THE ACCOUNTING REVIEW
Vol. 87, No. 4
2012
pp. 1309–1334

American Accounting Association
DOI: 10.2308/accr-50156

Identity, Incentives, and the Value of Information

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ABSTRACT: We examine the impact of identity preferences on the interrelation between incentives and performance measurement. In our model, a manager identifies with an organization and loses utility to the extent that his actions conflict with effort-standards issued by the principal. Contrary to prior arguments in the literature, we find conditions under which a manager who identifies strongly with the organization receives stronger incentives and faces more performance evaluation reports than a manager who does not identify with the organization. Our theory predicts that managers who experience events that boost their identification with the firm can decrease their effort in short-term value creation. We also find that firms are more likely to employ less precise but more congruent performance measures, such as stock prices, when contracting with managers who identify little with the organization. In contrast, they use more precise but less congruent measures, such as accounting earnings, when contracting with managers who identify strongly with the firm.

Keywords: *identity; incentives; multi-task agency; performance measure congruity; performance standards.*

We thank John Harry Evans III and Steven J. Kachelmeier (editors) as well as two anonymous referees for their helpful comments. We are grateful to Stan Baiman, Tim Baldenius, Jan Bouwens, Shane Dikolli, Paul E. Fischer, Robert F. Göx, Steve Hansen, Laurence van Lent, Brian Mittendorf, DJ Nanda, Thomas Pfeiffer, Jean-Pierre Ponssard, Bill Tayler, and research seminar participants at Stanford University, Tilburg University, University of Pennsylvania Wharton School of Business, the 2006 Operations Research Annual Conference, the 2007 Personnel Economics Workshop, the 2007 German Academic Association for Business Research Annual Meeting, the 2007 Accounting Research Workshop, the 2010 Management Accounting Section Research and Case Conference, and the 2010 European Accounting Association Annual Conference. Financial support has been provided by the Deutsche Forschungsgemeinschaft (DFG).

Editor's note: Accepted by John Harry Evans III.

Submitted: June 2007
Accepted: January 2012
Published Online: March 2012

I. INTRODUCTION

Agency theory is one of the most important theoretical paradigms in accounting research (Indjejikian 1999; Lambert 2001). It portrays a model of human motivation in which individuals are opportunistic maximizers of personal utility, resulting in a divergence of interest between self-interested and cooperative behavior. The theory posits that, in general, imperfect signals and conflicting interests between organizational members will lead to efficiency losses and reduced firm value (Jensen and Meckling 1976). Research in behavioral economics, on the other hand, provides substantial evidence that people have pro-social preferences and are not purely self-interested (Camerer 2003). In particular, organizational research suggests that people can take an identity as a part of an organization that inclines them to support the goals of the organization (Akerlof and Kranton 2000; Van Maanen and Schein 1979).[1]

Psychologists refer to "identity" as both a person's choice of a social reference category, such as a group, community, or organization with which to identify as well as its "self-image" or personal mental model with respect to that social reference category (Akerlof and Kranton 2000). A person's identity becomes a source of motivation when individuals internalize behavioral prescriptions so that they become internal evaluative standards to which the individual feels committed to satisfy (Akerlof and Kranton 2010; Cialdini and Trost 1998). Violating internalized standards creates anxiety and discomfort (Akerlof and Kranton 2000) and can result in strong negative emotions such as guilt and loss of self-esteem (Shamir 1990; Tangney and Dearing 2004; Tracy et al. 2007). Consequently, people who take an identity as part of an organization perceive a corresponding duty to act in concert with the standards of the organization.

The possibility that people identify with an organization opens new avenues for firms to influence their employees' decisions. By issuing standards, an organization can appeal to the sense of duty in its members.[2] This study investigates the optimal design of standards, incentives, and information systems when managers identify with an organization. Specifically, we examine the impact of identity preferences on the interrelation among optimal standards, incentives, and performance-measure characteristics.

The business community recognizes the importance of identity as an essential determinant of work-related behavior. Recent studies indicate that the military, universities, consulting firms, and high-tech companies systematically engage in initiatives to influence employees' behavior via their identities (Akerlof and Kranton 2010; Alvesson and Robertson 2006; Gioia et al. 2010; Ravasi and Phillips 2011). West Point drills and routines "inculcate non-economic motives" into cadets to align their objectives with those of the U.S. Army (Akerlof and Kranton 2005, 9). Similarly, some consulting firms cultivate an elite identity to generate "affective commitment" and "responsible autonomy" such that consultants will work hard even without traditional forms of control (Alvesson and Robertson 2006, 214).

Given the importance of identities for organizational behavior, researchers have done surprisingly little work on the use of identities as a form of control (Anteby 2008). This question is an intriguing research venue for accounting researchers for two reasons. First, identity preferences

[1] Studies of directors, accountants, investments bankers, and consultants suggest that organizational members pursue "fostered and desired occupational identities" (Anteby 2008, 202; see, e.g., Covaleski et al. 1998; Golden-Biddle and Rao 1997; Ibarra 1999). Moreover, research indicates that the strength with which people identify with an organization impacts cooperation, production, commitment, satisfaction, and turnover (Hillman et al. 2008; see, e.g., Ashforth and Mael 1989; Boivie et al. 2011; Dutton et al. 1994; Foreman and Whetten 2002; Golden-Biddle and Rao 1997).

[2] For example, at the Kellogg Graduate School of Management, the dean addresses new professors and doctoral student instructors to explain what the school considers to be appropriate behavior (Casadesus-Masanell 2004, 389). More generally, Akerlof (1982) suggests that *any* labor contract includes implicit or explicit standards.

may constitute a low-cost substitute for costly incentive and monitoring systems.[3] Second, and more important, identity preferences may have direct implications for the decision-influencing role of accounting because the value of accounting information for performance evaluation and compensation purposes may be reduced when agents exhibit strong identity preferences.

We consider an agency setting in which a principal hires an agent or manager. The principal offers a contract to the agent that includes a standard for the agent's effort level. The agent takes an identity as a part of the organization and loses utility to the extent that his actions conflict with standards issued by the organization. Empirical studies suggest that managers differ with respect to the identity they take in an organization (Boivie et al. 2011).[4] Critical events such as corporate identity initiatives or hostile takeovers can strengthen or undermine managers' identities.[5] We account for such variance in identity by considering variations in the degree to which agents internalize their organization's standards.[6]

A manager who internalizes a standard feels distress when deviating from it. This distress arises even though the manager's effort level is non-observable. Identity preferences do not reduce the disutility of effort; rather, they motivate a manager to provide effort *despite* the disutility of effort.[7] As a consequence, the manager does not fully reap the rewards of opportunism afforded by incomplete contracts. This sharply contrasts with the behavior of a classical self-interested agent who maximizes personal utility without considering the consequences for the organization.

Our model is associated with recent economic literature on guilt aversion and integrity, which has found that individuals have a basic disposition to experience distress when "disappointing people" or "breaking their own word" (Battigalli and Dufwenberg 2007; Charness and Dufwenberg 2006). Our model is also related to recent literature on work ethics (Casadesus-Masanell 2004; Carlin and Gervais 2009; Stevens and Thevaranjan 2010) that analyzes optimal employment contracts when agents experience disutility if their effort departs from a pre-defined standard set by the principal.[8]

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[3] For example, Hillman et al. (2008, 443) argue that "the more strongly an individual identifies with the organization, the more he will work to benefit it, because he sees himself as partly defined by the organization." With respect to contracting costs, Brickley et al. (2008, 620) write that if "everyone were to voluntarily reduce opportunistic behavior ... then the resources devoted to monitoring and enforcing exchanges could be used in more productive pursuits." In a similar vein, Akerlof and Kranton (2005, 11) state that "An employee who identifies himself as an insider in an organization needs little monetary inducement to perform a job well."

[4] Survey scales to measure organizational identification have been used and validated by Ashforth et al. (1998), Dukerich et al. (2002), and Shamir and Kark (2004), among others. Empirical studies suggest that people tend to identify more strongly with an organization the more they have "positive experiences of the organization ... perceive that the organization possesses distinctive and positive attributes ... perceive that the organization possesses a positive image likely to enhance their own; and ... perceive that the organization possesses values which are positive and congruent with their own" (Empson 2004, 763–764).

[5] See Ackerlof and Kranton (2005) and Ravasi and Phillips (2011) for examples of initiatives to strengthen identity; and see Giessner et al. (2011) for examples in which takeovers undermine individual identification with the firm.

[6] Throughout the study, we assume that all actors are perfectly informed about the actors' preferences such as their risk tolerance or the extent of their identification with the organization.

[7] Therefore, the notion of identity differs from the concept of intrinsic motivation based on needs for self-actualization (Maslow 1954), competence (White 1959), personal growth (Alderfer 1972), flow stimulation (Csikszentmihalyi 1975), self-determination (Deci and Ryan 1985), or achievement (McClelland 1988). Whereas an intrinsically motivated manager derives pleasure from performing an activity, a manager motivated by identity preferences does not necessarily enjoy performing the activity *per se*. Rather, the manager is motivated by a sense of duty or obligation toward the organization.

[8] Existing studies have also considered other motives as to why people adhere to standards. Kandel and Lazear (1992), Daido (2004, 2006), and Fischer and Huddart (2008) analyze models in which social norms are enforced by peer pressure. In their settings, norms can be subject to moral hazard and can therefore influence the optimal design of an organization. Conversely, in our study, standards are set by the principal and cannot be manipulated by agents. Furthermore, agents abide by standards because they identify with an organization and not because peer pressure forces them to do so. Hence, contrary to models of social norms and peer pressure, we analyze agents who *voluntarily* act within self-imposed confines.

These studies show that, in a single-task setting, contracts that account for an agent's nonmonetary preferences generally employ weaker incentives than the standard agency model. However, the information system in these studies reflects a single exogenous performance measure. This modeling choice abstracts away the relative usefulness of different performance measures and their incentive properties for the agent. Clearly, these issues become more important in settings in which agents engage in multiple activities. We attempt to add to the literature by investigating single- and multi-task settings with information systems that can produce multiple performance measures. This allows us to analyze the relative importance of performance-measure characteristics, the optimal incentive mix for a manager, and the value of incremental decision-influencing information for contracting purposes. Our study extends prior literature by investigating the impact of a manager's identity preferences on the organization's incentive system *and* its information system.

Our main findings are that if managers face a single task, then incentive rates and the value of additional reports for performance evaluation strictly decrease in the strength with which a manager identifies with the organization. This result matches common intuition and arguments made in the literature. In a multi-task setting, however, we find conditions under which a manager who identifies strongly with the organization receives stronger incentives and faces more performance evaluation reports than a manager who identifies less with the organization.[9]

We discuss applications of our theory and derive empirical predictions for settings in which managers significantly differ in their degree of identity or experience critical events that boost or undermine their identification with the firm. Our model predicts an inverse U-shaped relation between the number of performance measures and the strength of a manager's identity. Specifically, firms that inspire a strong (but not too strong) identity are more likely to use a mix of performance measures than less inspiring firms. Furthermore, firms are more likely to employ less precise, but more congruent, performance measures (e.g., stock price) when contracting with managers who identify little with their organization, while they use more precise but less congruent measures (e.g., accounting earnings) when contracting with managers who identify strongly with the firm. Our theory also predicts that managers who experience critical events that strongly boost their identification with the firm decrease their effort aimed at short-term value creation. Firms optimally react to these large identity shifts by providing steeper incentives while re-balancing relative incentive weights from more congruent but less precise to less congruent but more precise performance measures.

Overall, our model helps explain heterogeneity in performance measurement and incentive contracting within industries as a function of the identity managers take in their firms. More generally, our findings suggest that empirical compensation studies should proxy for a manager's identity to control for endogeneity.

The remainder of the paper is organized as follows: Section II presents the basic single-task, single-performance-measure model to characterize the optimal linear contract and standard that the principal offers to the agent. It demonstrates that contract parameters are not separable from the agent's identity preferences and finally investigates the value of an additional performance measure. Section III analyzes the impact of the agent's identity preferences on optimal incentive rates, effort choice, and the stewardship value of additional performance measures in a multi-task setting. Section IV concludes.

[9] In particular, these conditions refer to a setting in which a manager who does not identify with the organization exerts effort beyond the first-best on one task but less than first-best on the other task. In an agency setting, such conditions can arise if the performance measure is non-congruent and the agent is sufficiently risk-tolerant.

II. BASIC MODEL OF IDENTITY PREFERENCES IN A SINGLE-TASK SETTING

Agent's Action, Performance Measure, and Compensation

At date 0, the principal, acting on behalf of the firm's risk-neutral owners, hires an agent to provide personally costly effort $a \in \Re$ at date 1 in return for compensation at date 2. The agent's personal cost of effort is $\kappa(a) = \frac{1}{2}\, a^2$. At date 0, the principal also specifies a standard, s, for the agent's effort. We assume that the agent identifies with the organization and thus internalizes the standard such that the agent suffers an additional personal cost if he deviates from the standard:

$$\kappa_s(s, a) = \tfrac{1}{2}\, \gamma(s - a)^2,$$

where $\gamma \geq 0$ scales the loss of identity utility from deviating from the standard. We interpret γ as a measure of the strength with which the agent identifies with the organization.[10] Although violation of the standard is generally not observable by the principal, any deviation causes a personal cost to the agent. For simplicity, we assume that both a positive and a negative deviation from the standard result in a loss of identity utility, which increases with the level of violation.[11]

The agent's identity cost function, $\kappa_s(s, a)$, captures the notion that identity utility depends on the standard of the social reference category. When an agent identifies with an organization, he partly defines himself in terms of the organization and thus is sensitive to the externalities his actions exert on the organization. As a consequence, he perceives a duty to act in accord with the organization's standards and suffers emotional distress if he fails to do so. For such an agent, the standard defines the ideal effort level to serve the organization's best interest. Accordingly, the agent suffers a loss of identity utility because he is either "shirking" when providing effort that falls short of the standard or "ripping off the organization" when providing unnecessary but *costly* effort in excess of the standard. In the first case, the agent feels guilty because he does not contribute as is expected of him. In the second case, the agent feels guilty because he "games" the organization's compensation system by deliberately deviating from the effort the organization wants him to provide to increase his compensation.[12]

At date 2, performance measure y is publicly reported as $y = ma + \varepsilon$, where m is the report's sensitivity to the agent's effort and ε represents uncontrollable events, with $\varepsilon \sim N(0,\sigma^2)$.

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[10] Throughout the paper, we use the terms "identification with the organization" and "internalization of the standard," interchangeably. Implicitly, our analysis is restricted to a range of standards that the agent perceives to be "reasonable." In our setting, the principal sets the standard equal to the agent's first-best action, which can be regarded as a reasonable standard.

[11] Symmetric loss functions for deviations from standards are also used by Akerlof and Kranton (2005), Brueggen and Moers (2007), Casadesus-Masanell (2004), and Fischer and Huddart (2008). Furthermore, in a single-task setting, the principal will never set a standard below the agent's action, making the assumption of a symmetric loss function innocuous in the single-task setting.

[12] Examples of such reasoning include a surgeon who performs more surgery than necessary in terms of hospital-standards to increase his income, a CEO who accelerates the company's acquisition strategy because his compensation package increases in firm size, or a manager who is compensated based on annual earnings and who increases production without an according increase in sales to shift fixed costs to following periods to increase his current bonus. Aside from higher compensation costs, an agent's deviation from the standard may trigger additional costs for the firm in terms of an increased demand for coordination, slack, or even waste. These additional costs make the assumption about the agent's identity cost function more robust because an agent who identifies with the organization would feel even guiltier when purposely imposing additional costs on the firm with which he identifies. For example, if storing an excessive amount of units causes additional storage costs while increasing annual earnings, a manager feels more guilt about increasing production to boost his compensation. For simplicity, we do not explicitly consider these additional costs.

At date 0, the principal offers the agent a contract, represented by $z = (f,v,s)$, where f is the agent's fixed wage, v is the incentive rate for performance measure y, and s is the standard specified by the principal. Hence, given report y and contract z, the agent's compensation is $w(y, z) = f + vy$.

Agent's Preferences and Action Choice

We assume that the agent has a negative exponential utility function, which is multiplicatively separable in the utility from compensation, u_w, the disutility from effort, u_a, and the distress from not meeting the standard, u_s. Specifically:

$$u(z,a) = u_w(z,a)u_a(a)u_s(s,a) = -\exp[-r\Big(w - \kappa(a) - \kappa_s(s,a)\Big)],$$

where r denotes the agent's coefficient of absolute risk aversion. Maximizing the agent's expected utility is equivalent to maximizing the certainty equivalent, which is characterized by:

$$\begin{aligned} CE(z,a) &= E[w|z,a] - \kappa(a) - \kappa_s(s,a) - \tfrac{1}{2}\, rVar[w|z,a] \\ &= f + v\, ma - \tfrac{1}{2}\, a^2 - \tfrac{1}{2}\, \gamma(s-a)^2 - \tfrac{1}{2}\, rv^2\sigma^2. \end{aligned} \tag{1}$$

Differentiating (1) with respect to a, given contract z, provides the agent's incentive compatibility constraint:

$$vm + \gamma(s - a^\dagger) = a^\dagger, \tag{2}$$

where $a^\dagger$ denotes the action induced by contract z. The benefit to the agent of marginally increasing effort consists of an increase in compensation and, for $s > a$, a reduced identity utility loss because the agent's effort is closer to the standard. Hence, the agent's effort is motivated by monetary incentives, vm, and by identity incentives, $\gamma(s - a)$, which are substitutes with respect to the agent's effort choice. All else equal, Expression (2) implies that as the agent's identification with the organization increases, the standard becomes relatively more important in motivating the agent's effort.

Finally, the agent's individual rationality constraint reflects that he will only participate in the firm if his contract z provides him with his reservation certainty equivalent, which is normalized to zero:

$$CE(z, a^\dagger) \geq 0. \tag{3}$$

Principal's Preferences

We assume that the terminal value of the firm, which is not contractible, is a linear function of the agent's effort, $E[x|a] = ba$, where $b \in \Re$ is the agent's productivity. The expected net terminal value of the firm is:

$$\Pi(z,a) = E[x - w|z,a]. \tag{4}$$

In the first-best case in which the agent's action is contractible, no incentive risk is necessary to induce the agent to undertake a desired action, and it is optimal for the principal to specify first-best effort, $a^* = b$, and to set the standard equal to the first-best effort, $s^* = a^*$. Here, the optimal standard s^* does not depend on the agent's identification with the organization, γ, because the agent implements any action selected by the principal. If the principal sets $s^* = a^*$, then the agent will not suffer a loss of identity utility, implying that the agent's identity preferences are irrelevant.[13]

[13] This result indicates that a benefit of our modeling choices is that the first-best expected net profit is not affected by the strength of the agent's identity preferences. Consequently, we can investigate the agency loss for varying degrees of identity without the need to adjust for differences in first-best profits.

Optimal Linear Contract

We now consider the impact of an agent's identity preferences under second best. The principal chooses z to maximize her expected net payoff, (4), subject to the agent's incentive compatibility and individual rationality constraints, (2) and (3). Lemma 1 characterizes the agent's effort choice and the optimal contract offered by the principal.

Lemma 1: The principal's decision problem is separable in the contract's incentive parameters, incentive rate v and standard s. The agent's effort choice, $a^{\dagger}$, the optimal incentive rate, $v^{\dagger}$, and the optimal standard, $s^{\dagger}$, are characterized by (proofs are in Appendix A):

$$a^{\dagger}(v, s) = \frac{vm + \gamma s}{1 + \gamma}, \tag{5a}$$

$$v^{\dagger} = \frac{bm}{m^2 + r(1 + \gamma)\sigma^2}, \text{ and} \tag{5b}$$

$$s^{\dagger} = b. \tag{5c}$$

Although the optimal incentive rate depends on the agent's internalization of the standard, γ, it is independent of the standard itself (i.e., $\partial v^{\dagger}/\partial \gamma \neq 0$ and $\partial v^{\dagger}/\partial s = 0$). From the agent's individual rationality constraint, (3), with an optimal contract, the agent's expected compensation equals the sum of effort costs, identity costs, and risk premium. Substituting the induced action $a^{\dagger}$, (5a), into the sum of the agent's effort costs, identity costs, and risk premium yields:

$$\kappa(a^{\dagger}) + \kappa_s(a^{\dagger}, s) + \tfrac{1}{2} rVar[w|z, a^{\dagger}] = \tfrac{1}{2}[(1 + \gamma)^{-1}m^2 + r\sigma^2]v^2 + \tfrac{1}{2}\gamma(1 + \gamma)^{-1}s^2. \tag{6}$$

Expression (6) implies that the marginal cost to the principal of setting incentives via the incentive rate v varies with the agent's identity, γ, but is independent of the standard, s. Intuitively, increasing v yields an effort that is closer to the standard. For $a < s$, this increase in the agent's effort reduces the marginal cost of deviating from the standard, weakening identity incentives. Essentially, weaker identity incentives entail an additional cost to providing monetary incentives. Given a quadratic identity cost function, while this cost increases with the degree γ with which the agent internalizes the standard, it is independent of the action's deviation from the standard.

Lemma 1 also implies that the principal does not adjust the standard based on the strength of the agent's identification with the organization.[14] Consequently, the principal sets the same standard for agents with identical payoff productivity, b, even if the agents differ with respect to their identification with the organization, their risk tolerance, or the characteristics of their performance measures.[15]

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[14] Following (6), the marginal cost to the principal of setting standard s is $s\gamma(1 + \gamma)^{-1}$. Using (5a), the marginal benefit is $b\gamma(1 + \gamma)^{-1}$. Equating marginal benefit and marginal cost implies that the optimal standard, $s^{\dagger}$, is the agent's payoff productivity, b, which equals the agent's first-best action.

[15] In Appendix B we generalize this result by showing that in a multi-task LEN setting with quadratic effort cost and identity cost functions, the optimal standards are the agent's first-best actions. Intuitively, the marginal cost to the principal of setting the standards continues to be independent from the marginal cost of providing monetary incentives. Importantly, this result is independent of the number and properties of contractible performance measures available to the principal. While we can show that all of our main results hold with an identity cost function that increases linearly in the deviation from the standard, the result of a constant standard stems from the quadratic identity cost function. The latter analysis is available from the authors upon request.

The above discussion assumes that the principal sets a standard that exceeds the agent's effort. Proposition 1 next shows that this assumption is without loss of generality.

Proposition 1: In a single-task agency setting:

(i) the principal chooses a standard that exceeds the agent's effort (i.e., $s^{\dagger} > a^{\dagger}$);
(ii) an agent who fully identifies with the firm supplies first-best effort (i.e., $\lim_{\gamma \to \infty} a^{\dagger} = b$);
(iii) an agent's effort increases in his identity (i.e., $\partial a^{\dagger}/\partial \gamma > 0$); and
(iv) identity incentives and monetary incentives are substitutes (i.e., $\partial v^{\dagger}/\partial \gamma < 0$).

Proposition 1(i) in conjunction with $s^{\dagger} = b$ illustrates that identity incentives are generally not sufficient to achieve first-best because the moral hazard problem is not resolved when the agent suffers a loss of identity utility when deviating from a standard. This implies that the principal sets a standard from which the agent will surely deviate, i.e., the principal offers a contract that imposes identity costs on the agent.

When setting the standard, the principal trades off the identity costs and the benefits of identity incentives that motivate the agent to supply more effort.[16] Part (ii) of Proposition 1 shows that if the agent fully identifies with the firm, $\gamma \to \infty$, then he chooses the first-best action and thus suffers no identity costs.

By setting $s^{\dagger} > a^{\dagger}$, the principal imposes identity costs on the agent, which increase in the agent's desire to meet the standard. To avoid a loss of identity utility, the agent works harder. In turn, the principal reduces monetary incentives because the induced identity incentives more than compensate for the reduction in monetary incentives. This result confirms the finding of prior literature that the principal reduces incentives when contracting with an agent who strongly identifies with the firm (Akerlof and Kranton 2005).

Finally, the principal's expected net profit in the second-best case is given by:

$$\Pi^{\dagger}(\eta_1) = \tfrac{1}{2}\frac{\gamma}{1+\gamma}b^2 + \tfrac{1}{2}\frac{1}{1+\gamma} \cdot \frac{b^2 m^2}{m^2 + r(1+\gamma)\sigma^2}, \tag{7}$$

where η_1 indicates an information system that generates a single performance measure, y. Using (7), it is straightforward to show that the principal benefits from contracting with an agent who identifies with the organization and that the benefit increases in the agent's identity, γ. However, except in the knife-edge case where the agent fully identifies with the firm, $\gamma \to \infty$, the principal cannot achieve first-best. Therefore, the principal may want to reduce agency costs by contracting on multiple performance measures.

Stewardship Value of Additional Performance Measures

In many organizations, a principal has access to multiple performance measures. Earlier agency literature has provided extensive characterizations of the relative incentive weights for these measures and the stewardship value of additional performance measures (Lambert 2001). We next study how these characterizations change when the agent has identity preferences.

We extend the previous model by assuming that the principal may contract on a second signal, y_e, that reports on uncontrollable events affecting signal y. More specifically, information system η_2

[16] This result is similar to the argument that, in an adverse-selection setting, distorted performance measures may be beneficial to the principal. Following Maggi and Rodríguez-Clare (1995), given a convex cost of distortion, motivating distortion in equilibrium results in a higher marginal cost of distortion, which may provide a countervailing incentive that eases an agent's self selection. We thank Brian Mittendorf for pointing out this connection.

generates two signals, y and y_e, with $y = ma + \varepsilon$, $\varepsilon \sim N(0,\sigma^2)$, $y_e = \varepsilon_e$, $\varepsilon_e \sim N(0,{\sigma_e}^2)$, and $\text{Cov}[y,y_e] = \rho\sigma\sigma_e$.[17] The agent's compensation is given by $w = f + vy + v_e y_e$. Lemma 2 summarizes the optimal incentive rates and the principal's expected net payoff.

Lemma 2: Consider a single-task agency setting with two performance measures, y and y_e. The optimal incentive rates and the principal's expected net payoff become:

$$v^\dagger = \frac{bm}{m^2 + r(1+\gamma)(1-\rho^2)\sigma^2}, \tag{8a}$$

$$v_e^\dagger = -\rho\frac{\sigma}{\sigma_e}v^\dagger, \text{ and} \tag{8b}$$

$$\Pi^\dagger(\eta_2) = \tfrac{1}{2}\frac{\gamma}{1+\gamma}b^2 + \tfrac{1}{2}\frac{1}{1+\gamma}\cdot\frac{b^2m^2}{m^2 + r(1+\gamma)(1-\rho^2)\sigma^2}. \tag{8c}$$

Here the optimal standard is independent of the monetary incentives and hence is set to equal the first-best effort. By comparing the agent's performance in y with the one in y_e, the principal can filter out the impact of uncontrollable events on the agent's compensation (Antle and Demski 1988). Following (8a) and (8b), the agent's identity preferences affect the two incentive rates $v^\dagger$ and $v_e{}^\dagger$, such that both incentive rates decrease in the agent's identity, γ. Given that identity incentives substitute for monetary incentives, the incentive risk imposed on the agent via $v^\dagger$ decreases with γ. Consequently, less filtering via $v_e{}^\dagger$ is required for a stronger identification with the organization.

We define the value of an additional performance measure as the difference in expected net payoff to the principal with and without this measure. Specifically, given information system η_1 with a single performance measure, y, and information system η_2 with signals y and y_e, using (7) and (8c) the value of y_e becomes:

$$V^\dagger = \Pi^\dagger(\eta_2) - \Pi^\dagger(\eta_1) = \tfrac{1}{2}\frac{b^2m^2r\rho^2\sigma^2}{(m^2 + r(1+\gamma)\sigma^2)(m^2 + r(1+\gamma)(1-\rho^2)\sigma^2)}. \tag{9}$$

Proposition 2 summarizes the consequences of varying strength of the agent's identity on the optimal incentive ratio, $IR^\dagger = v_e{}^\dagger/v^\dagger$, and the value of an additional performance measure, $V^\dagger$.

Proposition 2: Consider a single-task agency setting with two performance measures:

(i) the ratio of the two incentive rates is independent of the agent's identity (i.e., $\partial IR^\dagger/\partial\gamma = 0$); and
(ii) the value of an additional performance measure is decreasing in the agent's identity (i.e., $\partial V^\dagger/\partial\gamma < 0$).

Proposition 2(i) implies that both incentive rates decrease at the same rate when the agent identifies more strongly with the organization. The key to this result is that optimal risk filtering via $v_e{}^\dagger$ is directly proportional to the risk imposed on the agent via $v^\dagger$ from (8b). Hence, while the relevance of monetary incentives declines with an agent's identification with the organization, the relative importance of an additional signal on uncontrollable events is independent of the agent's identity.

[17] Note that assuming y_e is not action-informative, $\partial E[y_e]/\partial a = 0$, is without loss of generality. We can always transform any signal y_a with $\partial E[y_a]/\partial a \neq 0$, into y_a', where $\partial E[y_a']/\partial a = 0$, such that (y,y_a') is an equivalent statistic for (y,y_a).

By filtering out the impact of uncontrollable events on an agent's compensation, the principal reduces the agent's risk premium. Consequently, stronger monetary incentives are more attractive to the principal. On the other hand, a stronger identification with the organization entails weaker monetary incentives, which reduces the value of an additional signal that can be used to filter out the impact of uncontrollable events.

For the single-task setting, our result matches the common intuition that identity incentives and monetary incentives are substitutes. Moreover, while the relative incentive weights placed on the measures are unaffected by an agent's perceived pressure to meet the standard, the value of an additional performance measure decreases with an agent's identity. Regarding the design of performance measurement systems, the latter results suggest that empirical studies on the relative importance of performance signals for incentive purposes do not need to control for an agent's identity when the set of measures is held constant. However, the set of performance measures decreases in an agent's identity, suggesting that neglecting an agent's identity in empirical studies introduces the possibility of correlated omitted variables.

III. IDENTITY PREFERENCES IN A MULTI-TASK SETTING

In this section, we extend our initial analysis to a multi-task setting. In multi-task agency settings, performance measure noncongruity introduces an additional efficiency loss to the principal (Feltham and Xie 1994). Accordingly, in this section, we explore the impact of an agent's identity on the interrelation between monetary incentives and performance measurement when an agent is responsible for multiple tasks with a single performance measure and multiple performance measures.

Two-Task Setting with a Single Performance Measure

Optimal Linear Contract

The impact of an agent's identity preferences becomes more subtle if the agent is responsible for multiple tasks. The agent now controls two tasks, a_1 and a_2, at cost $\kappa(a_1,a_2) = \frac{1}{2}(a_1^2 + a_2^2)$. The expected gross value of the firm is represented by $E[x|a_1,a_2] = b_1a_1 + b_2a_2$. As in the previous section, we initially consider an information system, η_1, that generates a single performance measure, $y = m_1a_1 + m_2a_2 + \varepsilon$, with $\varepsilon \sim N(0, \sigma^2)$.

The principal specifies a standard, s_i, for each action a_i, $i = 1,2$. To keep the analysis simple while retaining the same model structure, we assume that the agent's disutility of deviating from the standards is homogeneous, such that the agent has no direct preference for a specific standard, and separable, such that compliance with one standard does not affect the cost of deviating from the other standard:

$$\kappa_s(s_1, s_2, a_1, a_2) = \tfrac{1}{2}\gamma\left\{(s_1 - a_1)^2 + (s_2 - a_2)^2\right\}.$$

Using this parametrization, Lemma 3 characterizes the optimal contract and the principal's net payoff.

Lemma 3: Given a two-task agency setting with a single performance measure, the optimal standards, incentive rate, and the principal's expected net payoff become:

$$s_1^\dagger = b_1 \text{ and } s_2^\dagger = b_2, \tag{10a}$$

$$v^{\dagger} = \frac{b_1 m_1 + b_2 m_2}{m_1^2 + m_2^2 + r(1+\gamma)\sigma^2}, \text{ and} \tag{10b}$$

$$\Pi^{\dagger}(\eta_1) = \tfrac{1}{2}\frac{\gamma}{1+\gamma}(b_1^2 + b_2^2) + \tfrac{1}{2}\frac{1}{1+\gamma} \cdot \frac{(b_1 m_1 + b_2 m_2)^2}{m_1^2 + m_2^2 + r(1+\gamma)\sigma^2}. \tag{10c}$$

Several insights from the single-task setting regarding the impact of identity preferences remain valid for the two-task setting. For example, the standards are set equal to the first-best action, the incentive rate decreases with an agent's identification with the organization, γ, and the principal's expected net payoff increases with γ. However, while an agent's effort increases with γ in the single-task setting, the relation is more subtle in a multi-task setting.

Identity Preferences and Induced Effort

To understand the consequences of an agent's identity preferences in a multi-task setting, we first analyze the relative effort levels that can be induced by the principal. If there are two tasks, then the first-best effort ratio is $ER^* = a_1^*/a_2^* = b_1/b_2$. Under second best, the agent's effort allocation is characterized by:

$$ER^{\dagger}(v, s_1, s_2) = \frac{a_1^{\dagger}(v, s_1)}{a_2^{\dagger}(v, s_2)} = \frac{m_1 v + \gamma s_1}{m_2 v + \gamma s_2}. \tag{11}$$

When the agent does not identify with the organization, $\gamma = 0$, the effort ratio reflects the signal's sensitivity to the agent's actions (i.e., $ER^{\dagger} = m_1/m_2$ if $\gamma = 0$). Thus, the performance measure limits the inducible effort ratio such that a congruent performance measure, $m_1/m_2 = b_1/b_2$, is a necessary and sufficient condition for the principal to implement the first-best effort ratio. In contrast, when the agent identifies with the organization, $\gamma > 0$, the principal can induce any pair of actions. However, by setting optimal standards the principal does not, in general, induce the first-best effort ratio.[18] Specifically, using (10a) and (10b) in (11), the principal chooses to implement an effort ratio $ER^{\dagger}$ that reflects the agent's identity as well as the agent's risk aversion, the noisiness of the performance measure, and the agent's payoff productivity in both tasks. With a noncongruent performance measure, $m_1/m_2 \neq b_1/b_2$, identity incentives and monetary incentives induce divergent effort allocations. While identity incentives induce a first-best effort allocation such that $ER^{\dagger} = s_1{}^{\dagger}/s_2{}^{\dagger} = b_1/b_2$ if $v = 0$, monetary incentives induce an effort allocation along the sensitivity of the performance measure (i.e., $ER^{\dagger} = m_1/m_2$ if $\gamma = 0$), and the relative strength of monetary incentives varies with the incentive rate from (10b).

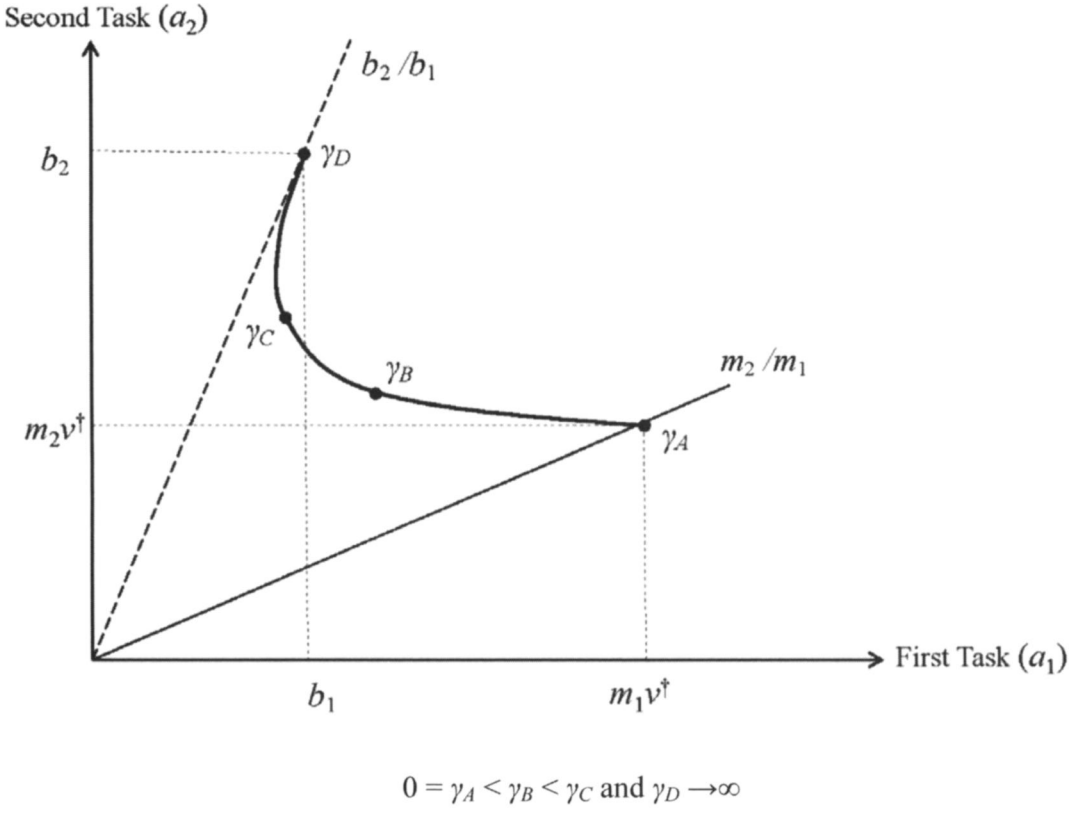
Considering the influence of identity preferences on an agent's effort in a multi-task setting, similar to the single-task setting, the agent's effort in each task is driven by identity and monetary incentives. While identity incentives increase in an agent's identity, monetary incentives decrease in γ. In a single-task setting, the first effect dominates, implying that an agent's effort increases with γ. Proposition 3 illustrates that the relation is more subtle in a multi-task setting.[19]

Proposition 3: In a two-task agency setting, the impact of an agent's identity on the effort induced by the principal is ambiguous. Necessary and sufficient conditions for a negative impact of identity on the effort for task i are:

[18] The first-best effort ratio is achieved only for knife-edge cases where the performance measure is congruent with the principal's payoff, the principal does not offer monetary incentives, or the agent fully identifies with the organization.

[19] For expositional brevity, we characterize all cutoff values, such as r_c and γ_c in the respective proofs.

FIGURE 1
Impact of an Agent's Identity on his Effort Allocation



(i) the performance measure places a relatively larger weight on task i as compared with task l (i.e., $m_i/m_l > b_i/b_l$, $i, l = 1,2$ and $i \neq l$);
(ii) the agent is sufficiently risk tolerant (i.e., $r < r_c$); and
(iii) the agent only weakly identifies with the firm (i.e., $\gamma < \gamma_c$).

Proposition 3 is illustrated in Figure 1. The solid line depicts the agent's effort allocation for varying degrees of identity, with γ increasing from γ_A to γ_D. Intuitively, under the conditions outlined in Proposition 3(i) and (ii), the second-best effort exceeds the first-best effort for one of the agent's tasks. In Figure 1, at γ_A, while the agent's effort in task 2 is below the standard $s_2{}^\dagger$ (i.e., $a_2{}^\dagger < b_2$ if $\gamma = 0$), the effort in task 1 exceeds the standard $s_1{}^\dagger$ (i.e., $a_1{}^\dagger > b_1$ if $\gamma = 0$). Applying the logic of Proposition 1(ii) to a multi-task setting, the agent supplies first-best effort if he fully identifies with the firm (i.e., $a_i{}^\dagger = b_i$ at $\gamma_D \to \infty$, $i = 1,2$). For a stronger identity, e.g., when increasing γ from γ_B to γ_C, the agent's effort allocation "moves closer" to first-best. Then, following the intermediate value theorem, the effort in one task necessarily decreases in the agent's identity.

A negative impact of identity on effort can also apply in settings where the agent's effort in his multiple tasks is below the standards, but the effort allocation is skewed toward one of the tasks.

Such a situation is depicted at γ_C, where $a_1^{\dagger} < b_1$ but, at the same time, $\partial a_1^{\dagger}/\partial\gamma < 0$. Recall that identity incentives increase in an agent's identity and the principal optimally reduces monetary incentives for higher γ. If the agent's risk aversion is neither too low nor too high, then this reduction of monetary incentives can dominate the increase in identity incentives.[20]

To summarize, in a multi-task setting, the impact of an agent's identity on effort is ambiguous. If effort is very hard to motivate with actions well below the standards, then an agent's effort in each task increases in his identity. Otherwise, the relation between an agent's effort and his identification with the organization can be U-shaped such that the effort first decreases in the agent's identity but then increases once the identity is sufficiently strong.

Our findings have interesting implications for an organization that ties incentive compensation to a single performance measure such as accounting earnings. If the measure is inherently noncongruent and does not reflect a manager's contribution to firm value adequately, a firm risks inducing an unbalanced allocation of effort across tasks. For example, activities aimed at increasing short-term value are generally assumed to be better reflected in performance measures than those aimed at increasing long-term value (Horngren et al. 2010; Ittner and Larcker 2003).[21] Recently, identity initiatives that foster employees' identification with their organization have been suggested as a remedy to the effort-allocation problem (Alvesson and Robertson 2006; Alvesson and Willmott 2002; Ravasi and Phillips 2011). Our model predicts that successfully implemented identity initiatives in firms that inspired a low identification before the initiative can undermine (boost) managers' effort in short-term (long-term) value generation. As a consequence, when short-term performance is critical to firm survival, e.g., due to short-term liquidity issues, this effect may constitute an important boundary condition to fostering identification in practice.

Accordingly, our model suggests that over the short run, a firm's performance measures may provide contrarian signals about the economic success of an identity initiative. This can trigger nontrivial costs for the firm if analysts and investors misinterpret a reduction in short-term performance as an indication that the initiative was not successful or even detrimental to firm value. Thus, our model also highlights the potential for the performance measurement system to reflect the economic success of identity initiatives only after a significant time lag.

Our theory further predicts that events that strongly weaken the identification with the firm,[22] can boost (undermine) employees' effort for tasks that are well (not well) reflected in the firm's performance measurement system. For example, after a merger employees of an acquired firm often identify less with their new organization than the employees of the acquirer (Giessner et al. 2011; Ullrich and van Dick 2007). Here our theory predicts that employees of the acquired firm will exert more effort on tasks that the new organization's performance measurement system measures well and provide less effort on tasks that are hard to measure relative to employees of the acquiree. Consequently, after a merger, employees of an acquired firm tend to engage more in short-term than in long-term value generation. More generally, our model predicts cross-sectional variation across firms with respect to the effort that managers exert on short-term versus long-term value creation as a function of their identification with the organization.

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[20] More precisely, $\exists\, r \in (r_u, r_c)$, where r_u yields $a_i^{\dagger}|_{\gamma=0} = b_i$, $i = \{i | m_i/m_l > b_i/b_l,\ i, l = 1,2 \text{ and } i \neq l\}$, and r_c is given in the proof to Proposition 3, such that $a_i^{\dagger} < b_i$ and $\partial a_i^{\dagger}/\partial\gamma < 0$ for γ is sufficiently small. This result shows that our assumption of an identity cost function where the agent experiences distress when he supplies effort above the standard is not a necessary condition for the ambiguous impact of identity on effort.

[21] In our model, one could think of a_1 as reflecting short-term effort and a_2 as reflecting long-term effort. Consequently, short-term effort being better reflected in the performance measure implies $m_1/m_2 > b_1/b_2$.

[22] Such events could include fear of downsizing, dim career perspectives, corporate restructuring, mergers and takeovers, strategic change, or continuing losses (Petriglieri 2011; Terry et al. 2001; Ullrich and van Dick 2007).

Identity Preferences and Performance Measure Choice

In this subsection, we consider the impact of identity preferences on the relative importance of precision and congruity, two key indicators of the contracting usefulness of performance measures. For the two-task setting, the expected net payoff to the principal under second best is given by (10c), and the first-best expected net payoff is $\Pi^* = \frac{1}{2}({b_1}^2 + {b_2}^2)$. Therefore, the loss of surplus to the principal is:

$$L = \Pi^* - \Pi^\dagger = \tfrac{1}{2}\frac{\dfrac{(b_2m_1 - b_1m_2)^2}{(1+\gamma)} + r(b_1^2 + b_2^2)\sigma^2}{m_1^2 + m_2^2 + r(1+\gamma)\sigma^2}. \tag{12}$$

According to Feltham and Xie (1994), $(b_2m_1 - b_1m_2)^2$ reflects the loss due to performance measure noncongruity, while the second term in the numerator of (12) reflects the loss due to performance measure noise. The total loss of surplus decreases in an agent's identity, γ. More importantly, Expression (12) suggests that γ affects the relative size of the two types of losses, in turn affecting the relative importance of performance measure congruity and precision for the solution of the agency conflict.

Proposition 4: In a two-task agency setting with a single performance measure, the loss due to noncongruity relative to the loss due to performance measure noise decreases with an agent's identification with the organization.

Key to Proposition 4 is that identity incentives induce the first-best effort allocation and substitute for monetary incentives. Thus, the second-best effort allocation induced by a noncongruent performance measure becomes less relevant for total effort allocation when an agent more strongly identifies with the organization.

Proposition 4 shows that identity preferences affect a principal's choice among performance measures. To illustrate this impact, consider a setting in which the principal may choose between two information systems, η_1' and η_1''. While η_1' discloses a congruent report y_1', signal y_1'' of η_1'' is noncongruent but more precise. Specifically, $y_1' = b_1a_1 + b_2a_2 + \varepsilon_1$, with $\varepsilon_1 \sim N(0,{\sigma_1}^2)$, and $y_2'' = m_1a_1 + m_2a_2 + \varepsilon_2$, with $\varepsilon_2 \sim N(0,1)$, $\text{Var}[y_1'] = {\sigma_1}^2 > \text{Var}[y_1''] = 1$, and $m_1/m_2 \neq b_1/b_2$.

Using this parametrization in (10c) yields the principal's expected net payoffs $\Pi^\dagger(\eta_1')$ and $\Pi^\dagger(\eta_1'')$. The principal strictly prefers η_1' over η_1'' if $\Pi^\dagger(\eta_1') > \Pi^\dagger(\eta_1'')$. This condition is equivalent to:

$$\sigma_1^2 < \sigma_c^2 \equiv \frac{(b_1^2 + b_2^2)\Big((b_1m_2 - b_2m_1)^2 + r(1+\gamma)(b_1^2 + b_2^2)\Big)}{r(1+\gamma)(b_1m_1 + b_2m_2)^2}, \tag{13}$$

where ${\sigma_c}^2$ equates $\Pi^\dagger(\eta_1')$ and $\Pi^\dagger(\eta_1'')$. Intuitively, the principal prefers the congruent system, η_1', over the noncongruent system, η_1'', if the congruent measure is not too noisy. From (13), the precision of y_1 that is necessary for the principal to prefer η_1' over η_1'' increases with an agent's identity (i.e., $\partial {\sigma_c}^2/\partial\gamma < 0$).

This section shows that, when organizations employ a single performance measure, the more employees identify with the firm, the less important is the measure's congruity relative to its precision. Therefore, our model predicts that firms are more likely to employ less precise but more congruent performance measures, such as stock prices, when contracting with managers who identify very little with their organization, while they will use more precise but less congruent measures, such as accounting earnings, when contracting with managers who strongly identify with their firm. This prediction is in accord with insights about incentive contracts of newly appointed CEOs who were either promoted from inside or hired from outside the firm (Bouwens and Kroos

2010). We would argue that managers who are promoted from the inside identify more strongly with the firm than managers who are hired from the outside.[23] As a consequence, it seems important to provide newly hired CEOs from the outside with congruent incentives, even if those incentives may rely on relatively noisy measures. In line with our predictions, Bouwens and Kroos (2010) find that incentives for new "outside" CEOs are based less on accounting earnings and more on stock market returns when compared with incentives for CEOs who were promoted from inside the firm.

Additional Performance Measures in a Multi-Task Setting

Optimal Linear Contract

To demonstrate how identity preferences affect the relative weights placed on performance measures and the value of additional performance measures in a multi-task setting, we extend the previous analysis by assuming that information system η_2 generates two performance measures, y and y_a. While y is an aggregate measure of the agent's effort in each task, a_1 and a_2, assume that y_a only captures effort for task a_1. Specifically, $y = m_1a_1 + m_2a_2 + \varepsilon$, $y_a = m_aa_1 + \varepsilon_a$, $\varepsilon \sim N(0,\sigma^2)$, $\varepsilon_a \sim N(0,{\sigma_a}^2)$, and $\text{Cov}[\varepsilon,\varepsilon_a] = 0$. With η_2, the agent's compensation is given by $w = f + vy + v_ay_a$.

Using this parametrization, Lemma 4 characterizes the optimal contract and the principal's net payoff.

Lemma 4: In a two-task agency setting with two performance measures, y and y_a, the optimal standards, incentive rates, and the principal's expected net payoff become:

$$s_1^\dagger = b_1, \text{ and } s_2^\dagger = b_2, \tag{14a}$$

$$v^\dagger = D^{-1}[\left(m_a^2 + r(1+\gamma)\sigma_a^2\right)(b_1m_1 + b_2m_2) - b_1m_1m_a^2], \tag{14b}$$

$$v_a^\dagger = D^{-1}[-m_1m_a(b_1m_1 + b_2m_2) + \left(m_1^2 + m_2^2 + r(1+\gamma)\sigma^2\right)b_1m_a], \text{ and} \tag{14c}$$

$$\begin{aligned}\Pi^\dagger(\eta_2) = {} & \tfrac{1}{2}\frac{\gamma}{1+\gamma}(b_1^2 + b_2^2) \\ & + \tfrac{1}{2}\frac{1}{1+\gamma}D^{-1}[(b_1^2 + b_2^2)m_2^2m_a^2 + r(1+\gamma)\left(b_1^2m_a^2\sigma^2 + (b_1m_1 + b_2m_2)^2\sigma_a^2\right)],\end{aligned} \tag{14d}$$

where:

$$D = \left(m_1^2 + m_2^2 + r(1+\gamma)\sigma^2\right)\left(m_a^2 + r(1+\gamma)\sigma_a^2\right) - m_1^2m_a^2.$$

Recall that, in a single-task setting, the incentive weight assigned to either a single or multiple performance measures decreases with an agent's identity, γ. Likewise, in a multi-task setting, the incentive weight for a single performance measure decreases with γ. To the contrary, in a multi-task setting with multiple performance measures, the impact of an agent's identity on the incentive rates is more subtle. Moreover, while the ratio of incentive rates, $IR^\dagger = v^\dagger/{v_a}^\dagger$, is independent of an agent's identity in a single-task setting, it varies in a nontrivial way with γ in a multi-task setting.

Proposition 5: In a two-task agency setting with two performance measures, y and y_a:

[23] See also Boivie et al. (2011) for a similar argument.

(i) the impact of an agent's identity on the incentive rates is ambiguous. Specifically, when an agent weakly identifies with the firm, the incentive rates increase in an agent's identity (i.e., $\partial v^{\dagger}/\partial\gamma > 0$ for $\gamma < \gamma'$ and $\partial v_a{}^{\dagger}/\partial\gamma > 0$ for $\gamma < \gamma''$); and

(ii) for an increasing identity, the principal assigns a relatively larger weight on performance measure y_a as compared with measure y if the latter is biased toward measuring task 1 (i.e., $\partial IR^{\dagger}/\partial\gamma < 0$ if $m_1/m_2 > b_1/b_2$).

Proposition 5 demonstrates how the triangular relation between managerial identity, performance measure congruity, and the principal's calibration of incentive rates to managerial identity and performance-measure congruity influences an agent's effort choice. The ambiguous impact of identity preferences on monetary incentives is driven by two disparate, though intertwined, effects. First, absent identity preferences, noncongruent performance measures impose a discount on incentives and thus tend to flatten incentives as compared with more congruent performance measures (Feltham and Xie 1994). Second, stronger identity preferences tend to reduce the bias imposed by noncongruent performance measures such that, for a given level of monetary incentives, stronger identity preferences reduce the "noncongruity discount" on monetary incentives. The reduced discount can make the use of stronger monetary incentives more attractive for the principal. Therefore, to improve a manager's effort allocation over multiple tasks, the principal will offer stronger incentives to managers who partially identify with the organization.

While the impact of an agent's identity on the incentive ratio is generally ambiguous, Proposition 5(ii) characterizes conditions where the principal assigns, for increasing γ, a relatively larger weight on y_a as compared with y. In a multi-task setting with non-aligned performance measures, varying the incentive ratio induces a variation in the agent's effort allocation. Specifically, for the conditions characterized in Proposition 5(ii), the principal places a relatively larger weight on performance measure y_a, which captures task 1, even though performance measure y is (also) biased toward measuring task 1. Again, the intuition for this result follows from the impact of identity preferences on the noncongruity discount on incentives.

The results of this section indicate that, when firms use multiple performance measures for incentive compensation, the level of a manager's identification with the firm influences both the absolute intensity of the manager's incentives and the relative incentive weights assigned to the different measures.[24] Employing a mix of performance indicators inevitably involves the use of some measures that are more congruent than others. Our model provides insight concerning how to choose the optimal intensity of the manager's incentives and how to re-balance the incentive weights assigned to more or less congruent performance measures as a function of the manager's identification with the firm. For example, many firms base their incentive compensation on some mix of stock price and accounting earnings. Our model predicts that the more managers identify with their organization, the more firms will put a higher weight on accounting earnings *vis-à-vis* stock prices in managers' incentives. Furthermore, we expect identity initiatives in low-identification firms to be associated with steeper incentives and a re-balancing of incentive weights from stock price to accounting earnings.

Stewardship Value of Additional Performance Measures

The expected net payoff to the principal increases as agents identify more strongly with the firm. In a single-task setting, the increase in net payoff with an information system that generates a

[24] More generally, our study suggests that incentive weights on performance measures vary non-trivially with a manager's "pro-social" or "other regarding preferences." Relatedly, Bouwens and van Lent (2010) find that a measure of group conformity asymmetrically influences the incentive weights on financial and nonfinancial measures of performance.

single performance measure is larger than the increase with an information system that generates two performance measures. Consequently, the stewardship value of an additional performance measure decreases with an agent's identity, implying that a principal will use fewer performance measures when contracting with an agent who identifies more strongly with the firm.

In a multi-task setting, given that information system η_1 generates y and information system η_2 generates y and y_a, using (10c) and (14d), the value of y_a, $V^\dagger = \Pi^\dagger(\eta_2) - \Pi^\dagger(\eta_1)$, is characterized by:

$$V^\dagger = \tfrac{1}{2}(1+\gamma)^{-1}\left(m_1^2 + m_2^2 + r(1+\gamma)\sigma^2\right)^{-1} D^{-1}[m_2(b_1m_2 - b_2m_1) - r(1+\gamma)\sigma^2 b_1]^2 m_a^2. \tag{15}$$

Proposition 6 shows that, in a multi-task setting, the value of an additional performance measure does not necessarily decrease in how strongly the agent identifies with the firm, suggesting an overall ambiguous relation between the number of signals used for performance evaluation and an agent's identification with the firm.

Proposition 6: In a two-task agency setting with two performance measures, y and y_a, the impact of an agent's identification with the firm on the value of an additional signal, y_a, is, in general, ambiguous.

(i) For a risk-neutral agent, the value of an additional performance measure decreases with the agent's identity (i.e., $\partial V^\dagger/\partial\gamma < 0$ if $r \to 0$);
(ii) For an extremely risk-averse agent, the value of an additional performance measure is unaffected by the agent's identity (i.e., $\partial V^\dagger/\partial\gamma = 0$ if $r \to \infty$); and
(iii) A sufficient condition for a positive impact of an agent's identity on the value of an additional performance measure is that the initial performance measure, y, is sufficiently misaligned (i.e., $m_1/m_2 - b_1/b_2$ is sufficiently positive).

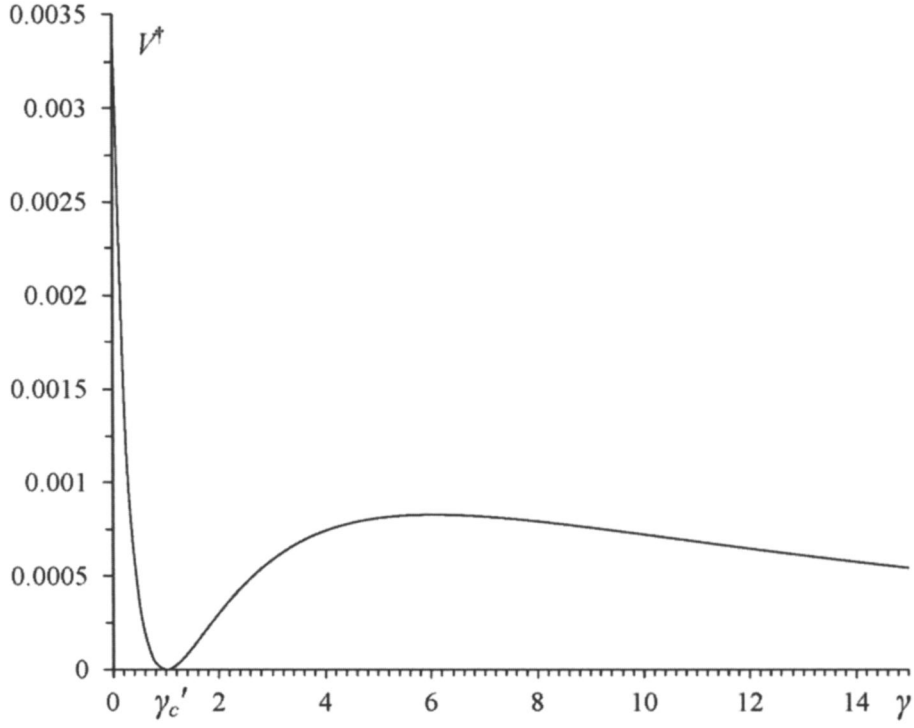
The key to Proposition 6(i) is that the principal can use the two performance measures generated by η_2 to construct an "overall" performance measure, which is congruent with her expected payoff. Agent risk-neutrality implies that, despite the noisiness of this constructed performance measure, the principal can still achieve first-best. Since $\Pi^\dagger(\eta_1)$ increases in γ, $V^\dagger$ decreases in the agent's identity. Intuitively, for a risk-neutral agent, efficiency losses relate only to performance measure noncongruity, and the relevance of this efficiency loss decreases with γ. On the other hand, for an extremely risk-averse agent, the principal refrains from offering monetary incentives. Under η_1 and η_2, the agent's effort is driven only by identity incentives, implying that the value of generating an additional performance measure is zero.

Proposition 6(i) and (ii) suggest that the value of an additional performance measure, $V^\dagger$, may increase in an agent's identity only for a sufficient risk tolerance (i.e., $\partial V^\dagger/\partial\gamma > 0$ only if $r \in (0, r_{max})$). Proposition 6(iii) states a sufficient condition for a positive impact of γ on $V^\dagger$ that complements the necessary condition on the risk tolerance.[25]

The key to Proposition 6(iii) is that the principal trades off marginal costs and benefits from contracting on the additional measure y_a. Assuming that the initial performance measure y is biased toward task 1, $m_1/m_2 > b_1/b_2$, a positive incentive weight on y_a increases the incentives for the agent to deviate further from the first-best effort allocation as it shifts the incentives toward task 1. However, as the two performance measures are not correlated, an increase in v_a enables the principal to decrease v and thus reduce the risk imposed on the agent. In turn, a negative incentive weight on y_a has the opposite effect, because it partly removes the incongruence associated with the initial measure. This allows the principal to increase v accordingly, thereby increasing the risk

[25] While the necessary condition of intermediate levels of risk tolerance is straightforward from Proposition 6(i) and (ii), characterizing this interval requires solving a fourth-order polynomial.

FIGURE 2
Impact of the Agent's Internalization of the Standard, γ, on the Value $V^{\dagger}$ of Generating an Additional Performance Measure in a Two-Task Setting



imposed on the agent. While the principal faces a trade-off between noncongruence and imposed risk even in the absence of identity preferences, the analysis in the section "Identity Preferences and Performance Measure Choice" indicates that, the stronger the agent's identity, the less important is the congruity of a performance measure to evaluate the agent. Thus, when the initial measure is biased toward task 1 and the agent is sufficiently risk-tolerant, absent identity preferences, the principal chooses $v_a{}^{\dagger} < 0$ to reduce the noncongruence associated with the initial performance measure. As γ increases, reducing the noncongruence becomes less important such that $v_a{}^{\dagger}$ approaches zero and, for some γ, the principal will choose $v_a{}^{\dagger} = 0$.[26] If γ increases further, then the noncongruence induced by monetary incentives becomes less consequential such that the principal uses the additional measure to reduce the induced risk imposed on the agent by setting $v_a{}^{\dagger} > 0$ while also reducing $v^{\dagger}$. Importantly, $V^{\dagger} = 0$ if $v_a{}^{\dagger} = 0$, implying an ambiguous relation between $V^{\dagger}$ and γ.

Figure 2 illustrates Proposition 6(iii) for parameter values $b_1 = b_2 = 1$, $m_1 = 3$, $m_2 = m_a = 1$, $r = 1$, and $\sigma = \sigma_a = 1$. Following (14c), $v_a{}^{\dagger} = 0$ for $\gamma = \gamma_c{}' = (m_2/b_1)(b_2m_1 - b_1m_2)/(r\sigma^2) - 1$, implying that $V^{\dagger} = 0$ if $\gamma = \gamma_c{}'$. For $\gamma < \gamma_c{}'$, the principal selects $v_a{}^{\dagger} < 0$ to construct an overall

[26] More generally, using (14c), the principal chooses $v_a{}^{\dagger} = 0$ if $-r\sigma^2 + m_2/b_1(1+\gamma)^{-1}(b_2m_1 - b_1m_2) = 0$, where the first term reflects the marginal cost from changing the agent's risk premium and the second term reflects the marginal benefit from reducing the loss due to non-congruity. It follows that $m_1/m_2 > b_1/b_2$ is a necessary condition for $v_a{}^{\dagger} = 0$.

performance measure that is more congruent with her payoff. Here, the value of an additional measure decreases in γ because identity preferences reduce the need for the principal to construct a more congruent overall performance measure. For $\gamma > \gamma_c'$, the principal selects $v_a^{\dagger} > 0$. While this yields an overall performance measure that is even less congruent with her payoff than y, the relatively strong identity incentives impair the agent's monetary incentives to select an effort allocation that differs substantially from first-best. In turn, choosing a positive incentive rate $v_a^{\dagger}$ enables the principal to reduce the incentive rate $v^{\dagger}$ for performance measure y, resulting in a beneficial reduction of the agent's risk premium. Finally, for sufficiently high γ (for $\gamma > 6.04$ in the example), identity incentives dominate the agent's action choice, monetary incentives are relatively less important, and the value of an additional performance measure decreases in the agent's identity.

The findings in this section pertain to a firm's decision whether to tie incentive compensation to the single most congruent measure available or to employ a mix of more or less congruent performance indicators. As shown, the solution to this question depends on the level of the manager's identification with the firm and the diversity of tasks assigned to the manager. Unlike in the single-task setting, the stewardship value of the additional measure is not unambiguously decreasing in the manager's identification with the firm. In particular, our analysis indicates that firms with an intermediate level of identification are more likely to apply some mix of performance measures than low-identification firms. The intuition for this result follows our previous finding that the congruity of a performance measure *vis-à-vis* its precision becomes less important in a multi-task setting, the more a manager identifies with his firm. More generally, given that managers vary considerably with respect to how strongly they identify with firms (Boivie et al. 2011), our findings provide a possible explanation for the observed heterogeneity in the number and type of performance measures used within industries.

IV. CONCLUDING REMARKS

This study extends a LEN model to allow a risk- and effort-averse agent to identify with an organization such that the agent's utility declines as his actions deviate from effort-standards set by the principal. We analyze the impact of the agent's identity preferences on optimal performance standards, incentive rates and ratios, the agent's effort, and the value of information for performance evaluation and compensation.

Our model yields comparative statics that provide predictions concerning how additional factors will affect performance-contingent compensation. In practice, managers vary considerably with respect to how strongly they identify with their organization (Boivie et al. 2011). For example, a manager's identification is likely to increase in his job tenure as managers adopt organizational standards to reduce cognitive dissonance and emotional distress rather than leaving the organization. We also expect identification to be increasing in the strength and the saliency of an organization's ideology or culture as managers self-select into organizations whose values and standards they share and in the resources an organization spends to influence its members' identities. Moreover, critical events such as corporate identity initiatives or hostile takeovers can boost or undermine managers' identity. Thus, firm owners face an additional reason to customize contracts to managerial characteristics.

Our analysis reveals that a positive impact of identity on monetary incentives is driven by the multi-task environment. Therefore, our findings suggest that the necessity to control for identity becomes more important as the managers' activities become more diverse. Assuming that higher-level managers are more often confronted with multiple tasks, we would expect that complementarities between identity preferences and monetary rewards are more pronounced at higher hierarchical levels. An interesting extension to our setting is the endogenous nature of a

firm's task assignment problem. In particular, we would expect that employees who strongly identify with their firms are generally assigned more diverse tasks than employees who identify weakly or not at all with their firm. For the same reason, we would expect firms to invest more in fostering their employees' identification with them, the more their business model requires their employees to take care of more diverse tasks that are difficult to measure.

Our model is a first step toward the analysis of identity preferences and the design of incentive and information systems. Understanding the interplay among these factors may provide guidance for future empirical work involving managers' identities. Clearly, our results are subject to the caveat of being based on simple representations of the agent's identity preferences, together with the restriction to linear contracts that is common to LEN models. Despite this limitation, we expect the economic mechanisms that cause identity incentives and monetary rewards to be partial substitutes or partial complements to continue to hold for optimal contracts.

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APPENDIX A
PROOFS

Lemma 1

Setting (2) equal to zero and re-arranging yields (5a). Setting (1) equal to zero and solving for f yields $f^{\dagger}$. Substituting $f^{\dagger}$ in (4) and using (5a) yields the principal's unconstrained maximization problem:

$$\Pi(f^{\dagger}, v, s, a^{\dagger}) = b(1+\gamma)^{-1}(vm + \gamma s) - \tfrac{1}{2}\gamma(1+\gamma)^{-1}s^2 - \tfrac{1}{2}[(1+\gamma)^{-1}m^2 + r\sigma^2]v^2. \quad \text{(A1)}$$

Note that $\Pi(f^{\dagger},v,s,a^{\dagger})$ is separable in s and v. Differentiating (A1) with respect to s and v, setting the derivatives equal to zero and solving for s and v yields (5b) and (5c). ■

Proposition 1

(i) Substituting (5b) and (5c) into (5a) yields:

$$a^{\dagger} = \left(m^2 + r(1+\gamma)\sigma^2\right)^{-1}(m^2 + r\gamma\sigma^2))b \leq b. \quad \text{(A2)}$$

(ii) Applying l'Hôspital's rule yields $\lim_{\gamma\to\infty} a^{\dagger} = b$.

(iii) and (iv) Differentiating (A2) and (5b) with respect to γ establishes the claim. ■

Lemma 2

The agent's certainty equivalent with two performance measures is characterized by:

$$CE(z,a) = f + (vm + \gamma s)a - \tfrac{1}{2}(1+\gamma)a^2 - \tfrac{1}{2}\{r(v^2\sigma^2 + 2vv_e\rho\sigma\sigma_e + v_e^2\sigma_e^2) + \gamma s^2\}. \quad \text{(A3)}$$

The agent's action choice is characterized by the solution to $\partial CE(z,a)/\partial a = 0$. Setting (A3) equal to zero and solving it for f yields $f^\dagger$. Substituting $f^\dagger$ and $a^\dagger$ in (4) yields the principal's unconstrained optimization problem. Solving the first-order conditions with respect to v, v_e, and s for the three variables yields (8a), (8b), and $s^\dagger = b$. Substituting these results in the unconstrained maximization problem yields (8c). ■

Proposition 2

(i) Dividing (8b) by (8a) yields ${v_e}^\dagger/v^\dagger = -\rho\sigma/\sigma_e$. Taking the derivative with respect to γ, and, for (ii), differentiating (9) with respect to γ establishes the claim. ■

Lemma 3

The agent's certainty equivalent in the two-task setting is given by:

$$CE(z,a_1,a_2) = f + v(ma_1 + m_2a_2) - \tfrac{1}{2}(a_1^2 + a_2^2) - \tfrac{1}{2}\gamma[(s_1 - a_1)^2 + (s_2 - a_2)^2] - \tfrac{1}{2}rv^2\sigma^2. \quad \text{(A4)}$$

Differentiating (A4) with respect to a_1 and a_2 yields the agent's effort choices ${a_1}^\dagger$ and ${a_2}^\dagger$. Setting (A4) equal to zero, solving for f, and substituting the result in (4) yields the principal's optimization problem:

$$\Pi(\eta_1, s_1, s_2, v, a_1, a_2) = b_1a_1 + b_2a_2 - \tfrac{1}{2}(a_1^2 + a_2^2) - \tfrac{1}{2}\gamma[(s_1 - a_1)^2 + (s_2 - a_2)^2] - \tfrac{1}{2}rv^2\sigma^2. \quad \text{(A5)}$$

Substituting ${a_1}^\dagger$ and ${a_2}^\dagger$ in (A5), differentiating the result with respect to v, s_1, and s_2, and solving the first-order conditions for these variables yields (10a) and (10b). Substituting ${a_1}^\dagger$ and ${a_2}^\dagger$ plus (10a) and (10b) in (A5) yields (10c). ■

Proposition 3

The proof is organized as follows: We first show the derivative of a_i with respect to γ and characterize the condition for $\partial {a_i}^\dagger/\partial\gamma < 0$, $i = 1,2$. Using this characterization, we establish the sufficient condition in (iii) and then show that the two necessary conditions in (i) and (ii) must hold. Differentiating (11a) with respect to γ yields:

$$\frac{\partial a_i^\dagger}{\partial\gamma} = \frac{b_i(m_l^2 + r(1+\gamma)\sigma^2)^2 + b_i m_1^2 m_2^2 - b_l m_1 m_2(m_l^2 + m_2^2 + 2r(1+\gamma)\sigma^2)}{(1+\gamma)^2(m_1^2 + m_2^2 + r(1+\gamma)\sigma^2)^2}, \quad \text{(A6)}$$

$i, l = 1,2$ and $i \neq l$.

Setting $\partial {a_i}^\dagger/\partial\gamma < 0$ and rearranging terms yields the following condition for $\partial {a_i}^\dagger/\partial\gamma < 0$:

$$\frac{b_i}{m_i} < \frac{b_l}{m_l} \cdot \frac{m_l^2(m_1^2 + m_2^2 + 2r(1+\gamma)\sigma^2)}{(m_l^2 + r(1+\gamma)\sigma^2)^2 + m_1^2 m_2^2}. \quad \text{(A7)}$$

(iii) The right-hand side of (A7) is monotonically decreasing in γ and goes to zero for $\gamma \to \infty$.

This indicates that for $\partial a_i^{\dagger}/\partial\gamma < 0$ to hold, γ cannot exceed a certain threshold, γ_c. Setting (A7) to equal zero and solving for γ provides γ_c:

$$\partial a_i^{\dagger}/\partial\gamma = 0 \text{ if } \gamma = \gamma_c = \frac{b_l m_1 m_2 - b_i(m_l^2 + r\sigma^2) + \sqrt{m_1 m_2 (b_l m_i - b_i m_l)(b_1 m_1 + b_2 m_2)}}{r b_i \sigma^2}. \tag{A8}$$

(i) Substituting $b_i/m_i = b_l/m_l$ in (A8) yields $\gamma_c < 0$.

(ii) The numerator of the right-hand side in (A8) is negative for high values of r. This indicates that for $\gamma_c > 0$, it has to be the case that $r < r_c$, where r_c yields a zero numerator in (A8), i.e.:

$$r_c = (b_i\sigma^2)^{-1}[m_l(b_l m_i - b_i m_l) + \sqrt{m_1 m_2 (b_l m_i - b_i m_l)(b_1 m_1 + b_2 m_2)}]. \blacksquare$$

Proposition 4

Taking the derivative of the numerator in (12) with respect to γ establishes the claim. ∎

Lemma 4

The agent's certainty equivalent is given by:

$$CE(z, a_1, a_2) = f + v(m_1 a_1 + m_2 a_2) + v_a m_a a_1 - \tfrac{1}{2}(a_1^2 + a_2^2) - \tfrac{1}{2}\gamma[(s_1 - a_1)^2 + (s_2 - a_2)^2] - \tfrac{1}{2} r(v^2\sigma^2 + v_a^2\sigma_a^2). \tag{A9}$$

Differentiating (A9) with respect to a_1 and a_2 and solving the first-order conditions for these variables yields the agent's effort choices ${a_1}^{\dagger}$ and ${a_2}^{\dagger}$. Setting (A9) to equal zero, solving for f, and substituting the result in (4) yields the principal's optimization problem:

$$\Pi(z, a_1, a_2) = b_1 a_1 + b_2 a_2 - \tfrac{1}{2}(a_1^2 + a_2^2) - \tfrac{1}{2}\gamma[(s_1 - a_1)^2 + (s_2 - a_2)^2] - \tfrac{1}{2} r(v^2\sigma^2 + v_a^2\sigma_a^2). \tag{A10}$$

Substituting ${a_1}^{\dagger}$ and ${a_2}^{\dagger}$ in (A10), differentiating the result with respect to v, v_a, s_1, and s_2, and solving the first-order conditions for these variables yields (14a), (14b), and (14c). Substituting ${a_1}^{\dagger}$ and ${a_2}^{\dagger}$ plus (14a), (14b), and (14c) in (A10) yields (14d). ∎

Proposition 5

(i) Differentiating Expression (14b) with respect to γ, setting $\partial v^{\dagger}/\partial\gamma > 0$, and solving the result for γ yields:

$$\gamma' = \frac{-\sigma\left(b_2 m_2 m_a^2 + r\sigma_a^2(b_1 m_1 + b_2 m_2)\right) + m_a\sqrt{m_1 m_2\left((b_1 m_2 - b_2 m_1)(b_1 m_1 + b_2 m_2)\sigma_a^2 - b_1 b_2 m_a^2\sigma^2\right)}}{r\sigma\sigma_a^2(b_1 m_1 + b_2 m_2)}.$$

Differentiating (14c) with respect to γ, setting $\partial {v_a}^{\dagger}/\partial\gamma > 0$, and solving the result for γ yields:

$$\gamma'' = \frac{\sigma_a m_a(b_2 m_1 - b_1 m_2) - r\sigma^2\sigma_a b_1 + \sqrt{m_1 m_2\left((b_2 m_1 - b_1 m_2)(b_1 m_1 + b_2 m_2)\sigma_a^2 + b_1 b_2 m_a^2\sigma^2\right)}}{r\sigma^2\sigma_a b_1}.$$

(ii) Substituting (14b) and (14c) in $IR = v^{\dagger}/{v_a}^{\dagger}$ yields the incentive ratio. Differentiating $IR^{\dagger}$ with respect to γ yields:

$$\partial IR^{\dagger}/\partial\gamma = rm_2 \frac{(b_1m_2 - b_2m_1)(b_1m_1 + b_2m_2)\sigma_a^2 - b_1b_2m_a^2\sigma^2}{m_a\left(b_2m_1m_2 - b_1\left(r(1+\gamma)\sigma^2 + m_2^2\right)\right)^2}.$$

Substituting $b_1/m_1 < b_2/m_2$ establishes the claim. ■

Proposition 6

(i) Setting $r = 0$ in (15) and differentiating with respect to γ yields:

$V^{\dagger}(\eta_2|\eta_1) = -\frac{1}{2}(1+\gamma)^{-2}(m_1^2 + m_2^2)^{-1}(m_2^2)^{-1}[m_2(b_1m_2 - b_2m_1)]^2 < 0.$

(ii) Letting r grow to infinity in (15) yields:

$\lim_{r\to\infty} V^{\dagger}(\eta_2|\eta_1) = 0.$

(iii) From (15), $V^{\dagger}(\eta_2|\eta_1) = 0$ for $\gamma = \gamma_\lambda \equiv (m_2/m_1 - b_2/b_1)\, m_1m_2\, /(r\,\sigma^2) - 1$, and $\gamma_\lambda > 0$ for $b_1m_2 - b_2m_1$ sufficiently positive. Moreover, $\partial V^{\dagger}(\eta_2|\eta_1)/\partial\gamma > 0$ if $\gamma = \gamma_\lambda$. ■

APPENDIX B
IDENTITY PREFERENCES IN A MULTI-TASK LEN SETTING

This section establishes that the optimal standards chosen by the principal in a setting with quadratic identity- and effort-cost functions are independent of the agent's degree of internalization of the standards (which implies $s_i^{\dagger} = b_i$), irrespective of the number of tasks that the agent is responsible for and irrespective of the characteristics of the information system available for contracting.

B.1 Agent's Preferences, Information System, and Action Choices

Assume the agent controls n activities that influence the payoff to the principal and let the vector $\mathbf{a} \in \Re^n$ represent his choice of effort levels. The personal cost of effort is assumed to be:

$$\kappa(\mathbf{a}) = \tfrac{1}{2}\,\mathbf{a}'\boldsymbol{\Gamma}_{\mathbf{a}}\mathbf{a},$$

where $\boldsymbol{\Gamma}_{\mathbf{a}}$ is a $n \times n$ symmetric, positive-definite matrix of effort cost parameters.

The agent's personal cost of deviating from the standard is assumed to be:

$$\kappa_s(\mathbf{s},\mathbf{a}) = \tfrac{1}{2}(\mathbf{s}-\mathbf{a})'\boldsymbol{\Gamma}_{\mathbf{s}}(\mathbf{s}-\mathbf{a}),$$

where the symmetric, positive-definite matrix $\boldsymbol{\Gamma}_{\mathbf{s}}$ represents the agent's degree of internalization of the standards.

The information system discloses a $m \times 1$-vector $\mathbf{y}$ of performance measures at date 2, i.e., $\mathbf{y} = \mathbf{M}\,\mathbf{a} + \boldsymbol{\varepsilon}$, where $\mathbf{M}$ is a $m \times n$-matrix of sensitivities of the signals to the agent's effort levels in his n tasks, and $\boldsymbol{\varepsilon}$ is a $m \times 1$-vector of normally distributed noise terms with $\boldsymbol{\varepsilon} \sim \mathrm{N}(\mathbf{0},\boldsymbol{\Sigma})$, and $m \times m$-covariance matrix $\boldsymbol{\Sigma}$.

At date 0, the principal offers the agent a contract, represented by $z = (f,\mathbf{v},\mathbf{s})$, where $\mathbf{s}$ is the standard specified by the principal and $\mathbf{v}$ is the agent's $m \times 1$ vector of incentive rates for each performance measure. Hence, the agent's compensation given performance measures $\mathbf{y}$ and contract z is $w(\mathbf{y},z) = f + \mathbf{v}'\mathbf{y}$. Applying the specifications to the agent's utility provides the following certainty equivalent:

$$CE(z,\mathbf{a}) = f + (\mathbf{M}'\mathbf{v} + \boldsymbol{\Gamma}_{\mathbf{s}}\mathbf{s})'\mathbf{a} - \tfrac{1}{2}\,\mathbf{a}'(\boldsymbol{\Gamma}_{\mathbf{a}} + \boldsymbol{\Gamma}_{\mathbf{s}})\mathbf{a} - \tfrac{1}{2}(r\mathbf{v}'\boldsymbol{\Sigma}\mathbf{v} + \mathbf{s}'\boldsymbol{\Gamma}_{\mathbf{s}}\mathbf{s}). \quad \text{(B1)}$$

Differentiating (B1) with respect to **a**, given contract z, provides the agent's action choice:

$$\mathbf{a}^{\dagger}(\mathbf{v},\mathbf{s}) = (\boldsymbol{\Gamma}_{\mathbf{a}} + \boldsymbol{\Gamma}_{\mathbf{s}})^{-1}(\mathbf{M}'\mathbf{v} + \boldsymbol{\Gamma}_{\mathbf{s}}\mathbf{s}). \tag{B2}$$

The resulting certainty equivalent (substituting (B2) into (B1)) is:

$$CE^{\dagger}(z) = f + \tfrac{1}{2}(\mathbf{M}'\mathbf{v} + \boldsymbol{\Gamma}_{\mathbf{s}}\mathbf{s})'(\boldsymbol{\Gamma}_{\mathbf{a}} + \boldsymbol{\Gamma}_{\mathbf{s}})^{-1}(\mathbf{M}'\mathbf{v} + \boldsymbol{\Gamma}_{\mathbf{s}}\mathbf{s}) - \tfrac{1}{2}(r\mathbf{v}'\boldsymbol{\Sigma}\mathbf{v} + \mathbf{s}'\boldsymbol{\Gamma}_{\mathbf{s}}\mathbf{s}). \tag{B3}$$

Again, the agent will only participate in the firm if his contract z is such that it provides him with his reservation certainty equivalent, which is scaled to equal zero, i.e.:

$$CE^{\dagger}(z) \geq 0. \tag{B4}$$

B.2 Principal's Preferences and Contract Choice

The expected gross value of the firm is assumed to be a linear function of the effort expended by the agent and is represented by $E[\mathrm{x}|\mathbf{a}] = \mathbf{b}'\mathbf{a}$, where the vector $\mathbf{b} \in \Re^n$ represents the agent's productivity with respect to the principal's payoff. The expected net terminal value of the firm is:

$$\Pi = E[x - w|\mathbf{a}]. \tag{B5}$$

To obtain the optimal contract, the principal chooses z to maximize (B5) subject to (B2) and (B4). Choosing f such that $CE^{\dagger}(z) = 0$ and substituting $f^{\dagger}$ and (B2) into (B5) gives the principal's unconstrained decision problem:

$$\begin{aligned}\Pi^{\dagger}(\mathbf{v},\mathbf{s}) = {} & \mathbf{b}'(\boldsymbol{\Gamma}_{\mathbf{a}} + \boldsymbol{\Gamma}_{\mathbf{s}})^{-1}\mathbf{M}'\mathbf{v} - \tfrac{1}{2}\mathbf{v}'\left(\mathbf{M}(\boldsymbol{\Gamma}_{\mathbf{a}} + \boldsymbol{\Gamma}_{\mathbf{s}})^{-1}\mathbf{M}' + r\boldsymbol{\Sigma}\right)\mathbf{v} + \mathbf{b}'(\boldsymbol{\Gamma}_{\mathbf{a}} + \boldsymbol{\Gamma}_{\mathbf{s}})^{-1}\boldsymbol{\Gamma}_{\mathbf{s}}\mathbf{s} \\ & - \tfrac{1}{2}\mathbf{s}'\boldsymbol{\Gamma}_{\mathbf{a}}(\boldsymbol{\Gamma}_{\mathbf{a}} + \boldsymbol{\Gamma}_{\mathbf{s}})^{-1}\boldsymbol{\Gamma}_{\mathbf{s}}\mathbf{s}.\end{aligned} \tag{B6}$$

Optimizing (B6) with respect to each incentive rate in **v** and each standard in **s** results in the following characterization of the optimal incentive rates and standards:

$$\mathbf{v}^{\dagger} = \mathbf{Q}^{-1}\mathbf{M}(\boldsymbol{\Gamma}_{\mathbf{a}} + \boldsymbol{\Gamma}_{\mathbf{s}})^{-1}\mathbf{b}, \tag{B7a}$$

$$\mathbf{s}^{\dagger} = \boldsymbol{\Gamma}_{\mathbf{a}}^{-1}\mathbf{b}, \tag{B7b}$$

with:

$$\mathbf{Q} \equiv \mathbf{M}(\boldsymbol{\Gamma}_{\mathbf{a}} + \boldsymbol{\Gamma}_{\mathbf{s}})^{-1}\mathbf{M}' + r\boldsymbol{\Sigma}.$$

Thus the standard is solely influenced by the marginal cost and productivity of the agent's effort choice and is set equal to the first-best effort level.