $y$ to the firm. Thus, hidden pay is inefficient. The assumptions also imply that $z_{\kappa}(y; \kappa) > 0$ for any $y > 0$, so the total cost of hiding pay is also increasing in $\kappa$ for $y > 0$. Throughout the paper, we assume that $\kappa > 0$.

The hidden pay variable $y$ captures the value in dollars (for the manager) of the compensation that the firm does not disclose. Hidden pay can take many forms. Firms can conceal perks by reporting them as business-related expenses.\(^{10}\) Option backdating allowed many firms to underreport the value of the stock options granted to their CEOs (Heron and Lie (2009)) and strategic timing of stock option grants or information releases by firms may achieve the same goal (Yermack (1997)). Some authors argue that defined-benefit pension plans for executives were a significant vehicle for hidden compensation prior to the 2006 regulatory changes that improved the disclosure of these plans (Bebchuk and Jackson (2005)). Further, hidden pay need not take the form of a monetary transfer. For instance, the board can compensate the manager by approving actions that generate private benefits for the manager, such as directing donations to the charities preferred by the manager, investing in the manager’s pet projects, or overinvesting if the manager has a preference for empire-building.

We assume that hidden pay is inefficient because of the direct costs of hiding monetary

\(^{10}\)For example, the Wall Street Journal reported that many corporate jets made frequent trips to resort destinations and that company disclosures often underreported the cost of executives’ personal flights (Maremont, Tom, and Mark McGinty, “Corporate jet set: Leisure vs. business,” Wall Street Journal, June 16, 2011). In the same year the article was published, the SEC investigated two firms for failing to disclose CEO perks, highlighting their personal use of company aircraft (McGinty, Mark, and Tom Maremont, “SEC probes Nabors’s executive perks, jets,” Wall Street Journal, November 11, 2011).
payments or perks or because of the expected cost of potential legal penalties for the firm if hidden pay is discovered.\footnote{For example, in a case initiated by the SEC in 2015, Polycom Inc. agreed to pay the SEC $750,000 to settle civil charges that the firm had failed to report corporate funds used for personal perks (Stynes, Tess, “Polycom Inc. agrees to pay $750,000 to settle SEC civil charges,” \textit{Wall Street Journal}, March 31, 2015).} Hidden compensation may also be inefficient simply because its value to the manager is lower than its cost to the firm. For example, a manager is likely to prefer a cash payment of $X$ dollars over an undisclosed perk (say, the use of a luxury suite at a football stadium whose lease is not reported as a perk) that costs $X$ dollars.

Hidden pay reduces profits, so in principle the labor market could try to infer hidden pay from profits. We sidestep this issue, allowing hidden pay to be fully hidden, by assuming that the labor market allocates board seats before profits are realized.

The assumption that the labor market does not observe profits before allocating seats is meant to capture the fact that reported profits provide little information about hidden pay at least in the short term. If the impact of hidden pay on profits takes time to materialize (for example, because donating to the charitable organization preferred by the CEO instead of the one that maximizes the reputational benefit for the firm takes time to affect profits) or if the board can hide this effect temporarily (e.g., by accounting manipulation or by borrowing from future periods as in Stein (1989)), hidden pay will not translate into lower profits in the short term. Moreover, even if hidden pay does affect profits, lower profits may be attributable to high noncompensation costs. If the variance of noncompensation costs is large relative to the amount of hidden pay, profits will provide little information about hidden pay.

One could incorporate imperfect learning from profits into the model by explicitly modeling how the board hides pay, how hidden pay affects profits over time, and how the labor market updates its belief about hidden pay from profits. However, doing so would greatly complicate the analysis with no obvious gain in insight. To capture the fact that learning about hidden pay takes time and the labor market has to act in the meantime, we simply assume that profits are realized after board seats are assigned. Therefore, in the model the only information available to the labor market for directors at the time it allocates seats is the compensation contract.

It is worth noting that the assumption that the board can hide pay is compatible with the labor market correctly inferring the amount of hidden compensation paid by the board.
in separating equilibria. It is also important to note that our results concerning the use of inefficient hidden pay rely crucially on the assumption that the board is able to hide pay. In Section IV.C we show that the board would not use inefficient perks in equilibrium if they were observable.

II. Reputational Concerns, Hidden Compensation, and the Level of CEO Pay

A. The Baseline Model

We first consider a baseline model in which the distribution of firm revenues is fixed and known, with expected revenues equal to $\bar{R}$, and the manager’s disclosed compensation contract consists solely of fixed pay $w_d$ (where the subscript stands for disclosed). We can restrict attention to fixed-pay contracts since shareholders and the manager are risk neutral and thus indifferent between a contract with fixed pay $w_d$ and any contract with expected pay $w_d$.

The manager’s utility is equal to disclosed pay $w_d$ if the board does not pay hidden compensation and to total pay $w_d + y$ if the board pays hidden compensation $y$ in addition to $w_d$. The manager’s reservation payoff is $w > 0$, so that the manager’s total pay has to satisfy the participation constraint

$$w_d + y \geq w.$$  \hspace{1cm} (2)

We note that disclosed pay $w_d$ can be lower than the manager’s reservation payoff $w$ as long as hidden pay $y$ ensures that the manager’s participation constraint is met. To simplify the discussion, in this section we assume that there are no constraints on $w_d$. In Section III, we introduce a more realistic nonnegativity constraint on the manager’s pay.

B. Hidden Pay Choice and the Board’s Preferences over Contracts

Since hidden pay is not observed by the labor market, the board’s choice of $y$ has no reputational consequences. Thus, given disclosed pay $w_d$, a board of type $t$ will pay the
hidden compensation \( y^*(w_d, t; \kappa) \) that, for fixed \( \mu \), maximizes its utility,

\[
U(w_d + y, \bar{R} - w_d - z(y; \kappa), \mu, t; \eta) = \bar{R} - w_d - z(y; \kappa) + tv(w_d + y) + \eta \mu,
\]

and satisfies the manager’s participation constraint, irrespective of whether the labor market knows its type or can infer it from its choice of disclosed contract.

The properties of \( y^*(\cdot) \), which we describe formally in Lemma A.1 in the Appendix, follow straightforwardly from our assumptions about the board’s preferences and the cost of hiding pay \( z(\cdot) \): a type-\( t \) board pays no hidden compensation if \( w_d \) is sufficiently high, in particular, if \( w_d \) is greater than or equal to a threshold \( w_d^t \). This threshold is greater than or equal to the manager’s reservation payoff \( \bar{w} \), since the board must pay hidden compensation to meet the manager’s participation constraint if disclosed pay is below \( \bar{w} \), and is decreasing in the cost of hiding compensation \( \kappa \). If disclosed pay is below the threshold \( w_d^t \), the board pays hidden compensation, with the amount of hidden pay decreasing in the level of disclosed pay. Even though hidden pay increases when \( w_d \) falls, the inefficiency of hidden pay ensures that total pay \( w_d + y^*(w_d, t; \kappa) \) falls if disclosed pay \( w_d \) decreases, except if \( w_d \) is so low that the hidden pay set by the board is just enough to ensure that the manager’s participation constraint holds, that is, \( w_d + y^*(w_d, t; \kappa) = \bar{w} \). Finally, for any given disclosed pay \( w_d \), the M board pays the manager higher hidden and total compensation than the I board, except if \( w_d \) is sufficiently high that both board types pay zero hidden compensation or sufficiently low that both types pay just enough hidden compensation to meet the manager’s participation constraint. In Figure 1, we show how hidden and total pay vary with disclosed pay for a particular specification of the board’s utility and the cost of hiding pay \( z \).\(^{12}\)

We assume throughout the paper that an M board would pay some hidden compensation if the disclosed pay left the manager at his reservation utility level. More precisely, we define \( \bar{\kappa} \) as the level of \( \kappa \) beyond which the M board would pay no hidden compensation if the manager’s disclosed pay were equal to his reservation value \( \bar{w} \). We assume that \( \kappa < \bar{\kappa} \) to avoid uninteresting corner cases in which both board types would behave identically in the absence of reputational concerns.\(^{13}\)

\(^{12}\)We derive \( y^* \) for this specification of the model in the Internet Appendix, which is available in the online version of this article on the Journal of Finance website.

\(^{13}\)Formally, we assume that there exists a \( \bar{\kappa} > 0 \) such that \( M v'(\bar{w}) - z_y(0; \bar{\kappa}) = 0 \), and thus \( M v'(\bar{w}) - z_y(0; \kappa) > 0 \) for \( \kappa < \bar{\kappa} \) (that is, the board’s marginal utility of hidden pay is positive at the manager’s
The board’s utility is defined in expression (1) as a function of the manager’s expected utility \( w \) and expected profits \( \pi \). However, since the board chooses a compensation contract, it greatly simplifies the analysis to redefine the board’s utility as a function of the disclosed contract. Given disclosed pay \( w_d \), the board pays hidden compensation \( y^*(w_d, t; \kappa) \), so that the manager’s total pay is \( w = w_d + y^*(w_d, t; \kappa) \) and the expected profit net of hidden pay is \( \pi = R - w_d - z(y^*(w_d, t; \kappa); \kappa) \). The indirect utility for a type-\( t \) board given disclosed contract \( w_d \) and labor market beliefs \( \mu \) is thus

\[
V^*(w_d, \mu, t; \kappa, \eta) = R - w_d - z(y^*(w_d, t; \kappa); \kappa) + tw (w_d + y^*(w_d, t; \kappa)) + \eta \mu. \tag{4}
\]

The primitive utility \( U \) has a strict single-crossing property: if the M board is willing to reduce the manager’s expected utility \( w \) in exchange for an increase in expected profits \( \pi \) or reputation \( \mu \), the I board strictly prefers such an exchange. As we prove in Lemma A.2 in the Appendix, \( V^* \) inherits this single-crossing property from \( U \). More precisely, if \( w''_d > w'_d \) and \( w''_d + y^*(w''_d, M; \kappa) > w \), then for any \( \mu'' \) and \( \mu' \),

\[
V^*(w'_d, \mu', M; \kappa, \eta) \geq V^*(w''_d, \mu'', M; \kappa, \eta) \Rightarrow V^*(w'_d, \mu', I; \kappa, \eta) > V^*(w''_d, \mu'', I; \kappa, \eta). \tag{5}
\]

The I board is thus more willing to reduce the manager’s disclosed pay in exchange for higher profits or reputation than the M board. The condition \( w''_d + y^*(w''_d, M; \kappa) > w \) ensures that if the M board reduced disclosed pay from \( w''_d \) to \( w'_d \), it would also reduce total pay. If the manager’s participation constraint is binding, so \( w''_d + y^*(w''_d, M; \kappa) = w \), then reducing disclosed pay would not affect total pay since total pay cannot be lower than \( w \).

C. **Disclosed and Hidden Pay in the Absence of Reputational Concerns**

Before we analyze the effect of boards’ reputational concerns on their compensation decisions, we describe boards’ compensation choices in the absence of reputational concerns.

Since hidden pay is costlier than disclosed pay, in the absence of reputational concerns boards will not make use of hidden pay. Moreover, since the M board places larger weight on the manager’s utility, it will pay the manager higher disclosed compensation.
**Proposition 1:** Let \( w_t^* \) be the disclosed pay chosen by a type-\( t \) board in the absence of reputational concerns. Then:

1. No board type pays hidden compensation: \( y^*(w_M^*, M) = y^*(w_I^*, I) = 0 \).
2. The \( M \) board offers greater compensation than the \( I \) board: \( w_M^* > w_I^* \).\(^{14}\)

A key premise of our analysis is that directors gain from having a reputation for independence. Proposition 1 implies that \( \pi_M^* \equiv \bar{R} - w_M^* < \pi_I^* \equiv \bar{R} - w_I^* \), so that in the absence of reputational concerns, expected profits are higher if the board is independent. Thus, as long as shareholders’ preferences determine the allocation of board seats, the labor market’s preference for independence could be derived endogenously within the model.

**D. Reputational Concerns and CEO Pay**

The labor market for directors cannot observe directors’ true independence. However, it observes the manager’s disclosed compensation and thus tries to infer the board’s independence from its compensation choice. Thus, when choosing a disclosed compensation contract, the board takes into account the impact of its choice on its reputation for independence.

While other board choices could conceivably serve as signals of board independence, we focus on CEO pay for several reasons. First, CEO pay has to be disclosed in a standardized way, which facilitates comparison across firms. Second, it is easier for outsiders to gauge the impact of compensation decisions on the manager’s utility than the impact of other kinds of board decisions. Third, even though the interests of shareholders and the manager regarding CEO pay are not necessarily opposed, there is a clear potential conflict of interests. Finally, regulation requires CEO pay to be set by independent directors, so pay decisions can be clearly attributed to the board’s independent directors.

The board chooses a public variable (the disclosed contract) and a hidden one (hidden pay). However, by using the indirect utility function \( V^* \) defined in Section II.B, we can represent the model as a signaling model in which the board chooses the public signal only. The labor market for directors observes the contract selected by the board, updates its belief

\(^{14}\)We note that the assumption \( M > I \) guarantees that \( w_M^* > w_I^* \) if \( w_M^* \) is an interior solution, but is consistent with \( w_M^* = w_I^* \) if the level of disclosed pay preferred by both board types is equal to the manager’s reservation payoff \( w \). The assumption that the \( M \) board pays hidden compensation if \( w_M = w \) (which requires \( Mv'(w) > z_y(0; \kappa) \)) guarantees that \( Mv'(w) > 1 \) (since \( z_y(0; \kappa) > 1 \)) and thus that \( w_M^* > w \).
that the board is independent, and allocates board seats. After solving this model, we can use the function $y^*(\cdot)$ to retrieve the equilibrium hidden pay.

We solve for the Perfect Bayesian equilibria of the model. To limit equilibrium multiplicity, we require any equilibrium to satisfy criterion D1. Although this equilibrium concept is standard (e.g., Fudenberg and Tirole (1991), page 452), we provide a definition that applies to our model. To be able to extend the equilibrium definition to the model with incentive pay in Section III, where contracts have a different form, in the definition we let $c$ denote a disclosed contract (which is simply equal to $w_d$ in this section) and $C$ the set of disclosed contracts (with $C = \mathbb{R}$ in this section). We denote by $\sigma = (\sigma_I, \sigma_M)$ a mixed strategy profile, where $\sigma_t$ is a probability distribution over $C$, and by $S_t$ the support of $\sigma_t$, and we let $S \equiv S_I \cup S_M$. We omit the parameters $\eta$ and $\kappa$ in the board’s indirect utility function $V^*$ for the sake of clarity.

**Definition 1 (Equilibrium):** A pair $(\sigma, \mu)$, where $\sigma$ is a mixed strategy profile and $\mu : C \rightarrow [0, 1]$ the labor market beliefs, where $\mu(c) = \Pr(I|c)$, is an equilibrium if:

1. For each $t \in \{I, M\}$, if $c_t \in S_t$, then $V^*(c_t, \mu(c_t), t) = V_t^e \geq V^*(c, \mu(c), t)$ for any $c \in C$, where $V_t^e$ is type $t$’s payoff given $\sigma$ and $\mu$.

2. For any $c \in S$, $\mu(c)$ is derived using Bayes’ rule.

3. For any $c \notin S$ and $t, t' \in \{I, M\}$, where $t \neq t'$, if:

   (a) $V^*(c, 1, t') > V_t^e$,
   
   (b) $V^*(c, 0, t) < V_t^e$, and

   (c) either (i) $V^*(c, 1, t) < V_t^e$ or (ii) for any $\mu \in [0, 1]$, if $V^*(c, \mu, t) \geq V_t^e$, then $V^*(c, \mu, t') > V_t^e$,

then $\mu(c) = 1$ if $t' = I$ and $\mu(c) = 0$ if $t' = M$.

The equilibrium definition requires that the board play optimally given the market’s beliefs (part 1) and that these beliefs be consistent (parts 2 and 3). Part 3 ensures that off-equilibrium beliefs satisfy criterion D1. In particular, part 3 requires that if (a) a contract $c$ is a profitable deviation for type $t'$ for $\mu$ sufficiently large, (b) $c$ does not weakly dominate the equilibrium strategy for type $t$, and (c) deviating to $c$ is strictly profitable for $t'$ whenever
it is weakly profitable for \( t \) (or deviating to \( c \) is not profitable for \( t \) for any \( \mu \)), then if the market observes \( c \), it must believe that the board setting \( c \) is of type \( t' \).\(^{15}\)

We assume that reputational concerns are not so strong as to make an M board willing to leave the manager at his reservation utility level in exchange for being perceived as independent. Formally, we assume that the parameter \( \eta \), which measures the value of a reputation for independence, is lower than a threshold \( \bar{\eta} \), defined as the value of \( \eta \) that would make the M board indifferent between (i) setting its preferred level of CEO pay and being recognized as M and (ii) setting pay equal to the manager’s reservation value and passing as I,

\[
U(w, \bar{R} - \bar{w}, 1, M; \bar{\eta}) = U(w^*_M, \bar{R} - w^*_M, 0, M; \bar{\eta}).
\]

The assumption that \( \eta < \bar{\eta} \) implies that the M board is not willing to set a level of disclosed pay \( w_d \) so much lower than \( \bar{w} \) that the sum of \( w_d \) and hidden pay \( y^*(w_d, M) \) is equal to the manager’s reservation payoff \( \bar{w} \), even if setting such a low disclosed pay allows the M board to pass as independent. This assumption ensures that the single-crossing property (5) holds for the relevant range of disclosed pay levels.

The single-crossing property (5) implies that if both board types set the same disclosed pay, then a deviation to a lower disclosed pay is profitable for a wider range of labor market beliefs for the I board. Thus, criterion D1 requires the labor market to infer that the deviating board is of type I, making the deviation profitable for the I board. It follows that there are no pooling equilibria.

**Lemma 1 (No pooling):** There are no equilibria in which both board types select the same contract with positive probability.

At a separating equilibrium, the labor market for directors identifies the M board as such, so that deviating from its equilibrium strategy cannot lead to a reputational loss for the M board. Therefore, at any separating equilibrium, the M board chooses its preferred disclosed pay, \( w^*_M \), since otherwise deviating to \( w^*_M \) would be a profitable deviation.

\(^{15}\)Criterion D1 requires that, upon observing a deviation \( c \), the labor market should believe that the deviator is of type \( t' \) if the set of labor market beliefs for which deviating to \( c \) is weakly profitable for \( t \) is strictly smaller than the set of beliefs for which deviating to \( c \) is strictly profitable for \( t' \). Conditions (a) to (c) of part 3 are obviously necessary for this condition to hold. The fact that \( V^* \) is continuous and increasing in \( \mu \) implies that they are also sufficient.
**Proposition 2:** At any separating equilibrium, the M board selects its preferred contract in the absence of reputational concerns, $w^*_M$, and pays no hidden compensation.

It is worth emphasizing that, although it chooses its preferred contract, the M board suffers reputationally at a separating equilibrium: since $\eta > 0$, at separating equilibria manager-friendly directors are indeed more likely to be fired or less likely to be hired to serve on other boards.

To analyze the I board’s equilibrium strategy, we define the *separating disclosed pay* $\tilde{w}$ as the maximum disclosed pay consistent with avoiding imitation by the M board. More precisely, $\tilde{w}(\kappa, \eta)$, or $\tilde{w}$ for short, is the disclosed pay lower than $w^*_M$ that makes an M board indifferent between (i) offering its preferred disclosed pay $w^*_M$ and being perceived as M and (ii) offering disclosed pay $\tilde{w}$ and being perceived as I,

$$V^*(w^*_M, 0, M; \kappa, \eta) = V^*(\tilde{w}, 1, M; \kappa, \eta).$$

(7)

The single-crossing property (5) implies that reducing the manager’s disclosed pay is more costly for an M board. Thus, the I board can avoid imitation by the M board by setting a sufficiently low disclosed pay. If the value of a reputation for independence $\eta$ is sufficiently low, the I board will not trigger imitation by the M board if it offers its preferred level of pay $w^*_I$, that is, $\tilde{w} \geq w^*_I$, so the I board will choose its preferred disclosed pay.

In contrast, if reputational concerns are stronger, so that $\tilde{w} < w^*_I$, the I board reduces the disclosed pay down to the separating pay $\tilde{w}$ to signal its independence. Since $\tilde{w}$ is the maximum disclosed pay that allows for separation, the unique equilibrium is thus the least-cost separating equilibrium.

For moderate reputational concerns, the reduction in pay necessary to dissuade the M board from imitating the I board (i.e., the reduction from $w^*_I$ to $\tilde{w}$) is small, so the I board does not compensate the manager in hidden ways for the reduction in disclosed pay. Recalling that $w^*_I$ is the threshold level above which the I board pays no hidden compensation, this type of equilibrium takes place if the separating pay $\tilde{w}$ is in the interval $[w^*_I, w^*_I]$. However, if reputational concerns are sufficiently strong, the I board is forced to reduce disclosed pay beyond the threshold $w^*_I$, and it compensates the manager in hidden ways for the reduction in disclosed pay. The following proposition formally states these results and shows how the equilibrium depends on the values of the parameters $\eta$ and $\kappa$ determining the strength of...
reputational concerns and the cost of hiding pay, respectively. To state the results, we define 
\( \tilde{\eta}(w_d, \kappa) \) as the value of the parameter \( \eta \) that, for a given \( \kappa \), would make the separating pay \( \tilde{w} \) equal to \( w_d \), that is, \( \tilde{w}(\kappa, \tilde{\eta}(w_d, \kappa)) = w_d \).

**Proposition 3:** Let \( w_I \) and \( y_I \) denote the I board’s equilibrium disclosed pay and hidden pay, respectively, and let \( w^I_\eta(\kappa) \) be the threshold level of disclosed pay below which a board of type \( t \) pays hidden compensation, expressed as a function of the parameter \( \kappa \). For each \( \kappa \in (0, \kbar) \), there exist unique thresholds \( \tilde{\eta}(w^*_I, \kappa) \leq \tilde{\eta}(w^I_\eta(\kappa), \kappa) < \tilde{\eta} \), where \( \kbar \) and \( \tilde{\eta} \) are the upper bounds on the parameters \( \kappa \) and \( \eta \), respectively, such that:

1. If \( \eta \in (0, \tilde{\eta}(w^*_I, \kappa)] \), then at the unique separating equilibrium, the I board sets its preferred disclosed pay \( w_I = w^*_I < w^*_M \) and pays no hidden compensation (\( y_I = 0 \)).

2. If \( \eta \in (\tilde{\eta}(w^*_I, \kappa), \tilde{\eta}(w^I_\eta(\kappa), \kappa)] \), then at the unique separating equilibrium, (i) \( w_I = \tilde{w} \in [w^I_\eta(\kappa), w^*_I) \), (ii) \( y_I = 0 \), and (iii) \( w_I \) is decreasing in \( \eta \) and nondecreasing in \( \kappa \).

3. If \( \eta \in (\tilde{\eta}(w^I_\eta(\kappa), \kappa), \tilde{\eta}) \), then at the unique separating equilibrium, (i) \( w_I = \tilde{w} < w^I_\eta(\kappa) \leq w^*_I \), (ii) \( y_I > 0 \), (iii) \( w_I \) is decreasing in \( \eta \) and increasing in \( \kappa \), and (iv) \( y_I \) is increasing in \( \eta \) and decreasing in \( \kappa \).

4. (i) \( \tilde{\eta}(w^*_I, \kappa) \) is nondecreasing in \( \kappa \) and \( \tilde{\eta}(w^I_\eta(\kappa), \kappa) \) is increasing in \( \kappa \), so when \( \kappa \) falls in the range of values of \( \eta \) for which \( \tilde{w} \) is lower than \( w^*_I \) or \( w^I_\eta(\kappa) \), respectively, increases. (ii) \( \lim_{\kappa \downarrow 0} \tilde{\eta}(w^I_\eta(\kappa), \kappa) = 0 \) and \( \lim_{\kappa \uparrow \kbar} \tilde{\eta}(w^I_\eta(\kappa), \kappa) = \tilde{\eta} \), so for any \( \eta \in (0, \tilde{\eta}) \), the I board pays hidden compensation in equilibrium if \( \kappa \) is sufficiently low and pays no hidden compensation if \( \kappa \) is sufficiently close to \( \kbar \). (iii) \( \tilde{\eta}(w^*_I, \kappa) < \tilde{\eta}(w^I_\eta(\kappa), \kappa) \) (so there are equilibria with \( w_I \in [w^I_\eta(\kappa), w^*_I) \)) if and only if \( w^*_I > \bar{w} \).

Proposition 3 implies that, for any \( \kappa \), the I board chooses its preferred disclosed pay for low values of \( \eta \), while it reduces disclosed pay below its preferred level and compensates the manager with hidden pay for high values of \( \eta \). Moreover, part 4(iii) of the proposition establishes that as long as the I board’s preferred level of disclosed pay gives the manager some rents (\( w^*_I > \bar{w} \)), there exist equilibria in which the I board reduces disclosed pay to separate from the M board, but the reduction is not large enough to induce the I board to compensate the manager with hidden pay. Thus, there are parameter values for which each of the three types of equilibrium described in parts 1 to 3 of Proposition 3 exists.
Proposition 3 also describes how equilibria depend on the parameter $\kappa$ determining the cost of hiding pay. When $\kappa$ decreases, it becomes cheaper for the M board to imitate the I board. Thus, the I board is forced to reduce disclosed pay to signal its independence (parts 2(iii) and 3(iii)). As a consequence (part 4), a low cost of hiding pay makes it more likely that the I board reduces disclosed pay below its preferred level and compensates the manager with hidden pay. In fact, as $\kappa$ goes to zero, the I board is forced to reduce disclosed pay below the manager’s reservation value, so there is hidden pay in equilibrium for any positive $\eta$ (as captured by the result that $\lim_{\kappa \to 0} \tilde{\eta}(w_d^I(\kappa), \kappa) = 0$ in part 4(ii) of the proposition).

Figure 2 displays the equilibria for different parameter configurations and shows how the relative magnitudes of the intensity of reputational concerns $\eta$ and cost of hiding pay $\kappa$ determine the type of equilibrium. If $\eta$ is small relative to $\kappa$, the I board can achieve separation while setting its preferred contract. If, in contrast, $\eta$ is large relative to $\kappa$, the I board reduces disclosed pay and may use hidden compensation.

To complete the equilibrium characterization, we note that an example of off-equilibrium beliefs that satisfy criterion D1 and support the equilibria described in Proposition 3 are beliefs that assign a probability of one to the board being independent for any off-equilibrium disclosed pay $w_d \leq \tilde{w}$ and a probability of zero to the board being independent for any off-equilibrium disclosed pay $w_d > \tilde{w}$, where $\tilde{w}$ is the separating level of pay.

Proposition 3 has four key implications. First, reputational concerns induce I boards to lower disclosed pay, which, other things equal, benefits shareholders. However, the second key implication of Proposition 3 is that since hidden pay is inefficient, the board’s reputation-seeking behavior may become an agency problem. This result links our paper with the literature on the potentially perverse effects of reputational concerns (e.g., Holmström (1999), Scharfstein and Stein (1990), Morris (2001), Ely and Välimäki (2003)).

The third implication pertains to the relationship between independence and the use of hidden pay. According to the rent extraction theory of executive compensation of Bebchuk and Fried (2004), rent extraction by managers causes outrage if it is recognized as such by outsiders. Thus, firms resort to camouflaged forms of pay to prevent outrage. Since the managers of firms with less independent boards are likely to be able to extract more rents, a possible corollary of the rent extraction theory is that firms with less independent boards will be more likely to use hidden pay. In contrast, Propositions 2 and 3 imply that I boards are more likely than M boards to pay their managers in hidden ways. Thus, in our model,
hidden pay does not emerge as a strategy by M boards to mislead investors. Instead, hidden pay emerges as a side effect of I boards’ efforts to signal their independence to shareholders. Since $y$ can capture not only opaque monetary payments but also the private benefits derived by the manager from inefficient firm actions, Propositions 2 and 3 suggest that independent boards may be more likely to destroy value by granting inefficient private benefits to the CEO in order to compensate him for a reduction in disclosed pay.

The fourth main implication of Proposition 3 pertains to the relationship between the strength of reputational concerns $\eta$ and the cost of hiding pay $\kappa$, and the equilibrium disclosed and hidden pay. The proposition shows that the I board reduces disclosed pay and increases hidden pay when the strength of reputational concerns increases or when the cost of hiding pay decreases. Therefore, changes in reputational concerns or the cost of hiding pay lead to the substitution between hidden and disclosed pay.

III. Board Reputation and the Design of CEO Compensation

In the baseline model of Section II, the distribution of the firm’s revenues is given and disclosed compensation contracts consist solely of fixed pay. In this section we extend the model and analyze how the board’s reputational concerns and the potential use of hidden pay affect the design of CEO compensation contracts and managerial incentives.

The timeline of the model is now as follows. The board designs the disclosed compensation contract for the manager and may pay the manager an additional amount of hidden pay. The manager takes an action, observed only by the manager, which determines the probability distribution of the firm’s revenue. The labor market for directors observes the disclosed compensation contract, but not hidden pay, and allocates board seats to the firm’s directors. Finally, revenue, pay, and profits are realized.

A. The Moral Hazard Model

To illustrate the impact of reputational concerns on the design of compensation contracts, we analyze a simple moral hazard problem. The risk-neutral manager chooses effort level $e \in [0, 1]$, which has a private cost for the manager $\frac{\gamma e^2}{2}$, with $\gamma > 0$. The manager’s effort
determines the probability distribution of the firm’s revenues: with probability \( e \), revenues are \( R_H \), and with probability \( 1 - e \), revenues are \( R_L \), where \( R_H > R_L \).

The board cannot observe \( e \), but revenues are contractible. Thus, a disclosed contract, which we denote by \( c \), specifies a salary \( s \) and a bonus \( b \) that the manager obtains in addition to the salary if revenues are high. The manager is protected by limited liability, so a disclosed contract \( c = (s, b) \) is feasible if \( s \geq 0 \) and \( s + b \geq 0 \). Although the bonus \( b \) could be negative, one can restrict attention to nonnegative \( b \) without loss of generality (we prove this result in Lemma A.4 in the Appendix), so we ignore the latter limited liability constraint hereafter.

**B. The Manager’s Action Choice**

The manager will choose the level of effort that solves

\[
\max_{e \in [0, 1]} s + y + \gamma e^2 - \frac{\gamma e^2}{2}.
\]  

The manager’s effort choice does not depend on \( s \) or \( y \) and is given by \( e(b) = \frac{b}{\gamma} \) if the solution is interior. To simplify the derivations, we assume that \( \frac{\gamma}{2} < R_H - R_L < \gamma \), where the first inequality ensures that the contract that generates the lowest profits among those that implement a given expected utility for the manager is a contract with \( b = e = 0 \), and the second inequality ensures that the first-best level of effort is interior.

We denote by \( w_d(c) \) and \( \pi_d(c) \) the manager’s expected utility and the expected profits, respectively, generated by the disclosed contract \( c \) if the manager receives only the pay determined by \( c \) (and no hidden pay) and responds optimally to the contract. We use the notation \( w_d \) to parallel the notation of the baseline model, where the manager’s expected utility if the board pays no hidden compensation is equal to the disclosed pay \( w_d \). With incentive pay, the manager’s expected utility is equal to the expected disclosed pay minus an additional term that captures the cost of the manager’s effort.

**C. Conditionally Optimal and Efficient Contracts**

As in the baseline model in Section II, the I board can achieve separation by choosing a contract that yields the manager a sufficiently low expected utility. However, while in the baseline model a unique contract achieves expected utility \( w_d \) for the manager if the
board pays no hidden compensation, namely, a contract with fixed pay $w_d$, here several combinations of salary and bonus can generate the same expected utility for the manager but different expected profits. Of these combinations, the one that attains utility $w_d$ for the manager at the least cost for shareholders plays a key role in the analysis. Accordingly, we define the conditionally optimal contract that yields expected utility $w_d$ for the manager, denoted by $c(w_d)$, as the contract that maximizes expected profits among the contracts that generate expected utility $w_d$ (i.e., $c(w_d)$) is such that $\pi_d(c(w_d)) \geq \pi_d(c)$ for any $c$ such that $w_d(c) = w_d$). We emphasize that our definition of conditionally optimal contracts requires these contracts to be optimal among those that generate exactly expected utility $w_d$, not among those that generate at least $w_d$, so that conditionally optimal contracts need not be efficient. Although the form of the conditionally optimal contracts in our setting is well known, we briefly discuss how it varies with the manager’s utility $w_d$.

Since the manager is risk neutral, in the absence of limited liability constraints expected profits are maximized with the bonus $b_{FB}$ that implements the first-best level of effort.\footnote{In our setting, the first-best level of effort is the one that maximizes the joint surplus of shareholders and the manager, that is, the effort level that maximizes $eR_H + (1 - e)R_L - \frac{2e}{2}$.} Thus, for values of the manager’s utility above the minimum value that can be attained with the first-best bonus, $w_{FB} \equiv w_d(0, b_{FB})$, the conditionally optimal contract pays the first-best bonus and the salary necessary to obtain the required utility (i.e., $c(w_d) = (w_d - w_{FB}, b_{FB})$ for $w_d \geq w_{FB}$). However, because of the limited liability constraint $s \geq 0$, it is not possible to obtain an expected utility below $w_{FB}$ with the first-best bonus. Instead, the conditionally optimal contract pays $s = 0$ and a bonus lower than the first-best bonus (i.e., $c(w_d) = (0, b(w_d))$, where $b(w_d) < b_{FB}$ is the bonus such that $w_d(0, b(w_d)) = w_d$).

It follows that if we restrict attention to conditionally optimal contracts, then if $w_d > w_{FB}$, reducing the manager’s utility is achieved by reducing the salary, which increases profits. However, if $w_d \leq w_{FB}$, reducing the manager’s utility requires lowering the bonus. For sufficiently high values of the manager’s utility, the decrease in expected pay achieved by lowering the bonus outweighs the decrease in expected revenues due to the effort reduction induced by the lower bonus, so that reducing the bonus increases expected profits. However, there is a threshold bonus $b_{SB}$ below which reducing the bonus reduces expected profits.\footnote{The bonus $b_{SB}$ is the bonus that maximizes expected profits if the only constraint on the manager’s utility is limited liability. Thus, lowering the bonus below $b_{SB}$ reduces profits. We note that $b_{SB}$ is also the profit-maximizing bonus in a standard setting with limited liability and a zero reservation utility for the}
Therefore, if we define a second-best (or constrained-efficient) contract to be such that no other contract yields higher expected utility to the manager without reducing expected profits, then a contract is second-best if and only if it is conditionally optimal and the bonus is greater than or equal to $b_{SB}$, since if the bonus is lower than $b_{SB}$ it is possible to increase both the manager’s expected utility and expected profits by increasing the bonus towards $b_{SB}$.

D. Contract Choice in the Absence of Reputational Concerns

Since the utility of either board type is increasing in expected profits and the manager’s utility, the preferred contract of either board type in the absence of reputational concerns is second-best. That is, if we let $c^*_t = (s^*_t, b^*_t)$ denote the $t$ board’s preferred contract and $w^*_t = w_d(c^*_t)$ the manager’s utility associated with contract $c^*_t$, then $c^*_t$ is the conditionally optimal contract that generates utility $w^*_t$ (i.e., $c^*_t = c(w^*_t)$) and the bonus $b^*_t$ is second-best (i.e., $b^*_t \geq b_{SB}$). Further, as in the baseline model, in the absence of reputational concerns neither board type would pay hidden compensation since hidden pay is inefficient.

The $M$ board’s preferred contract has a higher salary and bonus. More precisely, $s^*_M \geq s^*_I$ and $b^*_M \geq b^*_I$, where at least one of the two inequalities is strict, so that $w^*_M > w^*_I$. Since the preferred contract of each board type is second-best, it follows from $w^*_M > w^*_I$ that $\pi^*_M \equiv \pi_d(c^*_M) < \pi^*_I \equiv \pi_d(c^*_I)$.

E. Reputational Concerns and the Level and Structure of CEO Pay

In this section, we derive the consequences of the board’s reputational concerns for both the level and structure of CEO pay. As in Section II, we can define the board’s utility over disclosed contracts by incorporating the choice of hidden pay into the utility function. Since hidden pay does not affect the manager’s effort choice, given a contract $c$ and hidden pay $y$, the manager’s utility is $w_d(c) + y$ and expected profits are $\pi_d(c) - z(y; \kappa)$. Since hidden pay also does not affect the board’s reputation, given a disclosed contract $c$, a type-$t$ board will pay

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18We prove these results in the proof of Proposition 1 in the Appendix.
choose the hidden pay \(y(c, t; \kappa)\) that for fixed \(w_d(c), \pi_d(c)\), and \(\mu\) maximizes its utility,

\[
U(w_d(c) + y, \pi_d(c) - z(y; \kappa), \mu, t; \eta) = \pi_d(c) - z(y; \kappa) + tv(w_d(c) + y) + \eta \mu, \tag{9}
\]

and that satisfies the manager’s participation constraint \(w_d(c) + y \geq w\).

It follows from (9) that the optimal \(y\) does not depend on \(\pi_d(c)\) and depends on \(c\) only through \(w_d(c)\). Thus, the optimal hidden pay given a disclosed contract \(c\) is exactly the same as the optimal hidden pay derived in the baseline model for a contract with disclosed pay \(w_d(c)\) (i.e., \(y(c, t; \kappa) = y^*(w_d(c), t; \kappa)\), where \(y^*\) is the optimal hidden pay function described in Section II.B). We can thus define the (indirect) utility of a \(t\) board if the disclosed contract is \(c\) and the labor market beliefs are \(\mu\), which we call \(V^*\) as in the baseline model, as

\[
V^*(c, \mu, t; \kappa, \eta) = \pi_d(c) - z(y^*(w_d(c), t; \kappa); \kappa) + tv(w_d(c) + y^*(w_d(c), t; \kappa)) + \eta \mu. \tag{10}
\]

This utility function also has the strict single-crossing property (5) described in Section II.B. More precisely, if \(c'\) and \(c''\) are two contracts with \(w_d(c'') > w_d(c')\) and \(w_d(c'') + y^*(w_d(c''), M; \kappa) > w\), then the single-crossing property (5) holds replacing \(w_d(c')\) and \(w_d(c'')\) for \(c'\) and \(c''\), respectively. That is, if contract \(c'\) yields a lower utility to the manager than contract \(c''\) and the M board weakly prefers contract \(c'\) and labor market beliefs \(\mu'\) over contract \(c''\) and labor market beliefs \(\mu''\), the I board strictly prefers \((c', \mu')\) over \((c'', \mu'')\).

Therefore, as in the case of the baseline model, the model with incentive pay can be recast as a signaling model in which the board selects a disclosed compensation contract and has preferences over contracts described by the indirect utility function \(V^*\), which satisfies the single-crossing condition (5). The equilibrium definition in Section II.D applies unchanged to this model, letting the set \(C\) in the definition be the set of feasible salary-bonus pairs.

As in Section II.D, we assume that reputational concerns are not too strong, that is, we assume that \(\eta\) is lower than a threshold level that would make the M board indifferent between (i) setting its preferred contract and being recognized as M and (ii) selecting the conditionally optimal contract that keeps the manager at his reservation utility level \((c, \Sigma)\).

\[19\] We prove that \(V^*\) satisfies this property in Lemma A.2 in the Appendix.
and passing as I. This threshold, which we label $\tilde{\eta}$ as in the baseline model, satisfies

$$U(w, \pi_d(c(w)), 1, M; \tilde{\eta}) = U(w_M^*, \pi_M^*, 0, M; \tilde{\eta}).$$

(11)

We also assume that the efficiency loss caused by implementing zero effort is sufficiently large that the M board would not reduce disclosed pay to zero to pass as I, even if hidden pay were costless and reputational concerns strong. That is, letting $c_0 = (0, 0)$,

$$V^*(c_0, 1, M; 0, \tilde{\eta}) < U(w_M^*, \pi_M^*, 0, M; \tilde{\eta}).$$

(12)

Like in the baseline model, criterion D1 and the single-crossing property of $V^*$ ensure that there are no pooling equilibria and that the unique equilibrium is the least-cost separating equilibrium. In the baseline model, the I board separates in the least costly way by reducing disclosed pay the minimum amount consistent with separation, namely, by paying the separating disclosed pay $\tilde{w}$ that leaves the M board indifferent between choosing its preferred disclosed pay and imitating the I board. With incentive contracts, the I board separates in the least costly way by choosing the conditionally optimal contract $\tilde{c}$ that leaves the M board indifferent between choosing its preferred contract and being identified as M and choosing $\tilde{c}$ and passing as I. Contracts that are not conditionally optimal are not possible in equilibrium because if a contract is not conditionally optimal there is another contract that generates higher profits and slightly lower utility for the manager that the I board prefers over the initial contract. The single-crossing condition and criterion D1 imply that the I board would be able to convince the labor market of its independence by deviating to such a contract and thus obtain higher utility.$^{21}$ As in the baseline model, if $\tilde{w} = w_d(\tilde{c})$ denotes the separating level of utility, that is, the maximum utility for the manager consistent with separation that can be achieved with a conditionally optimal contract, then if the reduction in the manager’s utility required to attain separation is sufficiently large, that is, if $\tilde{w}$ is sufficiently low, the I board compensates the manager with hidden pay. In equilibrium the M board chooses its

\footnote{We note that for (12) to hold, the reduction in total surplus caused by deviating from $c_M^*$ to $c_0$, $(\pi_M^* + w_M^*) - R_L$, has to be greater than $\tilde{\eta}$.}

\footnote{We prove that equilibrium contracts are conditionally optimal in Lemma A.11 in the Appendix. We note that if $\eta > \tilde{\eta}$, equilibria with contracts that are not conditionally optimal are possible for some parameter values. For such parameter values, there is a large multiplicity of equilibria, but the results are otherwise qualitatively similar to those obtained for $\eta < \tilde{\eta}$.}
preferred contract, which is second-best, and pays no hidden compensation.

We establish these results in the proof of Proposition 3 in the Appendix, where we show that with the exception of part 4(ii) of the proposition, all of the results of Proposition 3 hold for the model with incentive pay if one reinterprets equilibrium disclosed pay in the statement of the proposition as the manager’s utility generated by the equilibrium disclosed contract. In part 4(ii) of Proposition 3, we show that in the baseline model when the cost of hiding pay is very low, the I board pays hidden compensation even if reputational concerns are very weak (formally, the threshold \( \eta(w^I_I(w, y)) \) of \( \eta \) above which the I board pays hidden compensation in equilibrium tends to zero as \( \kappa \) falls to zero). In the model with incentive pay, imitating the I board may require reducing the bonus, thus lowering the total surplus that can be shared between the manager and shareholders. This loss in surplus implies that if reputational concerns are sufficiently weak, the M board does not want to imitate the I board, even as the cost of hiding pay goes to zero, making it unnecessary for the I board to lower the manager’s utility to a level where it is compelled to use hidden pay.

Proposition 3 describes the effect of reputational concerns on the equilibrium expected disclosed pay (net of the manager’s cost of effort) and hidden pay. However, Proposition 3 does not describe how boards design incentive contracts. We next analyze the impact of reputational concerns on the structure of compensation contracts and the manager’s incentives.

In any equilibrium, the M board selects its preferred contract \( c^*_M \), which is always at least second-best. If reputational concerns are sufficiently weak, the I board selects its preferred disclosed contract \( c^*_I \), which is also second-best and, depending on parameter values, may also be first-best. For stronger reputational concerns, the I board is forced to deviate from its preferred contract. If its preferred contract is first-best, the I board initially lowers the manager’s salary, keeping the bonus unchanged. However, as reputational concerns increase, the I board eventually has to lower the manager’s utility below the minimum utility \( w_{FB} \) that can be attained with the first-best bonus to avoid imitation. The manager’s limited liability constraint implies that, to do so, the I board is forced to lower the bonus. As reputational concerns increase, the board has to further lower the bonus to avoid imitation until it is forced to set a bonus lower than the minimum second-best bonus \( b_{SB} \). Thus, when reputational concerns are strong enough, the I board chooses an inefficient contract. The impact of a reduction in the cost of hiding pay \( \kappa \) is similar to the effect of an increase in the strength of the board’s reputational concerns \( \eta \). Thus, a lower \( \kappa \) leads to lower salary and
bonus and may force the I board to choose inefficient contracts.

Proposition 4 below provides a formal statement of these results. To cover all of the relevant equilibria, we assume that if reputational concerns ($\eta$) are sufficiently strong and the cost of hiding compensation ($\kappa$) sufficiently low, the M board is willing to reduce the manager’s utility below the minimum value $w_{SB} \equiv w_d(0, b_{SB})$ that can be attained with a second-best contract to be perceived as independent. Since achieving a manager’s utility below $w_{SB}$ requires an inefficient contract, the M board is willing to choose an inefficient contract to pass as independent. Formally, we assume that if $\kappa = 0$ and $\eta$ is equal to its upper bound $\eta$, deviating to the conditionally optimal contract with the minimum second-best bonus, $c_{SB} = (0, b_{SB})$, is strictly profitable for the M board, implying that it is also profitable to deviate to inefficient contracts (with $b < b_{SB}$) sufficiently close to $c_{SB}$:

\[ V^*(c_{SB}, 1, M; 0, \eta) > U(w^*_M, \pi^*_M, 0, M; \eta). \]  

(13)

As in Section II.D, $\tilde{\eta}(w_d, \kappa)$ is the value of $\eta$ that makes the separating level of utility $\tilde{w}$ equal to $w_d$, that is, $\tilde{w}(\tilde{\eta}(w_d, \kappa), \kappa) = w_d$, where $\tilde{w}(\eta, \kappa)$ is defined by $V^*(c(\tilde{w}), 1, M; \kappa, \eta) = V^*(c^*_M, 0, M; \kappa, \eta)$. Thus, if $\eta > \tilde{\eta}(w_d, \kappa)$, then $\tilde{w}(\eta, \kappa) < w_d$.

**Proposition 4:** Assume that condition (13) holds and recall that $b_{FB}$ is the first-best bonus, $b_{SB} < b_{FB}$ the minimum second-best bonus, $w_{SB} = w_d(0, b_{SB})$ the minimum utility for the manager that can be attained with a second-best contract, and $w^*_I = w_d(c^*_I)$. Then,

1. In any equilibrium, the M board chooses its preferred disclosed contract $c^*_M = (s^*_M, b^*_M)$.

   The contract $c^*_M$ is second-best, $b^*_M > b_{SB}$, and $s^*_M = 0$ if $b^*_M < b_{FB}$.

2. For each $\kappa \in (0, \tilde{\kappa})$, the threshold $\tilde{\eta}(w_d, \kappa)$ is nondecreasing in $\kappa$, $\tilde{\eta}(w^*_I, \kappa) < \tilde{\eta}$, and

   (a) If $\eta \leq \tilde{\eta}(w^*_I, \kappa)$, the I board chooses its preferred disclosed contract $c^*_I = (s^*_I, b^*_I)$.

      The contract $c^*_I$ is second-best, $b^*_I > b_{SB}$, and $s^*_I = 0$ if $b^*_I < b_{FB}$. Further, $s^*_I \leq s^*_M$ and $b^*_I \leq b^*_M$, with at least one of the two inequalities being strict.

   (b) If $\eta > \tilde{\eta}(w^*_I, \kappa)$, the I board chooses a conditionally optimal disclosed contract $(s_I, b_I)$, where $s_I \leq s^*_I$ and $b_I \leq b^*_I$, with at least one of the two inequalities being

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\textsuperscript{22}We note that (13) holds if $\tilde{w} \leq w_{SB}$ or $\tilde{\eta}$ is greater than the reduction in total surplus $(\pi^*_M + w^*_M) - (\pi_d(c_{SB}) + w_{SB})$ caused by deviating from $c^*_M$ to $c_{SB}$. We also note that $w_{SB} > w_d(0, 0) = 0$ and $\pi_d(0, b_{SB}) > \pi_d(0, 0) = R_k$ (since $b_{SB} > 0$ and profits are increasing in $b$ for $b < b_{SB}$), so (13) is consistent with (12).
strict. Both $s_I$ and $b_I$ are nonincreasing in $\eta$ and nondecreasing in $\kappa$, and, for any $\eta \in (0, \bar{\eta})$, $b_I < b_{FB}$ for sufficiently low $\kappa$.

3. There exists a threshold level of $\kappa$, $\tilde{\kappa}(w_{SB}) \in (0, \bar{\kappa}]$, such that

(a) If $\kappa \in [\tilde{\kappa}(w_{SB}), \bar{\kappa})$, the I board’s bonus is second-best ($b_I \geq b_{SB}$) for any $\eta < \bar{\eta}$.

(b) If $\kappa < \tilde{\kappa}(w_{SB})$, there is a threshold $\bar{\eta}(w_{SB}, \kappa) \in (\bar{\eta}(w_I^*, \kappa), \bar{\eta})$ such that if $\eta \leq \bar{\eta}(w_{SB}, \kappa)$, the I board’s bonus is second-best ($b_I \geq b_{SB}$), and if $\eta \in (\bar{\eta}(w_{SB}, \kappa), \bar{\eta})$, the I board selects an inefficient bonus ($b_I < b_{SB}$).

(c) The threshold $\bar{\eta}(w_{SB}, \kappa)$ is nondecreasing in $\kappa$.

The first key implication of Proposition 4 is that boards’ reputational concerns can cause distortions in disclosed compensation contracts and that these distortions will take place at firms with I boards, since the manager’s limited liability constraint forces these boards to reduce the manager’s bonus to signal their independence.

The second implication of Proposition 4 is that the distortions caused by boards’ reputational concerns can be inefficient. In moral hazard problems with a risk-neutral manager protected by limited liability, such as the one we analyze, it is generally the case that the profit-maximizing contract is not first-best if the manager’s reservation payoff is sufficiently low. However, the profit-maximizing contract is constrained-efficient (second-best): given the limited liability constraint, there is no alternative contract that can make shareholders and the manager better off. Indeed, no board (regardless of its independence) would choose an inefficient contract in the absence of reputational concerns. Therefore, Proposition 4 does not just show that reputational concerns may lead to deviations from the first-best contract and that stronger reputational concerns cause larger deviations, but that these concerns can force I boards to choose constrained-inefficient contracts.

The third key implication of Proposition 4 is that the availability of hidden pay leads to greater distortions in disclosed compensation contracts. As the cost of hiding pay falls, the I board is forced to reduce the disclosed bonus to avoid imitation. If the cost of hiding pay is sufficiently low, the bonus chosen by the I board cannot be first-best and may not be second-best either. Thus, the availability of hidden pay leads to two sorts of inefficiencies. The first is the direct deadweight loss generated by the cost of hiding pay whenever hidden pay is used in equilibrium. The second inefficiency stems from the distortion in the disclosed
contract that results from the availability of hidden pay, a distortion that may occur even if hidden pay is not used in equilibrium. The case $\kappa \approx 0$ is especially interesting. In this case, imitation becomes very cheap for the M board, so the I board has to set a low and possibly inefficient bonus to avoid imitation. Because $\kappa \approx 0$, the direct deadweight loss from hidden pay, if used, is very small. However, the deadweight loss stemming from the inefficient distortion in the disclosed contract can be substantial.

It is worth comparing our results to those obtained by Dasgupta and Noe (2019), who also show that boards’ reputational concerns may distort their compensation decisions. In contrast to our results, in their model manager-oriented boards inefficiently distort their compensation policies. The difference between their results and ours stems mainly from the different way in which they model boards’ reputational concerns. Dasgupta and Noe (2019) assume that the board incurs an infinitely large cost if shareholders believe that the probability that the board is manager-oriented is larger than an exogenous outrage threshold, or if it chooses an action that would not have been chosen by a shareholder-oriented board if independence were observable. The first assumption rules out separating equilibria, and the second rules out many potential equilibria, among them equilibria in which the manager-oriented board chooses an efficient compensation policy but pays the manager more than what the shareholder-oriented board would have paid in the absence of reputational concerns.

It is important to note that our results do not follow from our particular specification of the manager’s moral hazard problem. In fact, we prove the results for any incentive problem satisfying some intuitive properties, with the key property being that the increase in profits that can be attained by lowering the manager’s pay decreases with the manager’s pay and becomes negative if pay is sufficiently low. These properties hold if, for example, the manager is risk averse with CARA preferences. Similarly, our results do not require the board’s utility to have the form given in (1). Essentially, what is needed for the results to hold is that the utility $V^*$ defined over contracts has the single-crossing property (5) and that the board is better off if it substitutes efficient disclosed pay for inefficient hidden pay.

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23 We state these properties formally in Section C of the Appendix.
24 Lemma A.2 in the Appendix states the properties of the board’s preferences that drive the results.
IV. Discussion

A. Empirical Implications Regarding CEO Pay

In this section, we outline the main empirical implications of the model concerning CEO pay, suggest potential empirical tests, and discuss existing empirical work to assess the plausibility of the model’s implications.

Propositions 2 to 4 have several empirical implications pertaining to differences in compensation across firms with different degrees of true independence. Importantly, these implications apply to differences in CEO compensation between observationally identical firms. In particular, they apply to firms with the same observable board characteristics, such as the fraction of formally independent directors. It is also worth noting that these predictions are not about the effects of changes in the parameter $I$ determining the weight that the I board places on the manager’s utility. Instead, they are about within-equilibrium differences between I and M boards (for fixed parameter values). We have the following implications concerning cross-sectional differences in true independence.

**IMPLICATION 1:** Greater true independence is associated with higher hidden pay.

**IMPLICATION 2:** Greater true independence is associated with lower disclosed pay, both fixed and variable.

It follows from Implications 1 and 2 that:

**IMPLICATION 3:** Hidden pay is more likely in firms that pay low disclosed compensation.

Since true independence (by definition) is not observable, Implications 1 and 2 are difficult to test. Implication 3 is potentially testable if one can obtain proxies of hidden pay, such as the use of option backdating or poorly disclosed compensation vehicles (like stock options or pension fund contributions before regulation standardized their disclosure), or the frequency of scandals or litigation related to misreporting of executive pay. To the extent that insider trading profits are not fully accounted for by shareholders, lax restrictions by firms on insider trading by their executives can also be a form of hidden pay. Roulstone (2003) and Henderson (2011) find that firms that restrict insider trading pay higher disclosed compensation, which suggests a substitution between disclosed and undisclosed forms of pay.

Since equilibria are separating and the M board sets a higher level of disclosed pay, the model also has the following implication:

**IMPLICATION 4:** Boards that pay higher disclosed compensation will suffer negative repu-
Although this prediction may appear unsurprising, it will not hold if a reputation for independence harms directors’ careers or plays no role in director selection, or if CEO pay is not considered a relevant signal of independence. Consistent with Implication 4, directors risk being singled out for their compensation decisions. CEO pay is a key factor determining the corporate governance ratings issued by corporate governance watchdogs, such as Institutional Shareholder Services (ISS) or GovernanceMetrics International, or activist institutional investors, such as CalPERS. CEO pay also affects the voting recommendations of proxy advisory firms (Institutional Shareholder Services (2011)), which have a substantial impact on voting outcomes (Alexander et al. (2009), Choi, Fisch, and Kahan (2009), Ertimur, Ferri, and Muslu (2011)) and mutual fund proxy voting decisions. In line with these practices, the evidence suggests that excessive CEO pay affects voting outcomes in corporate elections (Morgan, Poulsen, and Wolf (2006), Cai, Garner, and Walkling (2009), Fischer et al. (2009), Yermack (2010), Ertimur, Ferri, and Muslu (2011)).

The above predictions derive from cross-sectional differences in unobserved independence between observationally identical boards. The model also yields predictions derived from comparative statics results having to do with changes in potentially observable parameters.

Proposition 3 shows that increasing the cost of hiding compensation \( \kappa \) leads to higher disclosed pay, a result that leads to the following prediction.

**IMPLICATION 5:** More stringent disclosure requirements or stronger incentives by accountants and auditors to oppose or reveal hidden pay will lead to higher expected disclosed pay.

This prediction is potentially testable, as long as one can identify regulatory changes (or other exogenous changes) that affect the cost of hiding pay.

Proposition 3 also yields the following prediction about the relation between the reputational pressure faced by boards and disclosed and hidden pay.

**IMPLICATION 6:** Disclosed pay will be lower and hidden pay higher if directors face stronger reputational pressure.

Several factors influence the parameter \( \eta \), which captures the strength of the reputational pressure faced by boards. One could test Implication 6 by estimating the causal effect of changes in these factors on CEO pay. A key factor influencing \( \eta \) is shareholders’ influence over the director election process. Thus, \( \eta \) will likely increase if firms eliminate staggered
boards (in which only a fraction of directors are up for reelection each year), replace plurality
director elections (in which the director slate receiving the largest number of votes is elected)
by majority elections (in which director election requires a majority of the votes cast), or
otherwise facilitate shareholders’ ability to nominate directors.

The reputational pressure captured by \( \eta \) also depends on the amount of information
accumulated about directors and on their career concerns. Thus, \( \eta \) is likely to be lower
for directors with longer tenure and for older directors since the value of a reputation for
independence may be lower for such directors, both because there may be less uncertainty
about their independence and because their remaining career is shorter.

B. Pay Transparency, Reputational Pressure, and Shareholder Wealth

This section describes the impact on profits of changes in the cost of hiding pay and the
strength of directors’ reputational concerns.\(^{25}\)

Pay transparency and profits. Proposition 3 establishes that an increase in the cost of hiding
pay has both costs (higher disclosed pay and a higher cost of the hidden compensation paid
to the manager) and benefits (lower hidden pay) for shareholders. An important implication
of the proposition is that the costs can outweigh the benefits. To see why, note that there
are equilibria in which the I board reduces disclosed pay below its preferred level to signal its
independence, but does not compensate the manager with hidden pay (part 2 of Proposition
3). In this case, an increase in the cost of hiding pay only has costs since it allows the I board
to increase disclosed pay but does not reduce hidden pay. Thus, increasing the cost of hiding
pay may lower shareholder wealth, so there is such a thing as excessive pay transparency.
Equilibria of the sort just described are likely when the cost of hiding pay is relatively high,
so that the I board sets a relatively high disclosed pay and does not compensate the manager
with hidden pay, but not when the cost of hiding pay is so high as to allow the I board to
signal its independence by setting its preferred contract.

Hermalin and Weisbach (2012) also predict that stricter disclosure requirements can
increase CEO pay and argue that too much transparency may reduce firm value. However,
they analyze a very different mechanism. In their model, improving disclosure may increase
executive pay because managers capture some of the benefits of the better monitoring that

\(^{25}\)In the Internet Appendix, we formally prove the results discussed in this section.
results from improved disclosure or because they must be compensated for the costs that
greater disclosure imposes on them.

Even though our model predicts that greater transparency may reduce profits when the
cost of hiding pay, \( \kappa \), is already high, an increase in \( \kappa \) is likely to increase profits when \( \kappa \)
is low by causing a substitution of efficient disclosed pay for inefficient hidden pay. This
positive effect is amplified if the low cost of hiding pay, by making imitation cheap for the M
board, forces the I board to set an inefficiently low bonus to signal its independence. In this
case, increasing the cost of hiding pay allows the I board to efficiently increase the bonus,
which increases profits. The relation between the cost of hiding pay, \( \kappa \), and expected profits
is thus likely to be hump-shaped, but there are parameter values for which profits are always
weakly increasing in \( \kappa \) and others for which profits are always weakly decreasing in \( \kappa \).

**Reputational pressure and profits.** As with the cost of hiding pay, the relationship between
the intensity of the reputational pressure faced by boards, as captured by the parameter \( \eta \),
and equilibrium expected profits is likely to be hump-shaped.

If reputational concerns are so weak that the I board is able to avoid imitation by choosing
its preferred contract, a marginal change in \( \eta \) does not affect the I board’s choice of disclosed
contract, the I board’s hidden pay (which remains zero), or the resulting expected profits.
For higher values of \( \eta \), as \( \eta \) increases the I board has to reduce disclosed pay to separate
(parts 2 and 3 of Proposition 3). This decrease in disclosed pay is associated with higher
profits gross of hidden pay as long as the equilibrium contract is second-best (i.e., as long as
\( \eta < \bar{\eta}(w_{SB}, \kappa) \)). It also increases profits net of hidden pay unambiguously if the I board does
not pay hidden compensation (which happens as long as \( \eta < \bar{\eta}(w_I^* \kappa) \)), so that the reduction
in disclosed pay caused by the increase in \( \eta \) does not lead to an increase in hidden pay.

However, if reputational pressures are sufficiently strong that the I board is forced to
keep the manager’s (total) utility at his reservation level to signal its independence (i.e., if
\( w_I + y^*(w_I, I) = w \)), then increasing \( \eta \) leads to lower disclosed pay but also to an increase in
hidden pay that exactly compensates the manager for the reduction in disclosed pay in order
to meet the manager’s participation constraint, so that the manager’s utility is unchanged.
Thus, an increase in \( \eta \) reduces expected profits net of the cost of hidden pay since hidden
pay is inefficient. An increase in \( \eta \) can also reduce profits if reputational concerns are strong
enough that the I board is forced to choose an inefficient contract to signal its independence
(that is, if \( \eta > \bar{\eta}(w_{SB}, \kappa) \), as described in part 3 of Proposition 4). In this case, the reduction
in disclosed pay caused by an increase in $\eta$ actually lowers expected profits even if not accompanied by an increase in hidden pay. The decrease in profits may be magnified by an increase in inefficient hidden pay.

Although the preceding discussion implies that the relationship between reputational pressure and profits is likely to be hump-shaped, there are parameter configurations for which the relationship is weakly monotonic. For example, if the I board’s preferred contract generates expected utility for the manager equal to the manager’s outside option $w$, then the I board already pays the minimum amount consistent with the manager’s participation in the absence of reputational concerns, so that increasing the strength of reputational concerns cannot reduce the manager’s total pay and thus cannot increase profits either. However, a larger $\eta$ will reduce profits if it forces the I board to reduce disclosed pay and thus use inefficient hidden pay to meet the manager’s participation constraint.

C. Hidden vs. Public Perks

In Section I.B, we argue that the hidden pay variable $y$ can capture not only undisclosed monetary compensation, but also other forms of undisclosed nonmonetary compensation such as inefficient perks. At the same time, we assume that disclosed pay consists of either a fixed salary or a fixed salary and a bonus, but we do not allow the board to compensate the manager with disclosed inefficient perks. These assumptions raise two important and related questions. First, would our results change if we assumed that $y$ is observable? In other words, does the unobservability of $y$ play an essential role in our results? And second, are our results robust to allowing boards to use both hidden and disclosed inefficient perks?

The answer to the above questions is yes: the unobservability of $y$ plays a crucial role, and our results continue to hold if there are both public and hidden perks. Indeed, neither board type would offer the manager inefficient publicly observable perks, in sharp contrast to the case with hidden pay. To clarify this point, consider the setup of the baseline model, but assume that the labor market can observe $y$. In this setting, consider a potential equilibrium in which the I board pays disclosed inefficient perks $y_I > 0$ and disclosed cash $w_I$. A deviation by the I board that replaces the disclosed perks with the same amount of disclosed cash does not change total pay and increases profits because of the inefficiency of the disclosed perks. Thus, if the labor market belief that the board is type I upon observing this deviation is high
enough, the deviation is profitable for the I board, as is a deviation in which the increase in disclosed pay is slightly smaller than the reduction in disclosed perks (i.e., a deviation to \( y = 0 \) and \( w_d = w_I + y_I - \varepsilon \) for some small \( \varepsilon > 0 \)). Since the latter deviation reduces total pay, which is more valuable to the M board, criterion D1 requires the labor market to infer that such a deviation is by an I board, making the deviation profitable for the I board. Hence, equilibria in which the I board pays disclosed perks are not possible. Moreover, the argument behind Proposition 2 implies that in any separating equilibrium, the M board will not compensate the manager with inefficient perks either, since it can obtain higher pay and profits by replacing the inefficient perks with efficient disclosed pay. Therefore, the unobservability of \( y \) is key for our results, since if inefficient perks are public, there are no equilibria in which either board type makes use of them.

The same argument implies that if boards could use both hidden and public inefficient perks, they would not use public perks in equilibrium. Further, the availability of public perks does not have any impact on equilibrium outcomes. Thus, our simplifying assumption that boards cannot use inefficient disclosed perks is without loss of generality.

It is worth noting why the deviation described above does not rule out equilibria with hidden pay. Assume now that \( y \) is hidden and that in equilibrium the I board pays disclosed pay \( w_I \) and hidden pay \( y_I = y^*(w_I, I) > 0 \). As in the public \( y \) case, suppose that the I board deviates to \( w_d = w_I + y_I - \varepsilon > w_I \) and announces that it will pay no hidden compensation. Since \( y \) is not observable, boards choose the amount of hidden pay that is optimal given the disclosed contract and, as we show in Section II.B, the optimal level of hidden pay is such that total pay cannot fall when disclosed pay increases. Since the announced deviation involves increasing disclosed pay and reducing total pay, it is not credible and will thus fail to convince the labor market that the deviation is from an I board.

We note that the fact that \( y \) is hidden also implies that, even though our model can be formally mapped to a signaling model, our model has three features that set it apart from usual signaling models. First, a public signal (the disclosed contract) coexists with a hidden action (hidden pay). Second, since the hidden action can be adjusted together with the public signal, off-equilibrium deviations from equilibrium values of the public signal are associated with off-equilibrium changes in the hidden action. Third, the hidden action reduces the cost for the sender (the board) of using the public signal. This last feature is especially noteworthy since the existence of the hidden action, by lowering the cost for the
low type (the manager-friendly board) of imitating the high type (the independent board),
forces the high type to use the public signal more intensely and thus use the hidden action
to compensate for the cost of the public signal. Further, as Proposition 3 shows, reducing
the cost for the sender of the hidden action intensifies these effects.

V. Conclusion

Reputational concerns are arguably the single most powerful incentive for directors to act
in the interest of shareholders. The alignment of the interests of shareholders and the board
is especially important in the context of executive compensation because of the potentially
strong incentives that directors have to favor the CEO. In this paper, we analyze the impact
of boards’ reputational concerns on the level and structure of executive compensation.

Our model yields the expected result that reputational concerns induce directors to lower
executive pay. However, we show that reputational concerns may also induce boards to either
pay managers in hidden ways or to inefficiently distort managerial incentives. Moreover, a
key result of the model is that independent boards are more likely than manager-friendly
boards to pay in hidden ways or introduce inefficient distortions in the disclosed contract.
Importantly, hidden pay emerges in the model as an inefficient side effect of the efforts by
independent boards to signal their independence, rather than as a strategy by manager-
friendly boards to hide excessive pay from shareholders.

Another key implication of our model is that there is substitution between disclosed and
camouflaged forms of pay. In the cross section, independent boards pay lower disclosed
compensation and higher hidden compensation than manager-friendly boards. Independent
boards also substitute between disclosed and hidden pay as a response to changes in the costs
of camouflaging pay or in the value of a reputation for independence. The substitution of
hidden pay for disclosed pay leads to inefficient outcomes through two different mechanisms.
The first is that hidden flat pay is more costly to the firm than disclosed flat pay. The second
mechanism is that hidden pay may replace disclosed incentive pay, leading to inefficiently
weak managerial incentives. Interestingly, the latter distortion is likely to be large precisely
when the direct cost of hiding pay is low, so that the deadweight loss due to the availability
of hidden pay can be large even if the cost of hiding pay is negligible.

Our theory has several implications concerning the impact on executive compensation
of corporate governance trends and regulatory reforms that increase pay transparency and strengthen directors’ reputational concerns. In particular, we show that corporate governance changes that increase the reputational pressure faced by directors reduce disclosed pay, but also lead to an increase in the use of hidden pay. When reputational concerns are weak, these changes may benefit shareholders. However, when reputational concerns are sufficiently strong, a further increase in reputational pressure may reduce shareholder wealth.

We also show that corporate governance changes that make it more costly for boards to pay the CEO in hidden ways discourage the use of hidden forms of pay. However, by making it more costly for manager-friendly boards to imitate the compensation policies of independent boards, such changes also reduce the reputational pressure on independent boards to reduce executive pay and can lead to higher disclosed compensation. If disclosure requirements are sufficiently stringent, making them stricter may reduce shareholder value. The model therefore implies that too much pay transparency can harm shareholders.

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Appendix: Proofs

A. Outline of the Proofs

As we argue in Sections II.B and III.E, the baseline model in Section II and the model with incentive pay in Section III can be represented as signaling models in which the space of messages is the set of contracts and the board’s preferences over messages and the labor market beliefs $\mu$ are given by the utility function $V^*$, defined in expressions (4) and (10).

Although neither the set of messages nor the board’s indirect utility function is the same in the two models, in both models a contract $c$ maps into an expected utility for the manager $w_d(c)$ and expected profits $\pi_d(c)$ that the contract generates if the board pays no hidden compensation, and a choice of hidden pay by the board.\textsuperscript{26} Since the board’s hidden pay choice depends on the contract $c$ only through the payoffs $(w_d(c), \pi_d(c))$, the board’s preferences over contracts can be alternatively represented as preferences over contractual payoff pairs $(w_d, \pi_d)$ generated by those contracts (that is, payoff pairs generated by the disclosed contract alone in the absence of hidden pay), and these preferences are identical in the baseline model and the model with incentive pay.

It follows that if we represent the board as choosing contractual payoff pairs instead of contracts, the models in Sections II and III are identical in all respects except in the set of feasible contractual payoff pairs. However, these sets of payoff pairs share some properties that suffice to prove the results of both models simultaneously. We thus prove all the results by assuming that the board chooses contractual payoff pairs, instead of contracts. We then retrieve the equilibrium disclosed contract and hidden pay from the equilibrium payoff pair.

To prove the results we first characterize the function $y^*$ mapping contractual payoffs to hidden pay, and the board’s utility function $V$ defined over contractual payoff pairs. We next characterize the set of feasible contractual payoffs in each model and show that both sets share certain key properties. Finally, we prove our results for any signaling game with a set of feasible payoffs satisfying these properties and with preferences over payoffs given by $V$, thus proving the results that are common to the baseline model and the model with incentive pay simultaneously.

In all proofs we refer to the manager-friendly board and the independent board as M

\textsuperscript{26}In the baseline model, a contract specifies the manager’s disclosed pay, so that $c = w_d$, $w_d(c) = w_d$, and $\pi_d(c) = R - w_d$. In the moral hazard model, $c = (s, b)$ and $w_d(c)$ and $\pi_d(c)$ are derived in Lemma A.4.
and I, respectively. To simplify the notation we use $d$ to denote a (contractual) payoff pair $(w_d, \pi_d)$ (where $d$ stands for disclosed and refers to the fact that $w_d$ and $\pi_d$ are generated by the disclosed contract alone, in the absence of any hidden pay). We refer to $w_d$ and $\pi_d$ as (contractual) utility and profits, respectively. For the sake of clarity, we do not include the parameters $\eta$ and $\kappa$ as arguments of the functions $U$, $y^*$, and $\nabla$ when it is not necessary to make explicit reference to these parameters.

**B. Characterization of $y^*$ and $\nabla$**

Let $w(c, y)$ and $\pi(c, y)$ denote the manager’s expected utility and expected profits, respectively, given disclosed contract $c$ and hidden pay $y$. Let $w_d(c) \equiv w(c, 0)$ and $\pi_d(c) \equiv \pi(c, 0)$. We assume that $w(c, y) = w_d(c) + y$ and $\pi(c, y) = \pi_d(c) - z(y; \kappa)$. This assumption holds trivially in the baseline model. As discussed in Section III.E, it also holds in the moral hazard model since the manager’s effort choice does not depend on $y$.

**Lemma A.1 (Hidden pay):** Recall that $w$ is the manager’s reservation utility, and assume that there is a $\overline{w} > w$ such that $Mv'(\overline{w}) < 1$. Let $y(c, t; \kappa)$ be the optimal hidden pay for the type-$t$ board given contract $c$ and the parameter $\kappa$ representing the cost of hiding pay.

1. There is a function $y^*$ such that $y^*(w_d, t; \kappa) = \arg\max_{y \geq \max\{0, \overline{w} - w_d\}} U(w_d + y, \pi_d - z(y; \kappa), \mu, t; \eta)$ for any $\pi_d$ and $\mu$. For any $c$, $y(c, t; \kappa) = y^*(w_d(c), t; \kappa)$.

2. For any given $w_d$, the M board pays higher hidden compensation than the I board: $y^*(w_d, M; \kappa) \geq y^*(w_d, I; \kappa)$. Further, if $y^*(w_d, M; \kappa) > 0$ and the manager’s participation constraint is not binding ($w_d + y^*(w_d, M; \kappa) > \overline{w}$), then $y^*(w_d, M; \kappa) > y^*(w_d, I; \kappa)$.

3. Hidden pay is nonincreasing in $w_d$: if $w'_d > w_d$, then $y^*(w'_d, t; \kappa) \leq y^*(w_d, t; \kappa)$. Further, if $y^*(w_d, t; \kappa) > 0$, then $y^*(w'_d, t; \kappa) < y^*(w_d, t; \kappa)$.

4. The manager’s (total) utility $(w_d + y^*(w_d, t; \kappa))$ is nondecreasing in $w_d$ and is increasing in $w_d$ if the manager’s participation constraint is not binding: if $w'_d > w_d$, then either $w'_d + y^*(w'_d, t; \kappa) = w_d + y^*(w_d, t; \kappa) = \overline{w}$ or $w'_d + y^*(w'_d, t; \kappa) > w_d + y^*(w_d, t; \kappa)$.

5. Hidden pay is nonincreasing in the parameter $\kappa$ determining the cost of hidden compensation. Moreover, if $y^*(w_d, t; \kappa) > 0$ and $w_d + y^*(w_d, t; \kappa) > \overline{w}$, then $\kappa' > \kappa$ implies that $y^*(w_d, t; \kappa) > y^*(w_d, t; \kappa')$. 

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5. A type-\( t \) board pays hidden compensation if and only if \( w_d \) is lower than a threshold \( w^y_t \), which is nonincreasing (decreasing if \( w^y_t > w \)) in \( \kappa \) and such that \( w^y_M > w^y_I \).

6. Either \( w_d + y^*(w_d, t; \kappa) > w \) for all \( w_d \), or there exists a \( w_t \) such that \( w_d + y^*(w_d, t; \kappa) = w \) if and only if \( w_d \leq w_t \). If \( w_M \) exists, then \( w_M < w_I \).

**Sketch of proof:** The board’s optimal hidden pay given a contract \( c, y(c, t; \kappa) \), solves

\[
\max_{y \geq 0} \pi_d(c) - z(y; \kappa) + tv(w_d(c) + y) + \eta \mu \quad \text{(A1)}
\]

\[
s.t. \quad w_d(c) + y \geq w.
\]

Inspection of this problem shows that its solution does not depend on \( \pi_d(c) \), \( \mu \), or \( \eta \), and depends on \( c \) only through \( w_d(c) \). Hence, letting \( y^*(w_d, t; \kappa) \) denote the solution of

\[
\max_{y \geq 0} \pi_d - z(y; \kappa) + tv + \eta \mu \quad \text{(A2)}
\]

\[
s.t. \quad w_d + y \geq w
\]

for some fixed \( \pi_d \) and \( \mu \), it follows that \( y(c, t; \kappa) = y^*(w_d(c), t; \kappa) \), which proves part 0 of the lemma. We note that \( y^* \) is identical to the function \( y^* \) defined in Section II.B. The proof of parts 1 to 6 of the lemma is in the Internet Appendix. The results follow from the fact that the marginal utility of hidden pay for the board for a given \( w_d \), \( tv'(w_d + y) - z_y(y; \kappa) \), is increasing in \( t \) and decreasing in \( w_d \) (since \( v'' < 0 \) and \( \kappa \) (since \( z_{y\kappa} > 0 \))).

**Lemma A.2:** Let \( V^*(c, \mu, t; \kappa, \eta) \equiv U(w(c, y(c, t; \kappa)), \pi(c, y(c, t; \kappa)), \mu, t; \eta) \) and define \( V(w, \pi_d, \mu, t; \kappa, \eta) \equiv U(w + y^*(w_d, t; \kappa), \pi_d - z(y^*(w_d, t; \kappa); \mu, t; \eta) \). Then:

0. \( V^*(c, \mu, t; \kappa, \eta) = V(w_d(c), \pi_d(c), \mu, t; \kappa, \eta) \).

1. \( V \) is continuous, increasing in \( w_d, \pi_d \), and \( \mu \), nondecreasing (increasing if \( \mu > 0 \)) in \( \eta \), and nonincreasing (decreasing if \( y^*(w_d, t; \kappa) > 0 \)) in \( \kappa \).

2. If \( w''_d > w'_d \) and \( w'_d + y^*(w'_d, M; \kappa) > w \), then for any \( \pi''_d, \pi'_d, \mu'' \), and \( \mu' \), the following
(strict) single-crossing property holds:
\[
\nabla (w_d', \pi_d', \mu', M; \kappa, \eta) \geq \nabla (w_d'', \pi_d'', \mu'', M; \kappa, \eta) \Rightarrow \\
\nabla (w_d', \pi_d', \mu', I; \kappa, \eta) > \nabla (w_d'', \pi_d'', \mu'', I; \kappa, \eta).
\] (SC)

Therefore, if \( w_d(c'') > w_d(c') \) and \( w_d(c'') + y^*(w_d(c''), M; \kappa) > \underline{w} \), then for any \( \mu'', \mu' \):
\[
V^*(c', \mu', M; \kappa, \eta) \geq V^*(c'', \mu'', M; \kappa, \eta) \Rightarrow V^*(c', \mu', I; \kappa, \eta) \geq V^*(c'', \mu'', I; \kappa, \eta). \quad (A3)
\]

3. Let \((w_d', \pi_d')\) be such that \( y^*(w_d', t; \kappa) > 0 \). Then \( \nabla (w_d' + \epsilon, \pi_d' - \epsilon, \mu, t; \kappa, \eta) > \nabla (w_d', \pi_d', \mu, t; \kappa, \eta) \) for \( \epsilon > 0 \) small enough.

4. For any \( d' = (w_d', \pi_d') \), \( d'' = (w_d'', \pi_d'') \), and \( \delta \in [0, 1] \), \( \nabla (\delta d' + (1 - \delta) d'', \mu, t; \kappa, \eta) \geq \delta \nabla (d', \mu, t; \kappa, \eta) + (1 - \delta) \nabla (d'', \mu, t; \kappa, \eta) \), with strict inequality if \( \delta \in (0, 1) \) and \( w_d' \neq w_d'' \).

The lemma follows quite directly from the properties of \( U \) and \( z \) (namely, \( z_y > 1 \), \( z_yy > 0 \), and \( z_{yr} > 0 \)). The proof is in the Internet Appendix. The indirect utility functions defined in Sections II.B and III.E are particular instances of the function \( V^* \) defined in the lemma. The single-crossing condition (5) in Section II.B follows immediately from part 2 of the lemma.

C. The Sets of Feasible Contractual Payoffs

For \( \pi_u : W \to \mathbb{R} \) and \( \pi_l : W \to \mathbb{R} \), where \( W \subseteq \mathbb{R} \) and \( \pi_l(w_d) \leq \pi_u(w_d) \) for any \( w_d \in W \), define the set
\[
F(\pi_u, \pi_l) \equiv \{(w_d, \pi_d) \in \mathbb{R}^2 : w_d \in W, \pi_d \in [\pi_l(w_d), \pi_u(w_d)]\} \subset \mathbb{R}^2. \quad (A4)
\]

**Definition A.1:** A set of feasible payoffs \( F \) is admissible if there exist functions \( \pi_u : W \to \mathbb{R} \) and \( \pi_l : W \to \mathbb{R} \) such that (i) \( W = \mathbb{R} \) or \( W = [w_L, \infty) \subset \mathbb{R} \), (ii) \( \pi_l(w_d) \leq \pi_u(w_d) \) for any \( w_d \in W \), (iii) \( \pi_u \) is continuously differentiable, concave, and satisfies \( \pi_u'(w_d) \geq -1 \) for any \( w_d \in W \) and \( \pi_u'(w_d) = -1 \) for \( w_d \) large enough, and (iv) \( F = F(\pi_u, \pi_l) \). Let \( \mathcal{F} \) denote the set of admissible sets of feasible payoffs.

**Lemma A.3:** Let \( F_B \equiv \{(w_d, \pi_d) \in \mathbb{R}^2 : \pi_d = \bar{R} - w_d\} \) denote the feasible set of the baseline model. Define \( \pi_u^b : \mathbb{R} \to \mathbb{R} \) by \( \pi_u^b(w_d) = \bar{R} - w_d \). Then \( F_B = F(\pi_u^b, \pi_u^b) \in \mathcal{F} \).
Proof: The proof follows directly from the definitions of $F_B$ and $\pi^b_w$ and Definition A.1. ■

Let $F_{MH}$ denote the feasible set of the model with moral hazard in Section III:

$$F_{MH} \equiv \{(w_d, \pi_d) \in \mathbb{R}^2 : w_d = w_d(s, b), \pi_d = \pi_d(s, b), \text{ for some } s \geq 0 \text{ and } b \geq -s\}. \quad (A5)$$

The following lemma characterizes the functions $w_d(s, b)$ and $\pi_d(s, b)$ and shows that one can restrict attention to contracts with $b \in [0, \gamma]$ (the proof is in the Internet Appendix).

**Lemma A.4:** If $(w_d, \pi_d) \in F_{MH}$, then it can be implemented with a feasible contract with $b \in [0, \gamma]$. Letting $e(b)$ be the manager’s effort choice given bonus $b$, then if $b \in [0, \gamma]$, it follows that $e(b) = \frac{b}{\gamma}$, $w_d(s, b) = s + \frac{b^2}{2\gamma}$, and $\pi_d(s, b) = R_L - s + \frac{b}{\gamma}(R_H - R_L - b)$.

Since any feasible payoff pair can be implemented with a contract with $b \in [0, \gamma]$, hereafter we assume w.l.o.g. that $b \in [0, \gamma]$.

The following lemma characterizes $F_{MH}$ and shows that $F_{MH} \in \mathcal{F}$. The proof is in the Internet Appendix and follows from the argument presented in Section III.C.

**Lemma A.5:** Let $TS(e) \equiv R_L + e(R_H - R_L) - \frac{\gamma e^2}{2}$ be the joint surplus of the manager and shareholders, $e_{FB} \equiv \arg \max_{e \in [0, 1]} TS(e)$, $TS_{FB} \equiv TS(e_{FB})$, $b_{FB}$ be such that $e(b_{FB}) = e_{FB}$, and $w_{FB} \equiv w_d(0, b_{FB})$. Then:

1. $b_{FB} = R_H - R_L \in (0, \gamma)$, $w_{FB} = \frac{(R_H - R_L)^2}{2\gamma}$, $\max\{w_d + \pi_d : (w_d, \pi_d) \in F_{MH}\} = w_{FB} + \pi_d(0, b_{FB}) = TS_{FB}$.

2. Define $\pi_l, \pi_u : [0, \infty) \to \mathbb{R}$ as $\pi_l(w_d) = R_L - w_d$, and $\pi_u(w_d) = TS_{FB} - w_d$ for $w_d \geq w_{FB}$, and $\pi_u(w_d) = R_L + \left(\frac{2w_d}{\gamma}\right)(R_H - R_L) - 2w_d$ for $w_d \in [0, w_{FB})$. Then
   (a) $F_{MH} = F(\pi_u, \pi_l) \in \mathcal{F}$, and
   (b) $\pi_u(w_d) > 0$ if $w_d > w_{SB}$, and $\pi_u(w_d) < 0$ if $w_d < w_{SB}$, for $w_{SB} = \frac{(R_H - R_L)^2}{8\gamma} = w_d(0, b_{SB})$, where $b_{SB} = \frac{R_H - R_L}{2}$.
   Thus, if $w_d(s, b) < w_{SB}$, so $b < b_{SB}$, then $(s, b)$ is not second-best.

3. For any $w_d \geq 0$, there is a unique conditionally optimal contract $c(w_d) = (s_u(w_d), b_u(w_d))$, where $c(w_d)$ is the unique contract such that $(w_d(c), \pi_d(c)) = (w_d, \pi_u(w_d))$. If $w_d \geq w_{FB}$, then $b_u(w_d) = b_{FB}$ and $s_u(w_d) = w_d - w_{FB}$. If $w_d < w_{FB}$, then $s_u(w_d) = 0$ and $b_u(w_d) = \sqrt{2\gamma}w_d < b_{FB}$.
We note that \( \pi_u(w_d) \) describes the maximum profit attainable by contracts that generate utility \( w_d \) for the manager. If \( \pi_u'(w_d) > 0 \), the conditionally optimal contract that implements \( w_d \) is not second-best, since by switching to a contract with marginally higher \( w_d \) it is possible to increase both the manager’s utility and expected profits.

D. Proofs of the Main Results

D.1. Preferred Payoff Pairs in the Absence of Reputational Concerns

Proof of Proposition 1: To prove the proposition, we derive the optimal contractual payoff pair and then retrieve the corresponding contract. We prove the proposition for any set of feasible payoffs \( F = F(\pi_u, \pi_l) \in \mathcal{F} \), such that \( w \in W \), where \( W \) is the set of feasible levels of contractual utility. Lemmas A.3 and A.5 and \( w > 0 \) thus imply that the proposition holds for the models in Sections II and III, with sets of feasible payoffs \( F_B \) and \( F_{MH} \), respectively.

In the absence of reputational concerns, a type-\( t \) board will choose the contractual payoff pair \( d_t^* = (w_t^*, \pi_t^*) \in F(\pi_u, \pi_l) \) that, for fixed \( \mu \), maximizes \( \nabla(w_d, \pi_d, \mu, t; \kappa, \eta) \). Since \( \nabla \) is increasing in \( \pi_d \), at the maximum \( \pi_d = \pi_u(w_d) \) (so \( \pi_t^* = \pi_u(w_t^*) \)). Thus,

\[
\max_{d \in F(\pi_u, \pi_l)} \nabla(d, \mu, t; \kappa, \eta) = \max_{w_d \in W} \nabla(w_d, \pi_u(w_d), \mu, t; \kappa, \eta). \tag{A6}
\]

For fixed \( \mu, \kappa, \) and \( \eta \) (which we drop as arguments for the sake of clarity below), let

\[
\nabla^u(w_d, t; \mu, \kappa, \eta) \equiv \nabla(w_d, \pi_u(w_d), \mu, t; \kappa, \eta). \tag{A7}
\]

Suppose that for \( w_d \in W \), \( y^*(w_d, t; \kappa) > 0 \). Then, for \( \epsilon > 0 \) sufficiently small, we have

\[
\nabla^u(w_d + \epsilon, t) = \nabla(w_d + \epsilon, \pi_u(w_d + \epsilon), \mu, t) \geq \nabla(w_d + \epsilon, \pi_u(w_d) - \epsilon, \mu, t) > \nabla(w_d, \pi_u(w_d), \mu, t) = \nabla^u(w_d, t), \tag{A8}
\]

where the weak inequality follows from the facts that \( \nabla \) is increasing in \( \pi_d \) and \( \pi_u(w_d + \epsilon) \geq \pi_u(w_d) - \epsilon \), since \( \pi_u' \leq -1 \). The strict inequality follows from part 3 of Lemma A.2. Thus, if \( w_t^* \) exists, then \( w_t^* \geq \frac{w_t^*}{2} \), which proves part 1 of the proposition.
Since \( w_i^* \geq w_i^y \), one can write the board’s problem as

\[
\max_{w_d \in W} \quad V_u(w_d, t) \tag{A9}
\]

s.t. \( w_d \geq w_i^y \).

The assumptions that \( M' < 1 \) and \( \pi_u' = -1 \) for \( w_d \) large enough imply that \( w_i^* \) exists.

Let \( w_d \neq w_i^d \), \( \pi_d = \pi_u(w_d) \), \( \pi_d' = \pi_u(w_i^d) \), \( w_d'' = \delta w_d + (1 - \delta)w_i^d \), and \( \pi_d'' = \delta \pi_d + (1 - \delta)\pi_d' \), for \( \delta \in (0, 1) \). Since \( \pi_u \) is concave, \( \pi_u(w_d'') \geq \delta \pi_u(w_d) + (1 - \delta)\pi_u(w_i^d) = \pi_d'' \). Thus,

\[
V_u(w_d', t) = V(w_d'', \pi_u(w_d'), \mu, t) \geq V(w_d, \pi_d', \mu, t) > \delta V(w_d, \pi_d, \mu, t) + (1 - \delta)V_u(w_d', t) = \delta V_u(w_d', t) + (1 - \delta)V_u(w_d', t), \tag{A10}
\]

where the first inequality follows from the fact that \( V \) is increasing in \( \pi_d \) and the second inequality from part 4 of Lemma A.2. Thus, \( V_u \) is strictly concave in \( w_d \), so \( w_i^* \) is unique.

It follows from the proof of Lemma A.2 that \( V(w_d, \pi_d, \mu, t) \) is differentiable with respect to \( \pi_d \) and with respect to \( w_d \) for any \( w_d \neq w \), so \( V_u(w_d, t) \) is differentiable with respect to \( w_d \) for \( w_d > w_i^y \), since \( w_i^y \geq w \) and \( \pi_u \) is differentiable. Therefore, either \( w_i^* = w_i^y \) or \( w_i^* \) is an interior solution of problem (A9) given by the first-order condition

\[
V_{w_d}(w_i^*, t) = V_{w_d}(w_i^*, \pi_u(w_i^*), \mu, t) + \pi_u'(w_i^*) = tv'(w_i^*) + \pi_u'(w_i^*) = 0. \tag{A11}
\]

The function \( \pi_u \) is concave, \( \pi_u' \) is continuous, and \( \pi_u' = -1 < 0 \) for \( w_d \) sufficiently large. Thus, either \( \pi_u'(w_d) < 0 \) for any \( w_d \in W \) or there is a \( w_d^0 \) such that \( \pi_u'(w_d) \geq 0 \) if and only if \( w_d \leq w_d^0 \). If \( w_d \neq w \), then \( V_{w_d} < V_{w_d} + \pi_u' > 0 \) at \( w_d^0 \), since \( V_{w_d} > 0 \) and \( \pi_u'(w_d^0) = 0 \). If \( w_d = w \), the continuity of \( \pi_u' \) implies that for \( \delta > 0 \) small enough, \( V_{w_d} > 0 \) for any \( w_d \in [w_d^0 - \delta, w_d^0 + \delta] \) other than \( w_d^0 \) (since \( V_{w_d} \) is bounded away from zero in this interval), so \( V_u(w_d^0 - \delta, t) < V_u(w_d^0, t) < V_u(w_d^0 + \delta, t) \) since \( V_u \) is continuous. Thus, \( V_u \) is increasing in \( w_d \) at \( w_d^0 \), so that it is also increasing for \( w_d < w_d^0 \) since \( V_u \) is concave. Therefore, \( w_i^* > w_d^0 \).

If \( w_i^y \leq w_d^0 \), then \( w_i^* > w_d^0 \geq w_i^y \). If \( w_i^y > w \), then we show in the proof of part 5 of Lemma A.1 that \( tv'(w_i^y) - z_y(0; \kappa) = 0 \). Thus, \( z_y > 1 \) and \( \pi_u' \geq -1 \) imply that \( tv'(w_i^y) + \pi_u'(w_i^y) > 0 \), so (A11) implies that if \( w_i^y > w \), then \( w_i^* > w_i^y \). Therefore, \( w_i^* = w_i^y \) only if \( w_i^y = w > w_d^0 \). We note that this implies that if \( w_i^* > w \), then \( w_i^* > w_i^y \).
By definition of \( \tilde{\kappa} \), \( \kappa < \tilde{\kappa} \) implies that \( y^*(w, M; \kappa) > 0 \), so \( w_M^y > w \). Thus, \( w_M^y > w_M^0 > w \), and \( w_M^* \) is given by (A11) for \( t = M \). If \( w_i^* \) is an interior optimum, then \( I v'(w_i^*) + \pi_u'(w_i^*) = 0 \), so \( w_i^* < w_M^* \), since \( M > I \), \( v'' < 0 \), and \( \pi_u' \) is nonincreasing. If \( w_i^* \) is not interior, then \( w_i^* = w_i^y = w < w_M^* \), which completes the proof of part 2 of the proposition.

In the baseline model, the contract that implements \( d_i^* = (w_i^*, \pi_i^*) \) simply sets disclosed pay equal to \( w_i^* \). Since \( \pi_i^* = \pi_u(w_i^*) \) and \( w_i^* > w_0^d \), parts 2 and 3 of Lemma A.5 imply that in the moral hazard model, where \( w_0^d = w_{SB} \), the contract that implements \( d_i^* \) is conditionally optimal, unique, and equal to \( c_i^* = (s_u(w_i^*), b_u(w_i^*)) \), where \( b_u(w_i^*) > b_{SB} \), so \( c_i^* \) is second-best. Further, \( w_M^* > w_i^* \) implies that \( b_M^* \equiv b_u(w_M^*) \geq b_i^* \equiv b_u(w_i^*) \) and \( s_M^* \equiv s_u(w_M^*) \geq s_i^* \equiv s_u(w_i^*) \), with at least one of the inequalities being strict.

Letting \( d_M^* \) denote the payoff pair preferred by the M board, we define

\[
U_M^* \equiv U(d_M^*, 0, M; \kappa, \eta) = V(d_M^*, 0, M; \kappa, \eta), \text{ for any } \kappa, \eta. \tag{A12}
\]

**Lemma A.6:** Let \( F \in \mathcal{F} \) and \( d_i^* = (w_i^*, \pi_u(w_i^*)) \) be the payoff pair preferred by a type-\( t \) board. Consider \( d' = (w_d', \pi_d'), \mu' \), and \( \mu'' \), where \( \pi_d' \leq \pi_u(w_d') \) and \( \mu'' \geq \mu' \). If (i) \( w_d' < w_i^* \) and \( w_d'' \in (w_i^*, w_d') \), or (ii) \( w_d' > w_i^* \) and \( w_d'' \in [w_i^*, w_d') \), then \( V(w_d', \pi_u(w_d'), \mu'', t) > V(d', \mu', t) \).

*Sketch of proof:* The proof in the Internet Appendix follows immediately from the result (obtained in the proof of Proposition 1) that \( V(w_d, \pi_u(w_d), \mu, t) \) is strictly concave in \( w_d \).}

**D.2. Equilibrium**

We characterize the equilibria of the signaling game in which the board’s message space is the set of payoff pairs \( F \) (with \( F = F_B \) in the baseline model and \( F = F_{MH} \) in the moral hazard model), and the board’s preferences over contractual payoff pairs and labor market beliefs \( \mu \) are represented by \( V \). We then retrieve the equilibrium contracts and hidden pay from the equilibrium payoff pairs. The equilibrium is as defined by Definition 1 if one replaces contracts \( c \) by contractual payoff pairs \( d \), the set of contracts \( C \) by the set of feasible payoffs \( F \), and utility \( V^* \) (defined over contracts) by \( V \) (defined over payoff pairs).

Lemma A.7 provides necessary and sufficient conditions for a strategy profile to be an equilibrium for some beliefs satisfying criterion D1. The proof is in the Internet Appendix.
Lemma A.7: Let $F \in \mathcal{F}$ be the set of feasible contractual payoffs and $\sigma = (\sigma_I, \sigma_M)$ a mixed strategy profile. Let $\mu^*(d)$ be derived by Bayes’ rule from $\sigma$ for any $d \in S$, where $S = S_I \cup S_M$ and $S_I$ is the support of $\sigma_I$, and let $\overline{V}^e_t$ be $t$’s expected utility given $\sigma$ and $\mu^*$. Define $\bar{w}_I \equiv \max\{w_d : (w_d, \pi_d) \in S_I\}$. If $\bar{w}_I + y^*(\bar{w}_I, M) > w$, then there are beliefs $\mu$ such that $(\sigma, \mu)$ is an equilibrium if and only if $u(d) = \mu^*(d)$ for any $d \in S$ and the following conditions hold:

(A) For any $t$, $\nabla(d, \mu^*(d), t) = \nabla^e_t$ for any $d \in S_I$.

(B) For any $t$, $\nabla^e_t \geq \nabla(d, \mu^*(d), t)$ for any $d \in S$.

(C) For any $t$, $\nabla^e_t \geq \nabla(d^*_t, 0, t)$.

(D) $\nabla_M^e = \nabla(d, \mu^*(d), M)$ for any $d \in S_I$ such that $d \neq d^*_I$.

(E) $\nabla^e_I \geq \nabla(d, 1, I)$ for any $d \notin S$ such that $w_d < \bar{w}_I$.

Sketch of proof: Conditions (A) to (C) are obviously necessary. If M does not play $d \neq d^*_I$ and $d \in S_I$, then $\mu^*(d) = 1$, so if condition (D) does not hold, then condition (B) and the continuity of $\nabla$ imply that $\nabla_M^e > \nabla(d', 1, M)$ for a payoff pair $d'$ closer than $d$ to $d^*_I$, so $\nabla(d', 1, I) > \nabla(d, 1, I)$. Thus, part 3 of the equilibrium definition implies that I can profitably deviate to $d'$. If condition (E) does not hold, then there is some $d \notin S$ such that $w_d < \bar{w}_I$ and $\nabla^e_I < \nabla(d, 1, I)$. It follows that I could profitably deviate to $d$ if $\mu(d)$ is sufficiently high, and $\bar{w}_I + y^*(\bar{w}_I, M) > w$, $w_d < \bar{w}_I$, and the single-crossing property ensure that the range of values of $\mu$ for which it would be profitable to deviate to $d$ is wider for I than for M. Thus, part 3 of the equilibrium definition requires $\mu(d) = 1$, making it profitable for I to deviate to $d$.

Conditions (A) to (C) are sufficient if $\mu(d) = 0$ for any $d \notin S$, and conditions (D) to (E) guarantee that such belief system is consistent with the equilibrium definition.

For a given $F = F(\pi_u, \pi_I) \in \mathcal{F}$, define $\tilde{w}(\kappa, \eta)$ as

$$\nabla(\tilde{w}, \pi_u(\tilde{w}), 1, M; \kappa, \eta) = \nabla(w_M^*, \pi_u(w_M^*), 0, M; \kappa, \eta) = U_M^*,$$

(A13)

and let $\tilde{d} \equiv (\tilde{w}, \pi_u(\tilde{w}))$. Lemmas A.2 to A.5 imply that $\nabla(\tilde{w}, \pi_u(\tilde{w}), 1, M)$ is equal to $V^*(\tilde{w}, 1, M)$ in the baseline model and $V^*(c(\tilde{w}), 1, M)$ in the moral hazard model, so the
definitions of $\bar{w}$ in Sections II.D and III.E are particular cases of (A13). Define $\bar{\eta}$ as
\[
U(w, \pi_u(w), 1, M; \bar{\eta}) = U_M^*.
\] (A14)
Thus, (6) and (11) are special cases of (A14) for $F = F_B$ and $F = F_{MH}$, respectively.

If $w_L \equiv \min W$ exists, we assume that $M$ would not choose a contractual payoff pair with $w_d = w_L$ even if $\eta = \bar{\eta}$ and $\kappa = 0$, that is,
\[
\bar{V}(w_L, \pi_u(w_L), 1, M; 0, \bar{\eta}) < U_M^*.
\] (A15)
If $F = F_{MH}$, then $w_L = 0$ and is attained with the contract $(0, 0)$, so (A15) reduces to (12).

We prove all the remaining results for any set of feasible payoffs $F$ satisfying the following assumption.

**ASSUMPTION A.1**: $F = F(\pi_u, \pi_l) \in F$, where $\pi_u : W \to \mathbb{R}$ and $\pi_l : W \to \mathbb{R}$. Moreover, if $w_L \equiv \min W$ exists, condition (A15) holds and $\bar{w} > w_L$.

We assume hereafter that $\eta \in (0, \bar{\eta})$, $\kappa \in (0, \bar{\kappa})$, and $F$ satisfies Assumption A.1. Thus, we do not state these assumptions in each result for the sake of brevity. Assumption A.1 holds for the set of feasible payoffs $F_B$ of the baseline model and for the set of feasible payoffs $F_{MH}$ of the model in Section III under the assumption that (12) holds. Thus, by proving the results for any $F$ satisfying Assumption A.1, we prove all results for both models simultaneously.

**LEMMA A.8**: Let $W$ be the set of feasible levels of contractual utility. For any $\kappa > 0$, $\bar{w}$ exists and $\bar{w} > w_L = \min W$ if $w_L$ exists. (*The proof is in the Internet Appendix*).

The next lemma characterizes $I$’s equilibrium choice of contractual utility.

**LEMMA A.9**: Suppose that $(\sigma, \mu)$ is an equilibrium and $d_I = (w_I, \pi_I) \in S_I$, where $S_I$ is the support of $\sigma_I$. Then 1) $w_I \leq w^*_I$, 2) if $d_I \neq d_I'$, then $w_I \geq \bar{w}$, and 3) $\bar{w} + y^*(\bar{w}, M) > \bar{w}$, $w_I + y^*(w_I, M) > \bar{w}$, and $w_I > w_L$ if there is a minimum feasible contractual utility $w_L$.

**Proof**: Let $d_I \in S_I$, $\mu_I \equiv \mu(d_I)$, and $\bar{d}_I \equiv \max\{w_d : (w_d, \pi_d) \in S_I\}$. Let (A) to (E) refer to the conditions in Lemma A.7. We note that in the proof of Lemma A.7 we show that (A) to (D) are necessary even if $\bar{w}_I + y^*(\bar{w}_I, M) = \bar{w}$. Since $(\sigma, \mu)$ is an equilibrium, then (A) to (D) must hold, and (E) must hold as well if $\bar{w}_I + y^*(\bar{w}_I, M) > \bar{w}$. Lemma A.8 implies that
and \( d \) do not hold for \( I \). Hence if

Proof of Lemma 1

then by part 3 of Lemma A.9, \( d_1 \neq d^*_1 \) and \( \bar{w}_I + y^*(\bar{w}_I, M) > w \). If \( d^*_I \in S_M \), then (A) and (B) imply that \( V^e_M = \bar{V}(d^*_I, \mu^*(d^*_I), M) \geq V(d_1, \mu_1, M) \), so that \( w^*_I \geq w > w_M \), the single-crossing property, and (A) imply that \( V(d^*_I, \mu^*(d^*_I), I) > V(d_1, \mu_1, I) = V^e_I \), so (B) would not hold for \( I \). Hence if \( w_I > w^*_I \), then \( d^*_I \notin S_M \). Thus, if \( d^*_I \in S_I \), then \( \bar{V}(d^*_I, \mu^*(d^*_I), I) = V(d^*_I, 1, I) > V(d_1, \mu_1, I) = V^e_I \), violating (A). If \( d^*_I \notin S_I \), so \( d^*_I \notin S \), then \( w^*_I < w_I \leq \bar{w}_I \) and \( \bar{V}(d^*_I, 1, I) > V^e_I \) imply that (E) does not hold. Thus, if \( d_I \in S_I \), then \( w_I \leq w^*_I \), proving part 1 of the lemma.

If \( d_I \neq d^*_I \), (D) implies that \( \bar{V}^e_M = \bar{V}(d_I, \mu_I, M) \). Lemma A.6 and \( \bar{w} < w_M^* \) imply that if \( w_I < \bar{w} \), then \( \bar{V}^e_M = \bar{V}(d_I, \mu_I, M) < \bar{V}(\bar{d}, 1, M) = \bar{V}(d_M^*, 0, M) \), which violates (C). Thus, if \( d_I \neq d^*_I \), then \( w_I \geq \bar{w} \), which proves part 2 of the lemma.

If \( w_d + y^*(w_d, M) = w \), then \( \eta < \bar{\eta} \), \( \pi_u' \geq -1 \), and \( z(y) > y \) imply that \( U^*_M > U(w, \pi_u(w), 1, M) > U(w, \pi_u(w_d) - z(w - w_d), 1, M) = \bar{V}(w_d, \pi_u(w_d), 1, M) \). Hence, \( \bar{w} + y^*(\bar{w}, M) > w \). If \( w_I = w^*_I \), then \( w^*_I \geq w > w_L \) implies that \( w_I + y^*(w_I, M) > w \) and \( w_I > w_L \). If \( w_I \neq w^*_I \), then part 2 of the lemma implies that \( w_I \geq \bar{w} > w_L \), so that \( w_I + y^*(w_I, M) \geq \bar{w} + y^*(\bar{w}, M) > w \), which proves part 3.

Lemma A.10: Let \( (\sigma, \mu) \) be an equilibrium and \( S_I \) be the support of \( \sigma_I \). Assume that \( d_p = (w_p, \pi_p) \in S_I \cap S_M \) and that \( w_p > w_L \) if \( w_L = \min W \) exists. Then \( w_p + y^*(w_p, I) = w_p + y^*(w_p, M) = w \) (so that \( w_p \leq w_M \)).

Proof: The fact that \( d_p \in S_M \) implies that \( \mu_p \equiv d_p < 1 \), so \( \bar{V}(d_p, 1, I) > \bar{V}(d_p, \mu_p, I) = \bar{V}^e_I \). Since \( w_p > w_L \), there is a \( d' = (w_d', \pi_d') \in F \) close to \( d_p \) such that \( d' \neq d^*_I \), \( w_d' < w_p \), and \( \bar{V}(d', 1, I) > \bar{V}(d_p, \mu_p, I) = \bar{V}^e_I \). Thus, if \( d' \in S_I \), then \( \mu(d') = 1 \), and \( \bar{V}(d', 1, I) > \bar{V}(d_p, \mu_p, I) = \bar{V}^e_I \), which is not possible in equilibrium. Hence, \( d' \notin S \), but then \( w_p + y^*(w_p, M) > w \), \( \bar{V}(d', 1, I) > \bar{V}(d_p, \mu_p, I) = \bar{V}^e_I \), and \( w_d' < w_p \) imply that necessary condition (E) in Lemma A.7 does not hold. Thus, if \( d_p \in S_I \cap S_M \) and \( w_p > w_L \), then \( w_p + y^*(w_p, M) = w \).
\( w_d > w_L, \ d \in S_I, \) and Lemma A.10 imply that if \( d \in S_M, \) then \( w_d + y^*(w_d, M) = w. \) Thus, there is no equilibrium in which both types set the same payoff pair with positive probability. Correspondingly, there is no equilibrium in which both types set the same contract.  

**Proof of Proposition 2:** Suppose that \( d \neq d_M^* \) is played by M but not by I. Then equilibrium beliefs would be \( \mu(d) = 0. \) Thus, deviating to \( d_M^* \) would be profitable for M. Hence, if \( d \) is played by M but not by I, then \( d = d_M^* \). Recalling that \( c_M^* \) is the contract that implements \( d_M^* = (w_M^*, \pi_M^*) \) (with \( c_M^* = w_M^* \) in the baseline model), Proposition 2 follows. 

**Lemma A.11:** If \((w_d, \pi_d)\) is played with positive probability in equilibrium, then \( \pi_d = \pi_u(w_d). \) That is, the contract that implements \((w_d, \pi_d)\) is conditionally optimal. 

**Proof:** Let \( S_t \) denote the support of \( t \)'s equilibrium strategy and \( S = S_I \cup S_M. \) Lemma 1 and Proposition 2 imply that \( S_M \cap S_I = \emptyset \) and \( S_M = \{(w_M^*, \pi_u(w_M^*))\}. \) 

Assume that \( d_I = (w_I, \pi_I) \in S_I \) and \( \pi_I < \pi_u(w_I), \) and pick a \( d' = (w'_d, \pi'_d) \neq d_M^* \) (so \( d' \not\in S_M \)) with \( w'_d = w_I - \varepsilon, \ \varepsilon > 0, \) and \( \pi'_d > \pi_I. \) Since \( w_I > \max\{w_L, w_M^*\} \) (part 3 of Lemma A.9), for \( \varepsilon \) sufficiently small, \( w'_I > \max\{w_L, w_M^*\} \) and \( \pi_u(w'_d) > \pi_I \) (so \( d' \not\in F \) if \( \pi'_d \in (\pi_I, \pi_u(w'_d))), \) and \( \nabla(d', 1, I) > \nabla(d_I, 1, I) = \nabla_I. \) Now \( \nabla(d', 1, I) > \nabla_I \) implies that if \( d' \in S_I, \) so that \( \mu(d') = 1, \) then \( d_I \) cannot be played in equilibrium, and if \( d' \not\in S_I, \) then \( w'_d < w_I \) implies that condition (E) in Lemma A.7 does not hold and thus, since \( w_I > w_M^* \), \( d_I \) cannot be played in equilibrium either. As a result if \( d_I = (w_I, \pi_I) \in S_I, \) then \( \pi_I = \pi_u(w_I). \) 

The following lemma (whose proof is in the Internet Appendix) characterizes the threshold values of \( \eta \) that determine the location of the separating level of utility \( \tilde{w} \) relative to different threshold levels of the manager’s utility. 

**Lemma A.12:** Let \( W \in \{\mathbb{R}, [w_L, \infty)\} \) be the set of feasible levels of \( w_d. \) Define \( TS^* = \max\{w_d + \pi_u(w_d) : w_d \in W\} \) and \( w_d^* = \min\{w_d \in W : w_d + \pi_u(w_d) = TS^*\}. \) Let \( w_I^\eta(\kappa) \) be as defined in Lemma A.1, and \( w_I^* \) and \( w_M^* \) as defined in Proposition 1. Let \( \tilde{w}(\kappa, \eta) \) be the separating contractual utility defined in (A13), and define \( \eta(w_d, \kappa) \) as the level of \( \eta \) such that \( \tilde{w} = w_d, \) that is, \( \tilde{w}(\kappa, \eta(w_d, \kappa)) = w_d. \) 

1. If \( \kappa \in (0, \kappa), \) then \( 0 < \tilde{\eta}(w_I^*, \kappa) \leq \tilde{\eta}(w_I^\eta(\kappa), \kappa) < \tilde{\eta} \) and \( \tilde{w}(\kappa, \eta) \geq w_I^* \) for \( \eta \leq \tilde{\eta}(w_I^*, \kappa), \) 
\( \tilde{w}(\kappa, \eta) \in [w_I^\eta(\kappa), w_I^*] \) for \( \eta \in (\tilde{\eta}(w_I^*, \kappa), \tilde{\eta}(w_I^\eta(\kappa), \kappa)] \), and \( \tilde{w}(\kappa, \eta) < w_I^\eta(\kappa) \) for \( \eta \in (\tilde{\eta}(w_I^\eta(\kappa), \kappa), \tilde{\eta}). \) 

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2. $\tilde{w}$ is decreasing in $\eta$, nondecreasing in $\kappa$, and increasing in $\kappa$ if $\eta > \tilde{\eta}(w_1^0(\kappa), \kappa)$.

3. $\tilde{\eta}(w_1^*, \kappa)$ is nondecreasing in $\kappa$, $\tilde{\eta}(w_1^0(\kappa), \kappa)$ is increasing in $\kappa$, $\lim_{\kappa \to \kappa_0} \tilde{\eta}(w_1^0(\kappa), \kappa) = \tilde{\eta}$, $\lim_{\kappa \to 0} \tilde{\eta}(w_1^0(\kappa), \kappa) = 0$ if and only if $w_1^* \geq w_1^1$ or $w_d + \pi_u(w_d) = TS^*$ for all $w_d \in W$, and $\tilde{\eta}(w_1^*, \kappa) < \tilde{\eta}(w_1^0(\kappa), \kappa)$ if and only if $w_1^* > w$.

4. If $w_1^d$ exists and $w_1^d \geq w_1^*$, then $\tilde{w}(\kappa, \eta) < w_1^d$ for any $\eta, \kappa > 0$. If $w_1^d < w_1^*$, then there is a $\tilde{k}(w_1^d) \in (0, \tilde{k}]$, with $\tilde{k}(w_1^d) = \kappa$ if $w_1^d \geq w$, such that (a) if $\kappa \in (0, \tilde{k}(w_1^d))$, then there is a $\tilde{\eta}(w_1^d, \kappa) \in (0, \tilde{\eta})$ such that $\tilde{w}(\kappa, \eta) < w_1^d$ if and only if $\eta \in (\tilde{\eta}(w_1^d, \kappa), \tilde{\eta})$, (b) if $\kappa \in (\tilde{k}(w_1^d), \tilde{k})$, then $\tilde{w}(\kappa, \eta) = w_1^d$ for all $\eta \in (0, \tilde{\eta})$, and (c) $\tilde{\eta}(w_1^d, \kappa)$ is nondecreasing in $\kappa$ and $\lim_{\kappa \to 0} \tilde{\eta}(w_1^d, \kappa) = 0$, so that $\lim_{\kappa \to 0} \tilde{w}(\kappa, \eta) < w_1^d$ for any $\eta \in (0, \tilde{\eta})$.

5. Assume that there is a $w_1^0 > w_L$ such that $\pi_u^*(w_d) \geq 0$ if and only if $w_d \leq w_1^0$. Then:

(a) If

$$\nabla (w_1^0, \pi_u(w_1^0), 1, M; 0, \tilde{\eta}) > U_M^*,$$ (A16)

there is a $\tilde{k}(w_1^0) \in (0, \tilde{k}(w_1^d)]$ such that if $\kappa \in (0, \tilde{k}(w_1^0))$, then (i) $\tilde{\eta}(w_1^0, \kappa) \in (\tilde{\eta}(w_1^0, \kappa), \tilde{\eta})$, (ii) $\tilde{w}(\kappa, \eta) < w_1^0$ if and only if $\eta \in (\tilde{\eta}(w_1^0, \kappa), \tilde{\eta})$, and (iii) $\tilde{\eta}(w_1^0, \kappa)$ is nondecreasing in $\kappa$.

(b) If (A16) does not hold or $\kappa \in (\tilde{k}(w_1^0), \tilde{k})$, then $\tilde{w}(\kappa, \eta) \geq w_1^d$ for all $\eta \in (0, \tilde{\eta})$.

(c) If $w_1^0 \geq w$, then (A16) holds and $\tilde{k}(w_1^0) = \tilde{k}$.

(d) If $\tilde{k}(w_1^0) < \tilde{k}$, then $\tilde{k}(w_1^0) < \tilde{k}(w_1^d)$.

Proof of Proposition 3: We derive the equilibrium payoff pairs and then retrieve the corresponding equilibrium contracts. We prove the proposition for any set of feasible payoffs $F$ satisfying Assumption A.1.

Let $\sigma = (\sigma_I, \sigma_M)$ be the equilibrium strategy profile, $S_I$ the support of $\sigma_I$, and $S = S_I \cup S_M$. For any $d \in S$, let $\mu^*(d)$ be derived by Bayes’ rule from $\sigma$.

Let $d_I = (w_I, \pi_I)$ denote an element of $S_I$ and recall that $\tilde{d} = (\tilde{w}, \pi_u(\tilde{w}))$. Lemma A.9 implies that $w_I > w_M$, so conditions (A) to (E) in Lemma A.7 are necessary and sufficient for $\sigma$ to be an equilibrium strategy profile. Lemma 1 (which we prove for any $F$ satisfying Assumption A.1) implies that the equilibrium is separating. Thus, $\mu^*(d_I) = 1$ and, by
Proposition 2, $S_M = \{d^*_M\}$, so that $\mu^*(d^*_M) = 0$ and $\nabla^e_M = \nabla(d^*_M, 0, M) = \nabla(\tilde{d}, 1, M)$. Lemma A.11 implies that $\pi_I = \pi_u(w_I)$.

Let $\tilde{\eta}(w_d, \kappa)$ be defined by $\tilde{\omega}(\kappa, \tilde{\eta}(w_d, \kappa)) = w_d$, and suppose first that $\eta \leq \tilde{\eta}(w^*_I, \kappa)$, so that, by Lemma A.12, $w^*_I \leq \tilde{\omega}$. If $w_I < w^*_I$, part 2 of Lemma A.9 implies that $w_I \geq \tilde{\omega}$, which is not possible if $w_I < w^*_I$ and $w^*_I \leq \tilde{\omega}$. Hence, $w_I = w^*_I$, since, by part 1 of Lemma A.9, $w_I \leq w^*_I$. Thus, $d_I = (w^*_I, \pi_u(w^*_I)) = d^*_I$, $y_I = 0$, and $S_I = \{d^*_I\}$. By definition of $d^*_I$, $\nabla^e_I = \nabla(d^*_I, 1, I) > \nabla(d, 1, I)$ for any $d \notin S_I$. The inequalities $w^*_I \leq \tilde{\omega} < w^*_M$ and Lemma A.6 imply that $\nabla(d^*_I, 1, M) \leq \nabla(\tilde{d}, 1, M) = \nabla^e_M$. Thus, conditions (A) to (E) in Lemma A.7 hold, so there exist beliefs $\mu$ such that $(d^*_I, d^*_M, \mu)$ is an equilibrium, which proves part 1 of the proposition.

Suppose now that $\eta > \tilde{\eta}(w^*_I, \kappa)$, so by Lemma A.12, $\tilde{\omega} < w^*_I$. Lemma A.6 and $\tilde{\omega} < w^*_I < w^*_M$ imply that $\nabla(d^*_I, 1, M) > \nabla(\tilde{d}, 1, M) = \nabla^e_M$, so that if $d_I = d^*_I$, M would deviate to $d_I$. Thus, $d_I \neq d^*_I$, so part 2 of Lemma A.9 implies that $w_I \geq \tilde{\omega}$. Since $w_I \leq w^*_I < w^*_M$ (by part 1 of Lemma A.9) and $\pi_I = \pi_u(w_I)$, Lemma A.6 implies that if $w_I > \tilde{\omega}$, then M would deviate to $d_I$. Hence, if there is a separating equilibrium, $S_I = \{\tilde{d}\}$. We show next that such a separating equilibrium exists by checking that conditions (A) to (E) in Lemma A.7 hold.

Lemma A.6 and $\tilde{\omega} < w^*_I$ imply that $\nabla(d, 1, I) < \nabla(\tilde{d}, 1, I)$ for any $d$ with $w_d < \tilde{\omega}$, so (E) holds. Since $\nabla^e_M = \nabla(d^*_M, 0, M) = \nabla(\tilde{d}, 1, M)$, (A) to (C) hold for M and (D) holds. Finally, $\nabla(d^*_M, 0, M) = \nabla(\tilde{d}, 1, M) \geq \nabla(d^*_I, 0, M)$, the single-crossing condition (SC), $\tilde{\omega} < w^*_I$, and $w^*_I + y(w^*_I, M) > \omega$ (since $w^*_I \geq \omega$) imply that $\nabla^e_I = \nabla(\tilde{d}, 1, I) > \nabla(d^*_I, 0, I) > \nabla(d^*_M, 0, I)$, so conditions (A) to (C) hold for I as well. Therefore, conditions (A) to (E) in Lemma A.7 hold, so there exist beliefs $\mu$ such that $(\tilde{d}, d^*_M, \mu)$ is an equilibrium.

Since $w_I = \tilde{\omega}$, part 2 of Lemma A.12 implies that $\frac{\partial w_I}{\partial \eta} = \frac{\partial \tilde{\omega}}{\partial \eta} \geq 0$ (with strict inequality if $\tilde{\omega} < w^*_I$ and $\frac{\partial w_I}{\partial \eta} = \frac{\partial \tilde{\omega}}{\partial \eta} < 0$. If $\eta \in (\tilde{\eta}(w^*_I, \kappa), \tilde{\eta}(w^*_I(\kappa), \kappa)]$, then $w^*_I \leq \tilde{\omega} < w^*_I$ and $y_I = y^*(w_I, \kappa) = 0$. If $\eta > \tilde{\eta}(w^*_I(\kappa), \kappa)$, so that $\tilde{\omega} < w^*_I < w^*_M$, then $\frac{\partial w_I}{\partial \kappa} > 0$ and $y_I = y^*(w_I, \kappa) > 0$. If $y^*$ is nonincreasing in $\kappa$ and decreasing in $w_d$ if $y^* > 0$, it follows from $\frac{\partial w_I}{\partial \kappa} > 0$ that $y_I$ is decreasing in $\kappa$, and it follows from $\frac{\partial w_I}{\partial \eta} < 0$ that $y_I$ is increasing in $\eta$, which completes the proof of parts 2 and 3.

Part 4 follows directly from part 3 of Lemma A.12. In the baseline model, $w_d + \pi_u(w_d) = \tilde{R}$ for every $w_d$, so by part 3 of Lemma A.12, $\lim_{\kappa \downarrow 0} \tilde{\eta}(w^*_I(\kappa), \kappa) = 0$. In the model in Section III, $w^I = w_{FB}$ (for $w^I$ defined in Lemma A.12 and $w_{FB}$ defined in Lemma A.5), so, by part 3 of Lemma A.12, $\lim_{\kappa \downarrow 0} \tilde{\eta}(w^*_I(\kappa), \kappa) = 0$ if and only if $w^*_I \geq w_{FB}$. 

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The following off-equilibrium beliefs satisfy the equilibrium definition and support each of the three kinds of equilibrium described above: \( \mu(d) = 1 \) for \( d \notin S \) such that \( w_d \leq \tilde{w} \), and \( \mu(d) = 0 \) for \( d \notin S \) such that \( w_d > \tilde{w} \).\(^{27}\) To show that these beliefs satisfy the equilibrium definition, it is enough to show that there is no \( d \notin S \) with \( w_d \leq \tilde{w} \) such that conditions 3(a) to 3(c) of the equilibrium definition hold for \( t' = M \), and there is no \( d \notin S \) with \( w_d > \tilde{w} \) such that these conditions hold for \( t' = I \). In any equilibrium, \( \bar{V}_M^e = U_M^e = \bar{V}(\tilde{d}, 1, M) \). Hence, if \( d \notin S \) is such that \( w_d \leq \tilde{w} \leq w_M^* \), then \( \bar{V}(d, 1, M) \leq \bar{V}(\tilde{d}, 1, M) = \bar{V}_M^e \), so condition 3(a) does not hold for \( t' = M \). In any equilibrium, \( \bar{V}_I^e = \bar{V}(d_I, 1, I) \geq \bar{V}(\tilde{d}, 1, I) \), since either \( d_I = \tilde{d} \) or \( d_I = d_I^* \). Thus, if \( d \notin S \) is such that \( w_d > \tilde{w} \) and \( \bar{V}(d, \mu, I) \geq \bar{V}_I^e \) for some \( \mu \), then \( \bar{V}(d, \mu, I) \geq \bar{V}(\tilde{d}, 1, I) \), so that the single-crossing condition \( w_d > \tilde{w} \geq w_M \) imply that \( \bar{V}(d, \mu, M) - \bar{V}(\tilde{d}, 1, M) = \bar{V}(d, \mu, M) - \bar{V}_M^e > 0 \). Hence, if \( \bar{V}(d, 1, I) > \bar{V}_I^e \) (so 3(a) holds for \( t' = I \)), then \( \bar{V}(d, 1, M) \geq \bar{V}_M^e \). Thus, if \( \bar{V}(d, 0, M) > \bar{V}_M^e \) (so 3(b) holds for \( t = M \), then \( \bar{V}(d, \mu', M) = \bar{V}_M^e \) for some \( \mu' \in (0, 1) \). But then \( \bar{V}(d, \mu', I) < \bar{V}_I^e \), since \( \bar{V}(d, \mu', I) \geq \bar{V}_I^e \) implies \( \bar{V}(d, \mu', M) > \bar{V}_M^e \). Thus, 3(c) does not hold for \( t' = I \).

It follows from the equilibrium strategy profile derived above that I’s equilibrium contract \( c_t \) is equal to \( w_I \) in the baseline model and to \( c(w_I) \) in the moral hazard model.

**Proof of Proposition 4:** The proposition follows directly from Propositions 1 to 3 and Lemmas A.5 and A.12, which we prove for any feasible set satisfying Assumption A.1.

Letting \( w_d^0 \) and \( w_d^1 \) be as defined in Lemma A.12, Lemma A.5 implies that for the set of feasible payoffs \( F_{MH} \), \( w_d^0 = w_{SB} \) and \( w_d^1 = w_{FB} \), for \( w_{SB} \) and \( w_{FB} \) defined in Lemma A.5.

Part 1 of the proposition follows directly from \( d_M = d_M^* \) (by Proposition 2), \( w_i^* > w_{SB} \) (by Proposition 1), and part 3 of Lemma A.5 (which describes the conditionally optimal contracts). Part 2 follows directly from parts 1 to 3 of Proposition 3, \( w_i^* > w_{SB} \), part 3 of Lemma A.5, part 3 of Lemma A.12 (which shows that \( \tilde{w} < w_{FB} \) for sufficiently low \( \kappa \)), and the proof of Lemma A.12, where we show that \( \tilde{\eta} \) is nondecreasing in \( \kappa \). Finally, part 3 follows directly from Proposition 3, part 5 of Lemma A.12 (since condition (13) is equivalent to condition (A16) in Lemma A.12 if \( F = F_{MH} \)), and parts 2 (which shows that any contract with \( w_d < w_{SB} \) is inefficient) and 3 of Lemma A.5.

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\(^{27}\)The beliefs \( \mu(d) = 0 \) for any \( d \notin S \) also satisfy the equilibrium definition and support all these equilibria.
Table I
Summary of Notation

<table>
<thead>
<tr>
<th>Notation</th>
<th>Definition</th>
</tr>
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<tbody>
<tr>
<td>$U(w, \pi, \mu, t; \eta)$</td>
<td>The board’s utility function.</td>
</tr>
<tr>
<td>$t \in {I, M}$</td>
<td>The board’s type.</td>
</tr>
<tr>
<td>$\mu$</td>
<td>The labor market’s belief that the board is of type I.</td>
</tr>
<tr>
<td>$\eta$</td>
<td>The parameter that captures the strength of reputational concerns.</td>
</tr>
<tr>
<td>$c$</td>
<td>The disclosed compensation contract. In Section II, $c$ consists solely of fixed pay $w_d$. In Section III, $c = (s, b)$, where $s$ is the fixed salary and $b$ the bonus if revenues are high.</td>
</tr>
<tr>
<td>$y$</td>
<td>Hidden pay.</td>
</tr>
<tr>
<td>$z(y; \kappa)$</td>
<td>The cost of hiding pay.</td>
</tr>
<tr>
<td>$\kappa$</td>
<td>The parameter that captures the cost of hiding pay.</td>
</tr>
<tr>
<td>$\eta, \bar{\eta}$</td>
<td>The upper bounds of $\eta$ and $\kappa$, respectively.</td>
</tr>
<tr>
<td>$w_d(c)$ or $w_d$</td>
<td>The expected utility for the manager generated by a compensation contract. In Section II, $w_d$ also denotes the manager’s disclosed pay.</td>
</tr>
<tr>
<td>$\pi_d(c)$ or $\pi_d$</td>
<td>The expected profits generated by the disclosed contract.</td>
</tr>
<tr>
<td>$y(c, t; \kappa), y^*(w_d, t; \kappa)$</td>
<td>The $t$ board’s optimal hidden pay given $c$ and $w_d$, respectively.</td>
</tr>
<tr>
<td>$V^*(c, \mu, t; \kappa, \eta)$</td>
<td>The board’s indirect utility function defined over disclosed contracts.</td>
</tr>
<tr>
<td>$c^<em>_t, w^</em>_t$</td>
<td>$c^<em>_t$ is the contract preferred by a $t$ board in the absence of reputational concerns, and $w^</em>_t$ the manager’s utility generated by $c^<em>_t$. In Section II, $c^</em>_t = w^*_t$.</td>
</tr>
<tr>
<td>$\bar{w}(\kappa, \eta)$</td>
<td>The separating level of utility: the manager’s utility such that the M board is indifferent between setting a (conditionally optimal) contract $\bar{c}$ that gives utility $\bar{w}$ to the manager and being perceived as I and setting its preferred contract and being perceived as M. In Section II, $\bar{w}$ is also referred to as the separating level of pay.</td>
</tr>
<tr>
<td>$c(w_d)$</td>
<td>The conditionally optimal contract among those that generate utility $w_d$ for the manager.</td>
</tr>
<tr>
<td>$b_{FB}, w_{FB} \equiv w_d(0, b_{FB})$</td>
<td>The bonus that implements the first-best level of effort, and the minimum utility for the manager that can be achieved with the first-best bonus.</td>
</tr>
<tr>
<td>$b_{SB}, w_{SB} \equiv w_d(0, b_{SB})$</td>
<td>The minimum second-best bonus and the minimum utility for the manager that can be achieved with a second-best bonus.</td>
</tr>
<tr>
<td>$\nabla (w_d, \pi_d, \mu, t; \kappa, \eta)$</td>
<td>(Only used in the Appendix) The board’s indirect utility function defined over payoff pairs $(w_d, \pi_d)$.</td>
</tr>
<tr>
<td>$\pi_u(w_d)$</td>
<td>(Only used in the Appendix) The maximum expected profit consistent with giving utility $w_d$ to the manager.</td>
</tr>
</tbody>
</table>
Figure 1. **Disclosed, hidden, and total pay.** The figure displays the optimal hidden (solid line) and total (dashed line) pay for the I (black) and M (gray) boards for a specification of the model with the utility of a $t$ board given by $U(w, \pi, \mu, t; \eta) = \pi - \frac{t}{2}(\bar{v} - w)^2 + \eta \mu$, the cost of hidden pay given by $z(y; \kappa) = (1 + \kappa)(y + \kappa y^2)$, and parameter values $M = 1.5$, $I = 1$, $\kappa = 0.3$, $\bar{v} = 2$, and $w = 0.5$. The threshold $w^y_t$ for $t \in \{I, M\}$, is the value of disclosed pay below which the $t$ board pays hidden compensation. The threshold $w^y$ for $t \in \{I, M\}$, is the value of disclosed pay below which the $t$ board’s hidden pay is such that $w_d + y^*(w_d, t) = w$. The threshold $w_M$ is negative and is not displayed in the graph.
Figure 2. Equilibrium regimes – baseline model. The figure displays the equilibria for different values of the parameters $\kappa$ and $\eta$. In the graph, $\tilde{w}$ is the separating level of pay, $w^*_I$ the disclosed pay preferred by the I board, $w^y_I$ the disclosed pay below which the I board pays hidden compensation, and $w_I$ and $y_I$ the levels of disclosed and hidden pay, respectively, chosen by the I board in equilibrium. $\tilde{\eta}(w^*_I, \kappa)$ is the level of $\eta$ such that $\tilde{w}(\kappa, \eta) < w^*_I$ if and only if $\eta > \tilde{\eta}(w^*_I, \kappa)$. $\tilde{\eta}(w^y_I, \kappa)$ is such that $\tilde{w}(\kappa, \eta) < w^y_I$ if and only if $\eta > \tilde{\eta}(w^y_I, \kappa)$. As in Figure 1, $z(y; \kappa) = (1 + \kappa)(y + \kappa y^2)$ and $U(w, \pi, \mu, t; \eta) = \pi - \frac{t}{2}(\bar{v} - w)^2 + \eta \mu$. The parameter values ($I = 2.5$, $M = 4$, $\bar{v} = 0.7$, $R = 0.7$, and $w = 0.01$) are such that $w^*_I > \bar{w}$. 