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Career Concerns, Investment, and Management Forecasts

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Career Concerns, Investment, and Management Forecasts

ABSTRACT

A firm manager is concerned about both the firm value and the market assessments of his abilities. When investing in a project, he has private knowledge of his project-related ability that interacts with the project investment, and his general ability that produces a cash flow independent of the project cash flow. The concerns about the general (project-related) ability assessment create a signaling incentive to decrease (increase) investment. In the presence of underinvestment (overinvestment), higher-quality earnings information reduces (improves) equilibrium efficiency. When the manager issues an earnings forecast as an additional signaling device, the forecast is upwardly biased, and the equilibrium investment is smaller than that without a forecast. The latter is because the signaling incentive to decrease investment is strengthened. When the manager's concerns about the general ability assessment are relatively large, he is better off by committing to no forecast. Novel empirical predictions about investment and earnings forecast emerge.

Keywords: Career concerns; Investment; Earnings forecast; Efficiency

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I. INTRODUCTION

Prompted by Fama (1980) and Holmstrom (1982), numerous studies have examined how managers' career concerns affect their decision making in a variety of contexts. Capital investment is one of the most important decisions, and managers' firm/industry-specific expertise improves investment profitability. Managers also contribute to firms through general management skills and talents that are not directly related to a particular project or investment. Typically, managers have both kinds of ability in varying degrees, and firm characteristics determine the demand for a particular set of manager abilities (Terviö 2008; Lazear 2009). When the market has imperfect information about managers' investment-related and/or general abilities, it uses their investment decisions or firm performance indicators, e.g., earnings, to assess manager abilities. Because this assessment affects their career prospects, managers have incentives to favorably influence it. These incentives, however, may produce undesirable outcomes, for example, suboptimal investment in a project. In this respect, no prior study seems to have examined career-concerned managers' investment when they have *two* kinds of ability—one that interacts with project investment and the other that does not—which we respectively refer to as *project-related ability* and *general ability* throughout this study.

Also noteworthy is that relatively little attention has been paid to the effects of managerial career concerns on corporate disclosure. Beyer, Cohen, Lys, and Walther (2010, p. 306) note, "our understanding of how management's career concerns affect their disclosure strategies is still limited, a fact previously noted in the survey by Healy and Palepu (2001)." We specifically note that studies examining the effects of career concerns on the attributes of earnings forecasts (e.g., bias, accuracy, and frequency) are sparse, and that a more basic question regarding the effect on the decision whether to issue a forecast has been largely unaddressed. In addition, because investment affects future earnings, it could also affect management earnings forecasts. Thus, a further question is: how do career concerns simultaneously affect investment and earnings forecast decisions? This study seeks to fill these gaps in the literature.

To address the abovementioned questions, we present a model that has the following elements. A firm's total future cash flow has two random components (plus white noise). The first is a project's cash flow. Investment in the project and the firm manager's project-related ability (e.g., expertise in the project technology and management) complement each other in generating the project cash flow (à la Milgrom and Roberts 1990, 1995). Independently, the firm has an additional cash flow produced by the manager's general ability (e.g., administration skills, leadership, communication and interpersonal skills, and business/political networks that help him better manage the firm). When the manager makes a publicly observable investment in the project, he privately knows his project-related and general abilities. The financial reporting system of the firm generates a public report, which is a noisy estimate of the firm's total future cash flow. This report is referred to as (accounting) earnings, and its informational quality (measured by the precision of the noise contained in it) is referred to as earnings quality. The manager may issue a forecast of earnings, in which case if realized earnings differ from the forecast, he incurs a cost of forecast error. In making investment and forecast decisions, the manager seeks not only to increase the market value of the firm, but also to favorably influence outsiders' assessment of his abilities, thereby improving his career prospects. Specifically, regarding the latter, he cares about a weighted average of the market assessments of his project-related and general abilities, where the weight he places on the assessment of general ability reflects the market demand for this ability relative to that for project-related ability. Both the market valuation of the firm and ability assessments are based on the investment in the project, the earnings forecast (if issued), and the subsequent realization of earnings. In this setup, our focus is on the manager's incentives to use the investment and earnings forecast as signaling devices to improve his career prospects.

We obtain three main results. First, when the manager does not issue a forecast, there is a *trade-off* in the role of investment as a signaling device. Greater investment has a positive effect on the market assessment of the manager's project-related ability. This creates an incentive to increase investment, similar to the signaling incentive in the model of Bebchuk and Stole (1993). On the other hand, there is a countervailing incentive to decrease investment. This is because greater investment also has a negative effect on the market assessment of the manager's general ability that produces a cash flow independent of the project cash flow. Specifically, when earnings are realized, the market infers this ability by subtracting its expectation of the project cash flow from earnings. Because greater investment increases the project's expected cash flow, increasing investment negatively affects the general ability assessment. These two opposing signaling incentives create a tension, and this tension characterizes the manager's equilibrium investment.

Several corollaries follow. Equilibrium investment decreases with the weight the manager assigns to the market assessment of general ability relative to that of project-related ability. Thus, compared with the first-best case in which no information asymmetry regarding manager abilities exists, an efficiency loss arises from underinvestment (overinvestment) when the manager is highly concerned about the assessment of his general (project-specific) ability. We also show that equilibrium investment decreases with earnings quality and prior uncertainty about general ability. This is because both factors make the general ability assessment more sensitive to investment, and as a result, the manager's signaling incentive to reduce investment is strengthened. In the presence of an overinvestment (underinvestment), an increase in the concerns about the general ability assessment increases (decreases) equilibrium efficiency. This is because, as explained earlier, the manager with greater concerns about the general ability assessment invests less, which mitigates (amplifies) the overinvestment (underinvestment). In the same vein, higher-quality earnings increase (decrease) equilibrium efficiency in the presence of an overinvestment (underinvestment).

Next, when the manager issues an earnings forecast as an additional signaling device, he has a stronger incentive to decrease investment. This leads to our second main result that, ceteris paribus, the equilibrium investment with an earnings forecast is less than that without a forecast. The underlying intuition is as follows. The mana ger has an incentive to inflate the market expectation of future earnings and thereby favorably affect both the market valuation of the firm and the assessment of his general ability. Hence, he issues an upwardly biased forecast, relative to his private expectation of earnings. Next, when inferring the manager's general ability, the market does not use earnings; instead, it directly subtracts the project's expected cash flow (which increases with investment) from the total expected cash flow based on the forecast. This means that the market assessment of general ability is only based on the information contained in the investment and forecast. As a result, compared with the case of no forecast, reducing investment is more effective in improving the general ability assessment. This strengthens the manager's incentive to decrease investment when he issues a forecast than when he does not.

The equilibrium forecast bias increases when the manager is more concerned about the market assessment of his general ability, whereas it decreases when earnings quality is high. The reason for the latter is that when earnings are more precise about the firm's total cash flow, the market valuation of the firm relies more on earnings information than the forecast of earnings. Given the cost of forecast error, this weakens the incentive to issue a biased forecast. We also show that the equilibrium efficiency in the presence of a forecast increases with earnings quality. This contrasts with a potentially negative effect of earnings quality on the equilibrium efficiency in the absence of a forecast (see our results on ex ante efficiencies in Sections V and VI for details).

Last, we examine whether the manager is better off by making a commitment to issue a forecast, prior to knowing his abilities. Our ex ante commitment perspective is motivated by the empirical evidence that firms tend to have a policy on whether to provide earnings guidance.[1] The manager is better off by committing to a no-forecast policy if and only if his concerns about the general ability assessment exceed a certain threshold. The key economic force behind this result is that if he issues a forecast in this case, he suffers from a large efficiency loss from underinvestment as well as a large cost of forecast error on average. By committing to no forecast, he can reduce investment inefficiency and eliminate the cost of forecast error. The converse is true if the manager is highly concerned about the market assessment of his project-related ability.

To our best knowledge, our results that relate managerial career concerns to investment and earnings forecast decisions are new in the literature. In the real world, as modeled in the present study, managers have both general and specialized management skills (in varying degrees), and these skills are, to a certain extent, transferrable across firms and valued differently depending on the particular needs of a firm (Lazear 2009).[2] In this respect, the manager in our model who has relatively large concerns about the market assessment of his general (project-related) ability can be viewed as a generalist (specialist). Under this classification, we provide novel empirical predictions about the effects of career concerns on investment and earnings forecast decisions. First, regardless of the issuance of earnings forecasts, generalists tend to invest less in new projects, and they are more likely to choose a no-forecast policy. Second, for firms providing forecasts, (i) generalists are likely to issue forecasts with greater bias, and (ii) the bias is expected to be smaller when the firms have higher-quality earnings. Third, for firms not providing forecasts, we predict that those with higher-quality earnings are expected to invest less. In addition, higher-quality earnings (which reduce investment) improve investment efficiency of firms that have specialists (who tend to overinvest), but reduce investment efficiency of firms that have generalists (who tend to underinvest). Prior studies (e.g., McNichols and Stubben 2008; Biddle, Hilary, and Verdi 2009)

[1] Empirical findings suggest that whether to provide earnings forecasts is a sticky decision. That is, some firms are regular providers, whereas others do not issue any forecasts. See, e.g., Bushee, Matsumoto, and Miller (2003), Hirst, Koonce, and Venkataraman (2008), Chen, Matsumoto, and Rajgopal (2011), Choi, Myers, Zang, and Ziebart (2011), Houston, Lev, and Tucker (2010), Cai, Dhaliwal, Kim, and Pan (2014), and Aghamolla, Corona, and Zheng (2021).

[2] Murphy and Zábojník (2007) and Custodio, Ferreira, and Matos (2013) find that the market demand for general versus specialized skills varies across firms and industries, and show evidence on recent trends of increasing demand and pay premiums for generalists. There have been debates over the values of generalists versus specialists and the effects of economic and/or technological environment changes on their compensation, which are beyond the scope of this study; see Murphy and Zábojník (2004, 2007), Custodio and Metzger (2013) and Custodio et al. (2013).

document a positive effect of earnings quality on investment efficiency. Our predictions thus refine this "overall" positive effect, based on whether managers are generalists or specialists.

Below, Section II reviews related studies and highlights the differences and contributions of our study to the literature. Section III presents the basic model. Section IV provides the first-best case that serves as a benchmark in our analysis. Section V examines the manager's investment decision when he provides no earnings forecast. Section VI extends the basic model to the case in which the manager issues an earnings forecast. Section VII examines the manager's commitment to provide an earnings forecast. Section VIII concludes the paper. Appendix A discusses some of our modeling choices and relates them to future research opportunities. Appendix B provides all proofs.

II. LITERATURE REVIEW AND CONTRIBUTIONS

This paper contributes to the literature on career concerns by examining a career-concerned manager's investment and forecast decisions when he is privately informed of his abilities that differently contribute to firm performance. Narayanan (1985) notes that managers may select inefficient projects to boost short-term performance at the expense of long-term shareholder value. No prior study seems to have examined managers' incentives to signal their project-related and general abilities through investment. Although Bebchuk and Stole (1993) do not explicitly consider career concerns, one can interpret the project profitability in their model as a manager's project-related ability. In that case, their results would imply overinvestment due to a signaling incentive; this is reminiscent of Spence (1973). By contrast, in the presence of concerns about the market assessment of general ability, we show that underinvestment can be an equilibrium outcome. Given the recent trend in the CEO labor market that emphasizes general management skills (Murphy and Zábojník 2004, 2007; Custodio et al. 2013), our results provide new insights.[3]

This paper also contributes to the literature on earnings forecasts. As mentioned in the introduction, only a few studies have examined the effects of managers' career concerns on forecast issuance and, if issued, the effects on forecast attributes.[4] In addition, to our best knowledge,

[3] There exists a large body of literature that examines indirect communication of private information through signaling. Signaling devices include a retained fraction of firm ownership (Leland and Pyle 1977), capital structure (Ross 1977; Myers and Majluf 1984), investment (Bebchuk and Stole 1993), and dividend (Bhattacharya 1979; Miller and Rock 1985), along with combinations of multiple devices, e.g., investment and dividend (Kaplan and Pérez-Cavazos 2021). In our model, signaling occurs through either investment or a combination of investment and an earnings forecast.

[4] See Hirst et al. (2008) for a review of this literature. Shaikh (2015) finds that CEOs are less likely to issue earnings

no research has investigated how career concerns could affect the interaction between investment and forecast decisions in signaling contexts. The present study, by contrast, addresses this question. Our results on forecast bias and resulting efficiency also provide new insights. Furthermore, our result on forecast issuance extends Trueman (1986). Specifically, we show that while the manager caring more about the market assessment of project-related ability is more likely to issue a forecast, which is similar to Trueman's result, this likelihood is reversed if the manager cares more about the general ability assessment. Two recent studies are also related to our paper. Feller and Schäfer (2019) study financial reporting bias when managers are concerned about reputations in both the capital and labor markets. In a costless signaling setting, Aghamolla et al. (2021) examine managerial incentives to make a commitment to provide earnings forecasts to signal their abilities.

This study provides new results on financial reporting quality and investment efficiency in the presence of asymmetric information. As is typical in signaling models, the manager's signaling incentives decrease investment efficiency. We show that the effects of earnings quality on investment efficiency critically depend on (i) whether an earnings forecast is issued, and (ii) whether the manager is primarily concerned about the market assessment of project-related or general ability. These results produce empirical predictions that are not available from prior studies.

Last, there is a strand of literature that examines career concerns in moral hazard settings. Holmstrom and Ricart i Costa (1986) show that managerial career concerns may lead to goal incongruity in capital management. Gibbons and Murphy (1992) show that it is optimal to provide strong explicit incentives through compensation contracts if managers have weak implicit (career-related) effort incentives. Dewatripont, Jewitt, and Tirole (1999) generalize Holmstrom (1982) and compare the effects of information structures on effort incentives. In the mutual fund industry, Chevalier and Ellison (1999) find that young managers have different career-related incentives because they are more likely to be fired for poor performance and for taking bold actions. Our result that managers may under- or overinvest depending on their career concerns shares the spirit of Pae (2021). However, his model differs from ours in two important ways: (i) a manager invests

forecasts when their labor market options are limited. Pae, Song, and Yi (2016) find that managers with greater career concerns tend to provide downward earnings guidance. Earnings forecasts are a form of voluntary disclosure through which managers communicate private information. In the disclosure literature, Nagar (1999) examines how career concerns can affect disclosure incentives. Kothari, Susan, and Wysocki (2009), Baginski, Campbell, Hinson, Koo (2018), and Ali, Li, and Zhang (2019) report that managers may delay the disclosure of bad news due to career concerns. Without considering career concerns, Fischer and Verrecchia (2000), Beyer (2009), and Heinle and Verrecchia (2016) examine biases in earnings forecasts or in reported earnings.

effort that is unobservable to outsiders, and (ii) the manager's ability only pertains to general skills, about which there is no information asymmetry. In this setup, the focus of Pae (2021) is to examine how earnings quality is related to career concerns. He shows that, under certain conditions, a less career-concerned manager who underinvests effort makes a commitment to provide high-quality earnings information because it creates a counter-balancing incentive to increase effort. On the other hand, a highly career-concerned manager who overinvests effort lowers earnings quality to reduce effort overinvestment. In contrast to Pae (2021), earnings quality is exogenous in our model. Our focus is on a manager's incentives to use observable capital investment and earnings forecast as signaling devices in the presence of information asymmetry regarding two types of ability.[5]

III. BASIC MODEL

We present a single-period model that has three dates. All parties are risk-neutral, and the risk-free interest rate is zero. At date 1, a firm manager, who privately knows his abilities that affect the firm's future cash flows, makes a publicly observable investment in a project. The total cash flow of the firm is realized at date 3, and it has two random components (plus white noise, as specified below). The first component, referred to as a project cash flow, is determined by the investment in the project, I, and the project's profitability, $p \equiv m + \mu_p$, where $m > 0$ is a constant and μ_p is the manager's project-related ability. This ability is attributed to his expertise and knowledge that interact with investment I in generating a return from the project. Given p and I, the project cash flow is $pR(I)$, where R is an increasing function. Let cI^2 be the cost of investment, where $c > 0$ is a constant. The second component of the total cash flow is produced by the manager's general ability, denoted as μ_g, such as administration experience, leadership, interpersonal skills, and business networks with which he can better manage the firm. To save notation, we also denote the cash flow produced by the manager's general ability as μ_g.

Ex ante, μ_p and μ_g are independent random variables, $\mu_p \sim N(0, h_p^{-1})$ and $\mu_g \sim N(0, h_g^{-1})$, whose realizations are known only to the manager before he makes an investment I. In addition, they are unverifiable and cannot be disclosed credibly. Note that the manager's private knowledge of his project-related ability μ_p is the same as that of project profitability $p \equiv m + \mu_p$ because m is

[5] Appendix A discusses how the main results of our study would be affected if investment were unobservable. In the agency literature, several studies have examined the effect of managerial career concerns on contractual efficiency; e.g., Christensen, Feltham, and Sabac (2005), Autrey, Dikolli, and Newman (2007), Arya and Mittendorf (2011, 2015), and Christensen, Frimor, and Sabac (2020).

a publicly known constant. In sum, given (μ_p, μ_g) and I, the total future cash flow of the firm is

$$z \equiv [pR(I) + \mu_g] + \epsilon_z = \mu_z + \epsilon_z \sim N(\mu_z, h_z^{-1}), \tag{1}$$

where $\mu_z \equiv pR(I) + \mu_g$, and $\epsilon_z \sim N(0, h_z^{-1})$ is white noise realized at date 3.

At date 2, the financial reporting system of the firm generates a public report

$$y \equiv z + \epsilon_y, \tag{2}$$

where $\epsilon_y \sim N(0, q^{-1})$ is white noise. Given that y is an estimate of the firm's total future cash flow, we call it accounting earnings or, for brevity, earnings, and refer to the precision of the noise in y, i.e., q, as earnings quality. Based on investment I and earnings y, a competitive market value of the firm is determined, and manager abilities are assessed. At date 3, z is realized according to (1).

It remains to specify the manager's objective at date 1. Let η be the public information available at date 2. With private knowledge of (μ_p, μ_g) at date 1, the manager invests I to maximize

$$\Pi(\mu_p, \mu_g, I) \equiv E[V(\eta) + wA_g(\eta) + (1 - w)A_p(\eta) \mid \mu_p, \mu_g] - cI^2, \tag{3}$$

where (i) $V(\eta) \equiv E[z \mid \eta]$ is the market value of the firm, (ii) $A_p(\eta) \equiv E[\mu_p \mid \eta]$ and $A_g(\eta) \equiv E[\mu_g \mid \eta]$ are the market assessments of the manager's project-related and general abilities, respectively, and (iii) $w \in [0, 1]$ is a constant. That is, the manager is concerned not only about the firm value, $V(\eta)$, which we implicitly assume to be related to his current compensation in the firm, but also about the ability assessments, $A_g(\eta)$ and $A_p(\eta)$, which affect his career prospects and future payoff. We refer to the latter concerns as his career concerns. The weight he places on $A_g(\eta)$, i.e., w, reflects the market demand for his general ability μ_g relative to that for his project-related ability μ_p. For example, if this manager's project-related ability has lesser synergies with the projects/technologies of outside firms, it is likely to be less demanded. In this case, the manager cares more about the market assessment of his general ability that produces a cash flow independent of firm-specific projects/technologies, and thus places a relatively large weight on $A_g(\eta)$. Otherwise, his project-related ability is likely to be highly demanded, prompting him to assign a relatively large weight to $A_p(\eta)$. The model structure is common knowledge, and Figure 1 depicts the timeline.

[Insert Figure 1 about here.]

Before proceeding, we provide a few remarks on our modeling choices (see Appendix A for more remarks). First, the manager's project-related and general abilities, μ_p and μ_g, both have a zero mean. This is for simplicity. In reality, a manager may on average have a high project-related ability but a low general ability. We could capture this case by adding location parameters $E[\mu_p] > E[\mu_g]$ to the prior distribution of (μ_p, μ_g), and doing so would not qualitatively affect our results. In contrast, as will be shown, prior uncertainty about manager abilities, i.e., h_p^{-1} and h_g^{-1}, plays a key role in the analysis of signaling incentives. We also assume that μ_p and μ_g are independent, and thus the two cash flow components, $pR(I)$ and μ_g, are unrelated. In reality, manager abilities may be related due to potential spillovers.[6] For example, although not considered in our model, suppose that the firm has ongoing projects and invests in a new project for growth. In this case, μ_p is the manager ability to identify growth opportunities, choose an appropriate project, and increase its profitability, and μ_g represents the ability to improve the operating performance of the existing projects, e.g., assets in place. In the presence of synergies between the ongoing and new projects, a manager who manages ongoing projects well is more likely to have high performance in the new project, or vice versa. This synergistic effect can be captured in our model by using a positive correlation between manager abilities. Despite some changes in the analysis, our main results qualitatively remain the same (see Appendix A for further details).

Second, in the objective function, the manager is assumed to be equally concerned about the firm value, $V(\eta)$, and the market assessment of his abilities, $wA_g(\eta) + (1 - w)A_p(\eta)$. Again, this is to simplify analysis and sharpen intuition. As will be clear, most of our main results are driven by the *relative* importance between $A_g(\eta)$ and $A_p(\eta)$ in the manager's payoff, represented by w. The current model can be easily extended to a case in which the manager places different weights on $V(\eta)$ and $wA_g(\eta) + (1 - w)A_p(\eta)$. Appendix A provides a detailed discussion on this extension.

Last, the normality of (μ_p, μ_g) implies that project profitability $p \equiv m + \mu_p \sim N(m, h_p^{-1})$ can be negative. This necessitates us to allow negative investment and interpret it as divestment (similar to, e.g., Kanodia et al. 2005).[7] However, what matters to our analysis is not whether investment is positive or negative, but that the manager invests more when the project is more profitable, i.e., the equilibrium investment increases with p, which is intuitive. Therefore, to facilitate discussion, we additionally assume that the mean of p, i.e., m, is sufficiently large relative to its variance, in which case the probability that $p < 0$ is negligible.

[6] We thank an anonymous reviewer's comment on this matter. Although the contexts are different, our modeling choice is similar to that of Friedman, Hughes, and Michaeli (2021), whereas Gao and Liang (2013) assume perfectly correlated cash flows.

[7] If investment were restricted to be nonnegative, equilibrium investment would be zero for a positive measure of p. This creates tractability problems, especially in the analysis of ex ante efficiencies because of censored distributions of equilibrium investments in the space of (μ_p, μ_g). To avoid similar problems, some prior studies (e.g., Liang and Wen 2007; Dye and Sridhar 2008; Corona, Huang, and Hwang 2021) use approximation in computing ex ante payoffs. In contrast, allowing negative investment, we do not use such approximation.

IV. FIRST-BEST CASE

We start with the first-best case in which manager abilities (μ_p, μ_g) are public information. At date 2, given publicly available information $\eta = (\mu_p, \mu_g, I, y)$, the market value of the firm is

$$V(\eta) = E[z \mid \mu_p, \mu_g, I, y] = (1-\beta)E[z \mid \mu_p, \mu_g, I] + \beta y = (1-\beta)\mu_z + \beta y, \tag{4}$$

where $\beta \equiv \frac{h_z^{-1}}{h_z^{-1}+q^{-1}} \in (0, 1)$. That is, $V(\eta)$ is a weighted average of $\mu_z \equiv pR(I) + \mu_g$ (which is the expectation of total cash flow z conditional on μ_p, μ_g, and I) and earnings y (which is a noisy signal about z). When y is more precise, the weight placed on y increases, i.e., β increases with q. Because μ_p and μ_g are publicly known in the first-best case, the assessments of manager abilities are

$$A_g(\eta) = \mu_g \text{ and } A_p(\eta) = \mu_p. \tag{5}$$

At date 1, anticipating (4) and (5), the manager invests I to maximize

$$\begin{aligned}\Pi(\mu_p, \mu_g, I) &= E[V(\eta) + wA_g(\eta) + (1-w)A_p(\eta) \mid \mu_p, \mu_g] - cI^2 \\ &= [pR(I) + \mu_g] + w\mu_g + (1-w)\mu_p - cI^2,\end{aligned} \tag{6}$$

where the expectation is taken over y. This problem is equivalent to maximizing the project's expected net cash flow, $pR(I) - cI^2$. A key implication is that the solution to this problem, denoted as I^{fb} and referred to as the first-best investment, is independent of w. This means that if there were no information asymmetry regarding manager abilities, career concerns would be a nonissue. As long as $\Pi(\cdot)$ is concave in I, it is easy to verify that I^{fb} increases with project profitability $p \equiv m + \mu_p$ and thus with manager project-related ability μ_p, which is intuitive. To facilitate the comparison of the first-best results and the results in Sections V-VII, we hereafter set $R(I) = I$.[8]

Proposition 1 *Suppose that $R(I) = I$. Then, $I^{fb} = p / 2c$.*

Substituting $I = I^{fb}$ into $\Pi(\mu_p, \mu_g, I)$ and taking expectation over (μ_p, μ_g) yield the manager's first-best ex ante payoff

$$\Omega^{fb} \equiv (m^2 + h_p^{-1}) / 4c. \tag{7}$$

Because competitive investors break even, Ω^{fb} is the same as ex ante joint surplus or social welfare,

[8] With suitable conditions on R, assuming a specific form would be unnecessary in the first-best case. However, without it (as well as a specific form for the cost of investment, which we already assume to be cI^2), the equilibrium investment and forecast in Sections V-VII would be characterized only implicitly, causing tractability problems in examining their comparative static properties, efficiency implications, and manager commitment to issue a forecast.

and thus I^{fb} is a socially optimal investment. Note that Ω^{fb} increases with h_p^{-1}, the prior variance of the manager's project-related ability μ_p. Intuitively, when there is greater uncertainty about μ_p, conditioning investment on its realization is more valuable ex ante.

V. CAREER CONCERNS AND INVESTMENT

We return to the model, in which the manager invests I after privately knowing his abilities (μ_p, μ_g). He knows that the market infers (μ_p, μ_g) using investment and earnings information, (I, y), when it prices the firm and assesses his abilities. In contrast to the first-best case in which the manager's *sole* investment incentive is to maximize the expected net cash flow of the firm, he has *additional* incentives to use investment as a signaling device to favorably affect the market inference of his abilities. These signaling incentives are the focus of our analysis in this section.

The equilibrium in our model consists of the manager's investment, $I(\cdot)$, a competitive market value of the firm, $V(\cdot)$, and the market assessments of manager abilities, $A_g(\cdot)$ and $A_p(\cdot)$, such that: (i) $I(\cdot)$ maximizes $\Pi(\mu_p, \mu_g, I)$ stated in (3) for any given (μ_p, μ_g), $V(\cdot)$, $A_g(\cdot)$, and $A_p(\cdot)$; and (ii) $V(\cdot) = E[z \mid I, y]$, $A_g(\cdot) = E[\mu_g \mid I, y]$, and $A_p(\cdot) = E[\mu_p \mid I, y]$ for any given (I, y). In a rational expectations model, players make conjectures about other players' strategies, and these conjectures are self-fulfilling in equilibrium. In what follows, we restrict our analysis to an equilibrium in which $V(\cdot)$, $A_g(\cdot)$, and $A_p(\cdot)$ are linear functions of the observed variables, (I, y), and I^2. Note that the equilibrium characterized below is nonlinear in I because of I^2. Although I and I^2 are informationally equivalent, we include I^2 because, as will be shown, the Bayesian-updated market expectations of $V(\cdot)$ and $A_g(\cdot)$ depend on both I and I^2.

Manager's Investment Problem

Let the manager's conjectures of market valuation and ability assessment rules be

$$V(I, y) = v_o^c + v_I^c I + v_s^c I^2 + v_y^c y, \tag{8}$$

$$A_g(I, y) = a_o^c + a_I^c I + a_s^c I^2 + a_y^c y, \tag{9}$$

and

$$A_p(I, y) = b_o^c + b_I^c I + b_s^c I^2 + b_y^c y, \tag{10}$$

where we use superscript *"c"* to denote conjectured values. At date 1, given his private information (μ_p, μ_g) and the above conjectures, the manager invests I to maximize

$$\Pi(\mu_p, \mu_g, I) = E[V(I, y) + wA_g(I, y) + (1 - w)A_p(I, y) \mid \mu_p, \mu_g] - cI^2.$$

The first-order condition yields

$$I = k_o + k_p p, \tag{11}$$

where $$k_o = \frac{v_I^c + wa_I^c + (1-w)b_I^c}{2[c - v_s^c - wa_s^c - (1-w)b_s^c]} \text{ and } k_p = \frac{v_y^c + wa_y^c + (1-w)b_y^c}{2[c - v_s^c - wa_s^c - (1-w)b_s^c]}. \tag{12}$$

Provided that $k_p > 0$ (which will be the case in equilibrium), the manager increases investment I when project profitability p (equivalently, his project-related ability μ_p) increases. He also changes I with k_o and k_p, both of which depend on his conjectures of the market responses to investment and earnings, as well as the weights he assigns to the market assessments of abilities.

Market Valuation of the Firm

The market prices the firm, based on its expectation of the total cash flow, z, conditional on the available information, (I, y). Although the market does not know manager abilities, (μ_p, μ_g), it rationally conjectures his optimal investment rule and accordingly infers (μ_p, μ_g). Specifically, observing an investment I, the market believes that this I must be the manager's optimal investment stated in (11), with a conjecture of his investment rule (k_o, k_p) to be (k_o^c, k_p^c). This is equivalent to saying that the market considers the observed investment I as determined by

$$I = k_o^c + k_p^c p$$

for some p. Thus, given I and its conjecture (k_o^c, k_p^c), the market infers project profitability p to be

$$p^c \equiv (I - k_o^c) / k_p^c. \tag{13}$$

If $k_p^c > 0$ (which will be the case in equilibrium), a greater investment I increases the market inference of project profitability, p^c, and thus the market assessment of project-related ability. As will be shown, this creates a signaling incentive for the manager to increase investment.

Given I and p^c, the market expectation of the project cash flow is

$$E[pI \mid I, p^c] = p^c I. \tag{14}$$

Next, because the market knows that investment I does not contain information about manager general ability μ_g, it uses the prior distribution of μ_g to form its expectation of μ_g. That is,

$$E[\mu_g \mid I, p^c] = 0. \tag{15}$$

As a result, the market beliefs about the mean and variance of the total cash flow of the firm, z, are

$$E[z \mid I, p^c] = E[pI + \mu_g + \epsilon_z \mid I, p^c] = p^c I \tag{16}$$

and $$Var[z \mid I, p^c] = Var[pI + \mu_g + \epsilon_z \mid I, p^c] = h_g^{-1} + h_z^{-1}. \tag{17}$$

Note that the market expectation of total cash flow in (16) is the same as its expectation of the project cash flow in (14). This is because of (15) and $E[\epsilon_z \mid I, p^c] = 0$.

At date 2, after earnings y is released, the market values the firm at

$$V(I, y) = E[z \mid I, y, p^c] = (1 - \beta')E[z \mid I, p^c] + \beta' y = (1 - \beta')(p^c I) + \beta' y, \tag{18}$$

where $\beta' \equiv \frac{h_g^{-1}+h_z^{-1}}{h_g^{-1}+h_z^{-1}+q^{-1}} \in (0, 1)$. As in the first-best case, the firm value equals a weighted average of the market-expected total cash flow z prior to the arrival of y (i.e., $E[z \mid I, p^c] = p^c I$) and earnings y. The weight placed on y in (18), β', is greater than β in the first-best case because y contains information about general ability μ_g. To elaborate, recall that, in the first-best case, the remaining uncertainty about z is only the cash flow noise ϵ_z, whereas here it is $\mu_g + \epsilon_z$. To the extent that y provides incremental information about μ_g, its relevance to firm valuation increases, and this induces the market to rely more on y by placing a greater weight on it when forming an expectation of z. Note that β' increases with h_g^{-1} and q. Intuitively, with greater uncertainty about μ_g or more precise earnings information y about z, the market places a greater weight on y and reduces the weight placed on $E[z \mid I, p^c]$, which is its expected total cash flow prior to observing y. Substituting p^c given in (13) into (18) and rearranging terms, we see that the market has a valuation rule

$$V(I, y) = v_o + v_I I + v_s I^2 + v_y y,$$

where $$v_o = 0,\ v_I = -(1 - \beta')(k_o^c / k_p^c),\ v_s = (1 - \beta') / k_p^c, \text{ and } v_y = \beta'. \tag{19}$$

Market Assessment of Manager Abilities

First, consider general ability μ_g. As noted above, earning y provides information about μ_g. Thus, when updating beliefs about μ_g, the market uses y along with investment I. Specifically, it obtains a new signal about μ_g by subtracting its expectation of the project cash flow, $p^c I$, from y:

$$y - p^c I = \mu_g + \epsilon_z + \epsilon_y.$$

This signal has a zero mean and a variance $h_g^{-1} + h_z^{-1} + q^{-1}$. The Bayes Rule implies that the market assessment of the manager's general ability, conditional on (I, y) and its inference p^c, is

$$A_g(I, y) = E[\mu_g \mid I, y, p^c] = \gamma'(y - p^c I), \tag{20}$$

where $\gamma' \equiv \frac{h_g^{-1}}{h_g^{-1}+h_z^{-1}+q^{-1}} \in (0, 1)$.[9] $A_g(I, y)$ decreases with $p^c I$. That is, for any given y, when the market infers a greater expected cash flow of the project, $p^c I$, its assessment of general ability μ_g decreases because it expects a smaller contribution of μ_g to the firm's total cash flow z. As will be shown, this translates into the manager's incentive to reduce the market inference of the project's expected

[9] Note that γ' is less than β' stated below (18) because β' is the weight assigned to y in computing the expectation of total cash flow z, whereas γ' is the weight assigned to a signal about μ_g that only produces a part of z.

cash flow to improve the general ability assessment. Next, γ' increases with h_g^{-1} and q. Intuitively, the general ability assessment, $A_g(I, y)$, is more sensitive to the signal about μ_g, which is $y - p^cI$, when there is greater uncertainty about μ_g or when y provides more precise information about it. Using (20) along with (13), we can see that the market assessment of general ability is

$$A_g(I, y) = E[\mu_g \mid I, y, p^c] = a_o + a_I I + a_s I^2 + a_y y,$$

where $$a_o = 0,\ a_I = \gamma'(k_o^c / k_p^c),\ a_s = -\gamma' / k_p^c, \text{ and } a_y = \gamma'. \tag{21}$$

Second, consider project-related ability μ_p. Because p^c stated in (13) is the market inference of project profitability $p \equiv m + \mu_p$, it follows that

$$A_p(I, y) = E[\mu_p \mid I, y, p^c] = E[p - m \mid I, y, p^c] = b_o + b_I I + b_s I^2 + b_y y,$$

where $$b_o = -(k_o^c / k_p^c) - m,\ b_I = 1 / k_p^c, \text{ and } b_s = b_y = 0. \tag{22}$$

Provided that $k_p^c > 0$, $b_I > 0$ and thus $A_p(I, y)$ increases with I, which we noted earlier. Observe that $A_p(I, y)$ reduces to $b_o + b_I I = p^c - m$. That is, $A_p(I, y)$ solely depends on whether the market inference of project profitability, p^c, exceeds or falls short of the prior mean of project profitability, m.

Equilibrium

In equilibrium, all conjectures must be correct. This means that: (i) the conjectures in (8), (9), and (10) must be the same as the corresponding values in (19), (21), and (22); and (ii) $k_o^c = k_o$ and $k_p^c = k_p$ must hold. In essence, the manager seeks to improve the market assessment of his abilities (μ_p, μ_g) that he knows privately. This prompts him to use investment I as a signaling device, leading to an equilibrium investment different from the first-best investment.

Proposition 2 *The manager's equilibrium investment after privately observing* (μ_p, μ_g) *is*

$$I^* = k_o^* + k_p^* p,$$

where $$k_o^* = 1 - w,\ k_p^* = \frac{1-\gamma' w + (1-\beta')}{2c},\ \beta' \equiv \frac{h_g^{-1}+h_z^{-1}}{h_g^{-1}+h_z^{-1}+q^{-1}},\ \text{and } \gamma' \equiv \frac{h_g^{-1}}{h_g^{-1}+h_z^{-1}+q^{-1}}.$$

When $p > 0$, $$I^* > I^{fb} \text{ if and only if } w < w^o \equiv \frac{2c+(1-\beta')p}{2c+\gamma' p}.$$

The equilibrium firm value and the market assessments of manager abilities are determined by (19), (21), *and* (22), *respectively, where* k_o^c *and* k_p^c *are respectively replaced by* k_o^* *and* k_p^*.

Like the first-best investment, $I^{fb} = p / 2c$, the equilibrium investment, $I^* = k_o^* + k_p^* p$, does not depend on manager general ability μ_g. In addition, because $k_p^* > 0$, I^* increases with project profitability $p \equiv m + \mu_p$ and thus with manager project-related ability μ_p. However, I^* differs from I^{fb} (except for a knife-edge case explained below). This means that, unlike the first-best investment, the equilibrium investment does not optimally reflect project profitability to maximize the project's expected net cash flow. Below, we focus on the effect of manager career concerns on the difference between the equilibrium and first-best investments.

For any given p and $w \in [0, 1]$, using the expressions for k_o^* and k_p^*, it is easy to verify that $I^* > I^{fb}$ if and only if $(2c + \gamma'p)w < 2c + (1 - \beta')p$. To sharpen the intuition, Proposition 2 focuses on the case of a positive project profitability, $p \equiv m + \mu_p > 0$, which occurs almost always under our assumption that m is sufficiently large.[10] In this case, compared with the first-best investment, the manager overinvests (underinvests) when he is relatively more concerned about the market assessment of his project-related (general) ability. To elaborate, recall that in the first-best case in which manager abilities (μ_p, μ_g) are public information, the *sole* investment incentive is to maximize the project's expected net cash flow, and career concerns are a nonissue. Here, with private knowledge of (μ_p, μ_g), the manager has *additional* incentives to use investment I as a signaling device to affect the market inference of (μ_p, μ_g). First, recall from (13) that the market infers p and thus $\mu_p = p - m$ from I. In equilibrium, because $k_p^c = k_p^* > 0$, a greater I has a positive effect on this inference. This creates an incentive for the manager to *increase* investment. Second, recall from (20) that when updating its expectation of μ_g, the market subtracts the project's expected cash flow p^cI from earnings y. In equilibrium, a greater investment I has a negative effect on this expectation. This incentivizes the manager to *decrease* investment. Taken together, there is a tension between these two signaling incentives associated with investment. The magnitude of managerial concern about the general ability assessment, w, determines which incentive is dominant. Specifically, there exists a cutoff value $w^o \equiv \frac{2c+(1-\beta')p}{2c+\gamma' p}$ such that $I^* > I^{fb}$ if and only if $w < w^o$.

[Insert Figure 2 about here.]

To provide the intuition behind the necessary and sufficient condition, $w < w^o$, note that if $w^o > 1$, the manager always overinvests for any given $w \in [0,1]$. However, if $w^o < 1$ or, equivalently,

$$(1 - \beta') / \gamma' = q^{-1} / h_g^{-1} < 1, \tag{23}$$

then he may over- or underinvest depending on w. To elaborate, suppose that (23) does not hold.

[10] Recall that $p \sim N(m, h_p^{-1})$. Thus, for example, if $m > 5h_p^{-1/2}$, $\Pr[p \leq 0] < 2.87*(10)^{-7}$. Because this probability is negligible, we focus on the case of $p > 0$ when we report the results conditional on p in the main text. We discuss in Appendix A how they are modified when $p < 0$.

Intuitively, when y is very noisy and provides little information about μ_g (i.e., q^{-1} is very large), or when there is little uncertainty about μ_g (i.e., h_g^{-1} is very small), investment is not an effective signaling device to affect the market assessment of general ability μ_g; see (20) with γ close to zero. As such, the manager's primary signaling incentive is to increase investment to improve the market assessment of his project-related ability μ_p. This is why overinvestment always occurs. Next, suppose that (23) holds. When the uncertainty about μ_g is high, or when y is precise information about μ_g, there is a *trade-off* between the two signaling incentives, and one dominates the other depending on w and p. The cutoff value of w, denoted as $w^o \equiv \frac{2c+(1-\beta')p}{2c+\gamma' p}$, helps us graphically illustrate this dependence. As depicted in Figure 2, (i) w^o is a decreasing function of p, and (ii) $w^o \to 1$ as $p \to 0$, whereas $w^o \to q^{-1} / h_g^{-1}$ as $p \to \infty$. Collectively, these imply that (i) for any given p, the manager overinvests when he is relatively more concerned about the assessment of his project-related ability, i.e., when w belongs to the range of $[0, w^o)$, and (ii) this range shrinks as p increases. In sum, overinvestment (underinvestment) occurs in the shaded (unshaded) area. This result on the comparison of I^* and I^{fb} across (p, w) will be useful for our subsequent analysis of ex ante efficiency.

Corollary 1 *When $p > 0$, I^* decreases with w, q, h_g^{-1}, and c.*

Corollary 1 shows the monotonicity properties of the equilibrium investment, I^*, regardless of whether it is greater or less than the first-best investment, I^{fb}. We can see in Proposition 2 that I^* increases with $k_o^* = 1 - w$, and that it also increases with $k_p^* = \frac{1-\gamma' w+(1-\beta')}{2c}$ when $p > 0$. Thus, we only need to explain why the manager's relative concerns about general ability assessment (w), earnings quality (q), the uncertainty about general ability (h_g^{-1}), and the cost of investment (c) all decrease k_o^* and/or k_p^*. First, recall that the manager has signaling incentives to invest less to improve the general ability assessment, $A_g(\cdot)$, and to invest more to improve the project-related ability assessment, $A_p(\cdot)$. Hence, an increase in w decreases k_o^* and k_p^*, and thus the equilibrium investment. Second, earnings quality (q) and prior uncertainty about general ability (h_g^{-1}) decrease k_p^* through an increase in γ' and/or β'. For the intuition, consider an increase in γ'. As shown in (20), γ' is the sensitivity of $A_g(\cdot)$ to the signal about μ_g, which is $y - pI$. Thus, a higher γ' implies that reducing investment I has a greater positive effect on $A_g(\cdot)$. This strengthens the signaling incentive to decrease investment, as manifested by a decrease in k_p^*. For the effect of β', recall that when pricing the firm, the market assigns a positive weight $(1-\beta')$ to its expectation of the future cash flow, pI. When β' increases, this weight decreases, implying that reducing investment I has a less negative effect on firm value. This strengthens the incentive to invest less, i.e., k_p^* decreases with β'. Last, it is obvious that a higher cost of investment weakens the incentive to invest.

Empiricists may be interested in the effects of w and q on the equilibrium investment, I^*. In the real world, specialist managers are likely to be more concerned about the assessment of project-related ability than the assessment of general ability. In our model, this corresponds to the case in which w is relatively small. In contrast, large values of w are applicable to generalist managers who are likely to have greater concerns about the assessment of general management ability. Under this classification of manager types, Corollary 1 suggests that, ceteris paribus, specialists make larger investment in new projects (to signal their project-related ability) than generalists do. Next, irrespective of manager types, our result predicts that, ceteris paribus, firms providing higher-quality earnings information invest less. As explained above, the intuition is that, as long as managers are concerned about the market assessment of their general ability, they tend to have a stronger incentive to reduce investment when earnings information is more precise. To test this prediction, one may compare investment levels before and after a regulation that requires firms to provide higher-quality financial information, e.g., the Sarbanes-Oxley Act of 2002.

We conclude with a remark. In a signaling context, Bebchuk and Stole (1993) show that a manager may overinvest to improve the market inference of investment profitability. In the present study, a similar force drives our result of overinvestment if the manager has large concerns about the market assessment of project-related ability. A key difference is that if he is instead mainly concerned about the assessment of general ability, the signaling incentive to improve this assessment can dominate, in which case he underinvests. This indicates that (i) there is a trade-off in the manager's signaling incentives, and (ii) it changes with his relative concerns about the general ability assessment, $w \in [0, 1]$. To focus on the case in which either over- or underinvestment occurs depending on w, we hereafter focus on the parameter space in which (23) holds, i.e., $w^o < 1$.

Ex Ante Efficiency

We compute the manager's equilibrium payoff prior to knowing (μ_p, μ_g), and refer to it as his ex ante payoff for brevity. It equals

$$\Omega^* \equiv E[\Pi(\mu_p, \mu_g, I^*)] = \Omega^{fb}[4ck_p^*(1 - ck_p^*)] + mk_o^*(1 - 2ck_p^*) - c(k_o^*)^2, \qquad (24)$$

where (i) the expectation is taken over (μ_p, μ_g); (ii) Ω^{fb} is the first-best ex ante payoff stated in (7); (iii) k_o^* and k_p^* are the equilibrium variables stated in Proposition 2; and (iv) we use the result that

$$E[A_p(I^*, y)] = E[p - m] = 0 \text{ and } E[A_g(I^*, y)] = E[\gamma'(y - pI^*)] = 0.$$

Two remarks are in order. First, because the manager's equilibrium payoff equals the equilibrium social surplus for all (μ_p, μ_g), his ex ante payoff Ω^* equals ex ante social surplus. Second, because the expected market assessments of manager abilities are zero (as shown above), Ω^* is the equilibrium ex ante payoff from investment. We know from Proposition 2 that, except for a knife-edge case, the equilibrium investment, I^*, differs from the first-best investment, I^{fb}, that maximizes investment efficiency. Therefore, ex ante, an efficiency loss always exists ($\Omega^* < \Omega^{fb}$), and is solely attributed to investment inefficiency arising from the manager's signaling incentives. In addition, under our assumption of a sufficiently large m, project profitability p is positive almost always. This means that the economic forces behind the suboptimality of I^* and its comparative static properties for the case of $p > 0$ (as shown in Proposition 2 and Corollary 1) are mainly responsible for the comparative statics on the ex ante payoff Ω^*. For example, in the presence of overinvestment, an increase in w, q, h_g^{-1}, or c□all of which decrease I^*□alleviates overinvestment and thus improves equilibrium efficiency.

Corollary 2

(i) *Ω^* increases with w if and only if $w < w^* \equiv \frac{(1-\beta')+A}{\gamma'+A}$, where $A \equiv \frac{2c+m\gamma'}{m+2\Omega^{fb}\gamma'}$.*

(ii) *Ω^* increases with q, h_g^{-1}, and c if and only if $w < w^+ \equiv \frac{(1-\beta')+B}{\gamma'+B}$, where $B \equiv \frac{m}{2\Omega^{fb}}$.*

(iii) *Ω^* increases with h_p^{-1}. If $w \neq q^{-1} / h_g^{-1}$, its increasing rate is less than that of Ω^{fb}.*

Part (i) shows that the manager's ex ante payoff, Ω^*, is an inverted-U shape function of his concerns about the market assessment of general ability, w, with a unique maximum at $w = w^*$. The intuition is as follows. Recall that when w is relatively small, he mostly suffers from overinvestment than from underinvestment (he always suffers from overinvestment if $w \leq q^{-1} / h_g^{-1}$); see Figure 2. An increase in w, which decreases I^* and thus mitigates overinvestment, benefits him on average, i.e., Ω^* increases. However, if the manager has a relatively large w, he mostly suffers from underinvestment. In this case, an increase in w makes him worse off on average, i.e., Ω^* decreases, because underinvestment is amplified. The threshold at which the effect of w on Ω^*

changes from positive to negative is w^*.

Part (ii) states that Ω^* increases with earnings quality (q), uncertainty about manager general ability (h_g^{-1}), and the cost of investment (c) if and only if w is less than a cutoff value w^+. The intuition is similar to that in part (i). When w is relatively small (large), the manager mainly suffers from overinvestment (underinvestment). Thus, an increase in q, h_g^{-1}, or c that decreases I^* has, on average, a positive (negative) effect on Ω^*.

Part (iii) is driven by the fact that I^* changes with the manager's project-related ability μ_p. As in the first-best case, the ex ante value of conditioning investment on μ_p increases as the uncertainty about it increases, i.e., when h_p^{-1} increases. However, recall that the increasing rate of the equilibrium investment with respect to μ_p differs from that of the first-best investment due to signaling incentives which are absent in the first-best case (see our discussion below Proposition 2). This leads to the result that the increasing rate of Ω^* with respect to h_p^{-1} differs from that of the first-best ex ante payoff, Ω^{fb}. Specifically, note in (24) that: (i) its increasing rate depends on k_p^*; and (ii) if $w = q^{-1} / h_g^{-1}$, then $k_p^* = 1 / 2c$, and thus $\Omega^* = \Omega^{fb} - c(k_o^*)^2$. Except for this knife-edge case, $4ck_p^*(1 - ck_p^*) \in (0, 1)$. This means that the positive effect of h_p^{-1} on Ω^* is smaller than that on Ω^{fb}. In essence, signaling incentives prevent the manager from optimally incorporating his project-related ability into investment to maximize the firm's expected net cash flow (as he would do in the first-best case).

To summarize, Proposition 2 and Corollaries 1 and 2 collectively show that career concerns, earnings quality, and uncertainty about manager general ability—all of which are *irrelevant* to the efficiency-maximizing first-best investment—have efficiency implications. This is due to the presence of signaling incentives. In addition, the effect of uncertainty about manager project-related ability on the ex ante payoff does not fully materialize, compared with that in the first-best case.

VI. MANAGEMENT FORECAST AND INVESTMENT

We now extend the basic model to a setting in which the manager issues a management forecast of earnings; later, in Section VII, we will examine whether he is better or worse off by issuing a forecast. Specifically, we assume that when the manager invests I at date 1, he also provides a forecast F. This means that he can use both I and F as signaling devices. If the subsequent realization of earnings y differs from forecast F, the manager incurs a cost of a forecast error. Let this cost be quadratic in the forecast error, i.e., $J(y, F) \equiv (y - F)^2 / 2$. It follows that the manager's objective function changes to

$$\Pi(\mu_p, \mu_g, I, F) = E[V(\eta) + wA_g(\eta) + (1 - w)A_p(\eta) - J(y, F) \mid \mu_p, \mu_g] - cI^2. \tag{25}$$

The equilibrium of the extended model is similar to that of the basic model, except that (i) the manager chooses not only an investment I but also a forecast F, and (ii) the observed variables are I, F, and y. As in Section V, we focus on an equilibrium, in which the market value of the firm and the assessments of manager abilities, $V(\cdot)$, $A_g(\cdot)$, and $A_p(\cdot)$, are linear in (I, F, y) and I^2.

Manager's Investment and Forecast Problems

Let the manager's conjectures of market valuation and ability assessment rules be

$$V(I, F, y) = v_o{}^c + v_I{}^c I + v_s{}^c I^2 + v_F{}^c F + v_y{}^c y, \tag{26}$$

$$A_g(I, F, y) = a_o{}^c + a_I{}^c I + a_s{}^c I^2 + a_F{}^c F + a_y{}^c y, \tag{27}$$

and

$$A_p(I, F, y) = b_o{}^c + b_I{}^c I + b_s{}^c I^2 + b_F{}^c F + b_y{}^c y. \tag{28}$$

At date 1, given his private information (μ_p, μ_g) and the above conjectures, the manager chooses an investment I and a forecast F to maximize (25). The first-order conditions yield

$$F = f_o + f_z \mu_z, \tag{29}$$

where

$$f_o = v_F{}^c + wa_F{}^c + (1 - w)b_F{}^c, \text{ and } f_z = 1; \tag{30}$$

and

$$I = k_o + k_p p, \tag{31}$$

where

$$k_o = \frac{v_I^c + wa_I^c + (1-w)b_I^c}{2[c - v_s^c - wa_s^c - (1-w)b_s^c]} \text{ and } k_p = \frac{v_F^c + v_y^c + w(a_F^c + a_y^c) + (1-w)(b_F^c + b_y^c)}{2[c - v_s^c - wa_s^c - (1-w)b_s^c]}. \tag{32}$$

Note that, given (μ_p, μ_g, I), the manager's expectation of earnings y equals his expectation of cash flow z, which is $\mu_z \equiv pI + \mu_g$. This is because y is z plus white noise. Although there is a cost of forecast error, (29) and (30) show that the manager adds a bias f_o to his earnings expectation μ_z. This bias depends on his concerns about the ability assessments and his conjectures of the market responses to forecast F (i.e., w, $v_F{}^c$, $a_F{}^c$, and $b_F{}^c$). As shown in (31) and (32), the optimal investment is similar to that in the basic model; it depends on project profitability p and (k_o, k_p) that includes w and his conjectures of the firm valuation and ability assessment rules.

Market Valuation of the Firm and Assessment of Manager Abilities

Given I and F, the market conjectures the manager's optimal forecasting and investment rules to update its beliefs about the firm's total cash flow z and infer manager abilities (μ_p, μ_g). Let

$$F = f_o{}^c + f_z{}^c \mu_z \text{ and } I = k_o{}^c + k_p{}^c p$$

be the conjectures of those rules. First, given F, the market uses (f_o^c, f_z^c) to infer the expected total cash flow, μ_z, which is privately known to the manager. This leads to an inference

$$\mu_z^c \equiv (F - f_o^c) / f_z^c. \tag{33}$$

Second, as in Section V, based on I and (k_o^c, k_p^c), the market infers project profitability p to be

$$p^c \equiv (I - k_o^c) / k_p^c.$$

Last, the above inferences, μ_z^c and p^c, translate into an inference of manager general ability μ_g,

$$\mu_g^c \equiv \mu_z^c - p^c I = (F - f_o^c) / f_z^c - p^c I. \tag{34}$$

This expression shows that, given *I and F*, the market has a *direct* inference μ_g^c (in addition to a direct inference p^c), which was impossible without forecast F in Section V.[11] Provided that $k_p^c > 0$ and $f_z^c > 0$ (which will be the case in equilibrium), investment I has a positive effect on p^c, and forecast F has a positive effect on μ_g^c. In addition, as in the case of no forecast, (34) shows that a greater expected cash flow of the project, $p^c I$, has a negative effect on μ_g^c.

After the realization of earnings y, the market uses (I, F, y) and the above conjectures to determine firm value. The firm value is

$$V(I, F, y) = E[z \mid I, F, y] = (1 - \beta)\mu_z^c + \beta y = (1 - \beta)[(F - f_o^c) / f_z^c] + \beta y, \tag{35}$$

where $\beta \equiv \frac{h_z^{-1}}{h_z^{-1} + q^{-1}} \in (0, 1)$, and we use μ_z^c stated in (33) for the last equality.[12] Note that the weight placed on y in (35) is the same β as that in the first-best case, and thus is smaller than β' in the case of no forecast; see (18). This is because although the market uses conjectures, it has an inference of the expected total cash flow, μ_z^c, and thus the only remaining uncertainty it has is about cash flow noise ϵ_z, as in the first-best case. As noted in our comparison of β and β' below (18), this implies that the presence of an earnings forecast reduces the relevance of earnings information to firm valuation. It follows that, given (I, F, y), the market valuation rule is

$$V(I, F, y) = v_o + v_I I + v_s I^2 + v_F F + v_y y,$$

where

$$v_o = - v_F f_o^c,\ v_I = v_s = 0,\ v_F = (1 - \beta) / f_z^c, \text{ and } v_y = \beta. \tag{36}$$

We see two main differences between these coefficients and those in (19) for the case of no forecast. First, $v_s = v_I = 0$ here. This is because, from the perspective of firm valuation, what matters is the

[11] In Section V, although the market directly infers p from I, which is p^c in (13), it cannot do so for μ_g because I contains no information about μ_g. As a result, given I, the market expectation of μ_g is the same as its prior mean (see (15)). When y is subsequently realized, the market updates its expectation of μ_g to $A_g(I, y)$ by using y and its inference of the expected cash flow of the project, as stated in (20).

[12] In (35) and in what follows, for notational simplicity, we suppress the market conjectures inside the expectation operator when listing conditioning variables.

expected total cash flow, μ_z, about which the market has an inference $\mu_z{}^c$ that only depends on F. Thus, although the market uses investment I in inferring manager abilities, it regards I as containing no incremental information about cash flow z. Second, $v_o \neq 0$. Provided that $v_F > 0$, the sign of v_o is opposite to that of the conjectured bias, $f_o{}^c$. This means that, considering its response to forecast F (which is v_F), the market adjusts its expectation of z to undo the effect of the bias in F.

Next, consider the market assessments of manager abilities (μ_p, μ_g). We already know that the market has an inference of general ability μ_g, which is $\mu_g{}^c$ stated in (34). Given this inference, earnings y does not affect the market beliefs about μ_g. Hence,

$$A_g(I, F, y) = \mu_g{}^c = [(F - f_o{}^c) / f_z{}^c] - p^c I. \tag{37}$$

This can be restated as

$$A_g(I, F, y) = E[\mu_g \mid I, F, y] = a_o + a_I I + a_s I^2 + a_F F + a_y y,$$

where $$a_o = -a_F f_o{}^c,\ a_I = k_o{}^c / k_p{}^c,\ a_s = -1 / k_p{}^c,\ a_F = 1 / f_z{}^c, \text{ and } a_y = 0. \tag{38}$$

Compared with the coefficients in (21), (i) $a_o \neq 0$ because the market adjusts F to infer μ_z, as stated in (37), and (ii) $a_y = 0$ because y does not affect the market inference of μ_g, as noted earlier.

Last, note that the market does not use forecast F for its inference of the manager's project-related ability μ_p. Instead, as in Section V, it only uses investment I to infer project profitability p and then μ_p. Thus, the market assessment of μ_p is the same as that in Section V, i.e.,

$$A_p(I, F, y) = E[\mu_p \mid I, F, y] = E[p - m \mid I, F, y] = b_o + b_I I + b_s I^2 + b_F F + b_y y,$$

where $$b_o = -(k_o{}^c / k_p{}^c) - m,\ b_I = 1 / k_p{}^c, \text{ and } b_s = b_F = b_y = 0. \tag{39}$$

Equilibrium

An equilibrium is obtained by setting all the conjectures equal to their actual values in the above analysis. We focus on how the manager's signaling incentives associated with investment I are affected by the presence of an additional signaling device, i.e., forecast F.

Proposition 3 *The manager's equilibrium investment after privately observing* (μ_p, μ_g) *is*

$$I^{**} = k_o{}^{**} + k_p{}^{**} p$$

where $$k_o{}^{**} = (1 - w) \text{ and } k_p{}^{**} = (1 - w) / 2c.$$

When $p > 0$, $$I^{**} < I^*,$$

and $$I^{**} < I^{fb} \text{ if and only if } w > w^{oo} \equiv \tfrac{2c}{2c+p}.$$

The manager's equilibrium forecast after privately observing (μ_p, μ_g) *is*

$$F = f_o^{**} + f_z^{**}\mu_z,$$

where $$f_o^{**} = w + (1-\beta),\ \beta \equiv \frac{h_z^{-1}}{h_z^{-1}+q^{-1}},\ f_z^{**} = 1, \textit{ and } \mu_z = pI^{**} + \mu_g.$$

The equilibrium firm value and the market assessments of manager abilities are determined by replacing (f_o^c, f_z^c) *and* (k_o^c, k_p^c) *in* (36), (38), *and* (39) *with* (f_o^{**}, f_z^{**}) *and* (k_o^{**}, k_p^{**}) *stated above*.

Given that $k_p^{**} > 0$, the equilibrium investment, $I^{**} = k_o^{**} + k_p^{**}p$, increases with project profitability p and thus with manager project-related ability μ_p. The intuition is similar to that for the equilibrium investment I^* in the case of no forecast. However, I^{**} differs from I^* because k_p^{**} differs from k_p^*. In particular, note that I^{**} does not depend on earnings quality (q), uncertainty about manager general ability (h_g^{-1}), or uncertainty about cash flow noise (h_z^{-1}). This is because the market inference of general ability, $A_g(\cdot)$, does not depend on earnings y here (see (37)), whereas it depends on y in the case of no forecast in which those parameters are included in γ' (see (20)). As a result, the condition under which I^{**} differs from the first-best investment, I^{fb}, also differs from that under no forecast; here, $I^{**} \neq I^{fb}$ if and only if $(2c + p)w \neq 2c$. Below, to facilitate the discussion and sharpen the intuition, we again focus on the case of $p > 0$.

Recall that the manager cares about the market assessment of his general ability and hence has an incentive to reduce investment to favorably affect this assessment. Although this signaling incentive is "qualitatively" the same with or without a forecast, it is *stronger* in the presence of a forecast. This is why I^{**} is always less than I^*. To elaborate, we compare (37) and (20). Note that because $\gamma' < 1$, decreasing investment I has a greater positive effect on $A_g(\cdot)$ in (37) than in (20). In the same vein, the incentive to increase I to improve the market inference of project profitability (and thus the assessment of project-related ability) is weakened because a higher p^c has a greater negative effect on $A_g(\cdot)$ in (37) than in (20).

We compare the equilibrium investment, $I^{**} = k_o^{**} + k_p^{**}p$, and the first-best investment, $I^{fb} = p / 2c$. For any given $p > 0$, note that I^{**} decreases with w. In fact, $I^{**} \to 1 + (p / 2c)$ as $w \to 0$, and $I^{**} \to 0$ as $w \to 1$. Thus, as in the case of no forecast, the manager with a small (large) w overinvests (underinvests) because he is more concerned about the assessment of μ_p (μ_g). This is why there exists a cutoff value $w^{oo} \equiv \frac{2}{2+p}$ at which $I^{**} = I^{fb}$. Figure 2 also depicts w^{oo}, and note that $w^{oo} < w^o \equiv \frac{2c+(1-\beta')p}{2c+\gamma' p}$, where w^o is the value of w at which $I^* = I^{fb}$ (see Proposition 2). The intuition for this ordering is that, as stated above, the manager's signaling incentive to decrease investment is stronger when he issues a forecast than when he does not. For any given $p > 0$, because $w^{oo} < w^{o}$, the range of w in which overinvestment occurs is smaller in the presence of a forecast than in the absence of it (see Figure 2). Equivalently, for any given $w \in [0, 1]$, the set of p in which the manager overinvests is smaller when he issues a forecast than when he does not.

The equilibrium earnings forecast, $F = f_o^{**} + \mu_z$, has an upward bias $f_o^{**} > 0$, relative to the manager's private expectation of earnings. This reflects his incentive to increase the firm value and the market assessment of general ability; note in (35) and (37) that both $V(I, ,F, y)$ and $A_g(I, F, y)$ increase with F. However, the market subtracts its conjectured bias f_o^c from F, as shown in (35) and (37). In equilibrium, $f_o^c = f_o^{**}$, implying that the bias has no impact on the market inferences of total cash flow z and general ability μ_g. This is a "signal jamming" result (similar to Stein 1989; Fudenberg and Tirole 1995).

Corollary 3

(i) *When $p > 0$, I^{**} decreases with w and c.*

(ii) *f_o^{**} increases with w, but decreases with q.*

The intuition for why the equilibrium investment, I^{**}, decreases with the manager's concerns about the general ability assessment (w) and the cost of investment (c) is the same as that in the case of no forecast. Thus, we focus on part (ii).

When the manager has greater concerns about the assessment of his general ability, he has a stronger incentive to inflate F to improve this assessment. This is why the equilibrium forecast bias, f_o^{**}, increases with w. In addition, note that this bias does not disappear even when he has no concerns about the general ability assessment (i.e., even when $w = 0$). This is because he still has an incentive to inflate F to increase the firm value, $V(I, F, y)$. For the effects of earnings quality q, recall that β increases when y is more precise. Although a higher β has no impact on the general ability assessment (see (37)), it reduces the effect of F on the firm value through a decreased weight $1 - \beta$ (see (35)). Ceteris paribus, this weakens the incentive to inflate F.

We conclude with a remark on the equilibrium forecast bias from an empirical perspective. In our model, f_o^{**} is the difference between forecast F and the manager's private information about future earnings y. In practice, f_o^{**} is not directly testable because manager private information is unobservable. To address this issue, one can relate f_o^{**} to the average equilibrium forecast error,

$$E[y - F^{**}] = -f_o^{**} < 0,$$

where we use Proposition 3, $E[y] = E[z + \epsilon_y] = \mu_z$, and $f_o^{**} > 0$. Thus, we predict a negative average forecast error. Corollary 3(ii) further suggests that its absolute value increases with managerial concerns about the general ability assessment (w) but decreases with earnings quality (q).[13]

Ex Ante Efficiency When the Manager Issues a Forecast

This section examines ex ante efficiency in the extended model. We first use Proposition 3 to compute the manager's equilibrium payoff, $\Pi(\mu_p, \mu_g, I^{**}, F^{**})$, and then take expectation of it over (μ_p, μ_g). The resulting expression is his ex ante payoff with a forecast,

$$\Omega^{**} = \{\Omega^{fb}[4ck_p^{**}(1 - ck_p^{**})] + mk_o^{**}(1 - 2ck_p^{**}) - c(k_o^{**})^2\} - E[J(y, F^{**})], \quad (40)$$

where Ω^{fb} is the ex ante payoff in the first-best case, and

$$E[J(y, F^{**})] = [h_z^{-1} + q^{-1} + (f_o^{**})^2] / 2$$

is the equilibrium expected cost of forecast error. As in the case of no forecast, the expression inside the curly brackets in (40) is the equilibrium ex ante payoff from investment. Thus, compared with the first-best case, the manager is worse off for two reasons. First, for any w, the equilibrium investment is suboptimal, except when p satisfies $w = w^{oo}$. Second, there is a cost of forecast error. This cost cannot be avoided even with an unbiased forecast, i.e., $E[J(y, F^{**})] > 0$ even when $f_o^{**} = 0$, because there is inherent noise ϵ_z and ϵ_y in the firm cash flow and earnings. The manager can avoid this cost only when he does not issue a forecast (which we will examine in Section VII).

Corollary 4

(i) *Ω^{**} increases with w if and only if $w < w^{**} \equiv \frac{2c+m-(1-\beta)}{2(m+c+\Omega^{fb})+1}$. In addition, $w^{**} < w^*$, where w^* is stated in Corollary* 2.

(ii) *Ω^{**} increases with c if and only if $w < \frac{B}{1+B}$, where $B \equiv \frac{m}{2\Omega^{fb}}$.*

(iii) *Ω^{**} increases with q.*

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[13] Pae et al. (2016) find evidence that, given bad news, managers with greater career concerns are more likely to provide *downward* earnings guidance, which they define as a negative forecast surprise relative to the current market expectation of earnings. Note that their result is not comparable with our result on forecast bias, which we define as the difference between a forecast and the manager's private information. For example, an upwardly biased forecast can be downward earnings guidance, depending on the location of the current market expectation. In addition, they do not consider investment as a signaling device, which plays a key role in this paper.

(iv) Ω^{**} *increases with* h_p^{-1} *if* $w \neq 1$, *and its increasing rate is less than that of* Ω^{fb} *if* $w \neq 0$.

The basic intuition is essentially the same as that in the case of no forecast. Part (i) shows that the ex ante payoff with a forecast, Ω^{**}, is also an inverted-U shape function of w. We know from Proposition 3 that the manager mainly suffers from overinvestment (underinvestment) when w is relatively small (large). Because an increase in w reduces investment, it benefits the manager when w is relatively small, but makes him worse off when w is relatively large. Although a larger w has a negative effect on Ω^{**} through a greater forecast bias (Corollary 3(ii)), the basic shape of Ω^{**} remains unchanged. A direct computation also reveals that w^{**}, at which Ω^{**} attains a unique maximum, is less than w^{*} that maximizes the ex ante payoff with no forecast, Ω^{*}.[14]

Part (ii) shows that a higher cost of investment can either increase or decrease equilibrium efficiency depending on the magnitude of w. The intuition is similar to that in the case of no forecast. For example, when the manager has relatively small concerns about general ability assessment, overinvestment is the main source of efficiency loss. An increase in c reduces overinvestment, and thus improves investment efficiency. The converse is true when w is relatively large.

For part (iii), recall that earnings quality does not affect the equilibrium investment, I^{**}. However, higher earnings quality benefits the manager by directly decreasing the expected cost of forecast error and indirectly reducing the equilibrium forecast bias, f_o^{**}, as shown in Corollary 3(ii).

Last, as in the first-best case, conditioning investment on manager project-related ability has an ex ante value, and this value increases when there is greater uncertainty about it. However, similar to Corollary 2(iii), the effect of a more diffuse distribution of this ability on the equilibrium ex ante payoff is smaller than that on the first-best ex ante payoff, due to signaling incentives.

VII. COMMITMENT TO FORECAST

Sections V and VI considered settings with and without an earnings forecast. We now examine the manager's decision whether to make a *commitment* to provide a forecast *before* knowing his abilities (μ_p, μ_g) privately. This ex ante commitment decision differs from the decision whether to provide a forecast conditional on private information. Our modeling choice is consistent with a

[14] Technically, there are two reasons. First, the value of w that maximizes the ex ante investment payoff, $\Omega^{**} + E[J(y, F^{**})]$, is less than w^{*}. Second, there is a negative effect of w on the expected cost of forecast error. Both imply that the maximizer of Ω^{**} must be less than the maximizer of the ex ante investment payoff. This further implies that $w^{**} < w^{*}$.

practice that firms have an explicit or implicit policy on earnings guidance (Bushee et al. 2003).[15] Empirical findings also suggest that it is costly for firms to change their earnings guidance policy on an ad-hoc basis, presumably based on private information (Hirst et al. 2008; Chen et al. 2011; Choi et al. 2011; Houston et al. 2010; Cai et al. 2014; Aghamolla et al. 2021). In deciding whether to make a commitment to provide earnings forecasts, managers compare the benefits and costs of that commitment. In our model, this is equivalent to comparing the ex ante payoffs with and without a forecast. It is in this context that we examine the effect of managerial career concerns, represented by w, on the commitment decision.[16]

[Insert Figure 3 about here.]

Figure 3 depicts the ex ante payoffs with and without a forecast as functions of w, which are $\Omega^{**}(w)$ and $\Omega^{*}(w)$ stated in (40) and (24), respectively. We know from Corollaries 2(i) and 4(i) that both are inverted-U shape functions, and $w^{**} < w^{*}$. Let their difference be

$$D(w) \equiv \Omega^{**}(w) - \Omega^{*}(w).$$

The manager commits to providing a forecast if and only if $D(w) > 0$.

Proposition 4 *There exists a unique threshold* $w^F \in (0,1)$ *such that the manager commits to issuing an earnings forecast if and only if* $w < w^F$. *In addition,* w^F *decreases with* h_g^{-1}.

Under our assumption that the prior mean of project profitability (i.e., m) is sufficiently large, $D(w)$ decreases with w, and $D(w) > 0$ if and only if $w < w^F$.[17] This means that the manager with w less (greater) than a threshold prefers the policy that requires (prohibits) forecasting. Two limiting cases help us explain the key intuition. Consider $w \rightarrow 0$. In this case, although the manager on average suffers from overinvestment with or without a forecast, he suffers less with a forecast because his incentive to overinvest is weaker; recall that when $w = 0$, $I^{fb} < I^{**} < I^{*}$ for any $p > 0$. In addition, the equilibrium forecast bias is minimized. The expected gain from improved efficiency in investment exceeds the expected cost of forecast error, implying that $\Omega^{**}(0) > \Omega^{*}(0)$. Hence, by

[15] In a NIRI survey conducted in 2006, 86 percent of firms providing earnings guidance say that they have a commitment to issue guidance (https://www.complianceweek.com/earnings-guidance-down-but-far-from-out/6613.article).

[16] Studying this ex ante commitment decision allows us to avoid tractability problems that arise if the manager's forecast decision is conditioned on his private information. In a different context, Aghamolla et al. (2021) also examine a firm's ex ante commitment to provide an earnings forecast. Appendix A provides further discussion of this issue.

[17] If m is not sufficiently large, $D(w) < 0$ can hold for *all* w, in which case the result is that the manager *always* commits to *no* earnings forecast.

continuity, a manager with a sufficiently small w is better off with a commitment to issue a forecast. Next, let $w \to 1$. In this case, with or without a forecast, investment inefficiency is, on average, caused by underinvestment. The manager issuing a forecast suffers more because the incentive to reduce investment is stronger; recall that when $w = 1$, $I^{**} < I^{*} < I^{fb}$ for any $p > 0$. Moreover, the forecast bias is maximized. As a result, $\Omega^{**}(1) < \Omega^{*}(1)$. Thus, a manager whose w is sufficiently close to 1 is worse off with a forecast. Because $D(w)$ decreases with w, there exists a unique value of w, which we denote as w^F, such that $\Omega^{**}(w) > \Omega^{*}(w)$ if and only if $w < w^F$.

Proposition 4 also shows that the equilibrium threshold, w^F, decreases with prior uncertainty about manager general ability, h_g^{-1}. Figure 3 provides a graphical illustration. First, we know that $\Omega^{**}(w)$ is independent of h_g^{-1}. Second, it is easy to verify that a higher h_g^{-1} decreases the maximizer of $\Omega^{*}(w)$, which is w^* stated in Corollary 2(i).[18] This means that as h_g^{-1} increases, $\Omega^{*}(w)$ shifts leftward. After this shift, the manager with $w = w^F$ is no longer indifferent; instead, he strictly prefers no forecast, i.e., $\Omega^{*}(w^F) > \Omega^{**}(w^F)$. It follows that a new threshold corresponding to a higher value of h_g^{-1} must be lower than before. In other words, an increase in h_g^{-1} leads to an expansion of the range $(w^F, 1]$ in which the manager is better off by committing to a no-forecast policy.

As noted at the beginning of this section, empirical evidence indicates that firms do not frequently change their earnings guidance policy, and empiricists typically attribute this stickiness to the negative capital market consequences of changing a firm policy. Proposition 4 offers alternative explanations based on manager characteristics. First, managers who mainly care about the market assessment of their general ability (generalists) are more likely to adopt a no-forecast policy than managers who care more about their project-related ability assessment (specialists). Second, managers with high uncertainty in their general ability are less likely to provide forecasts. These results suggest that if a firm CEO's type does not substantially change over time, or if the firm does not replace its CEO with a different type CEO, the firm's policy on earnings guidance could be sticky. Also, the magnitude of the uncertainty regarding a CEO's general management skills could be a factor determining the firm's earnings guidance policy. Ceteris paribus, as the uncertainty declines over time, the firm is more likely to adopt a policy of providing guidance. Empiricists may test these predictions.

[18] The intuition for this decrease of w^* is subtle, but can be explained as follows. Corollary 1 shows that a higher h_g^{-1} decreases the equilibrium investment under no forecast, I^*, and this translates into a downward shift of w^o stated in Proposition 2. The latter implies that the manager suffers from underinvestment for a wider range of p than before. As a result, the value at which his ex ante payoff $\Omega^{*}(w)$ is maximized must be lower than before.

VIII. SUMMARY AND CONCLUSION

This paper considers a setting in which a firm manager invests capital in a project and may or may not provide an earnings forecast. Prior to making investment and providing a forecast, the manager has private knowledge of his skills and talents that interact with the project investment, as well as his management expertise that contributes to the firm's future cash flow independently of the project; these are respectively referred to as the manager's project-related and general abilities. Based on the investment, an earnings forecast (if any), and the realized earnings, the market competitively prices the firm and assesses manager abilities. The manager seeks to increase not only the market value of the firm, but also the market assessments of his abilities. Our focus is on his signaling incentives to improve the ability assessments through the investment and earnings forecast.

Two key forces drive our main results. First, ceteris paribus, greater investment has a positive effect on the market assessment of project-related ability, but it also has a negative effect on the general ability assessment. The manager considers the trade-off between these two effects in his investment decision. With or without a forecast, if he is highly concerned about the market assessment of general ability, he underinvests. On the other hand, if he is mainly concerned about the assessment of project-related ability, he overinvests. Second, in the presence of a forecast, the incentive to decrease investment is strengthened because doing so has a greater positive impact on the general ability assessment. Therefore, the equilibrium investment with a forecast is less than that without it. We also show that the equilibrium forecast has an upward bias.

We exploit these results to examine the comparative static properties of the equilibria and their efficiency implications. For example, in the absence of a forecast, an increase in the quality of earnings information may increase or decrease equilibrium efficiency, depending on whether under- or overinvestment occurs in equilibrium. However, in the presence of a forecast, higher-quality earnings information always improves equilibrium efficiency.

Last, we examine whether the manager is ex ante better off with a commitment to issue an earnings forecast. If he is primarily concerned about the market assessment of his general (project-related) ability, he is better (worse) off by committing to no forecast. Also, a manager is more likely to opt for a no-forecast policy when the market has high uncertainty about his general ability.

APPENDIX A

This appendix discusses some of our modeling choices. In some discussion, we also suggest potential avenues for future research.[19]

A.1 Spillovers Between Manager Abilities

We assume that the manager's project-related and general abilities, μ_p and μ_g, are unrelated, and thus the two cash flows, $pR(I)$ and μ_g, contribute to the firm's total cash flow independently. In the real world, manager abilities could be related due to potential spillovers. That is, as noted in Section III, managers with a high project-related ability could also have a high ability in general management on average, or vice versa. This can be captured in the present model by allowing the prior distribution of manager abilities to be positively correlated. Although the presence of spillovers would complicate the analysis, there would be no qualitative change in our main results. Specifically, spillovers would affect the analysis under no forecast as follows. Given a positive correlation between manager abilities (μ_p, μ_g), greater investment that improves the market inference of project-related ability also has a positive effect on the market inference of general ability through the statistical relation between μ_p and μ_g. This strengthens the incentive to increase investment, but weakens the incentive to reduce investment to improve the market assessment of general ability. However, as long as the manager cares about the general ability assessment that positively contributes to his future payoff, the latter incentive does not vanish. As a result, the basic economic forces behind the trade-off between the two signaling incentives remain qualitatively unchanged. Next, when the manager issues a forecast, the equilibrium investment and forecast in the present model remain unchanged. This is because, regardless of a correlation between two abilities, both the project-related and general abilities are perfectly inferred in equilibrium. The above discussion of the two cases with and without a forecast implies that our result on forecast issuance (that is, the manager with relatively large concerns about the general ability assessment is better off with no forecast) remains qualitatively unchanged.

A.2 Relative Importance of Ability Assessment in the Manager's Objective Function

In the manager's objective function, we assume that he is equally concerned about the firm

[19] We thank the editor and two anonymous reviewers for directing our attention to the issues discussed here.

value, V, and the market assessment of his abilities, $wA_g + (1 - w)A_p$. This is to sharpen the intuition for our main results in which the *relative* importance of A_g and A_p in the manager's payoff plays a critical role. This assumption can be relaxed. For example, we can change the objective function (3) in the base model as follows:

$$\Pi(\mu_p, \mu_g, I) = E[V(\eta) + \alpha\{wA_g(\eta) + (1 - w)A_p(\eta)\} \mid \mu_p, \mu_g] - cI^2.$$

That is, we add a parameter $\alpha > 0$ that represents the manager's *overall* concerns about the ability assessment relative to the firm value. We discuss how this change would affect the results in the present model that corresponds to the case of $\alpha = 1$. (Formal results supporting our discussion are available upon request.)

First, for any given $\alpha > 0$, note that αw and $\alpha(1 - w)$ replace w and $(1 - w)$, respectively. Because this is the only change, the basic economic forces underlying the manager's signaling incentives remain unchanged. As a result, for a given α, all the results related to the effects of the other parameters on the equilibrium variables remain qualitatively unchanged. Second, note that a higher α implies that both αw and $\alpha(1 - w)$ increase, i.e., the manager's concerns about A_g and A_p increase simultaneously. This makes some of the comparative static effects of α ambiguous in general. However, it can be shown that, with certain conditions on the magnitudes of the other parameters, the intuitions for our main results are preserved. Relatedly, instead of the threshold w^F in Proposition 4, one may consider a threshold of overall career concerns in terms of α. In this case, it can be shown that: (i) there exists a unique value $\alpha^F > 0$ such that the manager commits to no forecast if and only if $\alpha > \alpha^F$; and (ii) α^F decreases with w. These two results share the spirit of Proposition 4 in that the manager chooses not to issue earnings forecasts when his overall concerns about the ability assessment are large, and this tendency becomes stronger as w increases.

A.3 Labor Market Consideration

As noted in Section I, managers are concerned about their ability assessment because it affects the labor market demand for their skills/talents and thus their future payoff. However, we do not explicitly model how the demand for a manager's project-related and/or general abilities is determined. Instead, we use an exogenous parameter w to represent the relative importance of market assessments A_g and A_p in the manager's objective function in a reduced form. In this regard, it may be interesting to extend our model to a setting in which w is endogenously related to the manager's career opportunities that are largely determined by potential employers' needs for his management skills/talents. Specifically, suppose that $(m + \delta_p\mu_p)R(I) + \delta_g\mu_g$ is the expected future cash flow of a firm in the economy when it invests I and has a manager whose abilities are (μ_p, μ_g). In this extended setup, (i) (δ_p, δ_g) can be viewed as firm characteristics (with $\delta_p = \delta_g = 1$ for the firm in our model), and (ii) the manager's future employment opportunities can be characterized by a non-degenerating distribution of (δ_p, δ_g). Firm characteristics play critical roles in hiring and wage decisions. For example, examining a firm's CEO hiring decision, Murphy and Zábojník (2004) consider the case of $\delta_p \leq 1$ and $\delta_g = 0$, and show that the magnitude of δ_p is critical to the decision whether to hire a CEO from outside and the wage of a CEO. In our current model, the manager's career opportunities are such that small values of w correspond to the cases in which δ_p is large relative to δ_g, and the converse is true for large values of w. When this model is extended without using w, the manager's future payoff can be endogenously determined by a market mechanism through which a manager with abilities (μ_p, μ_g) is hired by a firm that has characteristics (δ_p, δ_g). It would be interesting to examine how a particular manager-firm match is determined, and in particular, how this market mechanism may affect our current results on managerial incentives to signal abilities through investment and earnings forecast decisions.

A.4 Investment Observability

In our model, investment is public information. In reality, managers may invest human capital, e.g., time and effort, about which outsiders may have limited information. If the investment is *unobservable* to outsiders, the manager cannot use it as a signaling device to directly influence the firm value and ability assessment. However, because (i) greater investment increases earnings on average, and (ii) the market uses earnings to price the firm and assess manager abilities, the incentive to increase investment to indirectly improve the market assessment of abilities persists. This means that, ceteris paribus, career concerns motivate the manager to increase investment. On the other hand, due to investment unobservability, a standard moral hazard problem arises, which weakens the incentive to increase costly investment. Taken together, it follows that the equilibrium investment generally differs from that in the first-best case (absent any private information). This engenders efficiency loss, similar to that in the model of Pae (2021).

When the manager issues an earnings forecast, there is a mix of moral hazard and adverse selection problems. It is a challenging task to formally characterize an equilibrium in this case, but we have the following conjectures about key economic forces. The manager can use the forecast to signal his unobservable investment that is based on his private knowledge of abilities, especially on project-related ability. If so, a tension in signaling incentives arises. Specifically, a high forecast signaling a large investment induces a high assessment of project-related ability, but this lowers the market assessment of general ability for the same reason as that in the case of observable investment. How the manager trades off these two opposing signaling effects of a forecast and the resulting bias in the forecast depend on the relative magnitudes of his concerns about the market assessment of project-related and general abilities. Also note that, unlike the observable investment case in the current model, there is residual uncertainty about general ability. This means that earnings information plays a role in the general ability assessment.

Given the above discussion of the trade-off in investment in the case of no forecast and the trade-off in signaling incentives in the case of a forecast, we conjecture that a manager with relatively large concerns about his general ability assessment will choose not to issue a forecast, similar to the case of observable investment. We leave it to future research to verify our conjectures.

A.5 Earnings Quality, Uncertainty in Manager Objective, and Ex Post Earnings Forecasts

Taking earnings quality q as exogenous, Corollary 2(ii) shows that when the manager does not issue a forecast, the effect of q on equilibrium efficiency can be negative for large values of w. This suggests that if earnings quality were an *endogenous* choice variable, some managers would prefer low-quality earnings information. Without considering career concerns, some prior studies obtain a similar result in different contexts. For example, Kanodia et al. (2005) show that imprecise accounting measurement of investment can be value-enhancing by mitigating signaling incentives. We show that career concerns may be an alternative explanation for a value-enhancing role of imprecise accounting earnings. That is, if the manager is highly concerned about the assessment of his general ability, low-quality earnings can improve efficiency by weakening the incentive for underinvestment. A full-fledged model of endogenous earnings quality awaits future research.

There are circumstances in which the market is *unsure* of manager objectives. Some prior studies examine the effects of this uncertainty on earnings management (Fisher and Verrecchia 2000; Dye and Sridhar 2004; Feller and Schäfer 2019) and disclosure (Einhorn 2007). Along this line of research, it may be interesting to extend our model to a case in which the market has uncertainty about the relative weight that the manager assigns to the market assessments of abilities, i.e., w is a random variable. As noted in Sections I and III, w can be related to a manager's outside career opportunities and/or personal career plans, of which he may be privately informed. We believe that addressing this issue would require significant modifications of the model for tractability. For example, irrespective of forecast issuance, the market inference of manager project-related ability is imperfect because the inference depends on the distribution of w. This creates nontrivial problems because the market valuation of the firm, its assessment of general ability, and the inference of forecast bias all depend on the distribution of w. Future research may explore how this additional dimension of private information reshapes the equilibrium of the present model.

Last, Section VII examines whether a manager is better or worse off with a commitment to provide an earnings forecast prior to knowing his abilities privately. Here, we discuss a key issue that arises when the decision whether to provide a forecast is modeled to be *conditioned* on manager private information, (μ_p, μ_g). Note that this decision itself can be a signal to the market, in addition to investment and forecast (if issued). This is similar to a key issue in Datar et al. (1991) that a firm's choice of an auditor, in addition to the auditor's report, affects the market beliefs about the firm's private information; also see Noe (1988). In a similar vein, nondisclosure in standard voluntary disclosure models (e.g., Verrecchia 1983; Dye 1985) conveys information about the distribution of undisclosed private information. In our model, an immediate consequence of conditioning the manager's forecast issuance decision on his private information (μ_p, μ_g) is that the space of (μ_p, μ_g) is partitioned into two subspaces such that he issues a forecast in one subspace but not in the other. Accordingly, in equilibrium, the market must update its beliefs about manager abilities within the subspace in which he either issues a forecast or not. It will be interesting to examine how the manager's private information space is partitioned, its comparative static properties, and efficiency implications. We leave this task to future research.

A.6 Comparisons of Investments When the Project Profitability is Negative

Propositions 2 and 3 compare the equilibrium investments, I^* and I^{**}, with the first-best investment, I^{fb}, and their differences for the case in which the project profitability, p, is positive and thus all the investments are positive. Although this occurs almost always under our assumption that the mean of $p \sim N(m, h_p^{-1})$ is sufficiently large, there is a negligible possibility that p is negative due to its normality. Here, we discuss how those comparisons change in the case of $p < 0$.[20]

[20] All the results based on ex ante payoffs are not affected by these changes because the payoff conditional on p is integrated over the entire range of $p \in (-\infty, \infty)$.

Suppose that $p < 0$. First, consider the first-best case for the basic intuition. Note that the manager's incentive is to divest, $I < 0$, to improve the project cash flow, pI, and thus the firm value. Second, consider the equilibrium in the case of no forecast under asymmetric information, in which the market correctly infers p. The difference from the case of $p > 0$ is that there is *no* tension in the manager's signaling incentives with respect to career concerns. Specifically, he has an incentive to *increase* investment to improve the general ability assessment; see (20) with $p^c < 0$. This means that, in equilibrium, the incentive to divest more for a higher firm value is traded-off against the incentive to divest less (or to make a positive investment) for the higher ability assessments of μ_p and μ_g. Instead of the condition for overinvestment stated in Proposition 2 (i.e., $w < w^o$), it follows that $I^* > I^{fb}$ if and only if $(2c + \gamma' p)w < 2c + (1 - \beta')p$, as noted in the discussion below Proposition 2.[21] Last, consider the case in which the manager issues a forecast. For the same reason as that in the case of $p > 0$, the signaling incentive to manipulate investment for a better assessment of general ability is stronger than it is in the case without a forecast. As noted above, because $p < 0$, the direction of this incentive is reversed to increase investment. Hence, we have $I^{**} > I^*$ always, which is the opposite to the result in Proposition 3. Furthermore, $I^{**} > I^{fb}$ for any $p < 0$ with no condition on w. Given that the signaling incentives are to increase investment, this is intuitive.

APPENDIX B

Proof of Proposition 1

The result directly follows from the first-order condition for (6), with $R(I) = I$. ■

Proof of Proposition 2

The first-order condition for the manager's investment problem is:

$$v_I^c + 2v_s^c I + v_y^c p + w(a_I^c + 2a_s^c I + a_y^c p) + (1 - w)(b_I^c + 2b_s^c I + b_y^c p) - 2cI = 0.$$

Solving this equation for I yields the optimal investment stated in (11) and (12). The second-order condition requires that

$$[v_s^c + w(a_s^c) + (1 - w)(b_s^c)] - c < 0.$$

It is easy to verify that the above inequality is satisfied in equilibrium in which all the conjectures must be correct, i.e., $v_o = v_o^c$, $v_I = v_I^c$, $v_s = v_s^c$, $v_y = v_y^c$, $a_o = a_o^c$, $a_I = a_I^c$, $a_s = a_s^c$, $a_y = a_y^c$, $b_o = b_o^c$, b_I

[21] Under (23), this can be refined as follows; $I^* > I^{fb}$ for all $p \in [-2c/(1 - \beta'), 0)$, and $I^* > I^{fb}$ if and only if $w > w^o$ for all $p \in (-\infty, -2c/(1 - \beta'))$.

$= b_I^c$, $b_s = b_s^c$, $b_y = b_y^c$, $k_o = k_o^c$, and $k_p = k_p^c$. The equilibrium stated in the text is established by using (19), (21), and (22) along with the above-stated equilibrium conditions. Next, given Proposition 1,

$$I^* > I^{fb} \text{ if and only if } k_o^* + k_p^* p > p / 2c.$$

Using k_o^* and k_p^* stated in the text, it is straightforward to show that when $p > 0$, this condition is equivalent to $w < w^o \equiv \frac{2c+(1-\beta')p}{2c+\gamma' p}$. ■

Proof of Corollary 1

Note that I^* increases with k_o^*, and it also increases with k_p^* when $p > 0$. Hence, the result follows because: (a) k_o^* decreases with w, and k_p^* decreases with w, c, β', and γ'; and (b) β' and γ' increase with q and h_g^{-1}. ■

Proof of Corollary 2

(i) Differentiating Ω^* in (24) and using k_o^* and k_p^* stated in Proposition 2 yield

$$\frac{\partial \Omega^*}{\partial w} = 2c(m + 2\gamma'\Omega^{fb})k_p^* - (m + 2\gamma'\Omega^{fb}) + k_o^*(2c + m\gamma').$$

Rearranging terms shows that Ω^* increases with w if and only if $k_p^* > (1 - k_o^* A) / 2c$, where $A \equiv \frac{2c+m\gamma'}{m+2\Omega^{fb}\gamma'}$. Using k_o^* and k_p^* stated in Proposition 2 reveals that this condition is equivalent to $w < w^* \equiv \frac{(1-\beta')+A}{\gamma'+A} \in (0, 1)$.

(ii) Note that

$$\frac{\partial \Omega^*}{\partial q} = \frac{\partial \Omega^*}{\partial k_p^*}\frac{\partial k_p^*}{\partial q} = [\Omega^{fb} 4c(1 - 2ck_p^*) - 2ck_o^* m]\frac{\partial k_p^*}{\partial q},$$

$$\frac{\partial \Omega^*}{\partial h_g^{-1}} = \frac{\partial \Omega^*}{\partial k_p^*}\frac{\partial k_p^*}{\partial h_g^{-1}} = [\Omega^{fb} 4c(1 - 2ck_p^*) - 2ck_o^* m]\frac{\partial k_p^*}{\partial h_g^{-1}},$$

and

$$\frac{\partial \Omega^*}{\partial c} = \frac{\partial \Omega^*}{\partial k_p^*}\frac{\partial k_p^*}{\partial c} = [\Omega^{fb} 4c(1 - 2ck_p^*) - 2ck_o^* m]\frac{\partial k_p^*}{\partial c}.$$

Because

$$\frac{\partial k_p^*}{\partial q} < 0, \ \frac{\partial k_p^*}{\partial h_g^{-1}} < 0, \text{ and } \frac{\partial k_p^*}{\partial c} < 0,$$

Ω^* increases with q, h_g^{-1}, and c if and only if $k_p^* > (1 - k_o^* B) / 2c$, where $B \equiv \frac{m}{2\Omega^{fb}}$. This is equivalent to $w < w^+ \equiv \frac{(1-\beta')+B}{\gamma'+B} \in (0, 1)$.

(iii) Because $4ck_p^*(1 - ck_p^*) > 0$ and Ω^{fb} increases with h_p^{-1} (see (7)), Ω^* increases with h_p^{-1}. Note that $4ck_p^*(1 - ck_p^*) < 1$ when $k_p^* \neq 1/2c$ or, equivalently, $w \neq q^{-1} / h_g^{-1}$. Hence, the increasing rate of Ω^* is less than that of Ω^{fb}. ■

Proof of Proposition 3

The steps to derive the manager's optimal investment and forecast rules are similar to those described in the proof of Proposition 2. That is, taking derivatives of the manager's objective function with respect to I and F, and solving the resulting first-order conditions for I and F under the equilibrium conditions that all the conjectures are the same as the actual values, we obtain the equilibrium stated in the text. The details are omitted here, but available upon request.

Fix $p > 0$. Given that $w \in [0, 1]$, $\beta' \in (0, 1)$, and $\gamma' \in (0, 1)$, $I^{**} < I^*$ follows because $k_o^{**} = k_o^*$ and $k_p^{**} < k_p^*$. Last, $I^{**} < I^{fb}$ if and only if $k_o^{**} + k_p^{**}p < p / 2c$, which is equivalent to $w > w^{oo} \equiv \frac{2c}{2c+p}$. ■

Proof of Corollary 3

(i) Note that I^{**} increases with k_o^*, and it also increases with k_p^* when $p > 0$. Hence, the result follows because k_o^* decreases with w, and k_p^* decreases with w and c.

(ii) The results follow because (a) f_o^{**} increases with w and decreases with β, and (b) β increases with q. ■

Proof of Corollary 4

(i) Differentiating Ω^{**} with respect to w and rearranging terms,

$$\frac{\partial \Omega^{**}}{\partial w} = -(2\Omega^{fb} + 2m + 2c + 1)w + [2c + m + (1 - \beta)].$$

Thus, Ω^{**} increases with w if and only if $w < w^{**} \equiv \frac{2c+m-(1-\beta)}{2(m+c+\Omega^{fb})+1} \in (0, 1)$. It is easy to verify that $w^{**} \equiv \frac{2c+m-(1-\beta)}{2(m+c+\Omega^{fb})+1} < w^* \equiv \frac{(1-\beta')+A}{\gamma'+A}$, where $A \equiv \frac{2c+m\gamma'}{m+2\Omega^{fb}\gamma'}$.

(ii) Note that

$$\frac{\partial\Omega^{**}}{\partial c} = \frac{\partial\Omega^{**}}{\partial k_p^{**}}\frac{\partial k_p^{**}}{\partial c} = [\Omega^{fb}4c(1-2ck_p{}^{**}) - 2ck_o{}^{**}m]\frac{\partial k_p^{**}}{\partial c}.$$

Because

$$\frac{\partial k_p^{**}}{\partial c} < 0,$$

Ω^{**} increases with c if and only if $k_p{}^{**} > (1 - k_o{}^{**}B) / 2c$, where $B \equiv \frac{m}{2\Omega^{fb}}$. This is equivalent to $w < \frac{B}{1+B} \in (0, 1)$.

(iii) Corollary 3 shows that $f_o{}^{**}$ decreases with q. The result then follows from (40), where

$$E[J(y, F^{**})] = [h_z^{-1} + q^{-1} + (f_o{}^{**})^2] / 2.$$

(iii) Because Ω^{fb} increases with h_p^{-1} and $4ck_p{}^{**}(1 - ck_p{}^{**}) = 1 - w^2$, it follows that Ω^{**} increases with h_p^{-1} if $w \neq 1$. If $w \neq 0$, $1 - w^2 < 1$. Hence, the increasing rate of Ω^{**} is less than that of Ω^{fb}. ■

Proof of Proposition 4

Using the expressions for Ω^{**} in (40) and Ω^{*} in (24), note that

$$D(w) = INV(w) - CFE(w),$$

where

$$INV(w) \equiv \Omega^{fb}[(1 - w^2) - (2 - \beta' - w\gamma')(\beta' + w\gamma')] + w(1 - w)m(1 - \gamma') + (1 - w)m(1 - \beta')$$

and

$$CFE(w) \equiv \tfrac{1}{2}[h_z^{-1} + q^{-1} + (f_o{}^{**})^2].$$

Given the assumption that m is sufficiently large, $D(w)$ decreases with w because

$$\frac{\partial INV(w)}{\partial w} = -2\Omega^{fb}[w(1 - \gamma'^2) + \gamma'(1 - \beta')] + (1 - 2w)m(1 - \gamma') - m(1 - \beta') < 0$$

and

$$\frac{\partial CFE(w)}{\partial w} = f_o{}^{**} > 0.$$

Also note that $D(0) > 0$ and $D(1) < 0$. Because $D(w)$ is continuous and decreases with w, the Intermediate Value Theorem implies that there exists a unique value of w, denoted as w^F, such that $D(w) > 0$ if and only if $w < w^F$.

Next, applying the Implicit Function Theorem to $D(w^F) = 0$ yields

$$\frac{dw^F}{dh_g^{-1}} = -\frac{\partial D / \partial h_g^{-1}}{\partial D / \partial w^F} < 0 \text{ if and only if } \frac{\partial D}{\partial h_g^{-1}} < 0$$

because the denominator is negative. Partial differentiation and rearranging terms yield

$$\frac{\partial D}{\partial h_g^{-1}} < 0 \text{ if and only if } w^F < w^\dagger,$$

where $w^\dagger \equiv [h_p^{-1} + m(2cqh_g^{-1} + 2cqh_z^{-1} + m + 2c)] / \{qh_g^{-1}[h_p^{-1} + m(m + 2c)] + 2cm(qh_z^{-1} + 1)\}$. Using these results, it can be verified that

$$D(w^\dagger) < 0 = D(w^F).$$

Because $D(w)$ decreases with w, this implies that $w^F < w^\dagger$. Thus, w^F decreases with h_g^{-1}. ■

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Date 1	Date 2	Date 3
• The manager's abilities, (μ_p, μ_g), are realized and privately known to the manager. • The manager invests I in a project.	• The firm reports earnings y publicly. • Based on public information, the market prices the firm and assesses manager abilities.	• The firm's total cash flow, z, is realized.

Figure 1. Timeline of the basic model.

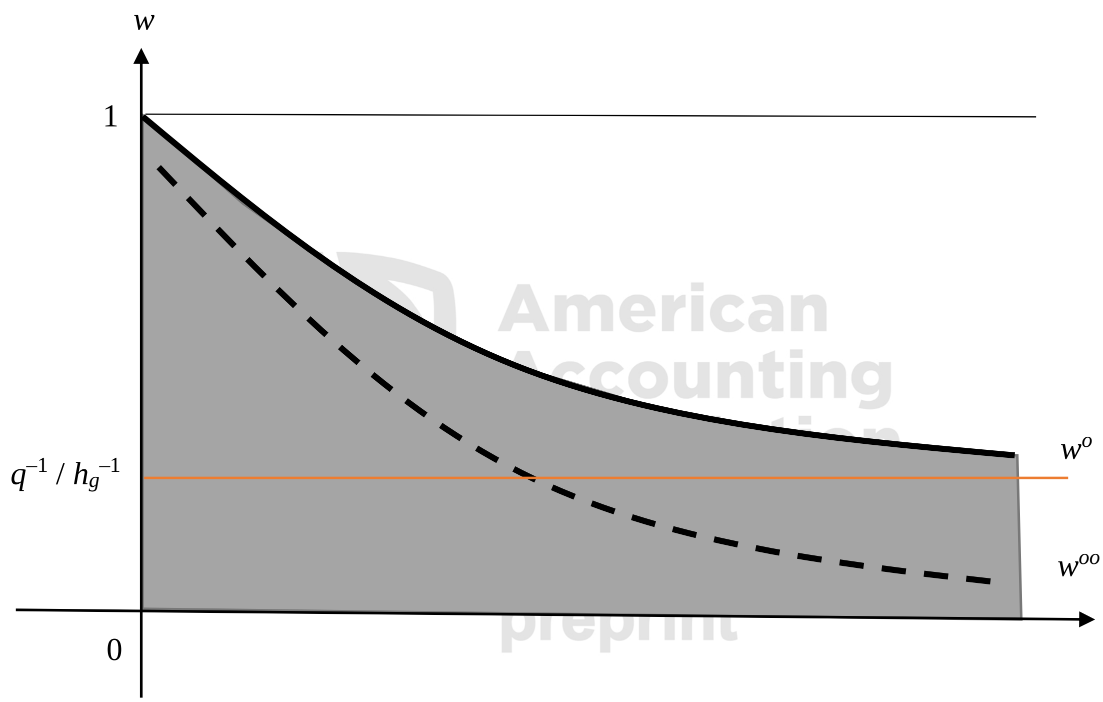

Figure 2. For a given $p > 0$, w^o is the value of w that induces the manager to choose the first-best investment, i.e., $I^* = I^{fb}$. When p and w are located in the shaded (unshaded) area, the manager overinvests (underinvests). In Section VI, when the manager provides an earnings forecast, w^{oo} plays the same role as that of w^o.

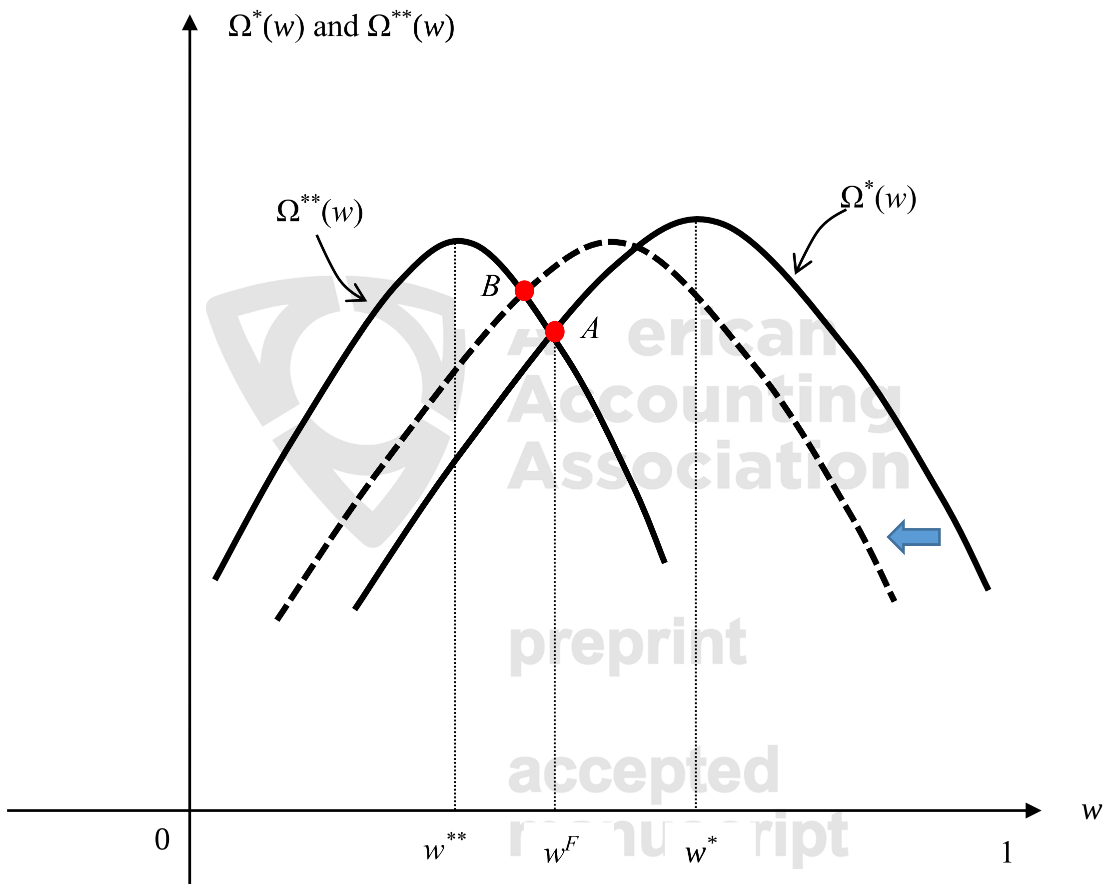

Figure 3. $\Omega^*(w)$ and $\Omega^{**}(w)$ are the ex ante equilibrium payoffs with and without a forecast, respectively. When h_g^{-1} increases, $\Omega^*(w)$ shifts to the left, which is depicted as a dashed curve. This shift changes the intersection of $\Omega^*(w)$ and $\Omega^{**}(w)$ from point A to point B, i.e., w^F decreases with h_g^{-1}.