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Delegation of Job Design and the Value of Communication with Imperfect Performance Measurement

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Abstract

We consider a multitask model with private, post-contract, pre-decision information and imperfect performance measurement and identify conditions under which the delegation of job design is preferred over centralization. A principal contracts with an agent who performs productive effort. After contracting, the agent becomes privately informed about his effort costs for performing one task. The principal can either decide centrally about the job design or delegate the decision whether to perform effort on this task to the agent. We find that delegation, although it entails a loss of control, can be preferred over centralization when the performance measure is incongruent. The principal may achieve a benchmark result with delegation that would be obtained with ex-ante observable effort costs. Moreover, we show that the benefit of communication in a centralized setting crucially depends on the nature of the congruity problem. Delegation may then be even preferred over communication-based centralization.

JEL Classifications: D86, M41, M52

Keywords: *Delegation, Communication, Incentive Contracts, Performance Measurement, Congruity, Job Design, Task Assignment*

INTRODUCTION

Within an organization, three interrelated systems of control are performance measurement, incentive compensation, and the allocation of decision rights, which Brickley, Smith, and Zimmerman (2016) have described with the picture of a three-legged stool. An efficient organizational design usually involves balancing these three legs in an optimal configuration and, in particular, balancing the trade-off between the benefits of delegating decisions to better informed parties against the loss of control associated with delegation and the need to provide incentives for the optimal use of private information. These trade-offs are further influenced by various factors, among them the quality of the performance measurement and information system, the production environment, or the possibility of communication. In this paper, we use a principal-agent model to investigate how the quality of performance measurement interacts with an agent's private information and affects the value of delegation and the value of communication. Available performance measures frequently represent economic consequences of actions and decisions only imperfectly (e.g., Feltham and Xie 1994; Baker 2000). It is therefore important to understand how changes of performance measure quality affect the interplay of incentive design and the allocation of decision rights.

We investigate a situation in which a risk-neutral principal contracts with a risk-neutral agent. The production environment encompasses the execution of effort on two tasks. The agent is specialized in a primary task and always performs effort on this task. A secondary task is optional and the agent's cost for performing effort on this task are unknown at the contracting stage. The respective effort cost parameter will be privately observed by the agent at a later stage. We analyze under what circumstances the principal benefits from delegating the job design, that is, the decision whether to perform effort on the secondary task or not, to the privately informed agent. The rationale for delegation is that the agent is better informed about the cost-benefit relation of the secondary task than the principal. However, in the presence of moral hazard and incongruent performance measurement, it is a priori unclear whether delegation can improve upon a centralized job design. Moreover, we consider the possibility of costless communication between agent and principal to investigate the value of communication in this setup.

We find that the delegation of job design dominates centralization if the performance measure is sufficiently incongruent, but not too much distorted towards the secondary task. The reason is that delegation allows the principal to elicit the agent's private cost information by observing the selected job design, which enables her to enhance performance pay schemes. Delegation can

even achieve the benchmark result of ex-ante observable effort costs when centralization cannot. We further show that delegation can be even preferred over communication-based centralization, depending on the type of congruity problem associated with performance measurement. We characterize circumstances under which delegation is more effective in eliciting private information than communication-based centralization and show that specific congruity problems can prevent the principal from exploiting truthful communication mechanisms. In particular, the principal cannot benefit from communication when the performance measure is distorted towards the agent's secondary task. Intuitively, in order to mitigate this type of congruity problem, which entails an overprovision of effort in the secondary task, the principal would like to pay a lower bonus to a low-cost agent than to a high-cost agent. However, such an incentive scheme hinders truthful communication, which requires to pay the low-cost agent a higher bonus than the high-cost agent. We extend the basic model to settings in which more than one agent is employed by the principal (teamwork setting) and show the robustness of our results for different assumptions regarding the contracting environment and the private cost information.

Our research is related to the theoretical literature on delegation and communication, multitasking, job design, and performance measurement. Previous theoretical research has studied the optimality of organizational design with respect to several different incentive problems, e.g., the provision of productive effort, information acquisition, investment decisions, or truthful reporting. In an overview, Mookherjee (2006) classifies this literature into a first branch that has established the "Revelation Principle"[1] as a central result, and a second branch that deviates from the assumptions underlying this principle. Within the first branch, as an example, Melumad and Reichelstein (1987) show in a principal-agent-setting with private pre-contract information that a delegation scheme can only replicate a communication-based centralization scheme in very special cases. Within the second branch, several authors have shown that delegation can indeed be preferred over centralization when additional frictions occur, e.g., information processing costs (Radner 1993; Bolton and Dewatripont 1994), costly communication or contract complexity (Melumad, Mookherjee, and Reichelstein 1992, 1997; Laffont and Martimort 1998), collusion among agents (Laffont and Martimort 1998; Faure-Grimaud, Laffont, and Martimort 2003; Mookherjee and Tsumagari 2004), incomplete commitment and renegotiation (Dessein 2002; Faure-Grimaud and Martimort 2001), or incomplete contracts (Aghion and Tirole 1997; Roider 2006). It has also been argued that delegation enhances

[1]The Revelation Principle establishes that centralized control cannot be dominated by any delegation arrangement in the absence of communication or information processing costs.

motivation or initiative and can therefore be preferred over centralization (Aghion and Tirole 1997; Baker, Gibbons, and Murphy 1999; Shin and Strausz 2014), or that delegation can improve investment decisions (Dutta and Fan 2012; Athey and Roberts 2001; Baiman and Rajan 1995). Several theoretical models have analyzed the delegation of a contracting decision to an agent, thereby establishing a three-tier hierarchy, and identified conditions under which it is optimal for the principal to delegate (Melumad, Mookherjee, and Reichelstein 1992, 1995; Macho-Stadler and Pèrez-Castrillo 1998; Feltham and Hofmann 2007; Feltham, Hofmann, and Indjejikian 2016). Another stream of literature has taken the delegation decision as exogenously given and investigated optimal mechanisms to ensure efficient effort provision, investment incentives, or truthful reporting (Baldenius 2003; Arya, Glover, and Routledge 2002).

Previous literature on performance measurement has emphasized the problem that aggregate performance measures might not exactly reflect an agent's contribution to the firm, which is commonly referred to as a congruity problem (e.g., Feltham and Xie 1994; Baker 2002). Incongruity in performance measurement might provide an additional friction to the delegation decision. While it has been well documented that incentive problems in multitasking settings can be mitigated by an appropriate job design (e.g., Holmström and Milgrom 1991; Itoh 1994; Hemmer 1995; Ratto and Schnedler 2008; Schöttner 2008; Kragl and Schöttner 2014), the delegation of job design decisions has not received much attention. Bushman, Indjejikian, and Penno (2000) investigate a connection between incongruent performance measurement and a classic moral hazard problem with pre-decision information and show that congruity affects the value of delegating effort provision, but they do not consider the full range of delegation decisions. Reichmann and Rohlfing-Bastian (2014) analyze a setting in which the authority to allocate a special task is delegated to an agent in a multi-task environment and show that the principal's choice of the agent being in charge of allocating the special task depends on the congruity problem associated with this task and the agents' regular tasks. However, they take the delegation decision as given and assume that effort costs are observable.

In our model, we focus on the optimality of delegating job design in a multitasking setting with a potentially incongruent performance measure, in which the agent has private post-contract pre-decision information about effort costs. We therefore combine the above mentioned different streams of literature and contribute to them in several ways. First, we combine the imperfect performance measurement approach based on multitasking established by Feltham and Xie (1994) and Baker (2002) with a situation in which the tasks' productivity is unknown at the time of contracting as

considered by Baker (1992) and explore the value of delegation and communication in such a setting. Second, we focus on the delegation of job design as a means for the principal to set incentives, which has not been studied extensively in the literature, but is an extremely relevant practical instrument. Third, we provide new insights to the value of communication in a setting with pivate, post-contract, pre-decision information when performance measurement is imperfect. We thus complement the category of incomplete contracts described by Mookherjee (2006) with a framework in which firm value is not contractible and the only performance measure available for contracting is imperfect. In this regard, we contradict Penno (1984) and show that costless communication is not always valuable even if private information is not observable ex-post, and we show that communication can have value even if the agent has perfect private information, but performance measurement is noisy, thereby complementing the analysis in Melumad and Reichelstein (1987, 1989).

Our results have important implications for whether or not firms should aim at acquiring information that is dispersed on lower hierarchy levels in order to enhance their organizational design and firm performance. In our model, the principal could acquire information on the effort costs of the secondary task by implementing truthful communication. However, information acquisition is worthwhile only if, due to congruity problems, the principal wishes to condition performance pay on the cost realization. By contrast, if a benchmark job design with ex-ante observable effort costs depends on the cost realization, the principal can induce this benchmark job design through delegation, without incurring any loss from not being informed about costs. This results in a situation in which the principal should delegate more often as the performance measure becomes more incongruent (but not too much distorted towards the secondary task). This result is of particular interest as experimental evidence has demonstrated that incongruity reduces superiors' tendency to delegate (Coats and Ranking 2017) and the literature on empowerment argues "that most firms have made mistakes over a long period in not delegating more decision rights to lower-level employees" (Brickley, Smith, and Zimmerman 2016).

The remainder of the paper proceeds as follows. In the next section, the basic model setup is described. Afterwards, we derive the case with ex-ante observable effort costs that serves as a benchmark. Next, we analyze the optimal organizational design with unobservable effort costs and illustrate the impact of incongruent performance measurement on the value of delegation. In the next section, we discuss the impact of communication on the setup with unobservable effort costs. It follows a discussion of some extensions and special cases to reconcile our results with previous literature and assess the robustness of our results. Finally, the last section concludes.

MODEL

We consider a single-period setting in which a principal (firm owner) contracts with an agent (manager or worker) to provide unobservable effort $e_\ell \geq 0$ in two productive tasks indexed by $\ell = 1, 2$. Task 1 is the agent's primary task that will always be assigned to his job because it matches his training, experience, or skills. In contrast, task 2 is a secondary task that may or may not be part of the agent's job.[2] At the time of contracting, the agent's effort costs for his primary task are known to both parties, whereas the effort costs for the secondary task are privately observed by the agent only after he has accepted the contract and entered the firm.

More specifically, we assume that the agent incurs effort costs $\kappa(e_1, e_2) = 1/2 \cdot e_1^2 + 1/2 \cdot c \cdot e_2^2$, where the cost parameter c is privately observed by the agent. Ex ante, c is a random variable with $c \in \{c_L, c_H\}$, $0 < c_L < c_H$, and $\Pr[c = c_L] = p \in (0, 1)$. Both tasks contribute to firm value Y, with $Y \in \{0, 1\}$ and

$$\Pr[Y = 1|e_1, e_2] = \min\{f_1 e_1 + f_2 e_2, 1\},$$

where $f_\ell > 0$ denotes the marginal productivity of effort in task ℓ for $\ell = 1, 2$. The realization of Y is non-verifiable and thus cannot be part of an incentive contract.[3] However, there is a verifiable, aggregate performance measure $P \in \{0, 1\}$, with

$$\Pr[P = 1|e_1, e_2] = \min\{g_1 e_1 + g_2 e_2, 1\}$$

and performance measure sensitivities $g_\ell > 0$ for $\ell = 1, 2$. The performance measure is congruent if the tasks' relative productivity is identical to their relative performance measure sensitivity, that is, $f_1/f_2 = g_1/g_2$. Otherwise, the performance measure is incongruent (Feltham and Xie 1994; Baker 2002). An incongruent performance measure potentially entails an inefficient effort allocation if the agent multitasks.

If effort was contractible and the cost parameter c was observable, the principal would compensate the agent for his effort costs and request first-best efforts $e_1^* = f_1$ and $e_2^* = f_2/c$, thereby earning the first-best profit $\Pi^{FB}(c) = 1/2(f_1^2 + f_2^2/c)$. Accordingly, in the first-best outcome, both tasks are assigned to the agent's job and the agent exerts strictly positive effort in both tasks because, at $e_1 = 0$ and $e_2 = 0$, marginal effort costs are zero, whereas the marginal increase in expected firm

[2] We assume that it is not profitable for the principal to hire another agent to perform task 2, for example due to a high reservation utility.

[3] The non-verifiability of Y puts the model in the category of incomplete contracts.

value, f_1 and f_2, respectively, is strictly positive. With unobservable effort and an incongruent performance measure, however, it is not clear if the agent should always engage in both tasks because excluding a task from the agent's job eliminates the congruity problem (Holmström and Milgrom 1991). We focus on a situation in which the firm never wants to exclude the agent's primary task, task 1, from the agent's job in order to prevent a congruity problem. We therefore assume that $1/2 \cdot g_1/g_2 \leq f_1/f_2$, implying that the performance measure does not overemphasize task 1 too much relative to task 2.[4] We further assume that the marginal productivities and performance measure sensitivities are such that the above probabilities for the realizations of Y and P remain strictly below one at the first- and second-best solution.[5]

Principal and agent are risk neutral and their reservation utilities are zero.[6] The principal wants to implement the organizational design that maximizes expected profit, which corresponds to the expected firm value net of wage costs. The organizational design stipulates a performance-based wage scheme and the set of feasible job designs, denoted by $T \subseteq \{S, M\}$, where S stands for single-tasking and M for multitasking. A centralized job design obtains when T is a singleton. In this case, the principal chooses ex ante whether or not the agent is allowed to work on task 2, that is, before the agent observes the effort cost parameter c. Specification $T = \{M\}$ allows the agent to multitask and hence exert effort in task 2, whereas $T = \{S\}$ means that the agent cannot engage in task 2. Accordingly, in the latter case, the principal decides that the agent should focus on his primary task only. In practice, a centralized job design can be enforced by providing the agent with access to the necessary tools or information to perform task 2 only if he is allowed to exert effort in the task.

When $T = \{S, M\}$, the principal delegates job-design authority to the agent, who then decides whether or not he wants to perform task 2 after he has observed c. The agent's job design choice, $t^d \in \{S, M\}$, is verifiable ex post and thus available for contracting. If the agent has worked on task 2, that is $e_2 > 0$, then $t^d = M$. If the agent has only performed task 1, that is $e_2 = 0$, then $t^d = S$. Verifiability of t^d thus means that it is verifiable whether or not the agent has exerted positive effort in task 2, while the exact effort level remains unobservable. Note that both $T = \{S, M\}$ and $T = \{M\}$ grant the agent full discretion in allocating effort across tasks. However,

[4] In the supplementary material, we show that $1/2 \cdot g_1/g_2 \leq f_1/f_2$ implies that excluding task 1 from the agent's job is never optimal.

[5] This can always be achieved by scaling the vectors $f = (f_1, f_2)$ and $g = (g_1, g_2)$ appropriately, which does not affect the nature of the congruity problem.

[6] Introducing a positive reservation utility $\bar{u}$ for the agent is straightforward and would only reduce the principal's profit by $\bar{u}$ without any further impact on the results.

a crucial difference between the two organizational designs is that $T = \{S, M\}$ enables the principal to use the agent's job design choice for contracting purposes and may allow the agent to signal his effort costs by his job design choice.[7]

The principal further specifies a performance-based wage scheme for each feasible job design $t \in T$, denoted by $W = \{(s^t, b^t) \mid t \in T\}$, where s^t denotes the flat wage paid to the agent under job design $t \in T$ and b^t the respective bonus that is paid if $P = 1$.[8] Accordingly, under centralization, the wage scheme is fixed ex ante, whereas under delegation the flat wage and the bonus may depend on the job design t^d that the agent has chosen.

- - - Insert Figure 1 about here - - -

Figure 1 illustrates the timing of the model. At $\tau = 1$, the principal chooses the organizational design according to which she offers employment to the agent. In case of centralization, the job design is established. At $\tau = 2$, the agent observes the organizational design and decides whether or not he wants to accept the employment offer. At $\tau = 3$, given that the agent accepted, he observes the effort cost parameter c. Under delegation, the agent then chooses t^d, that is, whether or not he will work on task 2. At $\tau = 4$, the agent chooses his effort level(s). Finally, at $\tau = 5$, the performance measure P and, in case of delegation, job design t^d are observed and wages are paid.[9] Our assumptions imply for the moment that principal and agent cannot communicate after contracts have been signed. As a consequence, the agent cannot be asked to make a report on c and the principal cannot offer a menu of contracts from which the agent is supposed to pick a contract after having observed c.[10] We analyze the case of post-contractual communication in a later section.

BENCHMARK: EX-ANTE OBSERVABLE EFFORT COSTS

As a benchmark, we first derive the optimal organizational design if the realization of the cost parameter c was observable to the principal and the agent at $\tau = 1$, that is, before the principal

[7] In case $T = \{M\}$, the agent can in principle decide to exert zero effort in the secondary task (i.e., choose $e_2 = 0$) but will never find this optimal under performance-related pay so that $T = \{M\}$ will always entail "true" multitasking. The reason is that the agent's marginal effort costs for engaging in task 2 are zero at $e_2 = 0$, whereas the performance measure sensitivity of task 2 is strictly positive (i.e., $g_2 > 0$). By contrast, as we will show, under $T = \{S, M\}$, choosing $t^d = S$ and thus $e_2 = 0$ can be optimal for the agent.

[8] Note that under the assumption of a binary performance measure, the structure of the wage scheme ensures optimality of the contracts.

[9] The firm value Y might be realized simultaneously with P or afterwards.

[10] Baker (1992), Prendergast (2002), and Raith (2008) make analogous assumptions.

chooses the organizational design and offers employment to the agent. Analyzing this setting allows us to isolate the impact of imperfect performance measurement on the optimal organizational design relative to the first-best solution and delivers preliminary results for the analysis in the following sections. We focus on the case of centralization in this section because the principal cannot gain from delegating the job design to the agent when the latter has no private information regarding his effort costs. In order to determine the optimal organizational design, we first describe the optimal wage scheme for each of the two centralized job designs in Lemma 1.[11]

Lemma 1 *Suppose that c is common knowledge at stage $\tau = 1$. Given the principal's choice of the job design, the following wage schemes maximize the principal's expected profit.*

(i) If the agent is allowed to perform task 2, that is, $T = \{M\}$, the principal implements the wage scheme $W^M(c) = (s^M(c), b^M(c))$ where

$$b^M(c) = \frac{g_1^2}{g_1^2 + c^{-1}g_2^2}\frac{f_1}{g_1} + \frac{c^{-1}g_2^2}{g_1^2 + c^{-1}g_2^2}\frac{f_2}{g_2}. \tag{1}$$

The principal earns the expected profit

$$\Pi^M(c) = \frac{1}{2}\frac{\left(f_1 g_1 + c^{-1} f_2 g_2\right)^2}{g_1^2 + c^{-1}g_2^2}. \tag{2}$$

(ii) If the agent is not allowed to perform task 2, that is, $T = \{S\}$, the profit-maximizing wage scheme is $W^S = (s^S, f_1/g_1)$ and the principal's expected profit is $\Pi^S = 1/2 \cdot f_1^2$.

In both cases (i) and (ii), the flat wages $s^M(c)$ and s^S are such that the agent's expected utility under the respective contract equals his reservation utility.

In case (i) of Lemma 1, the agent multitasks. If the performance measure is congruent (i.e., $f_1/f_2 = g_1/g_2$), the principal earns the first-best profit and offers the agent the same bonus under each cost realization (but different flat wages). If $f_1/f_2 \neq g_1/g_2$ and thus a congruity problem arises,

[11] All proofs are relegated to the Appendix.

the principal's profit is below the first-best result. The realization of c affects the severeness of the congruity problem and therefore the principal offers different bonuses for different realizations of c.[12] In particular, the optimal bonus decreases in c if and only if $f_1/f_2 < g_1/g_2$, that is, if the performance measure is distorted towards task 1. In this case, higher effort costs *exacerbate* the congruity problem as they make the agent exert even less effort in task 2. Using the incongruent performance measure for incentive provision becomes less effective and, therefore, the principal decreases the bonus. By contrast, if $f_1/f_2 > g_1/g_2$, the optimal bonus increases in c because the performance measure is distorted towards task 2, and higher effort costs thus *reduce* the congruity problem. Therefore, depending on the nature of the congruity problem, an agent with low costs may earn a lower or a higher bonus than an agent with high costs.[13]

In case (ii) of Lemma 1, the agent is forced to focus on his primary task only and hence the principal can induce first-best effort in this task. However, this organizational design comes at the cost of relinquishing profits attributed to task 2.

We can now use the results from Lemma 1 to derive the optimal organizational design if effort costs were observable ex ante in the following proposition.

Proposition 1 *Suppose that c is observable at $\tau = 1$. Define the threshold $\bar{c}$ such that*

$$\bar{c} = \begin{cases} \infty & \text{if } f_1/f_2 \leq 2 \cdot g_1/g_2, \\ \frac{1}{f_1/f_2(f_1/f_2 - 2 \cdot g_1/g_2)} & \text{if } f_1/f_2 > 2 \cdot g_1/g_2. \end{cases}$$

The principal wants the agent to perform task 2 if and only if $c \leq \bar{c}$. Hence, if $c \leq \bar{c}$, the principal implements $T = \{M\}$ and $W = W^M(c)$. Otherwise, the principal implements $T = \{S\}$ and $W = W^S$.

According to Proposition 1, the benchmark organizational design involves multitasking if and only if the agent's costs for the secondary task are below a threshold $\bar{c}$, which depends on whether and to what extent the performance measure is distorted towards task 2. If the performance measure is not too much distorted towards task 2, that is $f_1/f_2 \leq 2 \cdot g_1/g_2$, we obtain $\bar{c} = \infty$ and the job design always comprises both tasks. Note that this case includes a congruent performance measure

[12] The congruity problem can be measured by the angle between the two vectors $(f_1, f_2/\sqrt{c})$ and $(g_1/, g_2/\sqrt{c})$ (Schöttner 2008). The larger the angle, the more severe is the congruity problem. See also the proof of Corollary 1.

[13] This observation will become important later on when we introduce communication.

as well as a performance measure that is distorted towards the primary task (i.e., $f_1/f_2 < g_1/g_2$). By contrast, if the performance measure is sufficiently distorted towards task 2, that is $f_1/f_2 > 2 \cdot g_1/g_2$, the principal may prefer to exclude task 2 from the agent's job. The threshold $\bar{c}$ is then decreasing in g_2, which implies that task 2 will be excluded for more values of the parameter c as the congruity problem becomes more severe.

Three cases can occur with respect to the binary effort cost parameters: (1) the performance measure is *at most mildly distorted towards task 2* such that even the high-cost type has effort costs below the threshold value, that is, $c_H \leq \bar{c}$; (2) the performance measure is *moderately distorted towards task 2* such that the low-cost type is below the threshold, but the high-cost type is above the threshold, that is, $c_L < \bar{c} < c_H$; and (3) the performance measure is *severely distorted towards task 2* such that even the low-cost type is above the threshold, that is, $\bar{c} \leq c_L$. In the first case, the agent multitasks for both possible cost realizations. In the second case, only a low-cost agent multitasks. In the third case, the agent never multitasks regardless of his costs.[14]

In the following analysis, we will categorize the performance measure according to the cases (1)-(3) as either *at most mildly distorted towards task 2* (i.e., $c_H \leq \bar{c}$), or *moderately distorted towards task 2* (i.e., $c_L < \bar{c} < c_H$), or *severely distorted towards task 2* (i.e., $\bar{c} \leq c_L$). Note that this categorization relates performance measure characteristics to the possible realizations of the agent's cost parameter in order to properly reflect the impact of performance measure quality on the benchmark job design. This is in line with the observation that the impact of the congruity problem on the outcome for the principal is affected by the agent's effort costs for the different tasks (Schöttner 2008).

In the next section, we return to the initial situation in which c is unobservable at the time of contracting. From Proposition 1, it follows that the maximum ex-ante expected profit that the principal can earn when c is unobservable at the time of contracting is given by

$$\bar{\Pi}(c_L, c_H) := \begin{cases} p\Pi^M(c_L) + (1-p)\Pi^M(c_H) & \text{if } c_H \leq \bar{c}, \\ p\Pi^M(c_L) + (1-p)\Pi^S & \text{if } c_L < \bar{c} < c_H, \\ \Pi^S & \text{if } \bar{c} \leq c_L. \end{cases} \tag{3}$$

Henceforth, we will call $\bar{\Pi}(c_L, c_H)$ the *benchmark profit*.

[14] If $c_H = \bar{c}$ or $c_L = \bar{c}$, the principal is indifferent between single-tasking and multi-tasking for a low-cost or a high-cost agent, respectively.

OPTIMAL ORGANIZATIONAL DESIGN

Congruent performance measure

We start our analysis of the optimal organizational design with the special case of a congruent performance measure, that is $f_1/f_2 = g_1/g_2$. According to Lemma 1 and Proposition 1, in the benchmark, the principal allows the agent to multitask and pays him a bonus $b^M(c) = f_1/g_1$ that is independent of c and a flat wage $s^M(c) = -(f_1^2/2 + f_2^2/2c)$ that compensates the agent for the incurred effort costs. When c is unobservable at the time of contracting, the principal can achieve the benchmark profit by allowing the agent to multitask, that is choosing $T = \{M\}$, and paying the agent the bonus $b = f_1/g_1$ and the flat wage $s = ps^M(c_L) + (1-p)s^M(c_H)$ that compensates the agent for his expected effort costs. Hence, not observing c at the time of contracting is immaterial when the performance measure is congruent because the agent should multitask regardless of the realization of c and efficient effort incentives are independent of c. The principal thus implements the first-best allocation through a centralized job design.

The performance measure is at most mildly distorted towards task 2

We now turn to a situation in which the performance measure is incongruent, $f_1/f_2 \neq g_1/g_2$, but at most mildly distorted towards task 2 such that $c_H \leq \bar{c}$. According to Proposition 1, the principal would like the agent to multitask and implement a wage scheme that depends on c if c was observable at the contracting stage. With unobservable c, we obtain the result described in the following proposition.

Proposition 2 *Suppose that $f_1/f_2 \neq g_1/g_2$ and $c_H \leq \bar{c}$. There exists a threshold $\hat{c}$ with $\hat{c} < \bar{c}$ such that:*

(i) If $c_H \leq \hat{c}$, the optimal organizational design comprises a centralized job design with $T = \{M\}$ and $W = W^M(\gamma^{-1})$ with $\gamma := E[c^{-1}]$. The principal's expected profit is $\Pi^M(\gamma^{-1})$.

(ii) If $c_H > \hat{c}$, the principal delegates the job design to the agent. The optimal organizational design is $T = \{S, M\}$ and $W = W^M(c_L)$ if $t^d = M$ and $W = W^S$ if $t^d = S$. The principal's expected profit is $p\Pi^M(c_L) + (1-p)\Pi^S$.

When $c_H \leq \bar{c}$, the principal's choice between centralization and delegation is determined by the trade-off between implementing the benchmark job design in combination with an inflexible wage scheme that is designed for the "average type" (centralization, case (i) of Proposition 2), and implementing an inefficient job design for the high-cost type combined with wage schemes that are efficient conditional on the job design (delegation, case (ii) of Proposition 2). In the latter case, the wage for the low-cost type also corresponds to the benchmark wage scheme, whereas the wage for the high-cost type is only conditionally efficient. Centralization occurs if the high-cost type is below the threshold $\hat{c}$. In line with the benchmark case, the principal then effectively implements a *pooling equilibrium* in which the agent works on task 2 regardless of his effort costs. However, because the principal can condition the wage scheme on her ex-ante cost estimation only (i.e., the "average type"), expected profits are strictly below the benchmark profit.

By contrasts, if the high-cost type is above the threshold $\hat{c}$, the principal delegates the job design. The principal thus deviates from the benchmark job design by implementing a *separating equilibrium* in which only the low-cost agent works on task 2. Delegation allows the principal to elicit the agent's private cost information by observing the chosen job design, which she then uses to differentiate wage payments for the low- and high-cost type. Consequently, under delegation, the principal is able to implement the efficient wage scheme for the case $c = c_L$. As a drawback, delegation entails an inefficient job design if $c = c_H$, leading to profit $\Pi^S = \Pi^M(\bar{c}) < \Pi^M(c_H)$. However, if c_H is sufficiently close to $\bar{c}$ and exceeds the threshold $\hat{c}$, the former effect dominates the latter so that the principal prefers delegation over centralization. Only in the special case in which $c_H = \bar{c}$, the principal earns the benchmark profit because a high-cost agent than delivers the same expected profit for the principal under either job design (i.e., $\Pi^M(c_H) = \Pi^S$). We explain how the threshold $\hat{c}$ relates to the congruity problem in Corollary 1.

It is instructive to compare the optimal organizational design in our model with the outcome of a standard adverse selection model, in which contracting also takes places ex ante, that is, before the agent observes the realization of his cost type. The contract can typically condition on the non-random output produced by the agent and the associated payment. In such a setup, the principal earns the benchmark—in that case first-best—profit (see, e.g., Laffont and Martimort 2002). The agent reveals his type by the output that he delivers. Because contracting takes place ex ante, the principal can compensate the agent for his expected production costs and thus no trade-off arises between the extraction of information rents and output distortion. Hence, the agent's participation constraint binds. Ex post, the low-cost type earns a rent because he can mimic the high-cost type

and benefit from being able to produce the quantity demanded from the high-cost type at lower costs. The high-cost type, however, incurs a loss relative to his reservation utility. In our setting, the principal is not able to achieve the benchmark outcome. The reason is that, due to the uncertainty involved in performance measurement, the principal can screen the agent only by delegating the job design in combination with a wage scheme that induces only the low-cost type to multitask. In the benchmark, however, the agent should always multitask. Thus, as explained above, the principal faces a trade-off between implementing the benchmark job design with "average" incentives and implementing an inefficient job design that allows her to tailor incentives to the agent's type. In our setting, as in a standard adverse selection model, the agent never earns a rent ex ante. However, centralization and delegation exhibit an interesting difference with regard to the agent's ex post payoffs. Under centralization, just as in the standard adverse selection model, the low-cost type receives a rent in expectation, whereas the high-cost type incurs a loss in expectation. Under delegation, however, the agent's participation constraint is binding both ex ante and ex post. The low-cost type does not earn an information rent because he cannot benefit from mimicking the high-cost type. If the low-cost type mimicked the high-cost type, he would perform the primary task only, but he does not have a cost advantage in this task over the high-cost type. This subtle difference between centralization and delegation will become relevant if the agent can make an interim participation decision after he has observed his costs, which we discuss in a later section.

The performance measure is moderately distorted towards task 2

We next consider a situation in which the performance measure is moderately distorted towards task 2 such that, in the benchmark case in which c is observable at the contracting stage, only the low-cost agent should multitask, that is, $c_L < \bar{c} < c_H$. We obtain the result described in the following proposition.

Proposition 3 *Suppose that* $f_1/f_2 \neq g_1/g_2$ *and* $c_L < \bar{c} < c_H$. *The principal maximizes expected profits by delegating the job design to the agent,* $T = \{S, M\}$, *and offering the wage scheme* $W^M(c_L)$ *if* $t^d = M$ *and* W^S *if* $t^d = S$. *The agent performs task 2 if and only if* $c = c_L$ *and the principal earns the benchmark profit* $\bar{\Pi}(c_L, c_H)$.

Proposition 3 shows that the principal can replicate the benchmark outcome by delegating the job design to the agent when the performance measure is moderately distorted towards task 2.

In contrast to the above situation in which the performance measure is at most mildly distorted towards task 2, delegating the job design does not only allow the principal to screen the agent but also to implement the benchmark job design, which excludes the secondary task from the job for a high-cost agent due to the nature of the congruity problem. Moreover, the benchmark wage scheme induces the agent to choose the benchmark job design, implying that the principal does not need to distort wage payments. Analogous to the delegation setting described in Proposition 2, the agent neither earns a rent ex ante nor ex post, because the low-cost type cannot benefit from mimicking the high-cost type.

The performance measure is severely distorted towards task 2

If the performance measure is severely distorted towards task 2 such that $\bar{c} \leq c_L$, the principal attains the benchmark profit by centralizing the job design and assigning only task 1 to the agent's job, that is $T = \{S\}$ and $W = W^S$.

Comparative statics with respect to performance measure congruity

The previous analysis has related the optimal organizational design to the extent to which the performance measure is distorted towards the secondary task. It is, however, not clear yet how general performance measure congruity impacts the principal's delegation decision. In particular, it is not clear how the threshold $\hat{c}$, which—according to Proposition 2—is crucial for the delegation decision in case the performance measure is at most mildly distorted towards task 2, is affected by the severity of the congruity problem. The results presented in Proposition 2 and 3 enable us to derive the following corollary, which provides further information about the relationship between the nature of the congruity problem and the principal's decision to delegate.

Corollary 1 *Suppose that* $f_1/f_2 \neq g_1/g_2$. *The more severe the congruity problem, that is the larger the angle between the vectors* $(f_1, f_2/\sqrt{c})$ *and* $(g_1, g_2/\sqrt{c})$, *the smaller are the thresholds* $\hat{c}$ *and* $\bar{c}$.

(i) If $f_1/f_2 \leq 2 \cdot g_1/g_2$, *the principal delegates if and only if* $\hat{c} < c_H$.

(ii) If $f_1/f_2 > 2 \cdot g_1/g_2$, *the principal delegates if and only if* $\hat{c} < c_H$ *and* $c_L < \bar{c}$.

In case (i), the performance measure is either distorted towards the primary task or mildly distorted towards task 2. As the respective congruity problem worsens, $\hat{c}$ decreases and the principal thus delegates for a broader range of values for c_H. If the performance measure is distorted towards task 2 and this congruity problem worsens, at some point, the congruity problem is so severe that case (ii) applies. The principal then continues to delegate for smaller values of c_H when the congruity problem further exacerbates, provided that $c_L < \bar{c}$ holds. However, because a stronger congruity problem then also lowers $\bar{c}$, the principal prefers the agent to focus on his primary task and therefore centralizes the job design if the congruity problem becomes sufficiently severe, meaning that the performance measure is severely distorted towards task 2 (i.e., $\bar{c} \leq c_L$).

We can thus conclude that, as long as the principal wants the low-cost agent to multitask (i.e., $c_L < \bar{c}$) delegation is more likely the more severe the congruity problem is. Intuitively, a more severe congruity problem decreases profits under each organizational design, but less so under delegation because the ensuing flexible wage scheme can more effectively mitigate the detrimental effect of an increasingly distorted performance measure on the agent's incentives. The result that a more distorted performance measure leads to more delegation seems surprising, given the general perception that delegation entails a loss of control (e.g., Melumad, Mookherjee, and Reichelstein 1997). Hence, one would conjecture that less transparent environments such as environments in which performance measurement is more distorted, lead to less reliance on delegation. The results in Corollary 1, however, speak against this intuition. In the context of our model, a less transparent environment increases the benefits from delegation and makes the possibility of eliciting the agent's private information more valuable.[15] This result is, however, in line with empirical observations that indicate a more prevalent use of delegation by firms that face a more uncertain environment (Foss and Laursen 2005).

On the other hand, holding the quality of the performance measure fixed, delegation is optimal when the spread among effort costs is high, which makes it more likely that c_H exceeds $\hat{c}$ and c_L is below $\bar{c}$. The production environment then features rather high uncertainty about effort costs. In this situation, delegation—which allows the principal to elicit the agent's private information and to use the information to tailor wage schemes to the realized cost parameter—becomes more valuable.

- - - Insert Figure 2 about here - - -

[15] In a delegated contracting setup, Feltham, Hofmann, and Indjejikian (2016) find that more aggregate (and thus less transparent) performance measurement makes decentralized contracting more efficient due to incentive spillovers.

Figure 2 summarizes and illustrates the results presented in connection with Propositions 1-3 depending on the information available on the effort cost parameter c. In the benchmark case with ex-ante observable effort costs (left part of Figure 2, Proposition 1), the principal always chooses centralization and the job design depends on the realization of c relative to the threshold $\bar{c}$. With unobservable effort costs (right part of Figure 2, Propositions 2 and 3), the principal chooses delegation for $c_L < \bar{c} < c_H$ and also for some $c_H < \bar{c}$ as long as c_H remains larger than the threshold $\hat{c}$. In the latter case, the final job design differs from the benchmark whenever $c = c_H$.

COMMUNICATION

Proposition 2 has shown that, if $c_H < \bar{c}$ and thus the principal would always like the agent to multitask in the benchmark, no organizational design will be able to generate the benchmark profit $\bar{\Pi}(c_L, c_H)$. This result raises the question if, in such a situation, the principal may benefit from communication (e.g., Penno 1984). To answer this question, we now extend our model by introducing the possibility of costless communication between the principal and the agent when the latter has learned his effort costs. More specifically, we add the following actions to the timing of our model: At $\tau = 1$, the principal can offer a menu of organizational designs. At $\tau = 3$, after observing c, the agent chooses a design from the menu and communicates his choice to the principal.[16]

The following proposition shows that whether or not the principal benefits from communication depends on the nature of the congruity problem, that is, whether the performance measure is distorted towards the primary or the secondary task.

Proposition 4 *Suppose that* $f_1/f_2 \neq g_1/g_2$ *and* $c_H < \bar{c}$. *Moreover, assume that the principal and the agent can costlessly communicate at stage* $\tau = 3$.

(i) If the performance measure is distorted towards task 1, that is, $f_1/f_2 < g_1/g_2$, *the principal employs communication and earns the benchmark profit* $\bar{\Pi}(c_L, c_H)$.

(ii) If the performance measure is distorted towards task 2, that is, $f_1/f_2 > g_1/g_2$, *the principal does*

[16] Or, equivalently, the agent makes a report on c that leads to the implementation of a particular design that the principal has committed to ex ante.

not benefit from communication and therefore maximizes expected profits by implementing the organizational design described in Proposition 2.

If c was observable at the time of contracting, the principal would like the agent to perform task 2 regardless of the realization of the cost parameter c but stipulate different wage schemes for different realizations of c. The proof of Proposition 4 shows that the agent can be motivated to pick different wage schemes for different cost realizations only if these wage schemes stipulate a bonus that is decreasing in the agent's costs for task 2. In other words, the principal has to pay a higher bonus to a low-cost agent than to a high-cost agent. By Lemma 1, the principal indeed wants to do so if the performance measure is distorted towards task 1 (i.e., $f_1/f_2 < g_1/g_2$). This type of congruity problem is exacerbated when the costs for task 2 are high, as the agent then wants to exert even less effort in task 2. Consequently, the incongruent performance measure becomes less useful when c is high and the principal prefers to lower the bonus. As a result, the principal can stipulate a menu of wage schemes that resolves the problem of asymmetric information. The principal hence strictly benefits when communication is (costlessly) available relative to a situation where communication is not feasible.

By contrast, if the performance measure is distorted towards task 2 (i.e., $f_1/f_2 > g_1/g_2$), this type of congruity problem is mitigated when the costs for task 2 are high because the agent will then lower his effort in this task. Therefore, the principal would like to pay a higher bonus to a high-cost agent than to a low-cost agent. In this situation, she cannot benefit from communication and the optimal organizational design is identical to the one described in Proposition 2.

These results imply that delegation is the more effective instrument to elicit the agent's private information compared to communication if imperfect performance measurement prevents the principal from paying a higher bonus to the low-cost agent than to the high-cost agent. In particular, in a situation corresponding to case (ii) of Proposition 2, the principal strictly benefits from delegating job design authority relative to utilizing communication.

This result stands in contrast to previous literature which has evaluated the value of communication and demonstrated that delegation can at best replicate a communication-based centralization mechanism (e.g., Penno 1984; Melumad and Reichelstein 1987, 1989). We show that the delegation of job design can dominate truthful communication in a centralized setting in eliciting private information when the agent multitasks and performance measurement is imperfect.[17]

[17]Note that Melumad and Reichelstein (1987) and Melumad and Reichelstein (1989) assume pre-contract private information, however, they state that their results generally extend to post-contract pre-decision information as well.

EXTENSIONS

Teamwork

In the setting that we have studied so far, the principal can benefit from delegating the job design to the agent because, due to imperfect performance measurement, the optimal job design as well as the optimal incentive scheme may depend on the agent's privately observed effort costs. In particular, the optimal job design determines whether or not the agent should multitask. Another practically relevant setting in which the principal may want to delegate the job design to a better informed agent is a situation in which several agents contribute to a joint output by working on their specialized tasks and an additional task can be assigned to either agent, but the principal cannot observe which agent has the lowest costs for the additional task. We have analyzed such a situation in an earlier version of this paper.[18] The model setup comprises a team setting in which two agents, agent 1 and agent 2, exert effort in their specialized primary tasks, task 1 and task 2, respectively, and there is an additional task 3 that can be performed by either of the agents. All three tasks contribute to the non-verifiable firm value and a joint, potentially imperfect performance measure. Agent 1 is privately informed about his effort cost parameter $c \in \{c_L, c_H\}$ for the third task, which can be lower or higher than agent 2's effort cost parameter, which is normalized to 1, such that $c_L < 1 < c_H$.

In the first-best solution, the agent with the lower cost parameter should perform the additional task together with his specialized task. When the principal can observe c (benchmark), one of the following three job designs is optimal: (A) The additional task is assigned to agent 1, (B) the additional task is assigned to agent 2, (C) the additional task is not performed at all. The benchmark job design is determined by a trade-off between the agent's relative effort costs for the additional task and the congruity of the performance measure. In particular, case (C) arises when the congruity problems associated with both a multitasking agent 1 and a multitasking agent 2 are sufficiently severe. The results obtained in Propositions 2, 3, and 4 of the present paper qualitatively extend to a teamwork setting. The main difference is that, when the principal finds it optimal to delegate the job design to the privately informed agent 1, the agent cannot choose between all available job designs. Under delegation, the principal allows agent 1 to choose either between job designs (A) and (B) or between job designs (A) and (C). Intuitively, if the congruity problem when

[18] The earlier version of the paper and the proofs are available on SSRN, [Link has been eliminated for the double-blind review process].

agent 2 multitasks is sufficiently severe, the principal excludes the associated job design (B) from the outset.

However, with a congruent performance measure, the optimal organizational design in the single-agent setting analyzed in the present paper crucially differs from the optimal design in a teamwork setting as sketched above. In the former case, the present paper shows that the principal achieves the benchmark profit by *centralizing* the job design. In the latter case, the principal achieves the benchmark profit by *delegating* the job design to the privately informed agent. This difference emerges because, when the tasks can only be assigned to a single agent, a congruent performance measure calls for multitasking of the agent, whereas in a teamwork situation, the team member with the lower costs should multitask. Because the team members' relative effort costs remain unknown to the principal, the principal delegates the job design to the privately informed team member. These results imply that, in teamwork settings, the delegation of job design can be more valuable than in single-agent settings and thus contributes to explaining the increasing prevalence of so-called self-managed teams. These teams are endowed with broad authority to self-organize and their reporting requirements to higher hierarchical levels are significantly reduced (Lazear and Shaw 2007; Economist 2016; Deloitte 2016). Discretion over task assignments is considered one of the key components of self-organized teamwork (Cummings 1978; Cohen 1993). Despite the high practical relevance of self-organizing teams, economic theories on their optimal adoption are still scarce and empirical studies on their effectiveness show conflicting results (e.g., Wall, Kemp, Jackson, and Clegg 1986; Cordery, Mueller, and Smith 1991; Cohen and Ledford Jr 1994).

Interim participation constraint

So far, we have assumed that only an ex-ante participation constraint needs to be satisfied regarding the agent's decision whether or not he will work for the principal. Once the agent accepted the contract, he will stay with the firm regardless of the realization of the cost parameter c. In real-world employment relationships, however, the agent may be able to quit after having observed his effort costs. For instance, the dissolution of the contract may be allowed on short notice during a probationary period. We now briefly discuss how our results will change if we impose an interim participation constraint for the agent, which means that, after learning c, the agent's expected net payoff needs to be at least has high as his reservation utility.

Our results concerning the benchmark, in which c is ex ante observable, remain unaffected.

Now suppose that c is unobservable ex ante and communication is not feasible. The discussion of Propositions 2 and 3 has already revealed that, when the principal delegates job design authority to the agent, the agent's expected payoff equals his reservation utility also after he has learned c. Hence, the principal's profit under delegation remains unaffected by the introduction of an interim participation constraint. When the principal centralizes the job design such that the agent is required to focus on his primary task only, that is, $T = \{S\}$, an interim participation constraint does not have bite either and the principal's profit also stays the same.

The situation is quite different, however, if the principal centralizes the job design and allows the agent to multitask, that is, $T = \{M\}$. Both cost types are then compensated according to the same wage scheme. Without an interim participation constraint, the incentive contract is designed such that the agent's ex-ante participation constraint is binding and thus the agent earns his reservation utility of zero in expectation. However, after the agent has observed c, the low-cost type earns an expected rent, whereas the high-cost type incurs an expected loss relative to his reservation utility. Thus, the high-cost type would quit the employment relationship if this was feasible. As a consequence, the interim participation constraint has to be binding in the principal's contracting problem under a centralized job design with $T = \{M\}$, which implies that the principal's profit under centralization decreases relative to a situation with an ex-ante participation constraint only. If the principal wishes to retain the high-cost type, she will have to leave a rent to the low-cost type and the standard trade-off between rent extraction and production efficiency arises, making the principal lower the bonus. The principal can also accept that the high-cost type quits. In this case, she does not need to leave a rent to the low-cost type, but earns zero profits with probability $1 - p$. Overall, centralization becomes less attractive relative to the situation analyzed in Proposition 2, and thus delegation will more often dominate centralization. Moreover, with an interim participation constraint, delegation may also be optimal with a congruent performance measure.

Now suppose that principal and agent can costlessly communicate and communication is valuable when only an ex-ante participation constraint applies, that is, $f_1/f_2 < g_1/g_2$, as described in Proposition 4. For the same reasons as discussed above, an interim participation constraint will be binding and the principal faces the same trade-offs under communication-based centralization as under centralization. Hence, delegation also more often dominates communication-based centralization when the agent has the possibility to quit the employment relation after haveing observed his effort costs.

From an empirical perspective, these results suggest that agents who enjoy the flexibility to leave the firm at an interim stage might be more likely to have job design authority or, put differently, that firms can improve on employee retention by granting decision authority with respect to the job design.

More than two possible cost realizations

In our model, the cost parameter c is assumed to have only two possible realizations, c_L and c_H. In this section, we discuss the impact of this assumption on our results, in particular Proposition 3, which has established that delegation can achieve the benchmark outcome when centralization cannot. As explained above, this result relies on the perfect revelation of the agent's private information by his job design choice under delegation, which however no longer applies if there are more than two cost types but only two feasible job designs.

Note that the results of the benchmark case, presented in Lemma 1 and Proposition 1, hold for any distribution of c. To discuss the impact of the distribution of c on Proposition 3, we now assume that $f_1/f_2 > 2 \cdot g_1/g_2$ and restrict attention to a situation with three different possible cost realizations, that is, $c \in \{c_L, c_M, c_H\}$ with $0 < c_L < c_M < c_H$.[19] The ex-ante probability that $c = c_k$ occurs is denoted by $p_k \in (0,1)$, $k \in \{L, M, H\}$, with $p_L + p_M + p_H = 1$.

First suppose that $c_L < \bar{c} < c_M$, which implies that, in the benchmark, the principal wants the agent to multitask if and only if he has the lowest possible costs, that is, $c = c_L$. In this case, Proposition 3 immediately extends to a situation with three (or more) types. Analogous to a situation with a binary type space, type $c = c_L$ has no incentive to mimic any of the higher cost types because doing so entails single-tasking so that the agent's relative cost advantage becomes irrelevant. Types $c = c_M$ and $c = c_H$ do not want to mimic type $c = c_L$ because, if they multitasked under the contract $W^M(c_L)$, their expected utility would be negative. Moreover, the principal wishes to compensate type $c = c_M$ and $c = c_H$ according to the same wage scheme. Thus, in this situation, it is immaterial that the agent's job design choice does no longer perfectly reveal his type.

Now suppose that $c_M < \bar{c} < c_H$, that is, in the benchmark, the principal wants the agent to drop task 2 only if $c = c_H$. In this situation, the principal cannot replicate the benchmark outcome by delegating the job design because the benchmark comprises different wage schemes for type $c = c_L$ and type $c = c_M$. Moreover, if the principal wishes the agent to multitask for both

[19] The key arguments presented in this section however remain valid if there are more than three discrete types.

$c = c_L$ and $c = c_M$, she needs to ensure that neither of these two types prefers to mimic type $c = c_H$. Therefore, she needs to leave a rent to the agent in case $c = c_L$. Nevertheless, relative to centralization, delegation still exhibits the advantage that it allows the principal to partially separate the cost types and may therefore still dominate centralization. Moreover, as explained above, when an interim participation constraint needs to be met, the principal also needs to leave information rents to the agent under centralization.

CONCLUSION

In this paper, we investigate a production process with two tasks, one principal, and one agent who is responsible for exerting productive effort on productive tasks. One primary task directly matches the agent's abilities and is assumed to be fixed. A secondary task is optional and the agent's effort costs for performing this task are unknown ex ante and become private information of that agent after having signed the contract. The agent's performance is measured by an aggregate, potentially incongruent performance measure. The decision whether effort on the secondary task should be performed (i.e., the job design) can be either taken by the principal based on expectations about effort costs (*centralization*) or be delegated to the informed agent (*delegation*) who then needs to be incentivized to choose the job design in the principal's interest. Alternatively, the principal can communicate with the informed agent by offering a menu of contracts and decide on the job design after this information gathering (*communication-based centralization*). The optimal job design does not only depend on the effort costs for exerting the task, but also on the underlying congruity problem for the agent's primary and secondary task.

We show that a congruent performance measure always leads the principal to centralize the job design and let the agent multitask. An incongruent performance measure makes the delegation of job design valuable for the principal, because it allows her to elicit the agent's private information. We obtain four cases that differ with respect to the severeness of the congruity problem. First, if the performance measure is moderately distorted towards the secondary task, the principal always delegates the job design and implements a *separating equilibrium* in which the agent's choice of job design perfectly reveals his private information. That is, the agent performs effort on the secondary task only if he has low effort costs in doing so. In this situation, the principal achieves the hypothetical benchmark result of ex-ante observable effort costs. Second, if the performance measure is at most mildly distorted towards the secondary task and the high-cost type has relatively

high effort costs, the principal still delegates the job design and obtains an efficient wage scheme if the agent has low effort costs, but the job design is inefficient for a high-cost agent. Third, if the performance measure is at most mildly distorted towards the secondary task and even the high-cost type has sufficiently low effort costs for performing the secondary task, the principal centrally decides about the job design and implements a *pooling equilibrium* in which the agent always performs effort on the secondary task. We illustrate that a more severe congruity problem decreases the thresholds for the high-cost type and leads the principal to delegate more often, which stands in contrast to the general perception that delegation entails a loss of control and thus less congruent performance measures should lead to less delegation. Finally, if the performance measure is severely distorted towards the secondary task, the principal attains the benchmark profit by centralizing the job design and excluding the secondary task from the agent's job.

We moreover show that communication about effort costs is only valuable to the principal if the incongruent performance measure is distorted towards the agent's primary task. The reason is that a necessary condition for truthful reporting is that the high-cost type's contract has a lower bonus rate than the low-cost type's contract. If offering such contracts is not profitable for the principal due to the type of congruity problem, delegation leads to a higher expected return for the principal than communication-based centralization, which is a novel result in the literature on the benefits of delegation.

We further illustrate the impact of various assumptions on our results. We show that our main results with incongruent performance measures extend to a team setting with two agents and three tasks. However, the optimal organizational design in the team setting crucially differs from the single-agent setting when the performance measure is congruent. In the team setting, delegation is then still valuable as it gives the agent with the lower costs the opportunity to work on the additional task. We also demonstrate that the agent's possibility to leave the employment relation after having received his private information makes delegation more attractive to the principal, both compared to centralization and compared to communication-based centralization. Finally, we show that for more than two cost realizations, the principal is able to earn the benchmark profit by delegating the job design in fewer cases, but still benefits from delegation as it allows a partial separation of cost types (as opposed to centralization).

The theoretical analysis relies on some assumptions whose impact on the results might be addressed by future research. First of all, we assume that there are no interdependencies between the tasks. Instead, it could be plausible to assume that an agent's primary and secondary task are

complements or substitutes, leading to a link in the agents' effort costs (see, e.g., Dikolli, Hofmann, and Kulp 2009). Introducing such task interdependencies in our model has at least two effects. One of the effects is the impact on the multitasking problem. If the primary task and the optional task are complements (substitutes), there is another advantage (disadvantage) to multitasking. The other effect relates to the impact of task interdependencies on the congruity problem. However, we expect that the main results of the paper would persist. Another aspect in this regard could be a situation in which information about these interdependencies is private to the principal (e.g., Harris and Raviv 2005).

Second, we assume risk-neutral contracting parties. Introducing either limited liability or risk aversion for the agents would lead to rents or risk-premia for the agents under each organizational form (e.g., Datar 2000). It is not immediately clear, how the standard risk-incentive trade-off would change the benefits of delegation. If delegation requires to set additional incentives to ensure that the agent acts in the principal's interest, more risk aversion would lead to lower-powered incentives and thus lower benefits from delegation. Holmström and Milgrom (1991) predict in a multitask environment that an agent's set of feasible actions will be restricted when financial incentives decrease due to noisier performance measurement. Prendergast (2002), however, illustrated that the negative relation between risk and incentives is not empirically confirmed and argues that delegation is the reason why there might be a positive relation between risk and incentives. This reasoning, however, is only true if one assumes that delegation and incentives are complements, that is, more delegation goes along with more high-powered incentives. However, later research has illustrated that there is not always a complementary relation between delegation and incentives and that delegation and incentives can be substitutes when the performance measurement is imperfect.[20]. Third, we assume that the principal only has an aggregate performance measure at hand for designing incentive contracts. The use of such measures is commonplace (Che and Yoo 2001; Friebel, Heinz, Krueger, and Zubanov 2017) and it has been shown that aggregate performance measures might be optimal under some circumstances (Corts 2007; Arya and Mittendorf 2011). In our setting, additional performance measures which are informative about the agent's actions would help the principal to deal with the congruity and effort allocation problem. Finally, in the extension of the model with two agents, potential collusion among agents might constitute an additional reason for the principal to delegate (e.g., Villadsen 1995).

[20]See Rohlfing-Bastian and Schöttner (2018) for a theoretical analysis and Jia and van Veen-Dirks (2015) as well as De Varo and Prasad (2015) for empirical results

Our results have several implications for organizational design choices by firms. In particular, our finding that the delegation of job design can serve as a means to ensure the efficient use of private information and the provision of productive effort in a better way than communication-based centralization, supports the general idea of employee empowerment. From an incentive perspective, our model suggests that it can be optimal to equip lower hierarchical levels with considerable decision rights in particular if the information situation for the principal worsens or becomes less transparent. Moreover, our result that the benefit of communication depends on the properties of the performance measurement system suggests that firms should design their reporting schemes in accordance with the accounting system that is used for performance measurement. Finally, organizational design choices need to be aligned with the reporting requirements, given that under some circumstances the firm is better of by delegating a decision instead of relying on communication.

APPENDIX

Proof of Lemma 1. First consider the case where the agent performs task 2. The principal solves the following optimization problem at the first stage of the game:

$$\max_{\substack{s,b,e_\ell \\ l=1,2}} \quad (f_1 e_1 + f_2 e_2) - s - (g_1 e_1 + g_2 e_2) b \tag{4}$$

$$\text{s.t.} \quad (e_1, e_2) = \text{argmax}_{\hat{e}_1, \hat{e}_2} s + (g_1 \hat{e}_1 + g_2 \hat{e}_2) b - \frac{\hat{e}_1^2}{2} - \frac{c\hat{e}_2^2}{2}, \tag{5}$$

$$0 \leq s + (g_1 e_1 + g_2 e_2) b - \frac{e_1^2}{2} - \frac{c e_2^2}{2}. \tag{6}$$

Accordingly, the principal maximizes expected firm value net of the agent's expected wage payment, taking into account the agent's incentive compatibility constraint (5) and participation constraint (6). From (5) we obtain that $e_1 = g_1 b$ and $e_2 = {}^{g_2}/_{c} \cdot b$. These equations can be used to replace the effort levels in the principal's optimization problem. Because (6) must be binding under the optimal contract, we can simplify the principal's problem to

$$\max_b f_1 g_1 b + f_2 \frac{g_2}{c} b - \frac{(g_1 b)^2}{2} - \frac{(g_2 b)^2}{2c}. \tag{7}$$

Differentiating (7) with respect to b gives the optimal bonuses $b^M(c)$ in expression (1). Inserting the optimal bonus into the principal's profit function (7) gives the principal's expected profit $\Pi^M(c)$. Inserting the optimal bonus into the binding participation constraints gives the optimal flat wage $s^M(c)$. If task 2 is not assigned to the agent, we obtain the optimal wage and profit by setting $e_2 = 0$ and solving the principal's problem analogous to the above procedure. ■

Proof of Proposition 1. Using the results from Lemma 1, we obtain that $\Pi^M(c) > \Pi^S$ iff:

$$\frac{\left(f_1 g_1 + c^{-1} f_2 g_2\right)^2}{g_1^2 + c^{-1} g_2^2} > f_1^2 \qquad \Leftrightarrow \qquad \frac{1}{c} > \frac{f_1 g_2 (f_1 g_2 - 2 f_2 g_1)}{f_2^2 g_2^2}.$$

If ${}^{f_1}/_{f_2} \leq 2 \cdot {}^{g_1}/_{g_2}$, the right-hand side of the latter inequality is smaller or equal to zero. Hence, ${}^{f_1}/_{f_2} \leq 2 \cdot {}^{g_1}/_{g_2}$ is sufficient for $\Pi^M(c) > \Pi^S$ for all c. Now suppose that ${}^{f_1}/_{f_2} > 2 \cdot {}^{g_1}/_{g_2}$. We have $\Pi^M(c) \geq \Pi^S$ iff:

$$c \leq \frac{f_2^2 g_2}{f_1 (f_1 g_2 - 2 f_2 g_1)} = \frac{f_2}{f_1 (f_1/f_2 - 2 g_1/g_2)}.$$

Hence, the proposition follows. ■

Proof of Proposition 2. Suppose the principal centralizes the job design such that $T = \{M\}$. In order to determine the optimal wage scheme, the principal solves the following optimization problem at $\tau = 1$:

$$\max_{\substack{s,b,e_\ell \\ l=1,2}} \quad \mathrm{E}\left[(f_1 e_1 + f_2 e_2) - s - (g_1 e_1 + g_2 e_2) b\right] \tag{8}$$

$$\text{s.t.} \quad (e_1, e_2) = \mathrm{argmax}_{\hat{e}_1, \hat{e}_2} s + (g_1 \hat{e}_1 + g_2 \hat{e}_2) b - \frac{\hat{e}_1^2}{2} - c\frac{\hat{e}_2^2}{2}, \tag{9}$$

$$0 \leq \mathrm{E}\left[s + (g_1 e_1 + g_2 e_2) b - \frac{e_1^2}{2} - c\frac{e_2^2}{2}\right], \tag{10}$$

where $\mathrm{E}[\cdot]$ denotes the expectations operator with respect to the random variable c. Accordingly, the principal maximizes expected firm value net of the agent's expected payments, taking into account the agent's incentive compatibility constraint (9) and ex-ante participation constraint (10). From (9) we obtain that $e_1 = g_1 b$ and $e_2 = {}^{g_2}/_{c} \cdot b$. These equations can be used to replace the effort levels in the principal's optimization problem. Because (10) must be binding under the optimal contract, we can simplify the principal's problem to

$$\max_b \mathrm{E}\left[f_1 g_1 b + f_2 \frac{g_2}{c} b - \frac{(g_1 b)^2}{2} - \frac{(g_2 b)^2}{2c}\right]. \tag{11}$$

Let $\gamma := E[c^{-1}] = p c_L^{-1} + (1-p) c_H^{-1}$. Differentiating (11) with respect to b shows that the optimal bonus is $b = \frac{g_1^2}{g_1^2 + \gamma g_2^2} \frac{f_1}{g_1} + \frac{\gamma g_2^2}{g_1^2 + \gamma g_2^2} \frac{f_2}{g_2} = b^M(\gamma^{-1})$. The principal's expected profit is given by

$$\Pi^M(\gamma^{-1}) = \frac{1}{2} \frac{(f_1 g_1 + \gamma f_2 g_2)^2}{g_1^2 + \gamma g_2^2},$$

where $b^M(\cdot)$ and $\Pi^M(\cdot)$ are defined in Lemma 1.

We now show that $\Pi^M(c)$ is strictly decreasing in c for $c \leq \bar{c}$. From the first derivative of $\Pi^M(c)$, we obtain that $\Pi^M(c)$ is strictly decreasing in c iff:

$$\frac{1}{c} > \frac{g_1(f_1 g_2 - 2 f_2 g_1)}{f_2 g_2^2}.$$

Thus, if $f_1/f_2 \leq 2 \cdot g_1/g_2$ so that $\bar{c} = \infty$, $\Pi^M(c)$ is everywhere strictly decreasing in c. If $f_1/f_2 > 2 \cdot g_1/g_2$, $\Pi^M(c)$ is strictly decreasing in c iff:

$$c < \frac{f_2 g_2^2}{g_1(f_1 g_2 - 2 f_2 g_1)} := \rho.$$

We have $\bar{c} < \rho$ iff $f_1/f_2 > g_1/g_2$, which is true in the current case. Overall, $\Pi^M(c)$ is strictly decreasing in c for $c \leq \bar{c}$.

It is straightforward to verify that $\gamma^{-1} \in (c_L, c_H)$, so that we obtain $\Pi^M(c_L) > \Pi^M(\gamma^{-1}) > \Pi^M(c_H)$. Because $c_H \leq \bar{c}$ we have $\Pi^M(c_H) \geq \Pi^S$. Therefore, $T = \{M\}$ dominates $T = \{S\}$.

We now show that $T = \{M\}$ can be dominated by delegation, $T = \{M, S\}$. Suppose the principal implements delegation and offers the organizational design described in case (ii) of the proposition. The agent then performs task 2 if and only if $c = c_L$, which is shown in the proof of Proposition 3. The principal hence earns the expected profit

$$p\Pi^M(c_L) + (1-p)\Pi^S = p\Pi^M(c_L) + (1-p)\Pi^M(\bar{c}),$$

where, in case $\bar{c} = \infty$, we define $\Pi^M(\bar{c}) := \lim_{c \to \infty} \Pi^M(c) = \Pi^S$. Define

$$\Gamma(x) := p\Pi^M(c_L) + (1-p)\Pi^M(x),$$

implying that the expected profit under delegation is $\Gamma(\bar{c})$. Note that $\bar{c}$ is independent of c_L, c_H, and p. It can be verified that $\Pi^M(\gamma^{-1}) \leq \Gamma(c_H)$, where $\Pi^M(\gamma^{-1}) = \Gamma(c_H)$ holds if and only if $f_1/f_2 = g_1/g_2$. Hence, in the situation under consideration, $\Pi^M(\gamma^{-1}) < \Gamma(c_H)$. It follows that, if $c_H = \bar{c}$, then $\Pi^M(\gamma^{-1}) < \Gamma(\bar{c})$ and the principal thus prefers delegation to centralization. As c_H decreases, $\Pi^M(\gamma^{-1})$ increases while $\Gamma(\bar{c})$ stays constant. Hence, there is a threshold $\hat{c} < \bar{c}$ such that $\Pi^M(\gamma^{-1}) > \Gamma(\bar{c})$ for $c_H < \hat{c}$ and $\Pi^M(\gamma^{-1}) < \Gamma(\bar{c})$ for $c_H > \hat{c}$.

Defining $\gamma^{-1}(y) := (pc_L^{-1} + (1-p)y^{-1})^{-1}$, the threshold is implicitly described by $\Pi^M(\gamma^{-1}(\hat{c})) = \Gamma(\bar{c})$. We thus obtain

$$\frac{(f_1 g_1 + [pc_L^{-1} + (1-p)\hat{c}^{-1}] f_2 g_2)^2}{g_1^2 + [pc_L^{-1} + (1-p)\hat{c}^{-1}] g_2^2} = p\frac{(f_1 g_1 + c_L^{-1} f_2 g_2)^2}{g_1^2 + c_L^{-1} g_2^2} + (1-p)\frac{(f_1 g_1 + \bar{c}^{-1} f_2 g_2)^2}{g_1^2 + \bar{c}^{-1} g_2^2}. \qquad (12)$$

■

Proof of Proposition 3. Suppose the principal makes the offer described in the proposition and the agent has accepted the offer and has observed c. If the agent chooses $t^d = M$, payments will be made according to contract $W^M(c_L)$ and thus the agent earns

$$u^M(c) = s^M + b^M \left(g_1(g_1 b^M) + g_2 \frac{g_2 b^M}{c} \right) - \frac{(g_1 b^M)^2}{2} - c\frac{(g_2 b^M)^2}{2c^2} = s^M + \frac{(g_1 b^M)^2}{2} + \frac{(g_2 b^M)^2}{2c}$$

with $b^M = b^M(c_L)$ and $s^M = s^M(c_L)$. Contract $W^M(c_L)$ is designed such that $u^M(c_L) = 0$. Hence, as $u^M(c)$ is strictly decreasing in c, we obtain $u^M(c_H) < 0$. If the agent chooses $t^d = S$, contract W^S applies and the agent earns

$$u^S = s^S + b^S \left(g_1(g_1 b^S) \right) - \frac{(g_1 b^S)^2}{2} = 0.$$

Consequently, the agent chooses $t^d = M$ if $c = c_L$ and $t^d = S$ if $c = c_H$ and his expected net payoff is zero in each case. At the time of contracting, the agent earns his reservation utility in expectation and hence accepts the principal's offer. The principal cannot earn higher profits from any other contract offer. ■

Proof of Corollary 1. Case (i), where $\bar{c} = \infty$, follows immediately from Proposition 2. Now consider case (ii), where $\bar{c} < \infty$. We first show that, if $\hat{c} < c_H$ and $c_L < \bar{c}$ holds, the principal will delegate. Suppose that $\hat{c} < c_H$ and $c_L < \bar{c}$. Because $\hat{c} < \bar{c}$, we either have $\hat{c} < c_H \leq \bar{c}$ or $\bar{c} < c_H$. In the former case, Proposition 2 implies that the principal delegates. In the latter case, $c_L < \bar{c}$ in combination with Proposition 3 implies that the principal delegates. We now show that, if the principal delegates, then $\hat{c} < c_H$ and $c_L < \bar{c}$ will hold. Suppose the principal delegates. Proposition 3 and Proposition 2 imply that either $c_L < \bar{c} < c_H$ or $\hat{c} < c_H \leq \bar{c}$. In the first case, because $\hat{c} < \bar{c}$, we also have $\hat{c} < c_H$. In the second case, because $c_L \leq \hat{c}$ (which can be obtained from the implicit definition of $\hat{c}$ in equation (12)), we also have $c_L < \bar{c}$.

It remains to show how $\bar{c}$ and $\hat{c}$ change when the congruity problem becomes more severe. The severeness of the congruity problem can be measured by the angle between the vectors $(f_1, f_2/\sqrt{c})$ and $(g_1, g_2/\sqrt{c})$ (Schöttner 2008). Denoting this angle by θ, the principal's benchmark profit can be written as

$$\Pi^M(c) = \frac{1}{2}(f_1^2 + c^{-1} f_2^2)(\cos\theta)^2,$$

which illustrates that the principal's profit is affected by changes in g_1 and g_2 through the impact of these parameters on $\cos\theta$ or, equivalently, the angle θ. The term $\cos\theta$ can be written as

$$\cos\theta = \frac{f_1 g_1 + c^{-1} f_2 g_2}{\sqrt{f_1^2 + c^{-1} f_2^2}\sqrt{g_1^2 + c^{-1} g_2^2}},$$

and is decreasing in g_1 if and only if $g_1/g_2 > f_1/f_2$. Hence, if $g_1/g_2 > f_1/f_2$, the congruity problem is increasing in g_1 and the principal's profit is thus decreasing in g_1. Analogously, if $g_1/g_2 < f_1/f_2$, the congruity problem is increasing in g_2 and the principal's profit is thus decreasing in g_2.

First consider the threshold $\bar{c}$, which is defined in Proposition 1. If $f_1/f_2 < 2 \cdot g_1/g_2$, then $\bar{c} = \infty$ and a marginal change in the congruity problem will not affect the threshold. If $f_1/f_2 \geq 2 \cdot g_1/g_2$, then we also have $f_1/f_2 > g_1/g_2$ and thus the performance measure is distorted towards task 2. The congruity problem becomes more severe as g_2 increases, which entails a decrease in $\bar{c}$.

Now consider the threshold $\hat{c}$. W.l.o.g., suppose that $g_1/g_2 < f_1/f_2$, so that a more severe congruity problem corresponds to an increase in g_2. We employ again the implicit definition of $\hat{c}$ in equation (12). First, consider the situation in which $f_1/f_2 > 2 \cdot g_1/g_2$. The inequality implies that $\bar{c} < \infty$. We thus replace $\bar{c}$ in equation (12) by the definition of $\bar{c}$ as described in Proposition 1 and solve the equation for $\hat{c}$. Differentiation with respect to g_2 results in a strictly negative expression provided the parameters are in their allowable ranges, i.e., $1 > p > 0$, $f_1, f_2, g_1, g_2 > 0$, $c_L > 0$, and $f_1/f_2 > 2 \cdot g_1/g_2$. Hence, in this first case, the threshold $\hat{c}$ is strictly decreasing in the severeness of the congruity problem.

Second, consider the situation in which $f_1/f_2 \leq 2 \cdot g_1/g_2$. The inequality implies that $\bar{c} = \infty$. Solving equation (12) for $\hat{c}$, differentiating with respect to g_2, and letting $\bar{c}$ go to infinity results in a strictly negative expression provided the parameters are in their allowable ranges, i.e., $1 > p > 0$, $f_1, f_2, g_1, g_2 > 0$, $c_L > 0$, and $g_1/g_2 < f_1/f_2 < 2 \cdot g_1/g_2$. Hence, in this second case, the threshold $\hat{c}$ is also strictly decreasing in the severeness of the congruity problem. We note that if the congruity problem becomes less severe from the principal's perspective when g_2 increases, i.e., $g_1/g_2 > f_1/f_2$ ceteris paribus, the expression is positive and hence $\hat{c}$ increases in g_2. ■

Proof of Proposition 4. Suppose that the principal always assigns task 2 to the agent, $T = \{M\}$, and stipulates the menu of wage schemes $\{(s^L, b^L), (s^H, b^H)\}$. The latter needs to satisfy the

incentive-compatibility constraints

$$s^L + \frac{g_1^2(b^L)^2}{2} + \frac{g_2^2(b^L)^2}{2c_L} \geq s^H + \frac{g_1^2(b^H)^2}{2} + \frac{g_2^2(b^H)^2}{2c_L}, \tag{13}$$

$$s^H + \frac{g_1^2(b^H)^2}{2} + \frac{g_2^2(b^H)^2}{2c_H} \geq s^L + \frac{g_1^2(b^L)^2}{2} + \frac{g_2^2(b^L)^2}{2c_H}, \tag{14}$$

as well as the ex-ante participation constraint

$$(1-p)\left(s^H + \frac{g_1^2(b^H)^2}{2} + \frac{g_2^2(b^H)^2}{2c_H}\right) + p\left(s^L + \frac{g_1^2(b^L)^2}{2} + \frac{g_2^2(b^L)^2}{2c_L}\right) \geq 0. \tag{15}$$

The incentive-compatibility constraints ensure that the agent picks contract (s^L, b^L) if $c = c_L$ and contract (s^H, b^H) if $c = c_H$. They imply that:

$$\frac{g_1^2}{2}((b^L)^2 - (b^H)^2) + \frac{g_2^2}{2c_L}((b^L)^2 - (b^H)^2) \geq s^H - s^L, \tag{16}$$

$$s^H - s^L \geq \frac{g_1^2}{2}((b^L)^2 - (b^H)^2) + \frac{g_2^2}{2c_H}((b^L)^2 - (b^H)^2). \tag{17}$$

It follows that we must have

$$\frac{g_2^2}{2c_L}(b^L - b^H) \geq \frac{g_2^2}{2c_H}(b^L - b^H) \quad \Leftrightarrow \quad b^L \geq b^H.$$

The condition $b^L \geq b^H$ in turn implies that we must have $s^H \geq s^L$.

First consider the case $f_1/f_2 < g_1/g_2$. By Lemma 1, $b^M(c)$ is strictly decreasing in c. Hence, the principal can set $b^L = b^M(c_L)$ and $b^H = b^M(c_H)$. Furthermore, the principal can set $s^H - s^L$ such that (16) is binding, which implies that both incentive compatibility constraints are satisfied. Finally, note that the agent's participation constraint can be rewritten such that

$$s^H - p(s^H - s^L) + (1-p)\left(\frac{g_1^2(b^H)^2}{2} + \frac{g_2^2(b^H)^2}{2c_H}\right) + p\left(\frac{g_1^2(b^L)^2}{2} + \frac{g_2^2(b^L)^2}{2c_L}\right) \geq 0.$$

Thus, given b^L, b^H, and $s^H - s^L$, the principal can choose s^H to make the agent's participation constraint just binding.[21] It follows that the principal earns the benchmark profit $\bar{\Pi}(c_L, c_H)$ by

[21] Ex post, the agent earns a rent if $c = c_L$ but makes a loss if $c = c_H$.

offering $T = \{M\}$ and the above described wage menu.

Now consider the case $f_1/f_2 > g_1/g_2$, which by Lemma 1 implies that $b^M(c_L) < b^M(c_H)$. The constraint $b^L \geq b^H$ will then be binding and thus $b^L = b^H =: b$. Furthermore, $s^H = s^L$, and the optimal wage scheme does not depend on the realization of c. Hence, the principal maximizes expected profits by implementing the organizational design described in Proposition 2. ■

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FIGURES

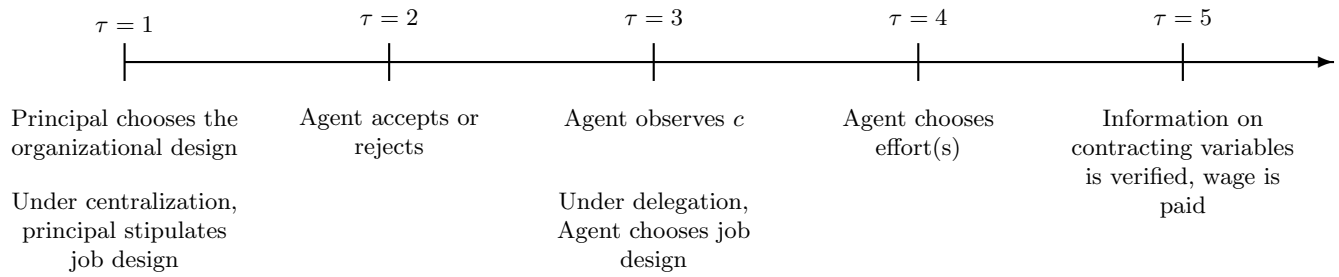

Figure 1: Timing of the Model

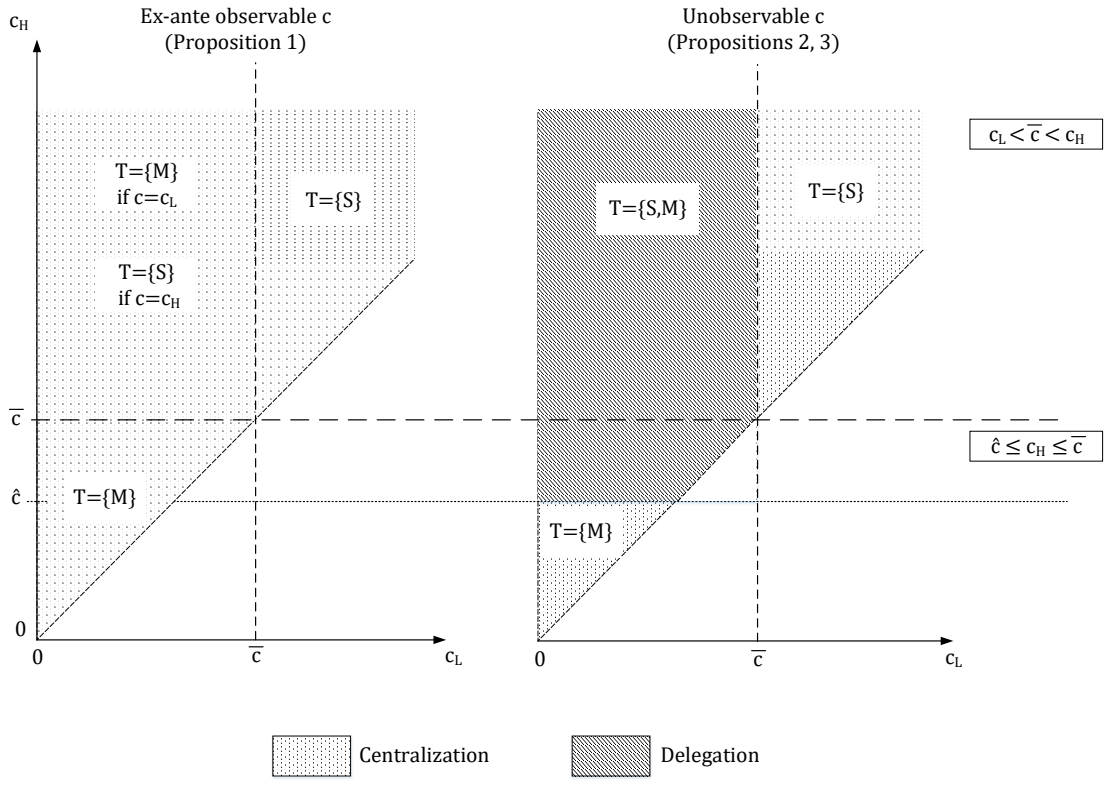

Figure 2: Optimal Organizational Design

Supplementary material (not for publication)

We show that the assumption $1/2 \cdot g_1/g_2 \leq f_1/f_2$ implies that the principal does not profit from excluding task 1 from the agent's job. We use results from Lemma 1. Suppose that the agent multitasks and hence profit is $\Pi^M(c)$ as given in Lemma 1. If the principal excluded task 1, profit would be $c^{-1}/2 \cdot f_2^2$. Multitasking weakly dominates task exclusion iff $c^{-1}/2 \cdot f_2^2 \leq \Pi^M(c)$, which is equivalent to

$$c^{-1} f_2^2 \leq \frac{(f_1 g_1 + c^{-1} f_2 g_2)^2}{g_1^2 + c^{-1} g_2^2} \quad \Leftrightarrow \quad \frac{c^{-1} f_2 g_1 (f_2 g_1 - 2 f_1 g_2)}{f_1^2 g_1^2} \leq 1.$$

A sufficient condition for the condition to hold is that $1/2 \cdot g_1/g_2 \leq f_1/f_2$.

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