Career Concerns and Mandated Disclosure

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Abstract

This paper examines the effects of mandated disclosure on the design of contracts and induced behavior in the presence of career concerns. We analyze the impact of two key properties of a mandated performance measure that is publicly disclosed: its sensitivity to the agent's effort and its informativeness about the agent's ability. We find that when the mandated measure is highly sensitive to the agent's effort but the measure is relatively uninformative about the agent's ability, the agent's effort (and the firm's output) will be higher and the pay-for-performance sensitivity will be lower relative to a scenario in which the measure is not mandated. In contrast, if the mandated measure's informativeness dominates the measure's sensitivity to effort, then effort is lower and the pay-for-performance sensitivity is higher in the mandated setting. We also characterize settings where a mandated disclosure would be desirable or not; variations arise because mandated disclosures can increase both effort and risk. Our results imply that mandating the public disclosure of performance measures, particularly measures that are relatively informative about ability but are difficult to influence through managerial effort, may have the unintended consequence of generating inefficiencies in firms' employment contracts.

1. INTRODUCTION

The economic consequences of mandated financial disclosures have been widely investigated in the accounting literature, focusing on such effects as capital market reactions (Bushee and Leuz [2005]), loss of proprietary information to competitors versus governance improvements (Lo [2003]), and interactions with ownership type in designing executive compensation contracts (Craighead, et al. [2004]). In this paper, we consider another possible consequence of mandated disclosures related to the potential impact on contractual arrangements with a firm's employees due to the career implications of such disclosures.

Career concerns are implicit incentives that arise because a manager expects future wages to be affected by the labor market's use of publicly observable performance measures to assess the manager's ability.[1] From a survey of more than 400 CFOs, Graham, et al. [2005] document that more than three-fourths of the respondents agreed that concern for external reputations was a primary motivation to hit earnings benchmarks. They state that "... the desire to hit the earnings target appears to be driven less by short-term compensation motivations than by career concerns." (p. 28). Additionally, career concerns can lead a firm's management to respond to publicly disclosed accounting measures *even if* the measures are not part of a formal incentive contract (Graham, et al. [2005]).[2]

An important feature of various analytical models of career concerns (e.g., Gibbons and Murphy [1992]; Meyer and Vickers [1997]) is that they are set in the context of explicit incentive

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[1]Two important types of implicit incentives are identified in the economics literature – those related to future-performance benchmarks affected by current performance and those related to career concerns. Managers do not want firms to incorporate superior current performance into relatively higher future performance goals (called the "ratchet effect"), and thus they may reduce their effort relative to that warranted by the explicit incentives alone (Indjejikian and Nanda [1999]). Managers also seek to become more valuable in the labor market through their job performance, and thus they may work harder than warranted by explicit incentives alone to develop a good reputation (the career effect).

[2] Empirical evidence highlights the importance of career-related implicit incentives in practice. For example, while security analysts may not have explicit incentives to make optimistic (and inaccurate) forecasts, they are still motivated to provide such forecasts because of implicit incentives: those who provide optimistic forecasts are 90% more likely to be promoted and 38% less likely to be demoted than other analysts (Hong and Kubik [2003]). CEOs nearing retirement, implying relatively low *implicit* incentives from career concerns, are consequently offered relatively more *explicit* incentives to take forward-looking actions (Gibbons and Murphy [1992]).

contracts and publicly-disclosed, contractible performance measures. Incentives provided by a firm's explicit contracts and those provided by the labor market in response to publicly disclosed performance measures may be substitutes for inducing appropriate effort levels (Fama [1980]). If all performance measures are costlessly contractible, then a firm may be able to perfectly adjust explicit contractual incentives in response to any career incentives. Indeed, empirical evidence based on publicly disclosed performance measures has supported theoretical predictions of the substitutability of explicit and implicit incentives derived from analytical models of career concerns (e.g., Gibbons and Murphy [1992]).

Several performance measures (such as many mandated disclosures), however, are publicly disclosed but may not be contractible due to the cost of verifying the information or the cost of contract complexity. [3] For example, executives are often compensated, at least in part, based on a formula that uses accounting income or share price. Yet, the detailed components of income, such as cost of sales, marketing expense, etc, are more rarely used in compensation arrangements, despite the fact that those details may be relatively informative about an executive's ability. [4] Banker and Datar [1989, p. 21] argue that relative simple performance measures are used because "... reporting all the basic transactions and other nonfinancial information about performance is costly and impractical ..." Murphy [1999] reports that approximately 40 percent of firms in his survey data used only one performance measure, usually some measure of accounting profit, to determine annual bonuses for CEOs, despite the availability of a number of alternative measures.[5]

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[3] Several prior studies on career concerns have assumed that outcomes are non-contractible (e.g, Holmstrom and Ricart i Costa [1986], Ricart i Costa [1988], Holmstrom [1999], Dewatripont, et al. [1999]). Salanie [1997] argues that observable information signals may be non-contractible because of, for example, (1) the inability (or unwillingness) of courts to verify ex post the values of variables observed by contracting parties, and (2) the costs of negotiating and writing contracts based on all observable variables.

[4] Measures may also be too costly upon which to contract if they induce dysfunctional behavior (from the firm's perspective) when explicitly used in contracts. For example, Ittner, et al. [2003] describe a large financial institution’s complex system of contractible performance measures (e.g., customer satisfaction, employee morale, branch quality index, assessment of community involvement, and assets under management), which ultimately became too costly for contracting because the system permitted managers “to game the system and earn bonuses without delivering financial results.”

[5] For example, the disclosure of complete details of managerial compensation packages (e.g., see Peterson and Kristof [2005]) contains structural compensation information upon which the firm would not contract but which would be relevant to the labor

When publicly mandated measures are not contractible due to cost or complexity, career incentives may induce a manager to respond with either too much or too little effort directed to those measures relative to the firm's preferred level. Unlike the case of contractible measures, this inefficiency cannot be counteracted perfectly through explicit contracts. Moreover, this inefficiency can be exacerbated by two important properties of the mandated disclosures: (1) the extent to which the disclosure is sensitive to the agent's effort and (2) the relative informativeness of the disclosure to the labor market (about the agent's ability).

This paper examines the effect of a mandated disclosure's measurement properties on the design of explicit contracts and induced behavior in the presence of career concerns. To sharpen the focus on career-induced incentives, we assume that contracting on the mandated measure is too costly to be worthwhile for the (exogenous) reasons given above. We consider a setting in which an existing performance measure is used to contract with an agent, and we evaluate the effects of two key properties of an additional mandated measure that is publicly disclosed: its sensitivity to the agent's effort and its informativeness about the agent's ability. In particular, for purposes of contrast, we assume that while the agent can influence the mandated measure through his effort, the measure is not as sensitive to effort as the contractible measure. At an extreme, if the agent cannot influence the observed measure through effort, career-induced effort incentives are eliminated, although career risk concerns remain.

We first consider a benchmark scenario, in which a contractible measure, such as accounting income, is public and therefore induces career incentives. We then consider the impact of an additional mandated disclosure that can be influenced by the agent's effort and that is informative about the agent's ability (through its correlation with the contractible measure). This mandated disclosure has two effects: implicit career incentives are increased and career risk

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market. Details of a CEO's compensation contract, including base salary, determinants of bonus pay, stock options, and restricted stock grants, may inform the labor market about the CEO's ability.

is increased. The explicit incentive weight on the contractible performance measure is adjusted accordingly. We show that the agent's effort may either increase or decrease, depending on the properties of the mandated disclosure.

Finally, we explore whether career effects influence firms' preferences regarding mandated disclosures of performance measures to the labor market. We characterize settings where mandated disclosures are desirable or not because they can be used to exploit or suppress career incentives: agency welfare is affected by career incentives and risk effects associated with disclosing a performance measure. Specifically, our results imply that mandated public disclosure of performance measures, particularly measures that are difficult to influence through managerial effort, may have the unintended consequence of generating inefficiencies in firms' employment contracts.

The economics literature contains several studies of implicit incentives based on career concerns that assume a context of publicly-observable and contractible performance measures. However, they do not specifically investigate the effect of career concerns in contexts where mandated non-contractible performance measures may also be available.[6] Other studies include a combination of contractible and non-contractible performance measures, but do not specifically consider the measurement properties of an incremental mandated disclosure.[7] Further work considers disclosure issues related to career concerns and assumes an adverse selection setting where the agent knows his ability-type, and turnover is either exogenously assumed (i.e., all agents work for a new principal in the second period) or endogeneously determined.[8] In contrast, we

[6] For example, Gibbons and Murphy [1992] study career concerns with a single publicly-observable performance measure. Meyer and Vickers [1997] develop a two-period agency model that considers how relative performance evaluation for two managers affects efficiency and overall welfare. They find that while relative performance evaluation has a strictly positive effect in static (i.e., one-period) models, this result may not hold in a dynamic model.

[7] For example, Kaarboe and Olsen [2006] consider a multitask, multiperiod setting in which multiple public performance measures exist, one of which is non-contractible.

[8] For example, see Calzolari and Pavan [Forthcoming] and Koch and Peyrache [2005] for settings where turnover is assumed to be exogeneous; the first-period principal observes performance outcomes privately and can commit to a disclosure policy to

assume the principal and agent have no private information, thereby eliminating an adverse selection setting (i.e., consistent with, for example, Meyer and Vickers [1997]).

In the accounting literature, several papers focus on the use and properties of different types of performance measures that are the basis for determining explicit incentives but do not consider the effect of implicit incentives.[9] Prior work also investigates the effect of career concerns on reporting behavior, project selection, and pay-for-performance sensitivity but do not focus on disclosure measurement properties.[10] Other papers explore implicit incentives *other than* career concerns using dynamic agency models with multiple performance measures.[11] Our paper builds on these analyses by considering the effect of mandated disclosures on explicit contracts and agent effort in the presence of career concerns. In addition, our paper addresses the call for more multi-period models of properties of contractible performance measures (Lambert [2001]).[12]

In Section 2, we develop the model and establish a benchmark with no incremental mandated disclosures. In Section 3, we consider the effects of a mandated disclosure on the explicit pay-for-performance component of the agent's contract, the agent's effort, and *ex ante* agency welfare. Section 4 concludes.

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second-period principals. Mukherjee [2005] considers disclosure incentives when the first-period principal has an informational advantage and turnover is endogenous.

[9] See, for example, Bushman, et al. [1996], Ittner, et al. [1997], Banker, et al. [2000].

[10] For example, Autrey, et al. [2006] study how both the strength of the agent’s career concerns and additional agent effort that can be dysfunctional to the principal but informative to the labor market affect incentive contracts. Sridhar [1994] finds that managerial reputation can induce managers to distort reports that they make about investment prospects, which can lead to sub-optimal investments. Nagarajan, et al. [1995] also show that reputational effects can create entrenchment costs that outweigh the benefits from delegating project selection decisions to managers with private information. In addition, Nagar [1999] shows that the capital market’s assessment of a manager’s human capital can deter a manager from publicly disclosing information. Lastly, Chen and Jiang [2006] find that career concerns can accompany (instead of substitute for) higher pay-for-performance sensitivity in explicit contracts, and that the optimal pay-for-performance sensitivity can be increasing in the underlying risk measure.

[11] For example, Indjejikian and Nanda [1999] develop a two-period model with known agent ability and focus on the implications of the ratchet effect. Christensen, et al. [2003] examine repeated renegotiation using a two-period agency model with correlated performance measures and find that the effort level is lower (higher) with positively (negatively) correlated performance measures. Sabac [2002] extends this analysis to N periods and finds the dynamic effects of repeated renegotiation on incentives are amplified when more periods are considered.

[12] Commonly cited models in the accounting literature on contractible performance measures are single-period models (e.g., Banker and Datar [1989]; Feltham and Xie [1994]; Datar, et al. [2001]).

2. THE MODEL

In this section, we describe our model and establish benchmark results for a setting with no incremental mandated disclosure. We consider a setting in which production occurs in each of two periods. Following Gibbons and Murphy [1992], we assume long-term contracts are not feasible.[13] At the beginning of period one, the principal in our model, along with other prospective employers, offers a single period contract to the agent. For simplicity, we assume that in period 2 employers in the labor market offer the agent a wage equal to the expected value of the agent's ability conditional on any observed period 1 performance measure outcomes.

2.1 Performance Measures, Contracts, and Preferences

In period 1, output x_1, which serves as a public contractible performance measure (e.g., accounting income), is a function of agent effort, e_1, agent ability, a, that is constant over time, and a transient shock, u_1, in an additively linear fashion:

$$x_1 = e_1 + a + u_1 \tag{1}$$

In period 2, output x_2, is produced. To simplify our analysis, we assume that x_2 is not a function of the agent's effort:[14]

$$x_2 = a + u_2 \tag{2}$$

Ability and both transient shocks are random variables which are initially unknown to all parties. For simplicity, we assume the variance in each transient shock is identical. Ability and transient shocks have the following distributions:

$$a \sim N(0, q\sigma^2),\ u_t \sim N(0, (1-q)\sigma^2)$$

[13] The effect of career concerns on a firm's contracts and profits crucially depends on the ability and willingness of the parties to commit. For example, if both principal and agent are able to fully commit over the entire term of employment, then no career concerns would arise.

[14] Eliminating the effect of effort on the period 2 outcome removes ratchet effects (discussed in Footnote 1) from our analysis and considerably simplifies subsequent notation. This assumption allows us to focus exclusively on the implicit incentives represented by career concerns and does not qualitatively change our primary insights.

where q represents the proportion of the total variance in each performance measure that is attributable to the unknown ability.[15] Thus, outcomes (or performance measures) have the following distributions: $x_1 \sim N(e_1, \sigma^2),\ x_2 \sim N(0, \sigma^2)$. The shock terms are independent of each other and of both abilities.

For tractability, assume the period 1 wage contract takes the linear form:

$$w_1 = \alpha_1 + \beta_1 x_1 \tag{3}$$

After accepting employment the agent chooses the level of effort to maximize his expected utility. The agent's cost of effort is a twice-differentiable convex increasing function of effort. For simplicity, we assume the functional form of cost of effort to be:

$$c_1 = \frac{1}{2} e_1^2 \tag{4}$$

Because effort is costly to the agent and outcomes are unaffected by effort in period 2, the agent exerts no effort in that period.

The agent has a constant absolute risk aversion utility function:

$$A = -\exp\{-r[w_1 - c_1 + w_2]\} \tag{5}$$

where r is the Arrow-Pratt measure of absolute risk aversion. Given the assumptions of linear wages and normally distributed performance measures, the agent's expected utility in certainty-equivalent form is:

$$\mathrm{E}A = \mathrm{E}[w_1] + E[w_2] - \frac{1}{2} e_1^2 - \frac{r}{2} \mathrm{var}(w_1 + w_2) \tag{6}$$

2.2 Benchmark Analysis

We initially analyze a benchmark case in which only output x_1 is public (e.g., an accounting income measure). In this disclosure regime, relevant variables are subscripted by X.

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[15] That is, $q = \mathrm{var}\, a \big/ \left(\mathrm{var}\, a + \mathrm{var}\, u_t \right)$, where $q \in (0,1)$.

The two-period model is solved using backward induction. First, the period 2 wage is determined (by the labor market) conditional on the observable period 1 outcome, x_1. Then, period 1 effort and incentive weight are determined, after considering the expected impact on the period 2 outcome. Because the period 2 outcome is not a function of effort, the wage has a fixed component only:

$$w_{2_X} = \alpha_{2_X} . \tag{7}$$

Further, we assume that the labor market sets this wage equal to the expected value of the agent's ability given the observable performance measure:[16]

$$\alpha_{2_X} = E\left[a \mid x_1\right]. \tag{8}$$

The only influence the agent can have on the second period wage arises through his influence on $E[a \mid x_1]$, that is, through the agent's impact on the period 1 performance measure. This wage is non-decreasing in period 1 effort because $E\left[a \mid x_1\right]$ is non-decreasing in x_1. Thus, through period 1 effort choices, the agent attempts to influence the labor market's assessment of his ability. Given the period 2 wage, we can proceed to the period 1 analysis. We begin by solving for the agent's choice of period 1 effort.

From (6), the agent's first period problem is:

$$\underset{e_{1_X}}{\text{Max}}\ \text{EA}_\text{X} = \text{E}[w_{1_X}] + E[w_{2_X}] - \frac{1}{2} e_{1_X}{}^2 - \frac{r}{2} \text{var}(w_{1_X} + w_{2_X})$$

The first-order condition on e_{1_X} implies:

$$e_{1_X}{}^* = \beta_{1_X} + \frac{\partial \alpha_{2_X}}{\partial e_{1_X}}, \tag{9}$$

[16] This assumption essentially represents a "zero-profit" condition in the labor market because $E[x_2 \mid x_1] = E[a \mid x_1] = w_{2_X}$. In other words, the labor market is perfectly competitive given the first-period performance measures.

where, from (8), $\frac{\partial \alpha_{2_X}}{\partial e_{1_X}} = \frac{\partial E\left[a \mid x_1\right]}{\partial e_{1_X}}$.[17] Period 1 effort is a function of two components. First, effort depends on the explicit period 1 incentive weight, β_{1_X}. Second, effort depends on the career effect, $\frac{\partial E\left[a \mid x_1\right]}{\partial e_{1_X}}$, that arises because the labor market observes x_1, updates its beliefs about the agent's ability, and adjusts the agent's market wage at the beginning of period 2.

Consistent with our assumptions regarding the labor market in the second period, we assume that prospective employers face a perfectly competitive labor market in the first period and that the agent holds all the bargaining power. Therefore, the principal must offer a first-period contract that maximizes the agent's expected utility in order to employ the agent.[18] This assumption highlights the role of the agent's career concerns. Each prospective employer solves the following period 1 problem (where the agent's expected utility is stated in certainty-equivalent form):

$$\underset{\alpha_{1_X},\beta_{1_X}}{\text{Max}}\ \text{EA}_X = \text{E}[w_{1_X}] + \text{E}[w_{2_X}] - \frac{1}{2}e_{1_X}{}^2 - \frac{r}{2}\text{var}(w_{1_X} + w_{2_X})$$

Subject to:

$$e_{1_X}{}^* = \beta_{1_X} + \frac{\partial E\left[a \mid x_1\right]}{\partial e_{1_X}} \qquad \text{(IC)}$$

$$\text{E}[x_1] + \text{E}[x_2] - \text{E}[w_{1_X}] - \text{E}[w_{2_X}] = 0 \qquad \text{(ZPC)}$$

The usual incentive compatibiliity constraint is given by (IC). The zero-profit condition (ZPC) can be further decomposed into a period-by period requirement, such that $E[x_1] = E[w_{1_X}]$,

[17] We consider the case in which e_1^* is positive. This condition holds when $r\sigma^2$ is sufficiently small.

[18] We assume that the principal earns zero profits in period one. This assumption is consistent with Gibbons and Murphy [1992] and, when the agent has all the bargaining power, with Meyer and Vickers [1997]. If the principal fails to maximize the agent's utility, some other bidder would hire the agent away. We emphasize that, while the zero-profit condition is convenient here, it is not necessary, as demonstrated by Meyer and Vickers [1997]. In particular, allowing the principal to earn positive profits causes a reduction in the fixed component of the agent's contract but does not affect the pay-for-performance slope, which is a primary focus of our analysis.

because *ex ante*, $E[x_2] = E[w_{2_X}]$. Substituting (IC) and (ZPC) into EA_X and differentiating with respect to β_{1_X} gives the optimal first-period performance measure weight, which solves:

$$1-\beta_{1_X} - \frac{\partial E\left[a \mid x_1\right]}{\partial e_{1_X}} - \frac{r}{2}\left(\frac{\partial \operatorname{var}\left(w_{1_X}+w_{2_X}\right)}{\partial \beta_{1_X}}\right) = 0 \qquad (10)$$

In the benchmark scenario, denote the career effect on effort as: $C_X \equiv \frac{\partial E\left[a \mid x_1\right]}{\partial e_{1_X}}$. From (A5) (see Appendix for equation references beginning with A), we have:

$$E[a \mid x_1] = \operatorname{corr}\left(a, x_1\right)(x_1 - \hat{e}_1) = q(x_1 - \hat{e}_1),$$

where $\hat{e}_1$ is the labor market's conjecture about the agent's period 1 effort level (which is correct in equilibrium).

To find the career effect on effort, C_X, differentiate $E\left[a \mid x_1\right]$ with respect to e_{1_X}. We can then derive each benchmark's period 1 effort and incentive weights by substituting C_X and (A10) into equations (9) and (10). This leads to Proposition 1.

PROPOSITION 1. For the benchmark (*X*) regime:

(i) First-period effort is $e^*_{1_X} = \beta^*_{1_X} + q$,

(ii) The incentive weight is $\beta^*_{1_X} = \frac{1}{1+r\sigma^2} - q$.

The explicit incentive weight behaves in an intuitive fashion. If no career incentives exist (q = 0), then $\beta^*_{1_X} = \frac{1}{1+r\sigma^2}$, a standard result. As implicit career incentives increase, the explicit weight decreases to offset the implicit incentives (note that the explicit weight can be negative for a sufficiently large q). The upshot is that career incentives have no effect on effort. Because x_1 is contractible, the principal is able to perfectly undo career incentives caused by disclosure of x_1.

Note, however, that the explicit pay-for-performance weight in the presence of career incentives may not behave in the same manner as a weight in the absence of such incentives. To see this, decompose the noise in performance measure x_1 into (see footnote 15)

$$\begin{aligned}\sigma^2 &= q\sigma^2 + (1-q)\sigma^2 \\ &= \text{var}\, a + \text{var}\, u_1\end{aligned}$$

We can then restate $\beta^*_{1_x}$ as

$$\beta^*_{1_x} = \frac{1}{1 + r(\text{var}\, a + \text{var}\, u_1)} - \frac{\text{var}\, a}{\text{var}\, a + \text{var}\, u_1}$$

Straightforward differentiation reveals that $\beta^*_{1_x}$ decreases as $\text{var}\, a$ increases, both because risk inherent in performance measure x_1 increases and because career incentives increase. As shown by Gibbons and Murphy [1992], if the labor market is less informed about the agent's ability, explicit incentives are reduced because implicit incentives increase.

In contrast, consider the effects of pure measurement error, $\text{var}\, u_1$, on the explicit incentive weight. Differentiation of $\beta^*_{1_x}$ with respect to $\text{var}\, u_1$ results in the following relationship:

$$\text{sgn}\left[\frac{\partial \beta^*_{1_x}}{\partial\, \text{var}\, u_1}\right] = \text{sgn}\left[-r(1 - r\,\text{var}\, a)(\text{var}\, a + \text{var}\, u_1)^2 + \text{var}\, a + 2r\,\text{var}\, a(\text{var}\, a + \text{var}\, u)\right]$$

As $\text{var}\, a$ becomes small (e.g., $\text{var}\, a \to 0$), we have $\frac{\partial \beta^*_{1_x}}{\partial\, \text{var}\, u_1} < 0$, which is consistent with standard intuition (i.e., in the absence of career incentives) regarding the effect of performance measure noise on incentive weights. However, if $\text{var}\, a$ becomes sufficiently large, this relationship reverses. For example, if $\text{var}\, a \geq 1/r$ (a sufficient, not necessary, condition), then

$\frac{\partial \beta_{1_x}^*}{\partial \operatorname{var} u_1} > 0$; noise increases the explicit performance weight because it sufficiently dampens the career incentive effect.[19]

3. MANDATED DISCLOSURE

In this section, we consider how an incremental mandatory disclosure of a measure that is informative about the agent's effort and ability affects first-period effort, explicit incentive weights, and the agent's expected utility. We first introduce the mandated disclosure measurement properties that define the mandated disclosure regime and then analyze the economic implications of the disclosure.

3.1 Mandated Disclosure Measurement Properties

Suppose that in period 1, a new measure y_1 is required to be disclosed by, for example, the SEC, FASB, or other regulatory agency. Further, consistent with our discussion in Section 1, assume that the cost of contracting on mandated measure exceeds its benefits.[20] This measure is a function of some random variable *b* that is correlated with ability *a* (for example, *b* may represent a related ability), and transient shock v_1 that is uncorrelated with u_t.[21] However, it provides information to the labor market about the agent's ability.[22]

Our analysis focuses on two measurement properties of the mandated disclosure. The first property is the sensitivity of the disclosure to effort, i.e., the measure y_1 may also be a function of first-period effort, where the sensitivity of this measure to first-period effort depends

[19] The fact that noise can increase explicit incentive weights in the presence of career concerns has also been noted by Kaarboe and Olsen [2006], Chen and Jiang [2006], and Autrey, Dikolli, and Newman [2006], although different modeling assumptions are applied. Further, Prendergast [2002] summarizes the empirical literature which suggests that on average performance measure noise is positively correlated with pay-for-performance weights. Career incentives may play a role in this relationship.

[20] If all measures are fully contractible, then while the terms of the contract will be adjusted to offset implicit incentives created by career concerns, the principal induces the same effort level and agency profits as in a setting with no career concerns. We highlight this result following Proposition 1 for the benchmark analysis and in Footnote 25 for the mandated disclosure analysis.

[21] For ease of presentation, we omit any mandated performance measure in period 2, i.e., y_2. No period 1 results are qualitatively affected by the inclusion of this measure, and in any case a non-contractible measure would not be used in period 2.

[22] If *a* and *b* are perfectly correlated then they can be interpreted as the same ability. We assume that both abilities are uncorrelated with the transient shocks.

on magnitude *k*, $k \in [0,1]$. The measure y_1 can be expressed as:

$$y_1 = ke_1 + b + v_1 \tag{11}$$

From (11), if $k = 0$, then y_1 does not depend on effort. More importantly, when *k* is less than 1, the sensitivity of the performance measure y_1 to the agent's effort is smaller than the sensitivity of measure x_1 to the agent's effort.

The second property of the disclosure relates to the disclosure's informativeness about ability. For tractability, we assume that ability *b* has the same distribution as ability *a* and that the transient shock v_1 has the same distribution as u_t; that is, $b \sim N(0, q\sigma^2)$, $v_1 \sim N(0,(1-q)\sigma^2)$. Therefore, $y_1 \sim N(ke_1, \sigma^2)$. However, the abilities captured by both *x* and *y* are correlated such that *y* provides information about ability that depends in magnitude on the correlation coefficient between the abilities, i.e., $\text{corr}(a,b) = \eta > 0$. Because of this correlation in abilities, the correlations between the performance measures are: $\text{corr}(x_1, y_1) = \text{corr}(x_2, y_1) = \eta q$.

The mandated measure creates two career-related effects. First, a direct implicit incentive effect occurs which depends both on how much the agent can influence the measure through his effort, measured by *k*, and by how much the labor market can learn from the measure about the agent's ability, measured jointly by η (how correlated abilities *a* and *b* are) and *q* (how much of the variance of the mandated measure is explained by ability *b*). Second, even if $k = 0$ (the agent has no influence on y_1 through effort), the mandated measure induces career-related risk due to the variability it creates in second-period wages.

As an example of the two types of ability, ability *a* might be operations-based, such as in managing current products, and ability *b* could be leadership-related, such as providing a consistent vision for managers across geographically-diverse operations within the firm.[23] The correlation, η, between abilities *a* and *b* could represent a synergy between the abilities. For example, outstanding leadership abilities in motivating geographically-diverse subordinates to coordinate might enhance a manager's ability to manage product lines. With such synergy, increases in one type of ability are associated with increases in the other type of ability.[24]

Continuing the example, outcome measure x_t could be accounting income, and performance measure y_1 might be a measure of segment performance (to illustrate an existing mandated disclosure) or employee morale (to illustrate a type of non-financial performance measure not currently mandated but for which some commentators have called for public disclosure, e.g., see Maines, et al. [2002] for a review of the literature). Overall, to the extent that performance measure y_1 is informative about ability *b* and ability *b* is positively correlated with ability *a*, then the labor market can infer something about ability *a* by observing performance measure y_1.

The effects of a mandatory disclosure on period 1 effort, incentives, and welfare again depend on how effort affects $E\left[a \mid x_1, y_1\right]$, i.e., $\frac{\partial E\left[a \mid x_1, y_1\right]}{\partial e_{1_{XY}}}$, which represents the career effect on effort, where the subscript *XY* indicates that both x_1 and y_1 are publicly observed. We first isolate this career effect and identify its consequences on effort and incentives. Next, we compare effort and incentives in the benchmark setting to those in the mandatory disclosure setting to highlight intuition for the impact of an incremental disclosure in the presence of career incentives. Finally, we compare

[23] To illustrate, Terhune, et al. [2004: 1] note that, "To many board members, the ideal Coke chairman and CEO is a visionary who commands admiration, delegates easily and communicates well with Coke's 50,000 or so employees and the public." The Coke board's assessment of the CEO's visionary ability may or may not also be sensitive to the CEO's effort.

[24] There could also be rivalry between the abilities. For example, a manager's vision for the firm's products may be incompatible with the firm's current products, making it difficult for the manager to manage the current products. With rivalry, increases in one type of ability are associated with decreases in the other type of ability. For simplicity, we assume the correlation between the different types of ability, η, is positive (i.e., $\eta > 0$).

welfare effects across regimes.

3.2 Career Effects, Period 1 Effort, and Incentives Across Regimes

The starting point for defining career effects in each regime is to identify the expected value of ability. In the *XY* regime, the labor market observes the realized x_1 and y_1. Conditional on observing both period 1 performance measures, the labor market's expectations about ability are:

$$\begin{aligned} \mathrm{E}[a \mid x_1, y_1] &= \operatorname{corr}\left(a, x_1 \mid y_1\right)(x_1 - \hat{e}_1) + \operatorname{corr}\left(a, y_1 \mid x_1\right)(y_1 - k\hat{e}_1) \\ &= \rho_1 (x_1 - \hat{e}_1) + \rho_2 (y_1 - k\hat{e}_1) \end{aligned} \tag{12}$$

where $\rho_1 \equiv \operatorname{corr}(x_2, x_1 \mid y_1) = \dfrac{q(1-\eta^2 q)}{1-\eta^2 q^2}$, $\rho_2 \equiv \operatorname{corr}(x_2, y_1 \mid x_1) = \dfrac{\eta q(1-q)}{1-\eta^2 q^2}$. Equation (12) shows that higher realizations of x_1 and/or y_1 result in a higher expectation of *a*, and therefore x_2.

Note that equations (9) and (10) continue to hold in the case of a mandated disclosure (with the subscript *X* replaced by *XY*) if that additional disclosure is not used in the agent's contract. Thus, to find the career effect C_{XY} in period 1 effort for the mandated disclosure regime, differentiate $E\left[a \mid x_1, y_1\right]$ with respect to $e_{1_{XY}}$. We can then derive period 1 effort and incentive weights by substituting C_{XY} and, as per equation (A11), $\operatorname{var}(w_{1_{XY}} + w_{2_{XY}})$ into equations (9) and (10). This leads to Proposition 2.[25]

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[25] If both x_1 and y_1 are contractible, then career incentives will be perfectly offset by reductions in explicit incentives, consistent with the benchmark regime. Let $\beta_{1_{BC}}$ and $\gamma_{1_{BC}}$ denote the incentive weights on x_1 and y_1, respectively where the subscript BC indicates "both contractible." Then standard dervations (similar to the derivation of Proposition 2) yield the following effort level and incentive weights:

$$e^*_{1_{BC}} = \beta^*_{1_{BC}} + \rho_1 + k\gamma^*_{1_{BC}} + k\rho_2$$

$$\beta^*_{1_{BC}} = \frac{1 - kq\eta}{1 + k^2 - 2kq\eta + r(1 - q^2\eta^2)} - \rho_1$$

$$\gamma^*_{1_{BC}} = \frac{k - q\eta}{1 + k^2 - 2kq\eta + r(1 - q^2\eta^2)} - \rho_2$$

It is straightforward that effort $e^*_{1_{BC}}$ is identical to a setting in which there are not career incentives.

PROPOSITION 2. For the mandated disclosure (*XY*) regime:

(i) First-period effort is given by $e^{*}_{1_{XY}} = \beta^{*}_{1_{XY}} + \rho_1 + k\rho_2$,

(ii) The incentive weight is $\beta^{*}_{1_{XY}} = \frac{1}{1+r\sigma^2}\left[1-\left(\rho_1 + k\rho_2\right)-\left(\rho_1+\rho_2\eta q\right)r\sigma^2\right]$.

Propositions 1 and 2 indicate that in the *X* and *XY* regimes, first-period effort is increasing in career concerns. In each of these cases, the career incentive effect is strictly positive because $\eta > 0$, $q>0$, $k>0$, $\rho_1 > 0$, and $\rho_2 > 0$. If no career concerns existed ($q = 0$, and thus $\rho_1 = \rho_2 = 0$), the weight on performance measure x_1 would be $\frac{1}{1+r\sigma^2}$, a standard result from a single period model – the weight is a decreasing function of risk aversion and noise in the performance measure (Banker and Datar [1989]). In comparison, the new terms in $\beta^{*}_{1_{XY}}$ reflect the optimal response to the agent's career concerns. These new terms include the impact of the implicit incentive created by career concerns on the direct cost of effort, $-\frac{\rho_1 + k\rho_2}{1+r\sigma^2}$, and on risk, $-\frac{(\rho_1+\rho_2\eta q)r\sigma^2}{1+r\sigma^2}$. Both of these terms are strictly negative.

Similar terms appear structurally in the $\beta^{*}_{1_X}$ incentive weight but differ in composition. Intuitively, these differences are due to the effects of the mandated disclosures on (1) the implicit incentives faced by the agent and (2) the risk imposed on the agent, which in turn affect the explicit incentives that the principal offers to the agent.

From Proposition 2, we can restate the pay-for-performance weight in the mandated disclosure regime as:

$$\beta^{*}_{1_{XY}} = \frac{1}{1+r\sigma^2}\left[1-\rho_2\left(k+\eta q r\sigma^2\right)\right]-\rho_1.$$

This weight is reduced by ρ_1 which directly offsets any career risk and incentive effects of the contractible measure x_1. However, because y_1 is not included in the contract, the explicit weight cannot entirely undo the effects of the mandated measure. The agent's effort can be restated as:

$$e^*_{1_{XY}} = \frac{1}{1+r\sigma^2}\left[1+\rho_2 r\sigma^2\left(k-\eta q\right)\right].$$

Consider the determinants of the career-related effects of the mandatory disclosure, y_1: *k*, which determines how much the agent can influence the measure; and ηq, which determines the informativeness of the measure about the agent's ability. As one would expect, the explicit incentive weight decreases and the agent's effort increases as *k* increases. That is, as the incentive provided by the mandated measure to increase effort increases, less weight is placed on the explicit pay-for-performance coefficient. However, the effects of η on the incentive weight and effort are more subtle. Differentiating $\beta^*_{1_{XY}}$ and $e^*_{1_{XY}}$ with respect to η yields:

$$\frac{\partial\beta^*_{1_{XY}}}{\partial\eta} = -\frac{(1-q)q(k-2\eta q+k\eta^2 q^2)}{(1-\eta^2 q^2)(1+r\sigma^2)}$$

$$\frac{\partial e^*_{1_X}}{\partial\eta} = \frac{(1-q)qr\sigma^2(k-2\eta q+k\eta^2 q^2)}{(1-\eta^2 q^2)(1+r\sigma^2)}.$$

The sign of both these expressions depends on the sign of $k-2\eta q+k\eta^2 q^2$. For *k* sufficiently small, this expression is negative; similarly, for η or *q* sufficiently small, the expression is positive. Thus, the effect of increases in the informativeness of the mandated measure on the pay-for-performance weight and the agent's effort depend on the relative size of *k* and ηq. If *k* is relatively large (small), a more informative mandated measure leads to a lower (higher) explicit weight and higher (lower) effort.

3.3 Mandated Disclosure's Effects on Effort and Incentives

We directly compare career effects, effort, and incentives in the benchmark regime and the mandated disclosure regime in the following proposition.

PROPOSITION 3. Comparing the *X* and *XY* regimes yields the following orderings:

Period 1 Expression	*Relative Ordering When* $k < \eta q$	*Relative Ordering When* $k > \eta q$
Career effect	$C_X > C_{XY}$	$C_{XY} > C_X$
Effort	$e^*_{1_X} > e^*_{1_{XY}}$	$e^*_{1_{XY}} > e^*_{1_X}$
Incentive weight	$\beta^*_{1_X} < \beta^*_{1_{XY}}$	$\beta^*_{1_{XY}} < \beta^*_{1_X}$

The career effect represents the marginal effect on effort of the market updating its beliefs about ability *a*. We show in the proof to Proposition 3 that if $k < \eta q$ then $\rho_1 + k\rho_2 < q$ and $e^*_{1_X} > e^*_{1_{XY}}$. That is, the career effect and the agent's effort are larger in the *X* regime than in the *XY* regime. This result follows because the expected value of the agent's ability is linear in effort in all regimes. Therefore, the derivative of the expected value of ability with respect to effort is equivalent to the slope coefficients in a linear regression of ability on observable period 1 performance measures.

In the *X* regime the labor market observes only the contractible measure x_1 so the relevant coefficient is a single slope coefficient in a linear regression of ability on x_1. However, in the *XY* regime, the labor market observes both x_1 and y_1. Due to multi-collinearity, the coefficient on any given right-hand-side variable in a linear regression will be lower in the presence of correlated right-hand-side variables. Thus, if the non-contractible measure is difficult for the agent to influence (i.e., *k* is sufficiently small), then the sum of the regression coefficients with two right-hand-side variables is less than the coefficient from a regression with only one of those right-hand side variables. Intuitively, the labor market places a lower weight on performance measure x_1 in the *XY* regime because it also observes the difficult-to-influence measure y_1.

In other words, in the mandated disclosure regime the labor market updates its priors about the agent's ability based on x_1 *and* y_1. However, the agent's effort has a limited effect on y_1 (i.e., k is relatively low), so the agent can do little to advance his career. When the labor market updates its priors using a performance measure over which the agent has little influence, the career concerns in the *XY* regime are lower than those in the *X* regime. Alternatively, if k is sufficiently high (i.e., y_1 is sufficiently influenced by effort), then the career effect is largest in the *XY* regime.

Finally, an important implication of Proposition 3 is that the effect of a mandated disclosure in the presence of an existing public performance measure depends critically on the relation between two key properties of the disclosure: the sensitivity (k) of performance measure y to effort and the informativeness (ηq) of the period 1 performance measures. When the sensitivity is low (i.e., the agent's influence of the mandated measure y is limited) relative to the correlation between the two first period measures, the career effect is greatest in the *X* regime. In the *XY* regime the labor market updates beliefs using two performance measures, one of which is a mandated measure that is influenced very little by managerial effort; the relative lack of influence that the agent has over that measure mitigates the career effect.

The implications of Sections 3.2 and 3.3 for the empirically observable pay-for-performance weight, β_1, can be summarized as follows. First, in settings where a mandated disclosure can be influenced to a greater degree by the agent (i.e., the disclosure is more sensitive to effort), the pay-for-performance measure receives less weight relative to a setting where less influence is possible. Second, when the degree of influence is small, mandated disclosures that are more informative about ability (i.e., through the correlation structure) imply a lower pay-for-performance weight relative to less informative disclosures. When the degree of influence is large, the opposite is true. Finally, comparing pre- and post-disclosure pay-for-performance weights, we expect post-disclosure weights to be higher than pre-disclosure weights when the degree of influence is low relative to the informativeness of the measure. When the degree of influence is relatively high, the opposite effect is more likely.

3.4 Welfare Implications

Next, we consider how properties of the performance measures affect whether an incremental mandated public disclosure of a measure has positive or negative economic consequences for the agency. Recall that firms are perfectly competitive in the labor market, implying a zero profit condition; thus, *ex ante* the firm earns zero profit, and the agent receives all the surplus. Therefore, our measure of agency welfare is the agent's expected utility at the beginning of period 1 (stated here in certainty-equivalent form):

$$\begin{aligned} EA_j &= \mathrm{E}[w_{1_j}] + \mathrm{E}[w_{2_j}] - \frac{1}{2}e_{1_j}{}^2 - \frac{r}{2}\mathrm{var}(w_{1_j} + w_{2_j}) \\ &= \mathrm{E}[x_{1_j}] + \mathrm{E}[x_{2_j}] - \frac{1}{2}e_{1_j}{}^2 - \frac{r}{2}\mathrm{var}(w_{1_j} + w_{2_j}) \\ &= e_{1_j} - \frac{1}{2}e_{1_j}{}^2 - \frac{r}{2}\mathrm{var}(w_{1_j} + w_{2_j}) \end{aligned} \qquad (13)$$

where the subscript *j* denotes the regime, $j \in \{X, XY\}$.

Consider how the effort-sensitivity, *k*, of the mandated performance measure y_1 affects the agent's utility. In the benchmark *X* regime, *k* has no effect on β_{1_X}, the agent's effort, or the agent's utility. On the other hand, in the mandated disclosure (*XY*) regime, as *k* increases, the career effect increases. As *k* increases, the pay-for-performance measure $\beta_{1_{XY}}$ decreases in response to any career effect. However, the single weight $\beta_{1_{XY}}$ is inadequate to offset career implications of two performance measures. The combined incentive effects of $\beta_{1_{XY}}$ and the career effect lead the agent to *increase* effort as *k* increases. Thus, the part of the agent's utility represented by $e_{1_{XY}} - \frac{1}{2}e_{1_{XY}}{}^2$

increases as *k* increases. Similarly, differentiation of $\text{var}(w_{1_{XY}} + w_{2_{XY}})$ reveals that risk decreases in *k* because *k* decreases the explicit incentive weight, $\beta_{1_{XY}}$. The joint effect is that the agent's utility increases in *k*.

Given that the agent's utility is unaffected by *k* for the *X* scenario and strictly increases in *k* for the *XY* scenario, it is not surprising that for low *k*, the *X* scenario would be preferred, and for high values of *k*, the *XY* scenario would be preferred. Figure 1 plots EA_X and EA_{XY} as a function of *k*. For low values of *k* the agent's utility is highest when no incremental measure is mandated, and for high values of *k* the agent's utility is highest when the mandated performance measure exists.

In addition, we plot the agent's utility when both x_1 and y_1 are contractible (see footnote 24 for effort level and incentive weights). Comparison of EA_{XY} and EA_{BC} (where the subscript *BC* indicates "both contractible") reveals the inefficiency created by the exclusion of the mandated measure from the agent's contract. This inefficiency is greatest when the degree of influence is relatively small (because the mandated measure imposes career risk) or large (because the mandated measure, if contractible, provides an efficient means of inducing effort).[26]

/Insert Figure 1 about here/

Finally, consider how the informativeness of the mandated measure, η, affects the agent's utility. In the *X* scenario, η plays no role. In the *XY* scenario, if $\eta = 0$, then $\rho_1 = q$ and effort (and hence risk) is unaffected by career effort incentives. Therefore, $EA_X = EA_{XY}$ for $\eta = 0$. Suppose instead that $k = 0$. Then increasing η merely adds career risk with no effort incentives, and $EA_X > EA_{XY}$ for all $\eta > 0$. However, if $k > 0$, then effort incentive outweighs career risk for sufficiently small η. Further, if *k* is sufficiently large (relative to other parameter

[26] The divergence between EA_{XY} and EA_{BC} also indicates the value to the firm of incurring the cost to contract on y_1. For extreme values of k (the agent's ability to influence the mandated measure), this contracting value is relatively large.

values), then the beneficial effect of the effort incentive may outweigh career risk for any value of η. Figure 2 plots EA_X and EA_{XY} as a function of η for $k = 0$, $k = ½$, and $k = 1$ to illustrate these relationships.

/Insert Figure 2 about here/

In summary, the agency welfare effects of a mandated disclosure depend on the degree to which the new measure can be influenced by the agent (i.e., the measure's effort-sensitivity) and how informative the measure is about the agent's ability (i.e., through the correlation structure). Mandated disclosures that are relatively more sensitive to the agent's effort are more likely to be beneficial in circumstances when contracting on the mandated disclosure is too costly.

4. CONCLUSION

Mandated financial disclosures have been widely studied in accounting. We consider the effects of measurement properties of such disclosures on contractual arrangements with a firm's managers when those disclosures have career implications because the labor market can use the disclosures to better assess managers' abilities. We focus on two key properties: the disclosure's sensitivity to effort, in that the agent can affect the mandated measure through his effort although the measure is not as sensitive to effort as an existing contractible measure; and the disclosure's informativeness about ability, in that the disclosure is assumed to be correlated with an existing contractible measure.

We show how, in the presence of career incentives, a mandated disclosure to the labor market affects the agent's effort level and the explicit incentive weight the principal uses for the contractible measure. We find that the relative magnitude of the explicit incentive and the agent's effort depend on how much the agent can influence the mandated measure through his effort and how informative the measure is about the agent's ability. Finally, we investigate the desirability of a mandated disclosure and identify settings for which such disclosures are harmful. Thus, we identify an additional consequence of mandated disclosures related to the efficiency of a firm's employment contracts.

Several modeling choices limit the generalizability of the results. For example, we exogenously assume incomplete contracting, a limited commitment setting, linear contracts, normal distribution of all random variables, and an agent who has a negative exponential utility function. For tractability, we also equate the variances between the different performance measures and assume no intertemporal correlation of measurement error.

Future research may consider the implications of mandated disclosures when the agent can take different types of actions – i.e., ability-intensive actions versus effort-intensive actions. The introduction of this factor would enable exploration of how mandated disclosures influence the relative allocation of effort to different tasks. Additionally, exploring the effect of mandated disclosures on contracts when the agent has private information about his ability would likely generate further insights.

FIGURES

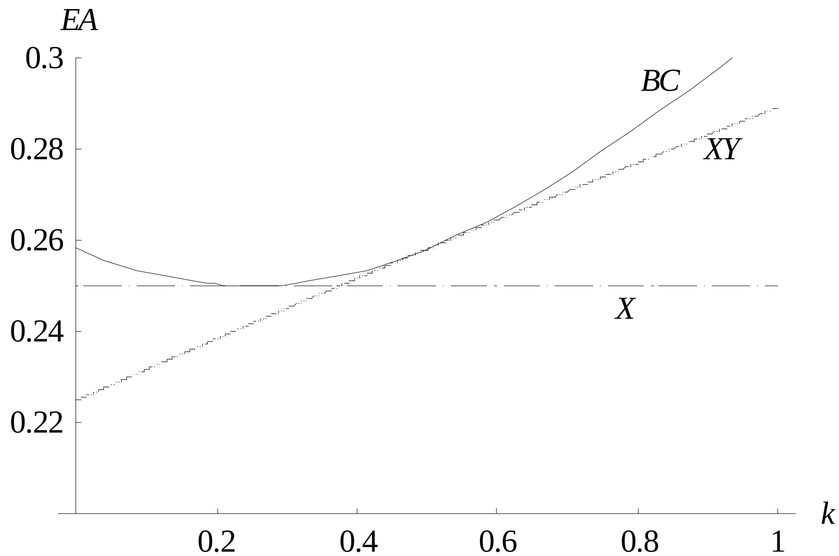

Figure 1 – Agent's expected payoff as a function of *k* in the *X* and *XY* regimes (parameters: $\sigma^2 = 1$, $r = 1$, $\eta = 0.5$, $q = 0.5$)

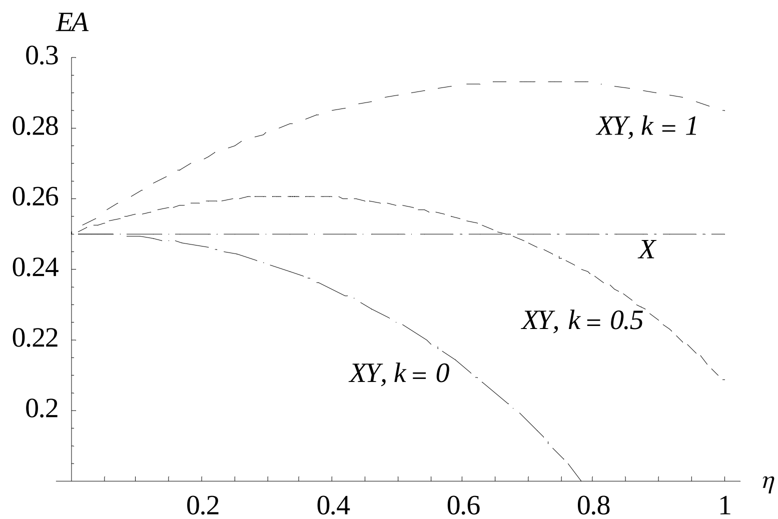

Figure 2 – Agent's expected payoff as a function of η in the *X* and *XY* regimes (parameters: $\sigma^2 = 1$, $r = 1$, $k = \{0, 0.5, 1\}$, $q = 0.5$)

APPENDIX

Summary of Covariances, Correlations, Expectations, Variances[27]

In the analysis below, where variables depend on a regime, we denote the regime by the subscript *j*, where $j \in \{X, XY\}$.

Covariances and Correlations

$$\text{cov}(x_1, y_1) = \eta q \sigma^2 \qquad corr(x_1, y_1) = \frac{\text{cov}(x_1, y_1)}{\sqrt{\text{var}\, x \,\text{var}\, y}} = \eta q = corr(a, y_1) \tag{A1}$$

$$\text{cov}(x_2, x_1) = \text{var}\, a = q\sigma^2 \qquad corr(x_2, x_1) = q = corr\left(a, x_1\right) \tag{A2}$$

$$\text{cov}(x_2, y_1) = \text{cov}(a, b) = \eta q \sigma^2 \qquad corr(x_2, y_1) = \eta q = corr\left(a, y_1\right) \tag{A3}$$

$$corr(x_2, x_1 \mid y_1) = \frac{q(1-\eta^2 q)}{1-\eta^2 q^2} \equiv \rho_1 \qquad corr(x_2, y_1 \mid x_1) = \frac{\eta q(1-q)}{1-\eta^2 q^2} \equiv \rho_2 \tag{A4}$$

Expectations

$$E[x_2 \mid x_1] = E[a \mid x_1] = \frac{\text{cov}(x_2, x_1)}{\text{var}\, x_1}(x_1 - \hat{e}_1) = q(x_1 - \hat{e}_1) \tag{A5}$$

where $\hat{e}_1$ = labor market's conjecture regarding period 1 effort

$$E[x_2 \mid x_1, y_1] = E[a \mid x_1, y_1] = \rho_1\left(x_1 - \hat{e}_1\right) + \rho_2\left(y_1 - k\hat{e}_1\right) \tag{A6}$$

$$E[w_{2_j} \mid x_1, y_1] = \rho_1(x_1 - \hat{e}_1) + \rho_2\left(y_1 - k\hat{e}_1\right) \tag{A7}$$

Variances

$$\text{var}(x_2 \mid x_1) = \text{var}(x_2)\left(1 - corr(x_2, x_1)^2\right) = \sigma^2(1-q^2) \tag{A8}$$

$$\text{var}(x_2 \mid x_1, y_1) = \sigma^2(1 - \rho_1 q - \rho_2 \eta q) \tag{A9}$$

$$\text{var}\left(w_{1_j} + w_{2_j}\right) = \text{var}\left(\alpha_{1_j} + \beta_{1_j} x_1 + \alpha_{2_j}\right)$$

Using $\alpha_{2_X} = E\left[a \mid x_1\right] = q(x_1 - \hat{e}_1)$ from (8) and (A5):

$$\text{var}(w_{1_X} + w_{2_X}) = \text{var}\left(\beta_{1_X} x_1 + q x_1\right) = \sigma^2\left(\beta_{1_X} + q\right)^2 \tag{A10}$$

Using (A6), $$\text{var}(w_{1_{XY}} + w_{2_{XY}}) = \sigma^2\left[\left(\beta_{1_{XY}} + \rho_1\right)^2 + \left(\rho_2\right)^2 + 2\eta q \rho_2\left(\beta_{1_{XY}} + \rho_1\right)\right] \tag{A11}$$

Proof of Proposition 1

Optimal e_{1_X}

$$\underset{e_{1_X}}{\text{Max}}\ \text{E}A = \text{E}[w_1] + E[w_2] - \frac{1}{2}e_1^{\,2} - \frac{r}{2}\text{var}(w_1 + w_2)$$

The first-order condition on e_{1_X} implies:

[27] Full derivations of these preliminary equations are available from the authors.

$$e_{1_X}{}^{*} = \beta_{1_X} + \frac{\partial \alpha_{2_X}}{\partial e_{1_X}} = \beta_{1_X} + \frac{\partial E\left[a \mid x_1\right]}{\partial e_{1_X}} = \beta_{1_X} + q \tag{A12}$$

Principal's Problem

The principal's period 1 problem is:

$$\underset{\alpha_{1_X},\beta_{1_X}}{\text{Max}}\ \text{EA}_X = \text{E}[w_{1_X}] + \text{E}[w_{2_X}] - \frac{1}{2}e_{1_X}{}^{2} - \frac{r}{2}\text{var}(w_{1_X} + w_{2_X})$$

Subject to:

$$e_{1_X}{}^{*} = \beta_{1_X} + q \qquad \text{(IC)}$$

$$\text{E}\left[x_{1_X}\right] + \text{E}\left[x_2\right] - \text{E}\left[w_{1_X}\right] - \text{E}\left[w_{2_X}\right] = 0 \qquad \text{(ZPC)}$$

Applying $\text{E}[x_2]=\text{E}[w_{2_X}] = \text{E}\left[a\right]$ to (ZPC) yields $\text{E}\left[x_{1_X}\right] = \text{E}\left[w_{1_X}\right]$.
Substituting $\text{E}\left[w_{1_X}\right]=\text{E}\left[x_{1_X}\right] = e_{1_X}$, (IC) and (A10) into the objective function yields:

$$EA_X = \left(\beta_{1_X} + q\right) - \frac{1}{2}\left(\beta_{1_X} + q\right)^2 - \frac{r\sigma^2}{2}\left(\beta_{1_X} + q\right)^2. \tag{A13}$$

Optimal β_{1_X}

Differentiating (A13) with respect to β_{1_X} and using (A10),

$$\frac{\partial EA_X}{\partial \beta_{1_X}} = 1 - (\beta_{1_X} + q) - r\sigma^2\left(\beta_{1_X} + q\right) = 0. \tag{A14}$$

$$\beta^{*}_{1\ X} = \frac{1}{\left(1 + r\sigma^2\right)} - q \tag{A15}$$

<u>Proof of Proposition 2</u>

Following the same procedure as in Proposition 1, the first-order condition on $e_{1_{XY}}$ implies:

$$e_{1_{XY}}{}^{*} = \beta_{1_{XY}} + \frac{\partial \alpha_{2_{XY}}}{\partial e_{1_{XY}}} = \beta_{1_{XY}} + \frac{\partial E\left[a \mid x_1, y_1\right]}{\partial e_{1_{XY}}} = \beta_{1_{XY}} + \rho_1 + k\rho_2 \tag{A16}$$

Similarly, the principal maximizes:

$$EA_{XY} = \beta_{1_{XY}} + \rho_1 + k\rho_2 - \frac{1}{2}\left(\beta_{1_{XY}} + \rho_1 + k\rho_2\right)^2 - \frac{r}{2}\text{var}(w_{1_{XY}} + w_{2_{XY}}) \tag{A17}$$

Differentiating (A17) with respect to $\beta_{1_{XY}}$ and using (A11),

$$\frac{\partial EA_{XY}}{\partial \beta_{1_{XY}}} = 1 - (\beta_{1_{XY}} + \rho_1 + k\rho_2) - r\sigma^2\left[\left(\beta_{1_{XY}} + \rho_1\right)^2 + \rho_2{}^2 + 2\eta q\rho_2\left(\beta_{1_{XY}} + \rho_1\right)\right] = 0. \tag{A18}$$

$$\beta^{*}_{1\ XY} = \frac{1}{\left(1 + r\sigma^2\right)}\left[1 - \left(\rho_1 + k\rho_2\right) - \left(\rho_1 + \rho_2\eta q\right)r\sigma^2\right] \tag{A19}$$

<u>Proof of Proposition 3</u>

Career Effect (C_j)

$$C_{XY} - C_X = \rho_1 + k\rho_2 - q$$
$$= \frac{q(1-\eta^2 q)}{1-\eta^2 q^2} + \frac{k\eta q(1-q)}{1-\eta^2 q^2} - q$$

which simplifies to:

$$C_{XY} - C_X = \frac{(1-q)\eta q(k-\eta q)}{1-\eta^2 q^2}$$

By inspection, this expression is >0 (<0), whenever $k > \eta q$ ($k < \eta q$) because 0<q<1 and $0 < \eta^2 q^2 < 1$.

Thus, $C_X > C_{XY}$ if $k > \eta q$ and $C_X < C_{XY}$ if $k < \eta q$.

First-period effort (e_1)

Using the optimal effort expressions in Propositions 1 and 2,

$$e^*_{1_{XY}} - e^*_{1_X} = \frac{1}{(1+r\sigma^2)}\left[1-(\rho_1+k\rho_2)-(\rho_1+\rho_2\eta q)r\sigma^2\right] + \rho_1 + k\rho_2 - \frac{1}{(1+r\sigma^2)}$$
$$= k\rho_2 - \rho_2\frac{k+\eta q r\sigma^2}{(1+r\sigma^2)}$$

This simplifies to:

$$e^*_{1_{XY}} - e^*_{1_X} = \frac{(1-q)\eta q r\sigma^2(k-\eta q)}{(1-\eta^2 q^2)(1+r\sigma^2)} > 0 \text{ if } k > \eta q \text{ and } <0 \text{ if } k < \eta q.$$

Incentive weight on x_1 (β_1)

Using the optimal incentive weight expressions in Propositions 1 and 2,

$$\beta^*_{1_{XY}} - \beta^*_{1_X} = \frac{1}{(1+r\sigma^2)}\left[1-(\rho_1+k\rho_2)-(\rho_1+\rho_2\eta q)r\sigma^2\right] - \left(\frac{1}{(1+r\sigma^2)} - q\right)$$
$$= q - \frac{(\rho_1+k\rho_2)+(\rho_1+\rho_2\eta q)r\sigma^2}{(1+r\sigma^2)}$$

This simplifies to $\beta^*_{1_{XY}} - \beta^*_{1_X} = -\frac{(1-q)(\eta q(k-\eta q))}{(1-\eta^2 q^2)(1+r\sigma^2)} < 0$ if $k > \eta q$ and > 0 if $k < \eta q$.

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