Accounting Standards, Regulatory Enforcement, and Investment Decisions*

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Abstract

We examine the influence of accounting standards and regulatory enforcement on reporting quality and investment efficiency. First, we find isolated changes to standards can have unintended consequences on reporting quality if their enforcement remains unchanged. In particular, raising accounting standards without improving enforcement can backfire and reduce reporting quality, which negatively impacts resource allocation decisions. Second, we find an increase in enforcement should be combined either with tougher or weaker standards depending on the structure of the regulatory penalties. Thus, standards and enforcement are either substitutes or complements. In this light, we advocate the careful coordination of standard-setting and regulatory enforcement to enhance investment efficiency.

Keywords: Accounting Standards, Regulatory Enforcement, Investment Decisions.

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1 Introduction

It is often argued that more stringent accounting standards and heightened regulatory enforcement are key ingredients for information to facilitate the allocation of resources within an economy. In contrast, venture capitalists often claim that stricter reporting standards and regulation discourage entrepreneurial activity as it makes it more costly to fund innovative projects and exit from these investments through a public offering of shares. Indeed, in 2012, the US Congress enacted the Jumpstart Our Business Startups (“JOBS”) Act that relaxed mandated disclosure and compliance obligations for “emerging growth companies” seeking public financing (see Dharmapala and Khanna, 2014). As technological innovation is vital for the continued growth of the economy, understanding the influence of accounting standards and regulatory enforcement on investment decisions is imperative.\footnote{On this matter, when interviewed about winning the 2014 Nobel Prize in Economic Science, Jean Tirole remarked that “regulation is a complex subject because it must be light enough to prevent entrepreneurship from being squelched, while ‘at the same time you need to have a state which is going to enforce those regulations’.” (Forelle and Horobin, 2014).}

Much attention has focused on the capital market effects of the recent adoption of International Financial Reporting Standards (IFRS) in a number of countries. The consequence of adopting IFRS on earnings is unclear. Some studies document an improvement in earnings quality (e.g., Landsman, et al. 2012), whereas other studies find an adverse effect or fail to find an effect (e.g., Ahmed, et al. 2013; Liu and Sun 2013). Importantly, however, Christensen, et al. (2012) argue that identifying the effect of changing accounting standards is confounded by changes to the regulatory environment.

This paper examines the impact of accounting standards and regulatory enforce-
ment on investment decisions. We model an agency setting in which a manager expends effort searching for an innovative technology and then issues an accounting report to solicit capital to finance the project from investors. The game has four dates: At date one, the board of directors hires a manager to discover and develop a new project and offers him an incentive contract. At date two, the manager privately observes the project’s quality—or probability of success—and issues a potentially misleading accounting report about the project. At date three, investors decide whether to fund the continuation of the project in light of the manager’s report. If the project is not funded, the firm is terminated. At date four, the outcome of the project, if funded, is realized, and the payoffs are made.

A key ingredient in our model is that the manager must expend effort to discover viable projects. To induce effort, the board of directors rewards the manager for firm continuation. This can be done either through a base payment or through a performance payment linked to the project’s success. Although both the base and performance payments are equally effective at inducing effort, directors prefer to use performance pay rather than base pay as it creates less incentive for manipulation.

The firm has a reporting system that classifies information about the project’s quality as being either favorable or unfavorable. To warrant a favorable classification, the project quality must exceed an official threshold in an accounting standard. Before the report is issued, the manager privately observes the quality of the project and decides whether to engage in costly misreporting. The manager misrepresents information and issues a favorable report when the quality of the project lies above a de facto or shadow threshold but below the de jure or official GAAP standard.²

A regulatory body investigates and imposes penalties on the manager if it can

²The term shadow threshold is introduced in Dye (2002).
prove the report violated the official GAAP standard. Penalties and litigation related costs for non-compliance are often large (e.g., Lowry and Shu 2002; Hersch and Viscusi 2007). We model these costs as having a fixed component and a variable component to explore how the structure of these costs affects manager behavior. A key distinction between the components is that while the fixed component does not vary with the GAAP standard, the variable component is affected by the extent of the project misclassification. Accordingly, a standard-setter influences the penalties that the regulator might impose. As an example, under SAB 104, a firm recognizes revenue when it is realizable, that is, readily convertible to known amounts of cash. Raising the evidentiary threshold for information about the realizability of cash that the firm is required to have to recognize revenue, while holding the economic circumstances fixed, increases the severity of misreporting and hence the variable penalties imposed on the nefarious manager.

Turning to the primary results, we establish that the link between the GAAP standard and the reporting outcome is subtle. For instance, changes to standards without carefully coordinated changes to their enforcement can reduce reporting quality and impair the efficient allocation of capital. We find that implementing stricter GAAP standards has two opposing effects on the shadow threshold: First, when the GAAP standard increases, the gap between the GAAP standard and any project quality realization below this standard widens, which raises the variable penalties. These penalties reduce the manager’s incentive to misreport. Hence, the manager responds to an increase in the GAAP standard by choosing a higher shadow threshold. We refer to this direct effect as the *deterrence effect*.

There is a second effect that counters the deterrence effect. We find that raising the GAAP standard increases the range of project quality realizations for which the
manager manipulates the report. The anticipation of a larger manipulation range increases the manager’s expected *ex ante* penalties, which makes it less attractive for the manager to search for new investment opportunities in the first place. To maintain effort incentives, therefore, the board of directors needs to offer the manager a higher bonus payment. The larger bonus, in turn, further tilts the manager’s preferences in favor of project continuation, and thereby strengthens the manager’s incentives to misreport. This response lowers the manager’s shadow threshold. We refer to this indirect consequence of strengthening the official GAAP standard as the *compensation* effect.

The dominant effect depends on the structure of the regulatory penalties. On one hand, when penalties are predominantly *variable* and thus vary with the extent of the manager’s misreporting, the deterrence effect dominates the compensation effect. Accordingly, an increase in the official GAAP standard increases the shadow threshold and, in turn, reduces overinvestment, consistent with the conventional view.

When regulatory enforcement strengthens or the probability the regulator detects misreporting increases, the manager will choose to manipulate less. If the first-best level of investment prevailed before the change in regulation, the increase in regulation raises the manager’s shadow threshold and thereby leads to underinvestment. In response, it is optimal for the standard-setter to lower the GAAP standard and induce a lower shadow threshold. This reaction restores the first-best level of investment. Thus, when penalties are predominantly variable, accounting standards and regulatory enforcement are substitutes for inducing efficient investment.

Moreover, when penalties vary with the extent of misreporting, optimal accounting standards induce manipulation. Despite the anticipate manipulation, these standards lead to improved reporting quality—a higher shadow threshold—and better invest-
ment decisions than alternative standards that do not induce any manipulation. Thus, our analysis highlights that the presence of misreporting can be positively related to reporting quality and investment efficiency, suggesting the level of manipulation is a poor proxy for the usefulness of financial reports.

On the other hand, when regulatory penalties are predominantly fixed, the compensation effect dominates the deterrence effect. In this case, the optimal compensation plan has the consequence that an increase in the official GAAP standard motivates the manager to reduce the shadow threshold. This decline makes the manager more likely to issue a favorable report, which increases overinvestment. Here we find the standard-setter’s ability to improve financial reporting is more limited: the best the standard-setter can do is to set GAAP standards that are so low that they quell a manager’s incentives to manipulate. In this environment, GAAP standards and regulatory enforcement are complements. As regulatory enforcement is strengthened, it is optimal to set stricter standards. In fact, enhancing enforcement without changing standards has no effect on reporting quality. Alternatively, raising GAAP standards while keeping the level of enforcement fixed reduces reporting quality. This result suggests standard-setting and compliance enforcement must be coordinated to reduce misreporting and improve investment efficiency.

The primary antecedent of our paper is Dye (2002). He shows that the ability to manipulate an accounting report yields a shadow threshold that the manager uses when deciding how to report the firm’s activities. In Dye’s model, in contrast to our study, an increase in an official GAAP standard yields an unambiguous increase in the shadow threshold. Kaplow (2011) extends the models of law enforcement by treating the proof threshold necessary to impose sanctions as a policy choice along with enforcement effort and level of punishment. Among his findings, he shows that
raising standards can increase the likelihood of inappropriately punishing benign acts. Our work is also related to Gao (2012) who, noting the ubiquity of binary classification in the accounting standards, shows that a binary classification rule can be ex ante optimal. He argues binary classification systems, which have the effect of destroying information, allow shareholders to commit to decision rules that are suboptimal ex post but nonetheless optimal ex ante.

Our work differs from Dye (2002), Kaplow (2011), and Gao (2012) in several ways. Most importantly, we seek to understand how accounting standards and regulatory enforcement influence project discovery and entrepreneurial activity. As a consequence, we focus on the activities of a manager in a moral hazard setting. In this setting, the board of directors offers the manager a pay plan to induce effort to discover innovative projects. We find that changing the official GAAP standard has both a direct effect on manipulation incentives and also an indirect effect through its impact on the manager’s compensation plan. Consequently, the impact of changes in the official GAAP standard on reporting quality and investment efficiency is subtle and depends on the nature of the regulatory environment and the moral hazard problem that firms face. Our model derives conditions under which standards and enforcement should be used as substitutes or complements.

Our study is also reminiscent of Dye and Sridhar (2004). They examine the trade-off between the relevance and reliability of information that investors use to value a firm. They do not consider the effects of changes in accounting standards on reporting behavior and investment efficiency, which is the focus of our study.

Another contribution of this paper is to explore how the structure of legal costs affects manager behavior. Much of the related accounting literature assumes that firms incur litigation costs when misreporting that vary with the extent of their mis-
reporting (e.g., Fischer and Verrecchia 2000; Guttman, Kadan, and Kandel 2006; Beyer 2009; Stocken and Fischer 2010; Einhorn and Ziv 2012). In contrast, in this paper, we model legal costs as having a fixed component and variable component. We find that the structure of litigation costs affects the optimal accounting standard and how standards and regulatory enforcement interact to determine investment efficiency. This observation further highlights the need to carefully coordinate accounting standards and regulatory environment to ensure investment efficiency.

The paper proceeds as follows. Section 2 characterizes the model. Section 3 determines the manager’s optimal behavior when the official GAAP standard is treated as being exogenous. Section 4 provides comparative static exercises examining the relation between the GAAP standard and the manager’s shadow threshold. Section 5 analyses the optimal design of accounting standards assuming the standard-setter wishes to maximize investment efficiency. Section 6 offers implications for policymakers and regulators. Section 7 relates some of the model’s predictions with empirical findings. Section 8 concludes. Proofs are relegated to the Appendix.

2 Model

Consider an environment with a firm and three risk-neutral players: current shareholders (represented by a benevolent board of directors), a manager, and potential investors in a firm. The firm has the opportunity to pursue an innovative technology but it requires funding. If the investors inject capital $I > 0$ into the firm to fund the project, the project either succeeds and generates cash flows of $x = X > 0$, or it fails and generates cash flows of $x = 0$. The probability of success is denoted by $\theta \in [0, 1]$, which we refer to as the project quality. When the project is not funded, the firm is
terminated, and the firm’s cash flows are zero.

The game has four dates:

**Date 1 – Contracting and effort choice:** At date $t = 1$, the board of directors hires a manager to develop the new project and offers him an incentive contract to encourage high effort. The information available for contracting is the outcome of the project if it is funded, $x$, as well the firm’s accounting report and the investor’s funding decision. Without loss of generality, we focus on a simple contract $(w_H, w_L)$, where $w_H$ and $w_L$ are the payments to the manager if investors fund the project and it succeeds ($x = X$) or fails ($x = 0$), respectively. The payment $w_L$ can be interpreted as a base payment when the project is continued and the payment $(w_H - w_L)$ as an additional bonus if the project is ultimately successful. If continuation of the project is not financed, the firm is terminated and, due to the lack of funds, the manager does not receive any compensation.

Payments are not tied to the accounting report because, as we shall show, investors fund the project if and only if the report is favorable. Hence, rewarding a favorable accounting report is equivalent to paying the manager a base pay for project continuation $w_L$. In addition, if the project is successful, the manager receives a bonus. The manager is protected by limited liability in that payments must be nonnegative, that is, $w_L, w_H \geq 0$.

After contracting with the board of directors, the manager makes an unobservable effort choice $a \in \{a_L, a_H\}$, with $a_H > a_L$, that increases the quality of the project $\theta$. Specifically, with probability $a$, the project is viable and with probability $(1 - a)$ it is not viable. If a project is viable, then $\theta$ follows a cumulative distribution function $F(\theta)$ with positive probability density $f(\theta)$ over the unit interval. Conversely, if a project is non-viable, then it always fails, that is, $\theta = 0$. To render effort $a$, the manager
privately incurs a cost $g(a)$, with $g(a_H) = G > 0$ and $g(a_L) = 0$. To avoid trivial solutions, we assume that the board finds it optimal to induce high effort $a = a_H$. The viability and the quality of the project are not observable to anybody other than the manager.

In the absence of additional information and before recognizing the manager’s compensation, a viable project has an expected net present value (NPV) of zero; that is, $E[\theta]X - I = 0$. As will become clear later, this assumption ensures that the accounting report is always useful to investors. Our results generalize to the case in which $E[\theta]X - I$ is mildly positive or negative. If, however, the expected NPV is extremely high, the investors always invest in the project regardless of report and, conversely, if the NPV is extremely low, the investors never invest.

**Date 2 – Manager reporting:** At date $t = 2$, the firm’s accounting system produces a publicly observable accounting report, $R \in \{R_L, R_H\}$, which reflects the results of the firm’s initial activities when exploiting the innovative technology. The report is either favorable, $R = R_H$, or unfavorable, $R = R_L$. The accounting report is prepared under a set of generally accepted accounting principles, which we label as a *GAAP standard*. This standard requires that the probability $\theta$ of successfully generating cash flows of $X$ must be sufficiently high for the firm to release a favorable report $R_H$. Specifically, the GAAP standard is a threshold, denoted $\theta_P$, with $\theta_P > 0$, that bisects the information about the project’s quality so that for all $\theta \in [0, \theta_P)$, the report is low $R = R_L$, and for all $\theta \in [\theta_P, 1]$, the report is high $R = R_H$. We will initially assume the GAAP standard $\theta_P$ is exogenous. Later, in Section 5, we shall determine the value of $\theta_P$ a standard-setter would choose to maximize investment efficiency.\(^3\)

\(^3\)Like Gao (2012b), we view the accounting measurement process as having two components:
The manager, however, need not comply with the GAAP standard. After privately observing the realization of the project’s quality $\theta$, the manager can decide whether to manipulate the classification of the project. Manipulation involves the manager sending a high report $R = R_H$ when in fact $\theta \in [0, \theta_P)$ or sending a low report $R = R_L$ when in fact $\theta \in [\theta_P, 1]$.

Non-compliance imposes a cost on the manager. A regulator agency, such as the SEC’s Division of Corporation Finance, investigates the firm’s report ex post with some probability and penalizes the manager if he failed to comply with the GAAP standard. The manager’s expected cost associated with non-compliance consists of a fixed part and a variable part and is given by

$$k(\theta, \theta_P) = \pi (K_F + |\theta_P - \theta| K_V),$$

(1)

where $\pi$ is the probability of regulatory detection, $K_F$ is a fixed penalty for non-compliance, and $|\theta_P - \theta| K_V$ is a variable penalty for non-compliance that increases in the distance between the GAAP standard and the project’s true quality. The regulatory enforcement penalties capture reputation damage, criminal sanctions, or the cost of being disbarred from holding positions of public office.\(^4\)

When $K_V > 0$, the standard-setter implicitly influences the cost of non-compliance by adjusting the GAAP standard. Specifically, for any given project quality $\theta$, with $\theta < \theta_P$, an increase in the GAAP standard $\theta_P$ increases the variable cost of non-compliance by $dk(\theta, \theta_P)/d\theta_P = \pi K_V$. In contrast, if $K_V = 0$, the standard-setter can first, the identification of transaction characteristics, and secondly, a measurement rule mapping transaction characteristics into an accounting report.

\(^4\)In this model, we do not consider investors’ ability to recover monetary penalties from the manager. If investors could recover damage penalties, the magnitude of these penalties would affect the firm’s cost of capital and, in turn, the equilibrium level of manipulation. For a study that considers these issues, see Laux and Stocken (2012).
influence the range over which the manager is supposed to report bad news but the penalty for non-compliance remains constant at $K_F$.

As we shall establish in Section 3, the manager will never choose to misclassify the project when its quality is high, $\theta \in [\theta_P, 1]$. On the other hand, when the project’s quality is low, $\theta \in [0, \theta_P)$, the manager may choose to misclassify the project to ensure a favorable report. Specifically, there exists a range of project qualities $\theta \in (\theta_T, \theta_P)$, with $0 < \theta_T \leq \theta_P$, for which the manager finds it optimal to misclassify the project. Following Dye (2002), we refer to the threshold $\theta_T$ as the *shadow threshold*. The shadow threshold and not the GAAP standard determines the report: the manager will issue a favorable report for all $\theta \in [\theta_T, 1]$ and an unfavorable report for all $\theta \in [0, \theta_T)$.

**Date 3 – Investment decision:** At date $t = 3$, the firm either continues the project to implement the new technology or the project is terminated. The firm, however, does not have any funds and has to raise the required capital $I > 0$ from investors to continue the project. Specifically, to continue, the firm needs to raise $I + w_L$ so as to finance the technology and to pay the manager’s base salary.\footnote{We assume a successful project yields a cash flow that is sufficient to allow the firm to pay the manager the bonus for success $(w_H - w_L)$.}

After observing the manager’s report $R$, the potential investors decide whether to provide capital $I + w_L$. Let $\theta_A > 0$ denote the manager’s shadow threshold that the investors anticipate. If the report is unfavorable ($R = R_L$), investors believe that $\theta \in [0, \theta_A)$ and, given the assumption $E[\theta] X - I = 0$, they do not find it attractive to provide capital. The project is then terminated. Conversely, if the report is favorable ($R = R_H$), investors believe $\theta \in [\theta_A, 1]$. They are willing to provide capital $I + w_L$ as long as the base wage payment $w_L$ is not too large (as we shall show, in the optimal...
contract $w_L = 0$).

**Date 4 – Project outcome:** A date $t = 4$, the project outcome is realized. The manager is compensated. The new investors receive a distribution of $D \leq X$ if the project succeeds and zero if it fails. To break-even on their investment, potential new investors require a distribution $D$ that satisfies

$$E[\theta|\theta \geq \theta_A]D = I + w_L. \quad (2)$$

The current shareholders receive a payoff and the manager is compensated only if the firm has a viable project, which occurs with probability $a_H$, and it releases a favorable report so that investors provide funding, which results when $\theta \geq \theta_T$. Accordingly, the expected current shareholder value, $U_S$, is given by

$$U_S = a_H \int_{\theta_T}^{1} (\theta (X - D) + w_L) f(\theta) d\theta - C, \quad (3)$$

where

$$C = a_H \int_{\theta_T}^{1} (\theta w_H + (1 - \theta)w_L) f(\theta) d\theta, \quad (4)$$

is the expected compensation paid to the manager.

To exclude additional agency conflicts between investors and the firm, we assume investors can observe the manager’s payment plan and thereby correctly anticipate the manager’s optimal choice of the shadow threshold, $\theta_A = \theta_T$.\footnote{Assuming the observability of the manager’s compensation contract comports with the current regulatory environment. In 2006, the Securities and Exchange Commission (SEC) issued a pronouncement requiring firms to provide transparent disclosure in “plain English” of executive and director compensation arrangements in proxy statements, annual reports and registration statements (see http://www.sec.gov/news/press/2006/2006-123.htm). In 2010, the Dodd-Frank Act heightened the disclosure requirements for pay-for performance compensation arrangements (see http://www.sec.gov/spotlight/dodd-frank/corporategovernance.shtml).} Using $\theta_A = \theta_T$, and
substituting (2) into (3) yields

\[ U_S = a_H \int_{\theta_T}^{I} (\theta X - I) f(\theta) d\theta - C. \]  

(5)

The first-best threshold that implements the net present value maximizing investment decision, denoted \( \theta_{FB} \), is determined by \( \theta_{FB}X - I = 0 \).

The time line and notation are summarized in Figure 1.

[Figure 1]

Before turning to the analysis, we pause to motivate two key ingredients in our model. First, we assume a binary reporting rule. The presence of binary evidentiary thresholds for the recognition of transactions is a ubiquitous feature of the extant accounting principles. As an example, consider the criteria for the recognition of revenue under SAB No. 104 – Revenue Recognition in Financial Statements. Revenue generally is recognized when, among other conditions, the transaction satisfies the evidentiary threshold of cash collectability being “reasonably assured”. In our model, \( \theta_P \) captures the evidentiary threshold that cash must have some probability of being realized to be recognized. As another example, under ASC 740 (formally SFAS 109), a valuation allowance is required for the amount of deferred tax assets for which it is more likely than not that the deferred tax asset will not be realized. In a similar fashion, ASC 450 (formally SFAS 5) requires that an estimated loss from a loss contingency to be recognized by a charge to income if, among other conditions, it is probable that an asset has been impaired or a liability has been incurred; a loss is defined as being probable when the future event is likely to occur. The key feature of these and many other accounting principles is that firms face evidentiary thresholds when recognizing events.
Second, the manager suffers expected litigation costs if the regulator determines that the firms failed to comply with the GAAP standard. In addition to the firm and its insurer having to make settlement payments, Lowry and Shu (2002) note that firms and their managers also incur a variety of other litigation related costs. The reputation cost, the opportunity cost of management’s attention being diverted to the lawsuit, and the cost of retaining a legal team are likely to be substantial. Indeed, for professional liability cases against directors and officers of corporations, Hersch and Viscusi (2007) find that insurers’ total defense costs (expenditures on in-house counsel, outside counsel, and other litigation expenses) are $0.90 for claims in which a suit was filed for each dollar that claimants receive.

In our model, we explore how the structure of these legal costs affects manager behavior. Like Polinsky and Shavell (2014), we model litigation related costs as having a fixed component and a variable component. This partitioning has both theoretical and empirical support. Katz (1988) models a litigation environment in which legal costs are shown to optimally increase in the level of damages. Hersch and Viscusi (2007) empirically find that defense costs increase in the scale and complexity of a claim; moreover, claims with higher stakes entail larger total defense costs, higher outside counsel costs, and lower in-house counsel costs. They document that an increase in case complexity drives a shift from in-house counsel to outside counsel, thereby increasing the variable component relative to the fixed component.

Modeling the litigation costs as having a fixed and variable component lends our model to a variety of applications. For instance, penalties that lead to a firm’s stock market suspension or delisting or prohibiting a manager permanently from acting as an officer or director of a public firm are relatively fixed and denoted by $K_F$; conversely, penalties that vary with the extent of the reporting misstatement and the
manager’s ill-gotten gains are relatively variable and are captured by $|\theta_p - \theta| K_Y$. As another application, a financial firm might misreport the fair value of assets on its balance sheet (e.g., the valuation of credit default swaps that the firm entered with other financial firms). In this case, regulators might impose a penalty that varies with the extent of the misstatement; these penalties are relatively variable. Regulators also might discipline the manager for the collateral consequences to other financial firms and the disruption of the financial markets that the fraud caused; these criminal penalties do not vary directly with the extent of the misstatement.

### 3 Effort and Manipulation

In this section, we determine the optimal contract the board of director will choose to offer the manager and the manager’s optimal reporting behavior. But before doing so, we characterize a benchmark case.

**Benchmark:** In the benchmark case, we suppose the manager cannot engage in manipulating his private information about the project’s quality $\theta$. The manager’s *ex ante* utility if he chooses effort $a$ is then given by

$$U^{BM}_M(a) = a \left( \int_{\theta_p}^{1} (\theta w_H + (1 - \theta) w_L) f(\theta) d\theta \right) - g(a).$$

The manager is compensated only if the project is viable and investors provide the firm with funding, which requires a favorable accounting report. Given this objective function, the manager exerts high effort if the following incentive constraint is satisfied

$$U^{BM}_M(a_H) \geq U^{BM}_M(a_L), \quad (6)$$

which can be written as

$$\int_{\theta_p}^{1} (\theta w_H + (1 - \theta) w_L) f(\theta) d\theta \geq \frac{G}{a_H - a_L}. \quad (7)$$
Condition (7) shows that the payments $w_H$ and $w_L$ are substitutes for providing the manager with incentives to work hard. The two payments are substitutes because effort increases the probability of project continuation funding and both payments $w_H$ and $w_L$ reward the manager for this event. In contrast, if the firm is terminated, the manager receives neither payment. As a result, in this benchmark case, any $(w_H, w_L)$ combination that satisfies (7) as an equality is optimal.

**Reporting strategy:** We now turn to the focal problem in which the manager can misreport and consider the manager’s optimal reporting strategy. Consider the case in which the manager observes that the project quality $\theta$ lies in the range $[\theta_P, 1]$. In the absence of manipulation, the firm will release a favorable report and investors will provide financing. Here the manager has no incentive to manipulate the report because he always prefers project continuation, which yields expected compensation of $\theta w_H + (1 - \theta)w_L$, over project termination, which leaves him empty-handed.

In contrast, suppose the manager observes a project quality $\theta$ that lies in the range $[0, \theta_P)$. In the absence of manipulation, the firm will release an unfavorable report and is terminated. Hence, the manager might wish to manipulate the report. The manager will manipulate the accounting report to obtain financing if and only if the expected compensation for project continuation equals or exceeds the expected cost of manipulation, that is, if

$$\theta w_H + (1 - \theta)w_L \geq \pi(K_F + (\theta_P - \theta)K_V).$$

We shall show below that the optimal contract sets $w_L = 0$. Since $w_H > w_L$, the manager’s expected compensation increases as the project’s quality $\theta$ increases. This increase makes misreporting more attractive. Thus, the left hand side of (8) is increasing in $\theta$. In addition, the expected variable penalty for non-compliance $\pi(\theta_P - \theta)K_V$ decreases as the project’s quality increases, implying that the right
hand side of (8) is decreasing in \( \theta \). Provided the fixed penalty for non-compliance, \( K_F \), is not too high, it follows that there is a unique threshold, denoted \( \theta_T \), such that the manager finds it optimal to engage in classification manipulation if \( \theta \geq \theta_T \) and does not engage in manipulation if \( \theta < \theta_T \). The next proposition summarizes the manager’s reporting strategy.

**Proposition 1** There exists a unique shadow threshold, \( \theta_T \), with \( 0 < \theta_T \leq \theta_P \), such that the manager issues a favorable report, \( R = R_H \), for all \( \theta \in [\theta_T, 1) \) and an unfavorable report, \( R = R_L \), for all \( \theta \in (0, \theta_T) \).

**Effort choice:** Given the manager’s optimal reporting strategy, the manager’s ex ante utility if he chooses effort \( a \) is

\[
U_M(a) = a \left( \int_{\theta_T}^{1} (\theta w_H + (1-\theta)w_L) f(\theta)d\theta - \int_{\theta_T}^{\theta_P} k(\theta, \theta_P) f(\theta)d\theta \right) - g(a).
\]

The first integral reflects the manager’s expected compensation, and the second integral captures the expected cost of inappropriately classifying the project. The manager exerts high effort if

\[
U_M(a_H) \geq U_M(a_L),
\]

which we can rewrite as

\[
\int_{\theta_T}^{1} (\theta w_H + (1-\theta)w_L) f(\theta)d\theta - \int_{\theta_T}^{\theta_P} k(\theta, \theta_P) f(\theta)d\theta \geq \frac{G}{a_H - a_L},
\]

In the optimal contract, the effort incentive constraint (10) is binding. Define \( G_a \equiv G/ (a_H - a_L) \), which reflects the severity of the moral hazard problem.

The next proposition characterizes the optimal contract.
Proposition 2 The optimal payment plan satisfies

\[
w^*_H(\theta_T) = \frac{G_a + \int_{\theta_T}^{\theta_P} k(\theta, \theta_P) f(\theta) d\theta}{\int_{\theta_T}^{1} \theta f(\theta) d\theta} \quad \text{and} \quad w^*_L = 0.
\] (11)

In the benchmark case in which the manager cannot misreport, the two payments \( w_H \) and \( w_L \) were substitutes for providing effort incentives. When the manager can manipulate the accounting report, Proposition 2 shows that it is optimal to reward the manager for success and not for failure in the sense that \( w^*_H > w^*_L = 0 \). The intuition for this result is as follows. By reducing \( w_L \) and increasing \( w_H \) (such that the effort constraint (10) remains satisfied), the manager’s compensation becomes more closely linked to the ultimate success of the project. As a consequence, the manager is less eager to invest in the new project when its quality is low, reducing his temptation to misreport. A lower level of manipulation is beneficial to shareholders, not only because it improves investment efficiency, but also because it reduces the cost of management compensation. It reduces compensation costs because the directors have to compensate the manager for his expected cost of non-compliance to provide him with sufficient incentives to work on the project in the first place. To minimize manipulation incentives, directors optimally set \( w_L = 0 \) and provide effort incentives via the bonus \( w_H \). This argument is formally established in Lemma 1 in the Appendix.

Equilibrium shadow threshold: With these observations in hand, the next proposition determines the optimal choice of shadow threshold \( \theta_T \) as a function of the GAAP standard \( \theta_P \). It establishes that the manager has no incentive to deviate from the GAAP standard if it is sufficiently low.

Proposition 3 Let \( \theta_P \) denote the GAAP standard that satisfies

\[
\theta_P G_a = \pi K_F \int_{\theta_P}^{1} \theta f(\theta) d\theta.
\] (12)
(i) If \( \theta_P \leq \theta_p \), the equilibrium shadow threshold is \( \theta_T = \theta_P \). The manager does not misclassify the project.

(ii) If \( \theta_P > \theta_p \), the equilibrium shadow threshold, \( \theta_T \), is the unique solution to

\[
\theta_T w^*_H(\theta_T) = \pi(K_F + (\theta_P - \theta_T)K_V),
\]

where \( w^*_H(\theta_T) \) is given in (11). The equilibrium shadow threshold, \( \theta_T \), is such that \( 0 < \theta_T < \theta_P \). The manager misclassifies the project for all \( \theta \in [\theta_T, \theta_P) \).

Proposition 3 shows that there is a unique threshold \( \theta_p \), which we refer to as the non-manipulation threshold, such that for all \( \theta_P \leq \theta_p \), the manager complies with the GAAP standard and chooses \( \theta_T = \theta_P \). When the GAAP standard is relatively low, deviating from the GAAP standard and misreporting to continue the project is unattractive to the manager not only because the project is unlikely to succeed and thereby yield the bonus of \( w_H \), but also because non-compliance involves an expected fixed cost of \( \pi K_F \). As the fixed penalty \( K_F \) declines, the non-manipulation threshold declines as well. In the extreme, for \( K_F = 0 \), we obtain \( \theta_P = 0 \).

When the first-best threshold, \( \theta_{FB} \), does not exceed the non-manipulation standard, \( \theta_p \), the standard-setter can implement the first-best investment level without creating incentives for manipulation simply by setting \( \theta_P = \theta_{FB} \leq \theta_p \). To avoid this uninteresting case, we focus on parameter constellations for which \( \theta_{FB} > \theta_p \). It follows from expression (12) that \( \theta_{FB} > \theta_p \) if and only if

\[
\theta_{FB} G_a > \pi K_F \int_{\theta_{FB}}^{1} \theta f(\theta) d\theta.
\]

Condition (14) is satisfied if the fixed penalty \( K_F \) is not too large and the effort control problem \( G_a \) is substantial. When the effort control problem is substantial, the board must offer the manager a large bonus. Such a bonus causes the manager
to favor implementing the project and thereby encourages misreporting. Further, it can be established that condition (14) ensures that $K_F$ is such that the condition for a unique shadow threshold, $\theta_T$, in Proposition 1 is satisfied.

Proposition 3 shows that the manager does not find it optimal to comply with the GAAP standard when the GAAP standard exceeds the non-manipulation threshold, $\theta_P > \theta_p$. In this case, the manager chooses a shadow standard that lies below the GAAP standard, and he misreports if the project quality $\theta \in [\theta_T, \theta_P)$.

4 Shadow Threshold Comparative Statics

We are interested in the question of how a change in the GAAP standard affects the manager’s choice of the shadow threshold and hence the firm’s investment decision. When the GAAP standard lies below the non-manipulation threshold, $\theta_P \leq \theta_p$, Proposition 3 established that $\theta^*_T = \theta_P$, and accordingly, the shadow standard always increases with an increase in the GAAP standard. Further, given the assumption that $\theta_{FB} > \theta_p$, the standard-setter will never choose a GAAP standard $\theta_P$ that lies below $\theta_p$ as doing so would induce inefficient investment.

Our focus, therefore, is on the more interesting case in which $\theta_P > \theta_p$. In this case, setting more stringent GAAP standards—raising $\theta_P$—does not necessarily increase the shadow threshold $\theta_T$, but can backfire and reduce $\theta_T$, thereby yielding more overinvestment. The fact that changing GAAP standards can lead to more or less efficient investment arises because changing the GAAP standard has two effects on the shadow threshold that work in opposite directions.

To highlight these offsetting effects, observe that Proposition 3 establishes that, for $\theta_P \geq \theta_p$, the equilibrium shadow threshold is determined by the equilibrium
condition given in (13). By applying the implicit function theorem to condition (13), the relation between the shadow threshold and the GAAP standard can be expressed as

$$\frac{d\theta_T}{d\theta_P} = \frac{K_V \pi - \theta_T \frac{dw^*_H}{d\theta_P}}{K_V \pi + w^*_H + \theta_T \frac{dw^*_H}{d\theta_T}}$$

(15)

where

$$\frac{dw^*_H}{d\theta_P} = \frac{K_F \pi f(\theta_P) + \int_{\theta_P}^{\theta_T} K_V \pi f(\theta)d\theta}{\int_{\theta_P}^{\theta_T} \theta f(\theta)d\theta} > 0,$$

(16)

$$\frac{dw^*_H}{d\theta_T} = \frac{\theta_T w_H - k(\theta_T, \theta_P) f(\theta_T)}{\int_{\theta_P}^{\theta_T} \theta f(\theta)d\theta} = 0.$$

(17)

Condition (15) shows that a change in the GAAP standard $\theta_P$ has a direct effect on shadow threshold $\theta_T$ and an indirect effect on $\theta_T$ via the bonus payment $w^*_H$. First, consider the direct consequence of a change in $\theta_P$, which we term the deterrence effect. When the GAAP standard increases, the penalty for non-compliance increases for any given project quality $\theta$, causing the manager to choose a higher shadow threshold. Formally, keeping $w_H$ fixed, we obtain

$$\frac{\partial \theta_T(\theta_P, w_H)}{\partial \theta_P} = \frac{K_V \pi}{w_H + K_V \pi} \in [0, 1).$$

(18)

The deterrence effect is weaker when the variable component of the non-compliance penalty, $K_V$, is smaller. In the extreme, when $K_V = 0$, the regulatory penalty is a constant and the deterrence effect on $\theta_T$ associated with changing $\theta_P$ disappears.

It is important to note that an increase in $\theta_P$ always increases the non-compliance region $(\theta_T, \theta_P)$. Although the shadow threshold increases with the GAAP standard (when $K_V > 0$), the moral hazard problem causes the shadow threshold to increase more slowly than the GAAP standard, widening the manipulation range $(\theta_T, \theta_P)$.
Second, consider the indirect consequence of an increase in GAAP standard $\theta_p$ via the manager’s compensation plan. We refer to this effect as the compensation effect. A change in the GAAP standard $\theta_p$ indirectly affects the shadow threshold $\theta_T$ because the bonus payment $w_H$ varies with changes in $\theta_p$. As just discussed, increasing the GAAP standard increases the manipulation range $(\theta_T, \theta_p)$, and hence the manager’s ex ante expected cost of manipulation. Since the manager only manipulates the report if the project is viable, the higher expected manipulation cost reduces the manager’s willingness to work on the project in the first place. To maintain the manager’s effort incentives, the directors must increase the bonus payment for a successful project. A larger bonus, in turn, makes it more attractive for the manager to manipulate the report and that causes the shadow threshold to decline.

In short, an increase in the GAAP standard raises the shadow threshold via the deterrence effect and lowers it via the compensation effect. The effect that dominates depends on the relative size of the fixed penalties $K_F$ and variable penalties $K_V$ for non-compliance. These relations are formally characterized in the next proposition. To simplify the exposition, we assume that $\theta$ is uniformly distributed on the unit interval for the remainder of the paper.\footnote{Our result that an increase in $\theta_p$ can reduce $\theta_T$ is not driven by the uniform distribution assumption; a proof is available upon request.}

**Proposition 4** Suppose $\theta_p > \theta_T$. The manager misreports and the manipulation range $(\theta_T, \theta_p)$ increases with the GAAP standard $\theta_p$. Moreover,

(i) If the fixed component of the regulatory penalties is relatively low, specifically $\pi K_F K_V < (K_V G_a - \pi K_F^2)$, then the shadow threshold $\theta_T$ increases in the GAAP standard $\theta_p$.

(ii) If the fixed component of the regulatory penalties is relatively moderate, specifically

$$\frac{\pi K_F K_V}{(K_V G_a - \pi K_F^2)}$$
\( 0 < (K_V G_a - \pi K_F^2 < \pi K_F K_V, \) then there is a unique interior GAAP standard, \( \hat{\theta}_p \in (\theta_p, 1), \) such that the shadow threshold \( \theta_T: \)

- increases in \( \theta_p \) for all \( \theta_p < \hat{\theta}_p; \) and
- decreases in \( \theta_p \) for all \( \theta_p > \hat{\theta}_p. \)

(iii) If the fixed component of the regulatory penalties is relatively high, specifically \( (K_V G_a - \pi K_F^2) < 0, \) then the shadow threshold \( \theta_T \) decreases in the GAAP standard \( \theta_p. \)

Proposition 4 (i) establishes that the shadow threshold increases in the GAAP standard when the fixed component of the regulatory penalties is relatively low. To develop the intuition for this relation, consider an extreme case in which \( K_F = 0 \) and \( K_V > 0 \) so that the condition \( \pi K_F K_V < (K_V G_a - \pi K_F^2) \) is satisfied. Both the deterrence and the compensation effects are present but the deterrence effect always dominates the compensation effect. As a consequence, the relation between the GAAP standard and the shadow standard is positive, that is, \( d\theta_T/d\theta_P > 0 \) for all \( \theta_P \in [\theta_P, 1]. \) To see this more formally, rewrite (15) using (16) and observe that

\[
\frac{d\theta_T}{d\theta_P} = \frac{K_V \pi - \theta_T \frac{d w_H^*}{d \theta_P}}{K_V \pi + w_H^*} = \frac{1}{(K_V \pi + w_H^*)} \left( K_V \pi - \frac{\theta_T \int_{\theta_T}^{\theta_P} K_V \pi f(\theta) d\theta}{\int_{\theta_T}^{\theta_P} f(\theta) d\theta} \right) > 0
\]

for all \( \theta_P \in [\theta_P, 1]. \) When \( \theta = \theta_T \) and the GAAP standard increases, the cost of non-compliance increases in proportion to \( K_V \pi, \) whereas the expected bonus for \( \theta = \theta_T \) increases as well, but only in proportion to

\[
\theta_T \left( \frac{d w_H^*}{d \theta_P} \right) = \theta_T \frac{\int_{\theta_T}^{\theta_P} K_V \pi f(\theta) d\theta}{\int_{\theta_T}^{\theta_P} f(\theta) d\theta}.
\]
Since $K_V \pi > \theta_T (d w_H^* / d \theta_P)$, it follows that when $\theta_P$ increases, the deterrence effect dominates the compensation effect, forcing the shadow threshold $\theta_T$ upward.

Alternatively, Proposition 4 (iii) shows that the shadow threshold decreases in the GAAP standard when the fixed component of the regulatory penalties is relatively high. Consider the extreme case in which $K_V = 0$ and $K_F > 0$ so that condition $(K_V G_a - \pi K_F^2) < 0$ is satisfied. Changes in the GAAP standard have no effect on the penalty that the manager suffers from misreporting. Accordingly, when the GAAP standard changes, the deterrence effect is absent whereas the compensation effect is still present. The compensation effect yields a negative relation between the GAAP standard and the shadow standard, that is, $d \theta_T / d \theta_P < 0$ for all $\theta_P \in [\theta_p, 1]$.

Lastly, when the penalties $K_V$ and $K_F$ lie in intermediate ranges so that condition $0 < (K_V G_a - \pi K_F^2) < \pi K_F K_V$ in Proposition 4 (ii) is satisfied, the deterrence effect dominates the compensation effect for low GAAP standards $\theta_P$ but the reverse is true for high GAAP standards $\theta_P$. Specifically, there is a unique interior threshold, denoted $\hat{\theta}_P$, with $\hat{\theta}_P \in (\theta_p, 1)$, such that the relation $d \theta_T / d \theta_P$ is positive for all $\theta_P < \hat{\theta}_P$ and negative for all $\theta_P > \hat{\theta}_P$. Consequently, the shadow threshold $\theta_T$ is an inverted U-shaped function of the GAAP standard $\theta_P$.

In the primary antecedent to our work, Dye (2002) finds the shadow threshold rises with an increase in the GAAP standard. This follows because Dye (2002) does not consider the agency problem of motivating the manager to work on new projects. Hence, the compensation effect is suppressed in his model, and accordingly, only the result characterized in Proposition 4 (i) prevails. Our analysis highlights that the relation between the shadow threshold and GAAP standards is subtle and depends crucially on the manager moral hazard problem, the nature of the regulatory environment, and the penalty structure associated with non-compliance.
5  Optimal Standards

In the previous sections, we treated GAAP standards as being exogenously fixed. Standard-setters, however, are expected to choose a set of optimal accounting standards. Statement of Financial Accounting Concepts No. 8—Conceptual Framework for Financial Reporting—defines the objective of financial reporting as being to provide financial information that is “useful to existing and potential investors, lenders, and other creditors in making decisions about providing resources to the entity” (para. OB2). Consequently, we model the standard-setter as choosing standards to maximize the efficiency of investment.\footnote{On this note, Barth (2006) suggests that, by considering the criteria standard-setters adopt when setting standards, research can provide insight into standard setting issues.}

Specifically, the standard-setter’s objective is

\[
\max_{\theta_p} U_W = a_H \int_{\theta_T}^{1} (\theta X - I) f(\theta) d\theta - G. \tag{19}
\]

As an aside, recognizing that the value of regulatory intervention lies in forcing firms to consider the negative externalities associated with their decisions, it is straightforward to introduce an additional conflict of interest between the firm and the society. We can assume that project failure creates costs to the society that neither the firm nor its investors take into consideration but that the standard-setter recognizes.\footnote{For instance, consider the cost imposed on the economy by the collapse of the American International Group in September 2008. The company was bailed out by the Federal Reserve Bank of New York. In light of the company’s size and complexity, federal officials feared that a “collapse of the company could bring down the global financial system.” The various rescue packages totaled $182 billion, making it the biggest federal bailout in United States history. See Michael J. De La Merce. “Bailout Over, U.S. Treasury Plans to Sell A.I.G. Shares.” \textit{New York Times} (December 10, 2012). See http://dealbook.nytimes.com/2012/12/10/u-s-to-sell-last-holdings-of-a-i-g-common-stock/}

Adding such a cost, provided it is not too large, does not qualitatively affect our results.
We now turn to determine the standard-setter’s choice of the GAAP standard. Differentiating the standard-setter’s objective in (19) with respect to $\theta_p$ yields

$$ \frac{dU_W}{d\theta_p} = -a_H (\theta_T X - I) f(\theta_T) \frac{d\theta_T}{d\theta_p}. $$

(20)

As $a_H$ and $f(\theta_T)$ are always positive, the standard-setter’s optimal choice of GAAP standard depends on the sign of $(\theta_T X - I)$ and $d\theta_T/d\theta_p$. Recall the first-best threshold $\theta_{FB}$ that implements the efficient level of investment is characterized by $(\theta_{FB} X - I) = 0$. By assumption (14), $\theta_{FB} > \theta_p$. Consequently, when the standard-setter chooses a GAAP standard equal to the non-manipulation threshold, $\theta_p = \theta_p$, the firm will overinvest in the project for all $\theta \in [\underline{\theta}_p, \theta_{FB}]$. Thus, suppose the standard-setter lowers the GAAP standard $\theta_p$ below $\underline{\theta}_p$. Lowering $\theta_p$ cannot be optimal because Proposition 3 (i) implies that any reduction in $\theta_p$ below $\underline{\theta}_p$ leads to an identical reduction in $\theta_T$, further increasing the level of overinvestment. Accordingly, the optimal GAAP standard, denoted $\theta_p^*$, must be at least as large as the non-manipulation threshold $\underline{\theta}_p$, and is characterized in the next proposition.

**Proposition 5**  The standard-setter’s optimal choice of GAAP standard $\theta_p^*$ is as follows:

(i) If the fixed component of the regulatory penalties is relatively high, specifically $K_Y G_a < \pi K_F^2$, then the optimal GAAP standard satisfies $\theta_p^* = \theta_p$. The manager complies with the accounting standard and chooses $\theta_T = \theta_p$.

(ii) If the fixed component of the regulatory penalties is relatively low, specifically $K_Y G_a > \pi K_F^2$, then the manager does not comply with the GAAP standard and chooses $\theta_T < \theta_p^*$. Further, the optimal GAAP standard $\theta_p^*$ is determined by either:

- $(\theta_T(\theta_p^*) X - I) = 0$ and $d\theta_T/d\theta_p \geq 0$, and it induces first-best investment; or
• \( (\theta_T(\theta_P^*)X - I) < 0 \) and \( d\theta_T/d\theta_P = 0 \), and it induces overinvestment; or,

• \( (\theta_T(\theta_P^*)X - I) < 0 \) and \( \theta_P^* = 1 \), and it induces overinvestment.

To develop the intuition underlying the results in Proposition 5, separately consider the two cases. First, when the fixed component of the penalty for non-compliance is high relative to the variable component, that is, \( K_VG_a < K_F^2\pi \), the compensation effect dominates the deterrence effect. Therefore, it follows from Proposition 4 that an increase in the GAAP standard \( \theta_P \) decreases the shadow threshold \( \theta_T \), \( d\theta_T/d\theta_P < 0 \), for all \( \theta_P \geq \theta_P^* \). The reduction in the shadow threshold increases the interval \((\theta_T, \theta_{FB})\) over which the investors inefficiently invest in a project. Hence, it is optimal for the standard-setter to lower the GAAP standard until it equals the non-manipulation threshold \( \theta_P^* = \theta_P \).

On the other hand, when the fixed component is not high relative to the variable component, that is, \( K_VG_a > K_F^2\pi \), the deterrence effect dominates the compensation effect. Accordingly, starting from the non-manipulation standard, \( \theta_P = \theta_P^* \), Proposition 4 implies an increase in the GAAP standard \( \theta_P \) increases the shadow standard \( \theta_T \). The increase in \( \theta_T \) is beneficial because it reduces the overinvestment interval \((\theta_T, \theta_{FB})\). The standard-setter therefore chooses to increase \( \theta_P \) until either the first-best investment level is implemented, \( \theta_T = \theta_{FB} \), or a further increase in the GAAP standard no longer increases the shadow threshold either because \( d\theta_P/d\theta_T = 0 \), or because \( \theta_P = 1 \) and raising the GAAP standard is not possible. The corner solution with \( \theta_P = 1 \) can occur only when the relation between \( \theta_P \) and \( \theta_T \) is positive for all \( \theta_P \geq \theta_P^* \). This relation holds only when the fixed component is relatively low, that is, \( K_VG_a > \pi K_F^2 + \pi K_F K_V \), as established in Proposition 4 (i). When the fixed component is not relatively high, the manager always engages in classification manipulation,
\( \theta_T < \theta^*_p. \)

Although the standard-setter can always eliminate reporting manipulating by pronouncing a GAAP standard with the characteristic that \( \theta_p = \theta^*_p \), such a standard is not optimal when the fixed component of the regulatory penalties is relatively low, formally \( K_V G_\alpha > \pi K^2_F \). Increasing the GAAP standard above the non-manipulation threshold, increases the shadow standard and hence improves investment efficiency, even though it is accompanied by an increase in the manipulation range \((\theta_T, \theta_P)\). This observation implies that setting standards that maximize investment efficiency is not equivalent to setting standards that minimize accounting manipulation. Consequently, we observe that the level of manipulation is not a good indicator of the quality of accounting standards.

In sum, our study suggests that the optimal design of a GAAP standard and the equilibrium magnitude of misreporting depends not only on the probability of regulatory detection or level of enforcement, \( \pi \), but also on the specific penalty structure—the mix of fixed and variable penalties. For a relatively high variable penalty, a standard-setter can exploit the fact that an increase in a GAAP standard increases the manager’s cost of non-compliance for any given project quality. Accordingly, this analysis suggests that a standard-setter should optimally set a GAAP standard that exceeds the non-manipulation standard, even though the manager is expected to deviate from the standard. In contrast, for a relatively low variable penalty, the standard-setter’s ability to positively influence the shadow threshold is more constrained. In this circumstance, it is best for the standard-setter to lower the recognition threshold and choose a GAAP standard that eliminates incentives for manipulation.
6 Enforcement and Standard Setting

Optimal accounting standards facilitate investors’ allocation of capital within the economy. Importantly, however, standards must be accompanied by the appropriate level of regulatory enforcement. Indeed, the adoption of IFRS in the European Union, perhaps the largest financial reporting change in history, was accompanied by a series of regulatory directives. Beginning with the Financial Services Action Plan in 1999, the European Union passed several directives, including the Transparency Directive requiring countries to create or designate an enforcement agency that reviews firm disclosure and the Prospectus Directive focused on regulating disclosure during public security offerings (see Christensen, et al. (2012) for more detail).

In this section, we characterize how the optimal design of the accounting standard varies with the intensity of regulatory enforcement, represented by the detection probability or regulatory enforcement parameter \( \pi \). The next proposition highlights the subtle relation between accounting standard-setting and regulatory enforcement.

**Proposition 6** Accounting standards and regulatory enforcement interact to determine investment efficiency as follows:

(i) If the fixed component of the regulatory penalties is relatively high, specifically \( K_V G_a < \pi K_p^2 \), then the optimal GAAP standard \( \theta^*_p \) increases in regulatory enforcement \( \pi \), implying accounting standards and regulatory enforcement are complements.

(ii) If the fixed component of the regulatory penalties is relatively low, specifically \( K_V G_a > \pi K_p^2 \), then the optimal GAAP standard \( \theta^*_p \) decreases in regulatory enforcement \( \pi \), implying accounting standards and regulatory enforcement are substitutes.

The interaction between accounting standards and regulatory enforcement depends on the regulatory agency’s penalty function. For a relatively high fixed penalty,
Proposition 5 (i) highlights that the standard-setter optimally chooses a GAAP standard that is just low enough to ensure that the manager has no incentive to misreport and deviate from the GAAP standard, that is, \( \theta_p^* = \theta_p = \theta_T \). An increase in the regulatory enforcement probability \( \pi \) increases the expected cost associated with non-compliance and pushes the non-manipulation standard \( \theta_p \) upward. However, as long as the standard-setter does not change the GAAP standard \( \theta_p \), the manager will not alter the shadow threshold, and we continue to observe \( \theta_T = \theta_p \).

However, recognizing the manager’s stronger inclination to comply with the GAAP standard, the standard-setter should strengthen the GAAP standard. The standard setter will optimally strengthen the GAAP standard until it once again attains the non-manipulation threshold, \( \theta_p^* = \theta_p \). Hence, stricter enforcement must be combined with stricter standards to have an effect on investment efficiency.

Alternatively, when regulatory enforcement probability \( \pi \) declines, the non-manipulation threshold \( \theta_p^* \) declines as well. Following Proposition 4 (i), the standard-setter’s best response then is to lower the GAAP standard, which, in turn, raises the shadow threshold \( \theta_T \), until \( \theta_p \) again equals \( \theta_p \). An immediate implication of this analysis is that for a relatively high fixed penalty, accounting standards and enforcement intensity are complements. In short, Proposition 6 (i) establishes that when the intensity of regulatory enforcement increases, setting tougher GAAP standards is optimal, and alternatively, when the intensity declines, relaxing GAAP standards is optimal.

On the other hand, for a relatively low fixed penalty, \( K_v G_a < \pi K_f^2 \), accounting standards and enforcement intensity are substitutes. In this case, Proposition 5 implies that the optimal GAAP standard is characterized by one of three conditions: First, when the optimal solution is characterized by \( (\theta_T X - I) = 0 \), the GAAP standard implements the first-best investment decision, \( \theta_T = \theta_{FB} \). As regulatory enforcement
intensity $\pi$ increases, the shadow threshold $\theta_T$ rises above the first-best level $\theta_{FB}$. In response, the standard-setter recognizing that $d\theta_T/d\theta_P > 0$, lowers the GAAP standard $\theta_P$ to restore first-best investment and avoid the underinvestment that would otherwise result. Conversely, when enforcement intensity $\pi$ decreases, the standard-setter heightens the GAAP standard to avoid overinvestment. Thus, enforcement and standards are substitutes for driving optimal investment decisions.

Second, when the optimal solution in Proposition 5 is characterized by overinvestment $(\theta_TX - I) < 0$ and $d\theta_T/d\theta_P = 0$, standard-setting and enforcement are again substitutes but for a different reason. An increase in enforcement intensity $\pi$ increases $\theta_T$, which causes the relation $d\theta_T/d\theta_P$ to become negative. In this case, however, the standard-setter will choose to lower the official standard $\theta_P$ to increase the shadow threshold and thereby reduce overinvestment. Third, Proposition 5 raises a third possible solution, $\theta^*_P = 1$, which can occur when $\pi K_F K_V < (K_V G_a - \pi K^2_F)$. As $\theta^*_P = 1$ is a corner solution, a marginal change in enforcement intensity $\pi$ has no effect on $\theta_P$. Hence, we ignore this case. In short, for a relatively low fixed penalty, $K_V G_a > \pi K^2_F$, standard-setters optimally relax GAAP standards if enforcement intensity strengthens and optimally raise them if enforcement intensity weakens.

Our analysis contributes to the debate about harmonizing cross-country financial information to ensure a high degree of comparability of financial statements.\textsuperscript{10} One implication of our model is that the behavior of standard-setters and regulatory agencies requires careful coordination.\textsuperscript{11} Isolated changes to accounting standards can have unintended negative effects on reporting quality when the enforcement of

\textsuperscript{10}For a survey of this discussion, see Barth (2006) and Leuz and Wysocki (2008).

\textsuperscript{11}See Zeff (1995) for an extensive discussion of the relationship between the SEC and the various private-sector standard setters.
the standards is ignored. For example, when the cost of non-compliance is associated mainly with fixed rather than variable penalties, we find that the strength of the standards and enforcement should be positively correlated. In contrast, when non-compliance is exposed to primarily variable penalties, the strength of the standards and enforcement should be negatively correlated. These results hint at the difficulty of converging U.S. GAAP and IFRS, which are developed to meet the reporting needs of various countries with different regulatory environments.

7 Empirical Predictions and Discussion

Much empirical work has examined the consequence of adopting more stringent accounting standards. In this regard, Proposition 4 predicts that strengthening accounting standards can raise or lower the quality of reporting depending on the structure of regulatory penalties that the firm incurs when misreporting. On the empirical front, Liu and Sun (2013) find the earnings quality of Canadian firms did not improve following IFRS adoption and, for the mining sector, earnings quality actually declined. Their finding is consistent with the predictions of our analysis assuming the fixed penalties from non-compliance are relatively high, IFRS are more stringent than the superseded standards, and the regulatory enforcement has not changed.

Our analysis establishes that accounting standards and the regulatory environment need to be carefully coordinated to ensure investment efficiency. Christensen, et al. (2012) argue that identifying the effect of changing accounting standards is confounded by changes to the regulatory environment. Consequently, in their study of the capital market effects of adopting IFRS, they separate the effect of changes in enforcement from changes in the accounting standards. Among their findings, they
establish that the liquidity benefits from adopting IFRS are muted when not accompanied by improvements in the enforcement environment. Moreover, they document a liquidity benefit for firms subject to heightened enforcement despite not adopting IFRS. They conclude that changes in enforcement are the primary determinant of the capital market benefits associated with the adoption of accounting standards.

In their discussion of this work, Barth and Israeli (2013) argue that strong enforcement and stricter standards both yield liquidity benefits. These benefits are greatest, however, when accompanied by strong enforcement of the standards. Our analysis highlights that the coordination of standards and regulatory enforcement is important, and moreover, whether the level of standards and regulatory enforcement are substitutes or complements depends on the structure of the regulatory penalties.

This study focuses on the structure of regulatory penalties. The penalties have a fixed component that does not vary with the extent of the firm non-compliance with the accounting standard and a variable component that does vary with the extent of the non-compliance. It might be argued that, in some cases, the penalty might vary with the extent of non-compliance because the ability of the regulator to detect misreporting depends on the extent of non-compliance. In other cases, the penalty might not vary with the extent of non-compliance because non-compliance is easy for the regulator to determine and does not vary with the extent of misclassification. The ease with which the regulator can establish non-compliance often depends on the verifiability of the reported information. Accordingly, our results offer insight into how the information that the standards require firms to report and the nature of the penalties that are imposed affect the level of the standards. When the fixed component of the regulatory penalties is relatively high because non-compliance is easy to identify, Proposition 5 establishes that the optimal GAAP standard is set so
that the manager does not misreport. For instance, a standard requiring that the firm recognize the acquisition cost of an asset at historical cost is relatively easy to verify. In this case, we would expect that standards that require assets be carried at historical cost would be set sufficiently low that the manager would not misreport. In contrast, when the fixed component of the regulatory penalties is relatively low because non-compliance is more difficult to identify and thus the penalties depend on the extent of misreporting, Proposition 5 shows that the optimal GAAP standard is set anticipating that the manager will misreport for some range of product quality. To illustrate, a standard requiring that the firm recognizes the fair value of an asset is more difficult to verify. In this case, we expect reporting standards to be stricter and thus misreporting to be more likely.

8 Conclusion

We study the impact of accounting standards and regulatory enforcement on investment decisions. More stringent standards and heightened enforcement are often viewed as being key ingredients for accounting information to be useful to capital market participants. We show the relation between accounting standards, regulatory enforcement, and firm reporting behavior is not that straight-forward. Indeed, setting stricter GAAP standards do not necessarily improve but can actually undermine the quality of financial reporting, leading to inefficient resource allocation decisions.

We characterize conditions under which accounting standards and enforcement of the standards are substitutes or complements. Specifically, when the regulatory penalties for noncompliance are relatively fixed and, therefore, do not vary much with the extent of non-compliance, accounting standards and enforcement are com-
plements. As enforcement is strengthened, it is optimal for accounting standards setters to raise reporting standards. Hence, this analysis suggests that in countries with stricter enforcement, it is optimal to have stricter accounting standards.

In contrast, when the regulatory penalties for non-compliance are relatively variable and, therefore, are sensitive to the extent of non-compliance, standard setting and enforcement are substitutes. As enforcement is strengthened, it is optimal for standard setters to lower accounting standards. Hence, when regulatory penalties are relative variable, countries with stricter enforcement have more lenient accounting standards.

Accordingly, to ensure an effective reporting environment, we suggest standard-setters and regulatory agencies ought to carefully coordinate their actions. This observation is consistent with the close partnership that exists between the FASB and the SEC (see Zeff 1995). It also hints at the problems national accounting policy-makers face when adopting a set of accounting standards that are not sufficiently responsive to the particular features of their countries’ regulatory and legal environment.
References


Appendix

This Appendix contains the proofs of the formal claims in the paper.

Proof of Proposition 2.

The standard setter will optimally choose a standard that exceeds or equals the non-manipulation standard \( \underline{\theta}_p \). Alternatively, to lower \( \underline{\theta}_p \) below \( \underline{\theta}_p \) leads to an identical reduction in the \( \underline{\theta}_T \) and hence further overinvestment.

For \( \underline{\theta}_p \geq \underline{\theta}_p \), the shadow threshold \( \underline{\theta}_T \) is uniquely determined when expression (8) is satisfied with equality, that is,

\[
\theta w_H + (1 - \theta) w_L = k(\theta_T, \theta_P). \tag{21}
\]

Using (4) and (5) and letting \( \lambda \) and \( \mu \) denote the Lagrange multiplier for the effort constraint (10) and the manipulation constraint (21), respectively, the Lagrangian of the problem is

\[
L = a_H \left( \int_{\theta_T}^{1} (\theta X - I) f(\theta)d\theta \right) - a_H \left( \int_{\theta_T}^{1} (\theta w_H + (1 - \theta) w_L) f(\theta)d\theta \right) \\
+ \lambda \left( \int_{\theta_T}^{1} (\theta w_H + (1 - \theta) w_L) f(\theta)d\theta - \int_{\theta_T}^{\theta_P} k(\theta_T, \theta_P) f(\theta)d\theta - G_a \right) \\
+ \mu \left( \theta_T w_H + (1 - \theta_T) w_L - k(\theta_T, \theta_P) \right).
\]

The necessary conditions for a solution include

\[
\frac{\partial L}{\partial w_j} \leq 0, \; w_j \geq 0, \; \text{and} \; \frac{\partial L}{\partial w_j} \cdot w_j = 0 \; \text{for} \; j = L, H,
\]

\[
\frac{\partial L}{\partial \theta_T} = 0.
\]

In the optimal solution, it holds that \( w_H > 0 \), which implies \( dL/dw_H = 0 \). We now have

\[
\frac{dL}{dw_H} = -a_H \int_{\theta_T}^{1} \theta f(\theta)d\theta + \lambda \int_{\theta_T}^{1} \theta f(\theta)d\theta + \mu \theta_T = 0 \tag{22}
\]
and
\[
\frac{dL}{d\theta_T} = -a_H (\theta_T X - I) f(\theta_T) + a_H (\theta_T w_H + (1 - \theta_T) w_L) f(\theta_T) - \lambda (\theta_T w_H + (1 - \theta_T) w_L - k(\theta_T)) f(\theta_T) + \mu (w_H - w_L - k'(\theta_T))
\]
\[= 0.\]

Rearranging (22) yields
\[
\lambda = a_H - \mu \frac{\theta_T}{\int_{\theta_T} \theta f(\theta)d\theta}.
\]

Substituting the manipulation constraint (36) into (23) yields
\[
\frac{dL}{d\theta_T} = a_H (-\theta_T X + I + k(\theta_T, \theta_P)) f(\theta_T) + \mu (w_H - w_L - k'(\theta_T, \theta_P)) = 0
\]
or
\[
a_H \frac{(X \theta_T - I - k(\theta_T, \theta_P))}{w_H - w_L - k'(\theta_T, \theta_P)} f(\theta_T) = \mu.
\]

Taking the first derivative of \(L\) with respect to \(w_L\) yields
\[
\frac{dL}{dw_L} = -a_H \int_{\theta_T}^{1} (1 - \theta) f(\theta)d\theta + \lambda \int_{\theta_T}^{1} (1 - \theta) f(\theta)d\theta + \mu (1 - \theta_T).
\]

Substituting (24) into (26) gives
\[
\frac{dL}{dw_L} = \mu \frac{\int_{\theta_T}^{1} (\theta - \theta_T) f(\theta)d\theta}{\int_{\theta_T}^{1} \theta f(\theta)d\theta},
\]
which is negative if \(\mu < 0\). If \((X \theta_T - I - k(\theta_T)) < 0\), then \(\mu < 0\) (see (25)), which implies that \(dL/dw_L < 0\) and, hence, \(w_L = 0\).

To proceed, we need to distinguish between two cases:
Case 1: Assume the optimal solution has the feature that $w_L = 0$. In this case, using (10) and (21), we have

$$w_H = \frac{G_a + \int_{\theta_T}^{\theta_P} k(\theta_T, \theta_P) f(\theta) d\theta}{\int_{\theta_T}^{1} \theta f(\theta) d\theta},$$

where

$$\theta_T w_H - k(\theta_T, \theta_P) = 0.$$

Substituting (28) into (21) gives the equilibrium shadow threshold, $\theta_T$, which satisfies

$$Q(\theta_T) \equiv \theta_T \frac{G_a + \int_{\theta_T}^{\theta_P} k(\theta) f(\theta) d\theta}{\int_{\theta_T}^{1} \theta f(\theta) d\theta} - k(\theta_T, \theta_P) = 0. \quad (29)$$

For $w_L = 0$ to be optimal, it must be that $\mu < 0$, which is satisfied if

$$\theta_T X - I - k(\theta_T, \theta_P) < 0.$$

Case 2: Assume that in the optimal solution it holds that $w_L > 0$. Then given (27), it must be that

$$\frac{dL}{d w_L} = \mu \frac{\int_{\theta_T}^{1} (\theta - \theta_T) f(\theta) d\theta}{\int_{\theta_T}^{1} \theta f(\theta) d\theta} = 0,$$

which implies that $\mu = 0$. Using (25) we have

$$\mu = a_H (\frac{\theta_T X - I - k(\theta_T)}{\theta_T X - I - k(\theta_T, \theta_P)}) f(\theta_T) = 0,$$

implying that $\theta_T X - I - k(\theta_T, \theta_P) = 0$.

In equilibrium, as shall be established in Proposition 5, the standard-setter will choose a standard $\theta_P$ that implements either $(\theta_T X - I) < 0$ or $(\theta_T X - I) = 0$ with $\theta_P > \theta_T$, which implies that $\theta_T X - I - k(\theta_T, \theta_P) < 0$. Hence, for the optimal accounting standard, case 1 is the relevant case, that is, the board of directors optimally sets $w_L = 0$ and $w_H$ is as characterized in (28).
The following lemma establishes that linking pay to performance reduces manipulation incentives and the cost of compensation.

**Lemma 1** Suppose that \( \theta_P \geq \theta_P \) and let \( \Delta \equiv w_H - w_L \). Motivating effort through a larger bonus payment \( \Delta \) and a smaller base payment \( w_L \):

(i) reduces the manager’s incentive to manipulate the report and increases the shadow threshold \( \theta_T \);

(ii) reduces the expected cost of compensating the manager, \( C \).

**Proof.** The board of directors can provide effort incentives through any base and bonus pay combination \((w_L, \Delta)\) as long as the effort incentive constraint (32) is satisfied. Given that \( w_L \) and \( \Delta \) are substitutes in providing effort incentives, the bonus \( \Delta \) required to induce \( a = a_H \) declines when the base payment \( w_L \) increases.

For \( \theta_P \geq \theta_P \), the shadow threshold is determined by the manipulation constraint (21). To study the effect of an increase in \( w_L \) on the level of manipulation, we apply the implicit function theorem to (36) to obtain:

\[
\frac{d\theta_T}{dw_L} = -\frac{1 - \frac{\theta_T}{E[\theta|\theta \geq \theta_T]}}{\Delta + \theta_T \frac{d\Delta}{d\theta_T} + K_V \pi} < 0, \tag{30}
\]

with

\[
\frac{d\Delta}{d\theta_T} = (w_L + \theta_T \Delta - k(\theta_T, \theta_P)) f(\theta_T)/ \left( \int_{\theta_T}^1 \theta f(\theta) d\theta \right) = 0.
\]

Expression (30) shows that the shadow threshold \( \theta_T \) declines with \( w_L \), increasing the non-compliance range \((\theta_T, \theta_P)\). The intuition for this result is as follows. A higher base pay, \( w_L \), which is associated with a smaller bonus, \( \Delta \), decouples the manager’s expected reward from the ultimate success of the project, making it more attractive for the manager to implement low quality projects. In the extreme, when \( w_L > 0 \) and \( \Delta = 0 \), the manager’s reward for implementing the project is independent of its
quality. As a consequence, the manager is strongly motivated to dissemble causing
the threshold $\theta_T$ to decline. In contrast, when the directors induce effort through a
larger bonus and a smaller base payment, the manager’s compensation is more closely
linked to the success of the project. This compensation plan reduces the manager’s
temptation to invest in the new project when its quality is low. Consequently, the
manager is less eager to manipulate the report, and the threshold $\theta_T$ increases.

Consider the expected compensation cost of inducing the manager to choose the
high effort. The cost of compensation, $C$, is determined by substituting the effort
constraint (10) into the compensation cost function (4), which yields
\[
C = a_H \left( G/(a_H - a_L) + \int_{\theta_T}^{\theta_P} k(\theta, \theta_P) f(\theta) d\theta \right). \tag{31}
\]

As mentioned, inducing effort through a larger base payment and a smaller bonus
increases the manager’s incentive to manipulate the report and thus reduces the
shadow threshold $\theta_T$; that is, $d\theta_T/dw_L < 0$. The increase in manipulation, in turn,
increases the cost of compensation; formally,
\[
\frac{dC}{dw_L} = -a_H k(\theta_T, \theta_P) f(\theta_T) \frac{d\theta_T}{dw_L} > 0.
\]

A change in the base payment $w_L$ affects the cost of compensation $C$ only indirectly
through the threshold $\theta_T$. Interestingly, the base payment does not directly affect the
manager’s expected compensation. To develop intuition for this observation, suppose
for a moment that the shadow threshold $\theta_T$ is held constant. The base payment
and the bonus are perfect substitutes for inducing effort. Thus, any increase in the
base payment is associated with a reduction in the bonus payment, thereby leaving
the compensation cost $C$ unchanged. In this case, any combination of $\Delta$ and $w_L$
that satisfies the effort constraint (10) is optimal. However, when $w_L$ increases, the
shadow threshold $\theta_T$ does not remain constant, but declines, as (30) shows. A lower
shadow threshold implies a higher expected cost of manipulation when the project is viable and hence makes working on the project less attractive for the manager. To maintain effort incentives, the directors have to compensate the manager for his increased manipulation cost by raising his bonus or base payment. As a result, the expected cost of inducing effort, $C$, goes up.

**Proof of Proposition 3.**

Suppose the manager uncovers a project with quality $\theta$ that lies in the range $[0, \theta_P)$. Using the definition $\Delta \equiv w_H - w_L$, the effort incentive constraint (10) can be written as

$$\Delta \equiv w_H - w_L = \frac{G_a + \int_{\theta_T}^{\theta_P} k(\theta, \theta_P)f(\theta)d\theta - \int_{\theta_T}^{1} w_L f(\theta)d\theta}{\int_{\theta_T}^{1} \theta f(\theta)d\theta}. \quad (32)$$

It follows from (8) that the manager chooses to manipulate the accounting report to obtain financing if and only if

$$w_L + \theta \Delta \geq k(\theta, \theta_P) = \pi (K_F + (\theta_P - \theta)K_V). \quad (33)$$

Holding the manager’s compensation contract $(w_H, w_L)$ fixed, the left-hand side of (33) increases in $\theta$ (as long as $w_H > w_L$) and the right-hand side decreases in $\theta$ for all $\theta \in [0, \theta_P)$. Hence, when

$$w_L + \theta_P \Delta \leq k(\theta_P, \theta_P) = K_F \pi, \quad (34)$$

the GAAP standard $\theta_P$ is sufficiently low that the manager has no incentive to deviate; hence he chooses $\theta_T = \theta_P$. Using the effort constraint (32) and recognizing that $\theta_T = \theta_P$, condition (34) can be written as

$$\theta_P G_a + \int_{\theta_P}^{1} (\theta - \theta_P) w_L f(\theta)d\theta < K_F \pi. \quad (35)$$
From Proposition 2, the board of directors sets \( w_L = 0 \) in the optimal compensation contract. As the left-hand side of (35) is less than the right-hand side when \( \theta_p \) is small and strictly increases in \( \theta_p \) without bound, there exists a non-manipulation threshold, denoted \( \theta_p \), that satisfies (35) as an equality (see (12) in Proposition 3). For all GAAP standards that satisfy \( \theta_p \leq \theta_p \), the manager complies with the standard and chooses \( \theta_T = \theta_p \).

In contrast, if \( \theta_p \geq \theta_p \), there exists a threshold \( \theta_T \in (0, \theta_p] \) that satisfies (33) as an equality:

\[
\begin{align*}
\Delta(\theta_T) = k(\theta_T, \theta_p),
\end{align*}
\]

where \( \Delta(\theta_T) \) satisfies (32) with equality. Note that for \( \theta_p = \theta_p \), condition (36) implies \( \theta_T = \theta_p \).

We show next that the threshold \( \theta_T \) that solves (36) is unique and satisfies \( \theta_T > 0 \). Substitute the effort constraint (32) into (36) to obtain the equilibrium manipulation choice condition

\[
\begin{align*}
w_L + \theta_T \Delta(\theta_T) = k(\theta_T, \theta_p),
\end{align*}
\]

As \( \theta_T \) converges to \( \theta_p \), the right hand side of (37) decreases in \( \theta_T \) and the left-hand side of (37) increases in \( \theta_T \) as long as \( w_L \) is not too large. To see this note that the derivative of the left hand side of (37) with respect to \( \theta_T \) is

\[
\begin{align*}
\Delta + \theta_T \frac{d\Delta}{d\theta_T} = \frac{G + \int_{\theta_T}^{\theta_p} k(\theta, \theta_p) f(\theta) d\theta - \int_{\theta_T}^{1} w_L f(\theta) d\theta}{\int_{\theta_T}^{1} \theta f(\theta) d\theta} + \theta_T \left( \frac{\theta_T \Delta - k(\theta_T, \theta_p) + w_L \theta_T f(\theta_T)}{\int_{\theta_T}^{1} \theta f(\theta) d\theta} \right).
\end{align*}
\]
which is positive for small $w_L$ because

$$\frac{\int_{\theta_T}^{\theta_P} k(\theta, \theta_P) f(\theta) d\theta - \theta_T k(\theta_T, \theta_P) f(\theta_T)}{\int_{\theta_T}^{1} \theta f(\theta) d\theta} > 0.$$  

Using the fact that in the optimal solution, the directors set $w_L = 0$ (see Proposition 2), it follows from the intermediate value theorem that there exists a unique $\theta_T > 0$ that satisfies the equilibrium manipulation choice condition (37).

To show that for $\theta_P > \underline{\theta}_P$ the shadow threshold $\theta_T$ lies below the GAAP standard $\theta_P$, suppose that $\theta_T = \theta_P$. Then, given the assumption $\theta_P > \underline{\theta}_P$, the left-hand side is larger than the right-hand side in (37). By lowering $\theta_T$ below $\theta_P$, the right-hand side in (36) increases by $K_V \pi$ and the left-hand side declines. Consequently, $\theta_T$ that solves (37) is less than $\theta_P$. ■

**Proof of Proposition 4:**

Consider the effect of a change in the official standard $\theta_P$ on the shadow threshold $\theta_T$. For $\theta_P \geq \underline{\theta}_P$, the shadow threshold $\theta_T$ is determined by condition (13), with $w_H^*$ satisfying (11). Solving for $\theta_T$ yields

$$\theta_T = \frac{1}{\pi (K_F + \theta_P K_V)} \left( G_a + \pi \left( K_F \theta_P + 0.5 K_V \left( 1 + \theta_P^2 \right) \right) - 0.5 \sqrt{Z_1 Z_2} \right), \quad (38)$$

where

$$Z_1 = (2G_a + \pi (1 - \theta_P) \left( K_V (1 - \theta_P) - 2K_F \right)), \quad Z_2 = (2G_a + \pi (1 + \theta_P) \left( 2K_F + K_V (1 + \theta_P) \right)).$$

Taking the first derivative of (38) with respect to $\theta_P$ yields

$$\frac{d\theta_T}{d\theta_P} = \frac{\theta_T}{(K_F + \theta_P K_V) \sqrt{Z_1 Z_2}} \left( G_a K_V + 0.5 \pi K_V^2 \left( 1 - \theta_P^2 \right) - \pi K_F \left( K_F + \theta_P K_V \right) \right).$$
The sign of $\frac{dQ}{d\theta_P}$ equals the sign of
\[
Q(\theta_P) \equiv \left( G_a K_V + 0.5 \pi K_V^2 \left( 1 - \theta_P^2 \right) - \pi K_F \left( K_F + \theta_P K_V \right) \right) . \tag{39}
\]

Observe that
\[
\frac{dQ(\theta_P)}{d\theta_P} = -\pi K_V \left( K_F + \theta_P K_V \right) < 0.
\]

Using (12), the non-manipulation threshold can be stated as
\[
\theta_P = \frac{1}{\pi K_F} \left( \sqrt{\pi^2 K_F^2 + G_a^2 - G_a} \right), \tag{40}
\]
which is nonnegative since $K_F \geq 0$. As a side note, recall from Proposition 3 that for $\theta_P = \theta_P$, we obtain $\theta_T = \theta_P$. We can rewrite (38) as
\[
\theta_T = \theta_P - \frac{0.5}{\pi (K_F + \theta_P K_V)} \left[ \sqrt{Z_1 Z_2 - 2 G_a - \pi K_V \left( 1 - \theta_P^2 \right)} \right]. \tag{41}
\]
For $\theta_P = \theta_P$, the term in square brackets in (41) is zero, confirming that $\theta_T = \theta_P$.

Substituting (40) into (39) yields
\[
Q(\theta_P) = \left( K_V G_a - \pi K_F^2 \right) \left( K_V \theta_P + K_F \right) / K_F,
\]
which is negative if $\tau \equiv (K_V G_a - K_F^2 \pi) < 0$ and positive if $\tau > 0$.

**Case** $\tau < 0$. For $\tau < 0$, starting from the non-manipulation threshold $\theta_P = \theta_P$, an increase in $\theta_P$ reduces $\theta_T$, $\frac{d\theta_T}{d\theta_P} < 0$, since $Q(\theta_P) < 0$. Given $\frac{dQ(\theta_P)}{d\theta_P} < 0$, we obtain $\frac{d\theta_T}{d\theta_P} < 0$ for all $\theta_P \geq \theta_P$.

**Case** $0 < \tau < \pi K_F K_V$. For $\tau > 0$, we obtain $\frac{d\theta_T}{d\theta_P} > 0$ when $\theta_P = \theta_P$ since $Q(\theta_P) > 0$. There is a unique interior standard, denoted $\hat{\theta}_P \in (\theta_P, 1)$, for which $Q(\hat{\theta}_P) = 0$ is satisfied in condition (39). Standard $\hat{\theta}_P$ can be stated as
\[
\hat{\theta}_P = \frac{\sqrt{\pi \left( 2 K_V G_a - \pi \left( K_F^2 - K_V^2 \right) \right)}}{\pi K_V} - \frac{K_F}{K_V} \tag{42}
\]
\[
= \frac{\sqrt{\pi \left( \tau + K_V G_a + \pi K_F^2 \right)}}{\pi K_V} - \frac{K_F}{K_V}.
\]
The standard $\hat{\theta}_P$ lies in the interior of $(\theta_P, 1)$ because (i) condition $\tau > 0$ ensures $\hat{\theta}_P > \theta_P$ and (ii) condition $\tau < \pi K_F K_V$ ensures $\hat{\theta}_P < 1$. To see (i) recall that for $\tau > 0$ we obtain $Q(\theta_P) > 0$. Because $\frac{dQ(\theta_P)}{d\theta_P} < 0$ and $Q(\hat{\theta}_P) = 0$, it follows that $\hat{\theta}_P > \theta_P$. To see result (ii) note that for $\theta_P = 1$, we obtain $Q(1) \equiv \tau - \pi K_F K_V$ (from (39)). Because $Q(1) < 0$ for $\tau < \pi K_F K_V$ and because $Q(\hat{\theta}_P) = 0$ and $\frac{dQ(\theta_P)}{d\theta_P} < 0$, it follows that $\hat{\theta}_P < 1$. Since there exists an interior level $\hat{\theta}_P$ for which $Q(\hat{\theta}_P) = 0$ and since $\frac{dQ(\theta_P)}{d\theta_P} < 0$, it follows that $\frac{d\theta_T}{d\theta_P} > 0$ for all $\theta_P \in (\hat{\theta}_P, \theta_P)$ and $Q(\theta_P) < 0$ and hence $\frac{d\theta_T}{d\theta_P} < 0$ for all $\theta_P \in (\hat{\theta}_P, 1)$.

If the standard setter chooses $\theta_P = \hat{\theta}_P$, the shadow threshold is given by

$$
\theta_T(\hat{\theta}_P) = \frac{\sqrt{\pi \left(2K_V G_a - \pi (K^2_F - K^2_V)\right)} - \sqrt{\pi \left(2G_a K_V - \pi K^2_F\right)}}{K_V \pi}
$$

$$
= \frac{\sqrt{\pi \left(K_V G_a + \pi K^2_V + \tau\right)} - \sqrt{\pi \left(G_a K_V + \tau\right)}}{K_V \pi}.
$$

**Case** $\tau > \pi K_F K_V$. From the discussion of the previous case, it immediately follows that $\frac{d\theta_T}{d\theta_P} > 0$ for all $\theta_P > \hat{\theta}_P$ if $\tau > \pi K_F K_V$.

For all three cases, an increase in the GAAP standard $\theta_P$ increases the manipulation range $(\theta_T, \theta_P)$ because $\frac{d\theta_P}{d\theta_P} < 1$. To see this, substitute (15) into $\frac{d\theta_P}{d\theta_P} < 1$, which yields

$$
-\theta_T K_F \pi f(\theta_P) - \theta_T \int_{\theta_T}^{\theta_P} K_V \pi f(\theta) d\theta < w^*_H \int_{\theta_T}^{1} \theta f(\theta) d\theta.
$$

This completes the proof. ■

**Proof of Proposition 5.**

Consider part (i). Suppose that $\theta_P = \theta_P = \theta_T$. Since $\theta_P < \theta_F$ (by assumption (14)) it holds that $(\hat{\theta}_P, X - I) < 0$. From Proposition 4, for $\tau \equiv (K_V G_a - K^2_F \pi) < 0$ an increase in the GAAP standard reduces $\theta_T$ for all $\theta_P \geq \theta_P$, that is, $d\theta_T/d\theta_P \leq 0$. 

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Thus, for \( \tau < 0 \), we have

\[
\frac{dU_W(\theta_P = \theta_p)}{d\theta_p} = -a_H \frac{d\theta_T}{d\theta_P} (\theta_P X - I) f(\theta_P) < 0, \tag{43}
\]

with \( \frac{d\theta_T}{d\theta_P} < 0 \) and \( (\theta_P X - I) < 0 \), and the standard setter optimally sets \( \theta_P = \theta_p \).

Consider part (ii). When \( \tau > 0 \), starting from \( \theta_P = \theta_p \), an increase in the GAAP standard increases \( \theta_T \), that is, \( d\theta_T/d\theta_P > 0 \). Thus, for \( \tau > 0 \), the expression in (43) is positive and, assuming an interior solution, the optimal standard is determined by setting (20) equal to zero and solving for \( \theta_P : \)

\[
\frac{dU_W}{d\theta_P} = -a_H (\theta_T X - I) f(\theta_T) \frac{d\theta_T}{d\theta_P} = 0. \tag{44}
\]

From Proposition 4, for \( 0 < \tau < \pi K_F K_V \) there is a unique interior threshold \( \hat{\theta}_P \in (\theta_p, 1) \) such that \( \frac{d\theta_T}{d\theta_P} > 0 \) for all \( \theta_P < \hat{\theta}_P \), \( \frac{d\theta_T}{d\theta_P} = 0 \) for \( \theta_P = \hat{\theta}_P \), and \( \frac{d\theta_T}{d\theta_P} < 0 \) for all \( \theta_P > \hat{\theta}_P \). Further, we know that \( \frac{d\theta_T}{d\theta_P} > 0 \) for all \( \theta_P \in [\theta_P, 1] \) if \( \tau > \pi K_F K_V \). The standard setter therefore increases the GAAP standard until (whichever occurs first):

(i) First-best is implemented, \( (\theta_T X - I) = 0 \). In this case, it must be that \( \frac{d\theta_T}{d\theta_P} \geq 0 \).

(ii) A further increase in \( \theta_P \) can no longer increase \( \theta_T \), that is, \( \frac{d\theta_T}{d\theta_P} = 0 \). In this case, we have \( (\theta_T X - I) < 0 \). From Proposition (4), this solution can occur when \( 0 < \tau < \pi K_F K_V \). The optimal GAAP standard is then determined by \( \theta_P = \hat{\theta}_P < 1 \), which is characterized in (42).

(iii) A further increase in \( \theta_P \) is not possible because \( \theta_P = 1 \). In this case, we have again \( (\theta_T X - I) < 0 \). From Proposition (4), this solution can only occur when \( \tau > \pi K_F K_V \).

Proof of Propositions (6).

Consider part (i). For \( \tau \equiv (K_V G_a - K_F^2 \pi) < 0 \), Proposition 5 established that the optimal GAAP standard is \( \theta_P = \theta_p \), which is determined by (12). Rearranging
(12) yields
\[
\frac{\theta_P}{1} \int_{\theta_P}^1 G_a \theta f(\theta) d\theta - K_F \pi = 0. \tag{45}
\]

Applying the implicit function theorem to this expression gives
\[
\frac{d\theta_P}{d\pi} = \frac{K_F \left( \int_{\theta_P}^1 \theta f(\theta) d\theta \right)^2}{G_a \left( \int_{\theta_P}^1 \theta f(\theta) d\theta + f(\theta_P)\theta_P^2 \right)} > 0.
\]

Alternatively, using the expression in (40) we obtain:
\[
\frac{d\theta_P}{d\pi} = \frac{G_a}{\pi^2 K_F \sqrt{\pi^2 K_F^2 + G_a^2}} \left( \sqrt{\pi^2 K_F^2 + G_a^2} - G_a \right) > 0.
\]

Consider part (ii). For \( \tau > 0 \), Proposition 5 established that the optimal GAAP standard \( \theta_P \) is determined either by \((\theta_T(\theta_P^*)X - I) = 0 \) and \( \frac{d\theta_T(\theta_P^*)}{d\theta_P} > 0 \); or \( (\theta_T(\theta_P^*)X - I) < 0 \) and \( \frac{d\theta_T(\theta_P^*)}{d\theta_P} = 0 \); or \( (\theta_T(\theta_P^*)X - I) < 0 \) and \( \theta_P^* = 1 \).

When the optimal GAAP standard is characterized by \((\theta_T(\theta_P)X - I) = 0 \) and \( \frac{d\theta_T(\theta_P)}{d\theta_P} > 0 \), the shadow threshold equals the first-best threshold \( \theta_T = \theta_{FB} \). Holding \( \theta_P \) constant, applying the implicit function theorem to (13) yields
\[
\frac{d\theta_T}{d\pi} = -\frac{\theta_T \frac{\partial w_H}{\partial \theta_T} - (K_F + (\theta_P - \theta_T)K_V)}{w_H + \theta_T \frac{\partial w_H}{\partial \theta_T} + \pi K_V}
\]
\[
= \int_{\theta_T}^{1} \theta(K_F + (\theta_P - \theta_T)K_V) f(\theta) d\theta - \int_{\theta_T}^{\theta_P} \theta_T(K_F + (\theta_P - \theta_T)K_V) f(\theta) d\theta
\]
\[
= (w_H^* + \pi K_V) \int_{\theta_T}^{1} \theta f(\theta) d\theta > 0.
\]

(Recall that \( \frac{\partial w_H}{\partial \theta_T} = 0 \) in equilibrium.) Condition (46) shows that the threshold \( \theta_T \) increases in enforcement \( \pi \). Thus, an increase in \( \pi \) pushes the threshold \( \theta_T \) above the first-best level, \( \theta_T > \theta_{FB} \). Since \( \frac{d\theta_T(\theta_P)}{d\theta_P} > 0 \), the standard setter optimally reduces the GAAP standard to lower \( \theta_T \) and to restore first-best investment. Thus, we obtain \( d\theta_P^*/d\pi < 0 \).
When the solution is characterized by \((\theta_T(\theta_P^*)X - I) < 0\) and \(\frac{d\theta_T^*(\theta_P^*)}{d\theta_P} = 0\), the GAAP standard equals \(\theta_P = \tilde{\theta}_P\), which is determined in (42). Taking the first derivative with respect to \(\pi\) gives:

\[
\frac{d\tilde{\theta}_P}{d\pi} = -\frac{1}{\pi^2 \tilde{\theta}_P K_V + K_F} G_a < 0.
\]

Finally, when the optimal GAAP standard is characterized by \((\theta_T(\theta_P^*)X - I) < 0\) and \(\theta_P^* = 1\), we have a corner solution and a marginal change in \(\pi\) has no effect on \(\theta_P^*\). ■
Date 1 - Contracting and effort
Board of directors contracts with an effort-averse manager to develop a project.
The manager discovers a viable project with probability $a_i$, where $i \in \{L, H\}$ and $L < H$. The manager’s cost of providing effort $a_i$ is $g(a_L) = 0$ and $g(a_H) = G > 0$.
A viable project is successful and generates cash flow of $X > 0$ with probability $\theta$; a non-viable project does not generate any cash flow.

Date 2 – Manager reporting
Manager observes the project quality $\theta$ and issues a report $R_i$ to investors. Standard setter specifies a GAAP standard $\theta_P$ such that for all $\theta \in (0, \theta_P)$ the unfavorable report $R_L$ is mandated and for all $\theta \in [\theta_P, 1]$ a favorable report $R_H$ is mandated.
The manager may dissemble and report $R_H$ when $\theta \leq \theta_P$ at a personal expected cost of $k(\theta, \theta_P) = \pi(K_F + |\theta - \theta_P| K_V)$.

Date 3 - Investment decision
Investors decide whether to finance continuation of the project given the report $R_i$ in return for a promised distribution of $D$. Investors inject capital $I + w_L$.

Date 4 - Outcome
The project outcome $X$ is realized.
Board pays the manager $w_H$ if the firm pursues the new project and it succeeds or $w_L$ if the firm pursues but it fails.
Distribution $D$ to investors is made.