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Objective versus Subjective Performance Evaluations

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Abstract

Why does incentive pay often depend on subjective rather than objective performance evaluations? After all, subjective evaluations entail a credibility issue. While the most plausible explanation for this practice is lack of adequate objective measures, I argue that subjective evaluations might sometimes also be used to withhold information from the worker. I furthermore argue that withholding information is particularly important under circumstances where the credibility issue is small. The statements are derived from a two-stage principal-agent model in which the stochastic relationship between effort and performance is unknown.

Keywords: Performance evaluation, principal-agent, moral hazard
JEL Codes: D83, D86, M12, M52

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1 Introduction

Many employers try to boost employee morale by relating compensation—pay, career, power, etc.—to performance. This paper examines how a worker's performance should be measured. One possibility is to establish in advance a comprehensible, visible evaluation procedure that disregards expertise of biased persons (*objective evaluation*). Alternatively, performance can be rated by the personal impression of the worker's supervisor, which is unverifiable (*subjective evaluation*). As an example, consider the evaluation of a project manager's work. His principal could either require initially specified, non-manipulable tests that determine the project's success at each stage until completion, or she may decide herself whether expectations are met.

If an employee's compensation depends on subjective performance evaluations, it is at the discretion of his supervisor. Honest evaluations come at a cost. An owner-manager, for instance, who would generally be tempted to understate performance and save on labor costs, might be forced to acquire credibility through obligatory bonus pools (paid out to some third party in case of negative evaluation, e.g., to charity) or up-or-out career systems (employee lost in case of negative evaluation).[1,2] If compensation depends on an objective evaluation, on the other hand, it is court-enforceable, and the employer does not incur such costs. Yet, subjective evaluations are common practice.[3]

[1]The same problem occurs with an employed manager if his interests are aligned with the owner's objectives. E.g., "the NSPS [a former pay system at the U.S. Department of Defense that involved subjective evaluations] has been roundly criticized by staff members and union leaders who say subjective performance evaluations could be used to limit pay. The review panel heard many complaints that supervisors were pressured not to give too many employees a rating of 4, out of 5, apparently because money was not available" (Washington Post, July 17, 2009).

[2]Supervisors can also be be tempted to *over*state performance so as not to disgruntle employees or when they are susceptible to bribery or currying favor by employees. See Prendergast (1999) for a discussion. Finally, discretion over compensation allows supervisors to discriminate workers based on sex, nationality, etc.

[3]Due to the availability of data, most studies on performance reviews consider CEO compensation. E.g., Bushman et al. (1996) found that in 190 of 248 firms in the USA bonuses were (at least partly) at the discretion of the board of directors. Murphy and Oyer (2003) examined 280 firms in the USA; 43% displayed

The most plausible explanation of this fact holds that employers use subjective performance measures to obtain more accurate evaluations of their workers. More precisely, they complement objective measures which do not capture all tasks that are to be carried out or which are subject to influences beyond the agent's control. For if the evaluation is incomplete, the agent might "game" the incentive contract and neglect tasks that are not included in the evaluation.[4] In fact, empirical studies document that subjective evaluations are more likely in jobs which comprise many tasks (see Brown 1990 and MacLeod and Parent 1999). If the evaluation is noisy, on the other hand, a risk-averse agent might not respond to incentive pay.[5]

However, sometimes employers seem to conduct subjective evaluations not out of necessity, as this theory suggests, but instead to *eschew* to establish comprehensive objective performance measures. The following list provides some examples:

- In 2003, the National Research Council (NRC), a think tank, examined the quality of project management within the U.S. Department of Energy. It stated a "lack of objective measures that makes it difficult to assess progress in improving project management", and "to build confidence within [...] Congress [...] and the public in the department's ability to manage the money it spends on its projects. Evidence continues to be anecdotal rather than objective, quantitative, and verifiable" (National Research Council 2003, pp. 31–32). A subsequent report by the NRC suggested a number of appropriate measures (see National Research Council 2005).
- A study on 17 U.S. investment banks revealed that employees in sales and trading divisions receive bonuses that largely depend on subjective performance appraisals

discretion in determining the size of bonus pools and 67% in allocating a bonus pool across participants. Gibbs et al. (2004), who surveyed car dealerships in the USA, report that subjective evaluations are also prevalent below CEO level.

[4]See Baker et al. (1994), Prendergast (1999), and the general analysis by Bernheim and Whinston (1998). This argument draws on the multi-tasking problem described by Baker (1992) and Holmstrom and Milgrom (1991) . E.g., as Bushman et al. (1996) note, a CEO has to plan the long-term strategy of the company. If it is concealed from the financial market, his performance should not only be measured with the stock price.

[5]See Rajan and Reichelstein (2009). This argument draws on the informativeness principle, established by Harris and Raviv (1979) and Holmstrom (1979) .

despite "the ease with which the profitability of an individual trader can be measured each day" (Eccles and Crane 1988, p. 170). All 17 banks had implemented bonus pools.

- The standards for associates to become partner at professional service firms are usually highly intransparent although many explicit performance measures are conceivable (see Gilson and Mnookin 1989). (According to Morris and Pinnington (1998), who surveyed law firms in the UK, the most important promotion criteria are: getting new business, fee-earning ability, technical skill, and getting on with clients.) At such organizations, up-or-out career systems are commonplace.

I suggest a possible complementary explanation, according to which subjectivity itself can be a desirable property of a performance measure. It builds on the assumption that evaluations *generate* information and that only subjective evaluations generate *exclusive* information, which can be concealed for some time.[6] My analysis applies to jobs with many tasks that are carried out sequentially (e.g., phases of project management) and, more generally, to long-term employment relationships in which performance can be assessed over time (e.g., after trading days or fiscal years until promotion decision). In a nutshell, subjective evaluations at early stages of such jobs are advantageous for the principal if details like productivity or ability are highly uncertain and can be inferred from performance.[7] This is because the worker could manipulate the incentive scheme if he learned about these details too soon and because the cost entailed by the use of subjective evaluations is actually low.

I derive my statements from a two-stage principal-agent model with hidden actions. Specifically, in each stage the wealth-constrained agent can exert effort to increase the likelihood of good performance in that stage, but effort is not observable. The principal can use incentive pay for profit maximization. Three further assumptions are important. First, the likelihood of good performance does not only depend on effort but also on an unknown, persistent, complementary parameter. Second, the principal wants the agent to work hard

[6]Indeed, concealed evaluations are often inherently susceptible to manipulation and can become unverifiable over time (i.e., equivalent to subjective evaluations).

[7]Early studies on evaluation practices by Govindarajan (1984) and Keeley (1977) indeed document significant positive correlation between the use of subjective evaluations and uncertainty about success on the job.

in each stage. Third, only the principal can evaluate performance. The third assumption is of course an extreme simplification. In many employment relationships, the worker has some idea about the produced output. Nevertheless, a comprehensive performance measure might require certain data that are not easily accessible to him (e.g., test results, sales numbers, or comparisons with other workers). I show that the assumption can be rephrased accordingly without affecting the qualitative results.

With this model, I compare the principal's profit in two scenarios that differ as to how she evaluates performance. In the *objective scenario*, the principal evaluates objectively in both stages. This means that it becomes public information at the end of each stage whether the agent was successful. In the *subjective scenario*, the principal evaluates subjectively in stage 1 and objectively in stage 2. Here, only she herself learns the outcome of stage 1, and it cannot be verified.[8]

The analysis yields that, in each scenario, the principal incurs incentive costs. In the objective scenario, contracts must take into account that the evaluation in stage 1 provides information about the unknown parameter and that the agent is in a better position to draw inference since he privately knows his effort choice. In particular, bad performance in stage 1 indicates an unfavorable state and thus calls for amplified incentive pay in stage 2. But this scheme must not tempt the agent to produce a failure on purpose. Therefore, the principal provides the same high-powered incentive also when stage 1 was successful. As a consequence, the agent can secure rent. In the subjective scenario, on the other hand, the principal optimally reveals her subjective evaluation of stage 1 only after stage 2, and only after particular histories. Incentive pay remains invariant over time, and the agent does not earn rent. However, the principal's discretion in determining the agent's performance bonus for stage 1 implies a credibility issue: ex post, the principal will always submit an evaluation which minimizes labor costs. She must therefore commit to pay the bonus regardless of the content of her evaluation—to the agent if he was successful and otherwise to a budget breaker. Hence, the use of subjective evaluations entails a cost as well, namely the payoff to

[8]This notion of objective and subjective evaluations is consistent with the recent literature; see, e.g., Murphy and Oyer (2003). Earlier papers considered subjective evaluations as being unverifiable but not necessarily private; see MacLeod (2003) and Fuchs (2007) for a discussion.

the budget breaker.

I show that greater uncertainty about the stochastic relationship between effort and performance renders the subjective scenario advantageous from the principal's perspective. Intuitively, this result can be explained as follows. The model captures greater uncertainty in form of more extreme posteriors about the unknown parameter. In particular, failure in stage 1 results in a more pessimistic posterior, so that the rent in the objective scenario increases. In the subjective scenario, in contrast, the principal benefits from more extreme posteriors. This is because she optimally rewards the agent according to a wage scheme that, in fact, only requires the subjective evaluation if the agent performs well in stage 2 (otherwise, there will be no bonus for stage 1). Now, this event becomes less likely with a negative but more likely with a positive evaluation if stage 1 gets more informative. Accordingly, the principal is less likely to submit a bad rating and pay the bonus to the budget breaker. Moreover, the bonus itself can be reduced, for the agent will be more confident to earn it. Both lowers the budget breaker's payoff, the cost to overcome the principal's credibility issue.

According to this paper, employers might thus establish subjective performance measures to withhold information from their workers and objective measures if verifiability is the major concern. Several papers indicate similar pros and cons of subjective and objective evaluations but do not explore the trade-off. Most closely related are recent papers by Bashkar (2012), DeMarzo and Sannikov (2011), and Kwon (2012), who study dynamic moral hazard problems in which performance is publicly observed. As in my model, both the principal and the agent do not know the stochastic relationship between effort and output and learn about it from past performance. The papers show that incentive pay involves extra costs for the principal since just the agent knows past effort.[9] It is not examined whether the principal would gain from subjective evaluations.

Closely related is also the analysis of interim feedback during long-term relationships by Lizzeri et al. (2002), who consider a dynamic moral hazard problem in which the principal

[9]Crémer (1995), Hirao (1993), and Manso (2011) consider similar settings in which the principal avoids the extra costs by either terminating the employment relationship or implementing a different technology after failure.

privately observes the agent's performance. They find that the principal should better not reveal the agent's interim performance before the job is finished, since she would otherwise have to pay more rent for the same effort provision. Different from my model, the stochastic relationship between effort and performance is commonly known, so that an interim evaluation does not have relevant informational content but only determines the agent's continuation payoff. If it is concealed, more effective carrot-and-stick schemes are possible. This effect is absent in my model, because shirking yields failure with probability one. Without uncertainty, in fact, the agent could not secure rent at all.[10] Moreover, the principal in the model by Lizzeri et al. (2002) can verify her evaluation (i.e., it is not subjective).

Incentive contracts with subjective performance measures are studied in the seminal papers by Fuchs (2007), Levin (2003), and MacLeod (2003). They consider situations in which the principal does not benefit from private instead of public information about performance but has no means to evaluate objectively. It is analyzed in detail how lack of verifiability exacerbates the contracting problem. Among these papers, Fuchs (2007) is most closely related to the present study. He also investigates a finitely repeated moral hazard problem and argues that subjective evaluations should only be revealed after the last stage. As with Lizzeri et al. (2002), evaluations do not have relevant informational content in his model. If the agent is kept uninformed about his continuation payoff, incentive pay involves more compressed wages, so that the truth-telling constraints for the principal are less severe. This effect is absent in my model, because—again—shirking yields failure with probability one. Without uncertainty, the date at which the principal reveals her subjective evaluation would in fact be irrelevant.

In terms of the model setup, finally, the paper is most closely related to recent work on interim performance feedback by Chen and Chiu (2013). They also consider a two-stage principal-agent model in which the outcome of stage 1 can be evaluated either objectively or

[10] Ederer (2010) investigates a feedback model that does allow for uncertainty. His analysis differs from the present one in that he considers tournaments and assumes an exogenously given bonus scheme. Interestingly, he finds that interim feedback can be advantageous, because it creates implicit incentives to increase initial effort so as to weaken the opponent's motivation. For further references in this strand of literature, see Footnote 18.

subjectively. The paper examines whether an interim evaluation of either kind is desirable *at all*. (In contrast to my model, pay can be made performance-contingent without interim evaluation, because the agent's effort levels in the two stages are complements with respect to the outcome of stage 2.) As the model does not assume ex-ante uncertainty about the stochastic relationship between effort and performance, the insights differ from my analysis.

This paper is organized as follows. The next section presents the model. Section 3 first derives the best contract for the objective and the subjective scenario, respectively. Afterwards, the two scenarios are compared with respect to the principal's profit, and it is shown that more uncertainty renders the subjective scenario advantageous. Section 4 concludes. Lengthy proofs are relegated to Appendix A. Appendix B demonstrates the benefits of subjective evaluations in a more general model.

2 The model

A principal in need for a project manager is matched to an agent. The quality of the match is determined by a random variable, whose distribution function is denoted by F and whose realization θ lies in the interval $[0, 1]$. Both parties do not know which state obtains.

Project management consists of two stages, and the final return to the principal depends on the agent's performance in each stage. In stage 1, the agent can exert effort $e_1 \in \{0, 1\}$ at costs $e_1 c$, where $c > 0$. The agent's effort provision is unobservable. However, the principal can collect relevant data and conduct a performance evaluation. I distinguish two scenarios, which differ as to the evaluation mode. In the *objective scenario*, an objective evaluation takes place. This means that performance is verifiable and commonly observed at the end of stage 1. In the *subjective scenario*, performance is not verifiable and privately observed by the principal at the end of the stage.[11] The relationship between effort and performance does not depend on the evaluation mode. Formally, performance is good ($x_1 = 1$) with probability $e_1\theta$ and bad ($x_1 = 0$) with probability $1 - e_1\theta$.

In stage 2, the agent exerts effort $e_2 \in \{0, 1\}$ and incurs costs $e_2 c$. Again, the principal

[11] Appendix B shows that the qualitative results also hold if the agent observes a noisy performance signal.

cannot monitor whether the agent shirks. In both scenarios, the agent's performance in stage 2 is objectively evaluated.[12] It is again either good ($x_2 = 1$) or bad ($x_2 = 0$); the good outcome obtains with probability $e_2\theta$. After stage 2, the project yields the principal an unobservable, unverifiable return of $\rho(x_1, x_2)$. I normalize $\rho(0, 0) = 0$ and assume $\rho(1, x_2) - \rho(0, x_2) = \rho(x_1, 1) - \rho(x_1, 0) = R > 0$.

Both parties are risk neutral, do not discount future payoffs, and have an outside option of zero. At the outset, the principal offers a contract to specify the agent's wage. It may be contingent on any verifiable data, possibly involving messages. The agent does not dispose of own resources, so that only non-negative wages are feasible. If the contract requires a budget breaker, a third party is available. All payments are made after stage 2.

In detail, the model has the following timing:

0. Match quality θ realizes, and the principal offers a contract.
1. Stage 1: The agent exerts effort e_1. Then, performance x_1 realizes. In the objective scenario, x_1 is commonly observed. In the subjective scenario, x_1 is privately observed by the principal.
2. Stage 2: The agent exerts effort e_2. Then, performance x_2 realizes. In both scenarios, x_2 is commonly observed. Finally, payments are made.

The agent's performance in stage 1 conveys information about the unknown quality of the match, which can be used to update the initial expectation $\mu = E[\theta]$. However, one has to take the agent's effort decision in stage 1 into account to interpret this information. If the agent exerted effort ($e_1 = 1$), the posterior expectation of match quality is either μ_1 (in case $x_1 = 1$) or μ_0 (in case $x_1 = 0$). Henceforth, I assume $1 > \mu_1 > \mu > \mu_0 > 0$.[13] If the agent was lazy ($e_1 = 0$), his performance is bad regardless of the quality of the match, so that no information is conveyed and the posterior expectation remains μ. An important property of the model is that the two parties might have to base their posteriors on imperfect

[12] I implicitly regard the evaluation mode as one of the principal's choice variables. The analysis will make clear that it is advantageous to evaluate objectively in stage 2.

[13] Precisely, $\mu = \int_0^1 \theta dF$, $\mu_1 = (1/\mu) \int_0^1 \theta^2 dF$, and $\mu_0 = [1/(1-\mu)] \int_0^1 \theta(1-\theta) dF$. The prescribed ordering holds for instance if F is discrete and assigns positive probability to at least three distinct realizations, or if F has a density that is supported on some non-degenerate subinterval of $[0, 1]$.

information: In both scenarios, the principal does not observe e_1. The agent, on the other hand, does not observe x_1 in the subjective scenario.

In the next section, I compare the two scenarios with respect to the principal's profit. As usual, the analysis involves a two-step procedure to derive optimal contracts. The first step is to assign to each effort plan a contract that implements it as cheaply as possible. The second step is to identify among these contracts a profit-maximizing one. Let (e_1, e_2) denote a deterministic effort plan that specifies the same effort level for stage 2 after all possible histories up to that stage. To concentrate the analysis on the relevant circumstances, I make the following assumption.

Assumption 1. *In both scenarios, the principal wants to implement effort plan* $(1, 1)$.

Claim A1 in Appendix A characterizes the assumption in terms of the model's primitives and shows that it holds if R, the principal's return from success in some stage, is sufficiently large.[14] Note that Assumption 1 in particular implies that the principal does not want to make e_2 contingent on the agent's past performance. However, the evaluation in stage 1 will be required to create incentives. I want to find out whether subjective or objective evaluations are more appropriate.

3 The analysis

In each stage, performance is bad for sure if the agent shirks.[15] If the model did not involve uncertainty about the quality of the match, this condition would imply that in the objective scenario the principal could appropriate the entire surplus.[16] In case the principal resorts to a subjective evaluation, on the other hand, incentive contracts typically distribute some

[14] I only take deterministic effort plans $(e_1, e_2(x_1))$ into account. Stochastic plans would be hard to implement in practice; see, e.g., Chapter 2.13 in Laffont and Martimort (2002).

[15] This assumption is to rule out the standard "limited liability rent", which would be due in both scenarios. If anything, the assumption should favor the objective scenario, where the agent's incentive constraints are more pressing since the principal cannot withhold the evaluation of stage 1.

[16] If match quality was known to be p, for instance, the principal could achieve this by paying c/p to the agent if he is successful in stage 1 and 2, respectively.

surplus to a budget breaker to confer credibility (see, e.g., MacLeod 2003). Hence, the principal would clearly prefer the objective scenario if the quality of the match was certain. The analysis will show that this ranking might be reversed under uncertainty.

3.1 Objective scenario

In the objective scenario, the agent's performance is objectively evaluated in both stages. Optimal contracts neither involve communication nor a budget breaker but consist of a performance-contingent wage scheme.

Let $w = (w_{x_1x_2})_{x_1,x_2\in\{0,1\}}$ be a wage scheme. To implement effort plan $(1,1)$, it must satisfy four incentive-compatibility constraints. First, the agent has to exert effort in stage 2 if he was successful in stage 1:

$$\mu_1 w_{11} + (1-\mu_1)w_{10} - c \geq w_{10}. \tag{1}$$

Second, he must also work hard if his performance was bad in stage 1, holding the pessimistic posterior μ_0:

$$\mu_0 w_{01} + (1-\mu_0)w_{00} - c \geq w_{00}. \tag{2}$$

Third, the agent must exert effort in stage 1 given that he will do so in stage 2:

$$\mu[\mu_1 w_{11} + (1-\mu_1)w_{10} - c] + (1-\mu)[\mu_0 w_{01} + (1-\mu_0)w_{00} - c] - c \geq \mu w_{01} + (1-\mu)w_{00} - c. \tag{3}$$

Fourth, shirking in both stages has to be unprofitable:

$$\mu[\mu_1 w_{11} + (1-\mu_1)w_{10} - c] + (1-\mu)[\mu_0 w_{01} + (1-\mu_0)w_{00} - c] - c \geq w_{00}. \tag{4}$$

Finally, the contract should be acceptable for the agent:

$$\mu[\mu_1 w_{11} + (1-\mu_1)w_{10} - c] + (1-\mu)[\mu_0 w_{01} + (1-\mu_0)w_{00} - c] - c \geq 0. \tag{5}$$

Since $\mu > \mu_0$, the last constraint is automatically satisfied with *strict* inequality by (3), (2), and the limited liability condition. Put differently, the agent can secure rent if the principal wants to implement effort plan $(1,1)$ in the objective scenario. This is because if he complies, his performance in stage 1 conveys information about the unknown quality

of the match. More specifically, bad performance gives rise to the pessimistic posterior μ_0. Since the agent must continue to work hard, the principal has to offset the demotivating experience by a high reward for good performance in stage 2. But if the agent actually failed in stage 1 because he shirked, no information is conveyed via his performance, so that he is not pessimistic to be successful through hard work in stage 2. However, the principal deems the outcome of stage 1 to be informative since, in equilibrium, there is no shirking; she provides the same high-powered incentive whenever performance in stage 1 is bad. Taking limited liability into account, the agent must therefore get a strictly positive payoff if he deviates from effort plan $(1,1)$ and works according to $(0,1)$. Hence, it requires a rent to make $(1,1)$ incentive-compatible.

The cheapest wage schemes that implement effort plan $(1,1)$ thus solve

$$\min_{w\geq 0} \mu[\mu_1 w_{11} + (1-\mu_1)w_{10}] + (1-\mu)[\mu_0 w_{01} + (1-\mu_0)w_{00}] \quad s.t. \quad (1)\text{–}(4).$$

Lemma 1. *In the objective scenario, wage scheme w^* with*

$$(w^*_{00}, w^*_{10}, w^*_{01}, w^*_{11}) = \left(0, \frac{c}{\mu}, \frac{c}{\mu_0}, \frac{c}{\mu} + \frac{c}{\mu_0}\right).$$

implements effort plan $(1,1)$ as cheaply as possible.

Proof. Note first that (3) and (2) together ensure (4). Next, I reformulate (1)–(3):

$$\mu_1(w_{11} - w_{10}) \geq c, \tag{1'}$$

$$\mu_0(w_{01} - w_{00}) \geq c, \tag{2'}$$

$$\mu[\mu_1(w_{11} - w_{10}) + w_{10} - \mu_1(w_{01} - w_{00}) - w_{00}] \geq c. \tag{3'}$$

It is now routine to verify that (2') and (3') bind and that the proposed wage scheme indeed solves the program. □

The wage scheme in Lemma 1 rewards performance in stage 2 independently of performance in stage 1.[17] In particular, wages do not condition on the principal's posterior expectation of match quality, so that the agent has no incentive to manipulate it. Relative

[17]The optimal wage scheme is not unique. For instance, $w = (0, 0, c/\mu_0, c/(\mu\mu_1) + c/\mu_0)$ also satisfies all constraints and is equally costly as w^*.

to this posterior, however, the wage scheme is too high-powered when stage 1 was successful (constraint (1) holds with strict inequality). As a consequence, the principal does not get the entire surplus but shares it with the agent. The following notation for the generated surplus and the agent's payoff will be helpful in stating this result:

$$S = \mu R - c \tag{6}$$

$$A = \left(\frac{\mu}{\mu_0} - 1\right) c. \tag{7}$$

Lemma 2. *In the objective scenario, the principal's profit is $2S - A$, the agent receives A, and the budget breaker is not involved.*

3.2 Subjective scenario

Consider now the subjective scenario, where the agent's performance in stage 1 is not verifiable and privately observed by the principal. Clearly, to provide an incentive to work hard repeatedly the agent needs to be rewarded depending on his performance in each stage. The principal must therefore make the wage scheme contingent on her subjective evaluation, which leads to two difficulties.

First, due to its subjective nature, the performance evaluation in stage 1 may lack credibility: ex post, the principal could prefer to submit a dishonest evaluation to save on wages. But the agent will shirk if he cannot be sure to receive a reward for good performance. To overcome this difficulty, the principal must involve the budget breaker. Transfers to this third party will solve her credibility problem.

The second difficulty relates to the fact that this principal-agent relationship comprises two stages, rather than just one. More precisely, it is not clear whether the principal should reveal her evaluation already before stage 2 begins, or afterwards, and in which form this should be done.[18] I take the following approach to address these issues. First, I derive

[18]Exactly these questions are raised by the literature on interim feedback during long-term relationships. For example, Lizzeri et al. (2002), who consider a situation without uncertainty, find that the principal should not communicate the agent's interim performance before the project is completed. Suvorov and van de Ven (2009), on the other hand, show that if the principal cannot commit to a wage scheme, coarse feedback in

a payment scheme involving wages to the agent and transfers to the budget breaker that implements effort plan $(1,1)$ as cheaply as possible with *mediated* talk. The presence of a mediator allows for additional communication protocols and can only benefit the principal. In a second step, I show that face-to-face communication after stage 2 works as well as mediated talk. The advantage of this approach is that the benchmark case with mediator can be analyzed using the revelation principle for multistage games (Myerson 1986).

So suppose for the moment a mediator (i.e., an impartial person with whom each party can communicate confidentially) is available to coordinate communication. According to the revelation principle, the cheapest contracts that implement effort plan $(1,1)$ can be found in the class of contracts with the following communication protocol: Before stage 2, the principal reports her evaluation in form of a verifiable message $m \in \{0,1\}$ to the mediator, who publicly reveals it after stage 2. No further communication takes place; in particular, the agent does not receive interim feedback about his performance in stage 1.[19] The revelation principle furthermore asserts that contracts may without loss of generality specify payments which induce the principal to submit an honest report. In the following, I restrict the analysis to contracts with these properties.

Let $w = (w_{mx_2})_{m,x_2\in\{0,1\}}$ be a wage scheme and denote by $b = (b_{mx_2})_{m,x_2\in\{0,1\}}$ a scheme of non-negative transfers from the principal to the budget breaker. Here, $m \in \{0,1\}$ stands for the principal's reported evaluation, which will be honest in equilibrium. I refer to a combination (w,b) as a *payment scheme*.

The wage scheme must make effort plan $(1,1)$ incentive-compatible for the agent given

connection with a bonus payment is beneficial. Similarly, in dynamic tournaments it might be advantageous to announce an ordinal midterm ranking (Gershkov and Perry 2009), provide full feedback (Ederer 2010), or partially disclose the participants' interim performance (Goltsman and Mukherjee 2011).

[19] In general, the revelation principle prescribes that the agent receives recommendations from the mediator as to which effort to provide and that the agent sends reports to the mediator as to which effort he *did* provide. Here, recommendations would be superfluous since the agent is always supposed to work hard. Reports would also be superfluous: The principal would always expect that the agent reports hard work. The agent would have to be indifferent between all reports. Thus, neither the principal's incentives to be honest nor the agent's incentives to work hard would change with reports.

that the principal truthfully reports to the mediator. In contrast to the objective scenario, the agent is now uninformed about past performance when choosing an effort level in stage 2. He can only use the prior expectation to estimate the quality of the match. Therefore, the incentive constraint for stage 2 pools the conditions (1) and (2):

$$\mu[\mu_1 w_{11} + (1-\mu_1)w_{10} - c] + (1-\mu)[\mu_0 w_{01} + (1-\mu_0)w_{00} - c] \geq \mu w_{10} + (1-\mu)w_{00}. \quad (8)$$

Furthermore, the incentive constraints (3) and (4) must be met to induce hard work in each stage. The agent's participation is then guaranteed by the limited liability assumption.

Of course, the wage scheme will only be credible for the agent if the principal is indeed willing to truthfully report her subjective evaluation to the mediator. Since the report is not transmitted to the agent before the project is completed, it cannot affect effort but only payments. Whenever wages alone would tempt the principal to cheat, transfers to the budget breaker need to be specified such that the correct report leads to the lowest total payment for the principal. Formally, in case the principal observes good performance this requires

$$\mu_1(w_{11} + b_{11}) + (1-\mu_1)(w_{10} + b_{10}) \leq \mu_1(w_{01} + b_{01}) + (1-\mu_1)(w_{00} + b_{00}), \quad (9)$$

whereas for bad performance it has to be

$$\mu_0(w_{01} + b_{01}) + (1-\mu_0)(w_{00} + b_{00}) \leq \mu_0(w_{11} + b_{11}) + (1-\mu_0)(w_{10} + b_{10}). \quad (10)$$

I have now identified all conditions which a payment scheme must satisfy to implement effort plan $(1,1)$ with mediated communication. Conditions (3), (4), and (8) rule out deviations by the agent to the effort plans (0,1), (0,0), and (1,0), respectively. Conditions (9) and (10), on the other hand, ensure that the principal honestly reports her subjective evaluation of stage 1 to the mediator.[20] Hence, the cheapest payment schemes solve

$$\begin{aligned} \min_{(w,b)\geq 0} \quad & \mu[\mu_1(w_{11} + b_{11}) + (1-\mu_1)(w_{10} + b_{10})] \\ & + (1-\mu)[\mu_0(w_{01} + b_{01}) + (1-\mu_0)(w_{00} + b_{00})] \\ s.t. \quad & (3),\ (4),\ (8),\ (9),\ and\ (10). \end{aligned}$$

[20] If $b = 0$, straightforward algebra shows that (9) is incompatible with (3). The budget breaker is thus indeed indispensable in the subjective scenario with mediator (a fortiori, also without mediator).

Lemma 3. *In the subjective scenario with mediator, payment scheme* (w^*, b^*) *with*

$$(w^*_{00}, w^*_{10}, w^*_{01}, w^*_{11}) = \left(0, 0, \frac{c}{\mu}, \frac{c}{\mu\mu_1} + \frac{c}{\mu}\right)$$

and

$$(b^*_{00}, b^*_{10}, b^*_{01}, b^*_{11}) = \left(0, 0, \frac{c}{\mu\mu_1}, 0\right)$$

implements effort plan $(1, 1)$ *as cheaply as possible.*

Proof. See Claim A2 in Appendix A. □

The payment scheme in Lemma 3, (w^*, b^*), in fact *pointwisely* satisfies the principal's truth-telling constraints for each performance outcome of stage 2:

$$w^*_{11} + b^*_{11} = w^*_{01} + b^*_{01}$$

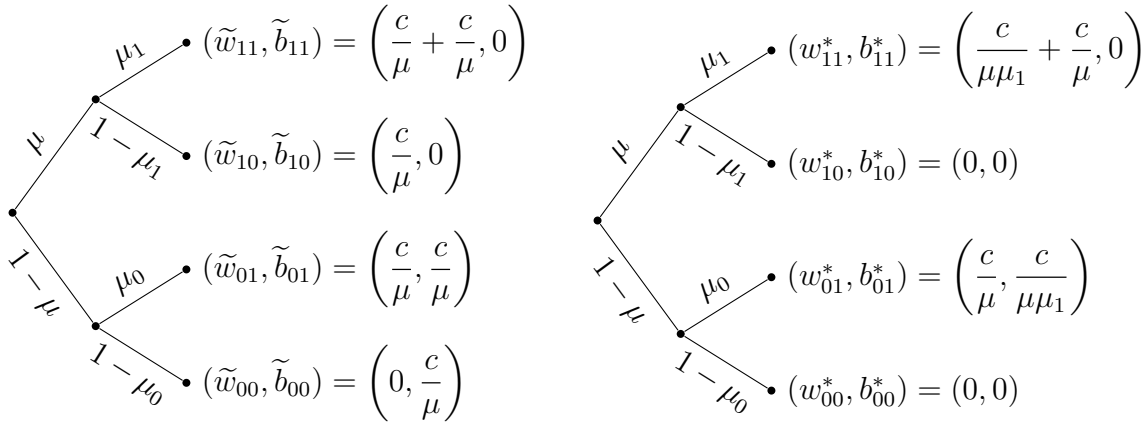
and

$$w^*_{10} + b^*_{10} = w^*_{00} + b^*_{00}.$$

Thus, if the principal had to report her subjective evaluation *after* stage 2, rather than before, she would be honest as well. I now exploit this property to construct a contract that implements effort plan $(1, 1)$ in the original setting without mediator at same costs as the best contracts with mediated talk.[21] Since the presence of a mediator did not preclude any mode of face-to-face communication, it is impossible to find a better contract. Let the payment scheme be (w^*, b^*). Communication proceeds as follows. After stage 2, the principal reports her evaluation of stage 1 in form of a verifiable message $m \in \{0, 1\}$ to the agent. No further communication takes place. From the agent's perspective, nothing has changed as compared with mediation, provided that the principal is still willing to report truthfully. And this is indeed the case, for any report results in the same payment.

Without transfers to the budget breaker, the principal would always report bad performance to save on wages. The (non-mediated) contract described above confers credibility by committing the principal to pay the bonus for stage 1 regardless of the content of her

[21] The optimal payment scheme with mediator is not unique. For instance, scheme (w, b) with $w = (0, c/\mu, c/\mu, 2c/\mu)$ and $b = b^*$ also satisfies all constraints and is equally costly as (w^*, b^*).



(a) Payment scheme $(\widetilde{w}, \widetilde{b})$ (b) Payment scheme (w^*, b^*)

Figure 1: Non-contingent versus contingent reward for stage 1

subjective evaluation—to the agent if he was successful and otherwise to the budget breaker. The payoff to the budget breaker is the cost entailed by the principal's credibility issue. I state this result using the notation

$$B = \left(\frac{1}{\mu_1} - 1\right) c. \tag{11}$$

Lemma 4. *In the subjective scenario, the principal's profit is $2S - B$, the agent's payoff is zero, and the budget breaker receives B.*

I finally highlight an important property of the derived contract: it only rewards the agent for success in stage 1 if he performs well in stage 2 again. Figure 1 illustrates the benefit of this arrangement. The panel on the left-hand side depicts the payments under the scheme $(\widetilde{w}, \widetilde{b})$, which rewards good performance in stage 1 independently of stage 2 with the bonus c/μ. Here, the budget breaker's payoff is $\widetilde{B} = (1/\mu - 1)c$. Scheme (w^*, b^*), depicted on the right-hand side, only differs from $(\widetilde{w}, \widetilde{b})$ in that it just rewards the agent for stage 1 if stage 2 is successful as well. In expectation, (w^*, b^*) provides the agent with the same bonus as $(\widetilde{w}, \widetilde{b})$, so that—given risk-neutrality—he has the same incentive to work hard. But the budget breaker's payoff is just $B < \widetilde{B}$.

The principal essentially benefits from making the bonus for stage 1 contingent on good performance in stage 2 because that event is more likely with a *positive* subjective evaluation,

which indicates *high* match quality. Hence, the probability that the bonus will be paid out to the budget breaker, rather than the agent, reduces.

3.3 Comparison of the scenarios

The previous findings can be used to compare the two scenarios with respect to the principal's profit. By Lemmas 2 and 4, implementing hard work in each stage requires incentive costs, namely A in the objective and B in the subjective scenario. Proposition 1 follows immediately.

Proposition 1.

1. *Suppose $A = B$. The scenarios are equivalent with respect to the principal's profit.*
2. *Suppose $A < B$. The principal's profit is strictly larger in the objective scenario.*
3. *Suppose $A > B$. The principal's profit is strictly larger in the subjective scenario.*

Each scenario has its own problem if the agent is to work hard repeatedly. In case performance in stage 1 is objectively evaluated (i.e., in the objective scenario), the outcome of stage 1 cannot be concealed from the agent. It conveys information about the unknown quality of the match, which just the agent can interpret correctly with certainty. Therefore, the agent receives private information before the project is completed, and it secures him a rent. With a subjective evaluation (i.e., in the subjective scenario), on the other hand, this problem does not arise. It is the principal who obtains private information, and she may communicate with the agent only after his job is done. But in contrast to the objective scenario, the principal must involve the budget breaker to make the evaluation credible. Each problem can be more substantial, and each ranking of the scenarios can arise.

Uncertainty about match quality causes the problem in the objective scenario. More uncertainty, in form of more extreme posteriors after stage 1, increases the rent that the agent can secure by pretending to have a pessimistic belief. In contrast, more uncertainty *diminishes* the problem that arises in the subjective scenario. Recall that, in this scenario, the principal optimally rewards the agent for stage 1 only if stage 2 is successful. Now, this event becomes less likely after a negative and more likely after a positive evaluation if stage 1 gets more informative about match quality. Hence, the probability with which the principal

pays the bonus to the budget breaker decreases. Moreover, the principal can decrease the bonus itself, for the agent will be more confident to earn it. Both lowers the budget breaker's payoff, the cost entailed by the credibility issue. In summary, more uncertainty is detrimental in the objective but beneficial in the subjective scenario. I state this result using the concept of mean preserving spread (MPS) as a criterion for differences in uncertainty.[22]

Proposition 2. *Suppose F is replaced by an MPS.*

1. *In the objective scenario, the principal's profit decreases.*
2. *In the subjective scenario, the principal's profit increases.*

Proof. By the definition of MPS, the prior μ does not change. The posteriors μ_1 and μ_0, on the other hand, are expectations of a convex and a concave function, respectively (see Footnote 13). It follows that μ_1 is greater and μ_0 smaller than given F. Thus, the MPS leaves S unchanged, raises A, and lowers B. In light of Lemmas 2 and 4, this finding concludes the proof. □

4 Conclusion

This paper suggests a possible explanation as to why incentive pay sometimes depends on subjective performance evaluations even though comprehensive objective appraisal systems seem feasible. My analysis builds on two central assumptions. First, an evaluation is considered as a means to generate information about the worker's performance that would remain unknown otherwise. Second, the acquired information is either private and unverifiable or public and verifiable, depending on whether the employer rates subjectively or objectively. Verifiability is clearly an important concern since discretionary compensation entails a credibility issue for the employer. I show that, nevertheless, subjective evaluations can be advantageous because they allow to withhold information from the worker. Indeed, withholding information seems particularly important under circumstances where the credibility issue is small. According to my analysis, subjective evaluations might be particularly

[22]Given two distribution functions F_1 and F_2 of match quality, F_2 is an MPS of F_1 if and only if $\int_0^1 h(\theta)dF_2 \leq \int_0^1 h(\theta)dF_1$ for any concave function h over $[0,1]$; see, e.g., Proposition 6.D.2 in Mas-Colell et al. (1995).

prevalent at early stages of employment relationships in which characteristics that determine the worker's success on the job are highly uncertain.

Appendix A

Claim A1. *Let S, A, and B be as defined in (6), (7), and (11), respectively. Effort plan $(1,1)$ is optimal among all plans $(e_1, e_2(x_1))$ if and only if*

$$\min\{2S, (1-\mu)(\mu_0 R - c)\} \geq \max\{A, B\}.$$

Proof. According to Lemmas 2 and 4, the principal's maximum profit with effort plan $(1,1)$ is $2S - A$ in the objective and $2S - B$ in the subjective scenario. The maximum *surplus* with other plans $(e_1, e_2(x_1))$ is $\max\{0, 2S - (1-\mu)(\mu_0 R - c)\}$, where $2S - (1-\mu)(\mu_0 R - c)$ is the surplus generated with plan $(e_1, e_2(x_1 = 1), e_2(x_1 = 0)) = (1, 1, 0)$. Suppose the agent is to work according to this plan and gets the wage $c/\mu + c/\mu_1$ if he is successful in both stages, c/μ if he is successful just in stage 1, and zero wage otherwise. A routine check shows that he is willing to comply. If the principal evaluates objectively in both stages, she can thus implement effort plan $(1, 1, 0)$ and fully appropriate the generated surplus, which concludes the proof. □

Claim A2. *In the subjective scenario with mediator, payment scheme (w^*, b^*) with*

$$(w^*_{00}, w^*_{10}, w^*_{01}, w^*_{11}) = \left(0, 0, \frac{c}{\mu}, \frac{c}{\mu\mu_1} + \frac{c}{\mu}\right)$$

and

$$(b^*_{00}, b^*_{10}, b^*_{01}, b^*_{11}) = \left(0, 0, \frac{c}{\mu\mu_1}, 0\right)$$

implements effort plan $(1,1)$ as cheaply as possible.

Proof. I first derive some auxiliary results.

(A) Consider the choice variables w_{00}, b_{00}, and b_{11}. Suppose $(\widehat{w}, \widehat{b})$ satisfies all constraints. Then the alternative payment scheme (w', b') with

$$w' = (0, \widehat{w}_{10}, \widehat{w}_{01}, \widehat{w}_{11} + \widehat{b}_{11})$$

and

$$b' = \left(0, \widehat{b}_{10}, \widehat{b}_{01} + \frac{1-\mu_0}{\mu_0}(\widehat{w}_{00} + \widehat{b}_{00}), 0\right)$$

also satisfies all constraints and yields the same value of the objective function. Hence, I may without loss of generality set $w_{00} = b_{00} = b_{11} = 0$.

(B) Next, I show that the truth-telling constraint (9) binds. Suppose not. Then $(\widetilde{w}, \widetilde{b})$ with

$$\widehat{w} = \left(0, \frac{c}{\mu}, \frac{c}{\mu}, \frac{2c}{\mu}\right)$$

and

$$\widehat{b} = (0, 0, 0, 0)$$

would be an optimal solution. Since it violates (9) and as the program is linear, (9) must bind.

(C) Consider now the choice variables w_{10}, b_{10}, and b_{01}, and take **(A)** and **(B)** into account. The binding truth-telling condition (9) reads

$$\mu_1 w_{11} + (1-\mu_1)(w_{10} + b_{10}) = \mu_1(w_{01} + b_{01}),$$

and the second truth-telling condition, (10), reads

$$\mu_0(w_{01} + b_{01}) \leq \mu_0 w_{11} + (1-\mu_0)(w_{10} + b_{10}).$$

For the moment, ignore (10). Suppose $(\overline{w}, \overline{b})$ satisfies all other constraints. Then, the alternative payment scheme $(\underline{w}, \underline{b})$ with

$$\underline{w} = \left(0, 0, \overline{w}_{01}, \overline{w}_{11} + \frac{1-\mu_1}{\mu_1}\overline{w}_{10}\right)$$

and

$$\underline{b} = \left(0, 0, \overline{w}_{11} + \frac{1-\mu_1}{\mu_1}\overline{w}_{10} - \overline{w}_{01}, 0\right)$$

also satisfies all constraints and yields at least the same value of the objective function ("at least" because $b_{10} = 0$ is optimal). Here,

$$\underline{b}_{01} = \overline{w}_{11} + \frac{1-\mu_1}{\mu_1}\overline{w}_{10} - \overline{w}_{01}$$

is indeed a non-negative transfer because $\overline{w}$ satisfies (3), which requires

$$\mu[\mu_1 w_{11} + (1-\mu_1)w_{10} - \mu_1 w_{01}] \geq c.$$

The alternative payment scheme actually also satisfies the ignored truth-telling constraint (10). I may hence set $w_{10} = b_{10} = 0$ and $b_{01} = w_{11} - w_{01}$.

According to **(A)**–**(C)**, I may search for an optimal solution among all payment schemes (w, b) that satisfy

$$w = (0, 0, w_{01}, w_{11})$$

and

$$b = (0, 0, w_{11} - w_{01}, 0).$$

The optimal values w_{01}, w_{11} can be derived from

$$\begin{aligned} \min_{w_{11} \geq 0, w_{01} \geq 0} \quad & \mu w_{11} \\ s.t. \quad & \mu\mu_1(w_{11} - w_{01}) \geq c & (3') \\ & \mu\mu_1 w_{11} + (1-\mu)\mu_0 w_{01} \geq c + c & (4') \\ & \mu\mu_1 w_{11} + (1-\mu)\mu_0 w_{01} \geq c. & (8') \end{aligned}$$

This program is solved by $w_{01} = c/\mu$, $w_{11} = c/(\mu\mu_1) + c/\mu$. □

Appendix B

This appendix shows that the benefits of subjective evaluations are not a peculiarity of the original model, in which only the principal can evaluate performance. To this end, consider the *alternative subjective scenario*, which differs from the original one in that the agent privately observes a performance signal $s \in \{0, 1\}$ at the end of stage 1. Let $Pr(x_1 = s) = \alpha \in (1/2, 1)$ be the probability that the signal coincides with the principal's subjective evaluation.

The main result of this section, Claim B1, establishes a lower bound on the principal's profit. I use the notation

$$\alpha_0 = \min\{\mu, (1-\alpha)\mu_1 + \alpha\mu_0\}$$
$$A' = \left(\frac{\mu}{\alpha_0} - 1\right) c.$$

Claim B1. *In the alternative subjective scenario, the principal's profit is at least* $2S - A' - B$.

Observe that A' is lower than A, the agent's payoff in the objective scenario. In particular, it holds that $A'+B<A$ if the posteriors μ_0 and μ_1 are sufficiently low and high, respectively. More uncertainty thus also renders the alternative subjective scenario advantageous for the principal.

Claim B1 follows from Claim B2. I construct a contract that implements effort plan $(1,1)$ in the alternative subjective scenario using the same communication protocol as the non-mediated contract derived in section 3.2. Accordingly, the payments do not depend on the agent's signal but only on the the principal's reported evaluation of stage 1 and on the objective evaluation of stage 2.[23]

Claim B2. *In the alternative subjective scenario, payment scheme* (w', b') *with*

$$(w'_{00}, w'_{10}, w'_{01}, w'_{11}) = \left(0, 0, \frac{c}{\alpha_0}, \frac{c}{\mu\mu_1} + \frac{c}{\alpha_0}\right)$$

and

$$(b'_{00}, b'_{10}, b'_{01}, b'_{11}) = \left(0, 0, \frac{c}{\mu\mu_1}, 0\right)$$

implements effort plan $(1,1)$.

Proof. First, the agent has an incentive to exert effort in stage 2 if he worked hard in stage 1 and observes $s=1$:

$$\alpha[\mu_1 w'_{11} + (1-\mu_1)w'_{10} - c] + (1-\alpha)[\mu_0 w'_{01} + (1-\mu_0)w'_{00} - c] \geq \alpha w'_{10} + (1-\alpha)w'_{00}. \quad \text{(B.1)}$$

Second, the agent also has an incentive to exert effort in stage 2 if he worked hard in stage 1 and observes $s=0$:

$$(1-\alpha)[\mu_1 w'_{11} + (1-\mu_1)w'_{10} - c] + \alpha[\mu_0 w'_{01} + (1-\mu_0)w'_{00} - c] \geq (1-\alpha)w'_{10} + \alpha w'_{00}. \quad \text{(B.2)}$$

Moreover, w' satisfies the conditions (3)–(5). The contract thus implements effort plan $(1,1)$ if the principal is willing to submit an honest evaluation. Indeed, any report results in the same payment for the principal:

$$w'_{11} + b'_{11} = w'_{01} + b'_{01}$$

[23] As the agent's signal is only imperfectly correlated with the subjective evaluation, the budget breaker's payoff should be greater than zero also if the contract takes the signal into account.

and

$$w'_{10} + b'_{10} = w'_{00} + b'_{00},$$

which concludes the proof. □

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