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The failure of the delegation principle in a principal-agent model with transfers

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Abstract

In a principal-agent model with monetary transfers, we show that the delegation principle always fails even if preferences are perfectly aligned. This result holds if (i) the principal is committed to taking an action that is payoff-relevant for both parties if the agent rejects the proposed contract and (ii) the principal can contractually extract surplus from the agent.

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1 Introduction

There are many situations where individuals who must make decisions do not have all the necessary information. In organizations, the information that decision makers lack often lie in the hands of their subordinates. Consequently, in practice, the delegation of decision rights to subordinates is a widespread feature of organizations. Moreover, a basic principle of decision making in organizational theory, namely the *delegation principle*, is to decentralize authority to those who have information (see, for instance, Milgrom and Roberts 1992 or Saloner *et al.* 2001). This is all the more valid when preferences are perfectly aligned. In a principal-agent setting, Krishna and Morgan (2008) show that if the informed agent's preferences are perfectly aligned with those of the principal, it is optimal to fully delegate decision power to the informed agent. They also show that delegation is partially optimal (i.e., for a subset of states of nature) under a small divergence in preferences[1].

To the best of our knowledge, organizational theory always assumes that the agent's utility is not impacted by the decision if he does not take part in making it. In other words, his reservation utility is independent of the decision. We claim that this assumption is too restrictive because there are situations where decisions within an organization can affect the welfare of all its members whether they participate in the decision making process or not[2]. In this context, the agent's reservation utility becomes inextricably dependent on the final decision. For example, consider a manager who must renew the computer hardware of his subordinate, and suppose that she is not fully aware of the subordinate's needs. The hardware choice is payoff-relevant for both parties since it has an effect on the subordinate's working conditions. The manager can ask the subordinate to communicate his needs. If he refuses, the manager has to choose new hardware based on what she thinks would be good for the subordinate, given her limited information.

In this article, we show that the delegation principle fails when the principal is committed to taking an action that is payoff-relevant for both parties if the agent rejects the contract. Interestingly, this holds even when the preferences of the agent and the principal are perfectly aligned. Our result suggests that new insights can be gained in organizational theory by adopting our point of view. Following Krishna and Morgan (2008), we enrich the Crawford and Sobel (1982) model by considering a principal-agent setting with monetary transfers[3] where the principal has to take an action which affects both their payoffs. We consider a perfect commitment case which differs from the standard literature in terms of the agent's participation constraint. More specifically, we assume that the principal is committed to taking an action if the agent rejects the contract. This *default action* determines the agent's reservation utility which in turn affects his participation constraint. This implies that the agent is inextricably involved in the relationship whether he accepts the contract or not. The existence of a default action

[1]These results are established in the benchmark case of their article. Their main contribution is about the effects of imperfect commitment on the optimal contract.

[2]Legislative organization provides several examples of such situations (see Baron 2000 or Krehbiel 2004 for more details).

[3]In the context of legislative organization, Baron (2000) uses monetary transfers to capture all "resources and rewards" that a legislator can use to provide "motivation" for a committee to specialize in policy areas and to fully report private information. Resources and rewards are advantages including for instance budgets, favors or career opportunities that a legislator can grant (or not) to committee members. Similarly, in our framework, monetary transfers capture all possible present and future (positive or negative) changes to the agent's welfare within the organization.

provides a credible threat which allows the principal to extract surplus from the agent[4]. A main feature of the optimal contract is that delegation is eliminated. Nevertheless, the optimal contract is not trivial in the sense that it only involves bounded transfers. In order to understand the absence of delegation in the optimal contract, consider the situation where the preferences of both parties are perfectly aligned. In this context, it is always optimal to delegate decision making to the agent if, in addition, we do not allow the principal to extract surplus from the agent. However, in our framework, surplus extraction is possible due to the principal's commitment to making a decision. The optimal contract in this case is such that the default action is chosen by a subset of agent types without transfers. This gives the principal a lower payoff than delegation in these states but this loss is more than compensated by surplus extraction in the remaining states.

Related literature. This article contributes to the literature on contracting for information between an agent and a principal. Starting from the classic cheap talk model of Crawford and Sobel (1982), many authors suppose that the principal has commitment power (Melumad and Shibano 1991, Kahn and Tsoulouhas 1999, Baron 2000, Ottaviani 2000, Dessein 2002, Krishna and Morgan 2008, Ambrus and Egorov 2017). We contribute to this literature by introducing a type-dependent reservation utility based on a default action which is an action that the principal chooses if contracting fails[5]. As in Baron (2000), we allow for bidirectional transfers (i.e., transfers from the principal to the agent as well as transfers from the agent to the principal). Baron (2000) studies the effects of contracting arrangements in legislative organization. The legislature embodies the role of the principal and structures its arrangements with an "informational committee". In this context, the legislature provides resources and rewards to the committee to create incentives for the revelation of private information. If the committee remains silent, it is discharged and the legislature then chooses a policy without providing rewards. This policy can be interpreted as a default action. However, our approach is different since we study a principal-agent problem while Baron (2000) focuses on an extensive form game that applies only to legislative organization. In a moral hazard problem where the agent's effort determines the probability of success of a project, Bester and Krähmer (2008) show that it is not optimal to delegate the project selection to the agent. In contrast to our framework, the principal's objective in their article is to induce a high effort rather than extract information. Mookherjee et al. (2020) consider a setting where the principal can delegate contracting with the agent to an expert who does not observe the agent's type but is better informed about it than the principal. They find that delegation is not optimal if *ex-ante* collusion between the expert and the agent is possible.

[4]The possibility of surplus extraction by the principal is considered in other articles, see for instance Bester and Krähmer (2008).

[5]In a different context, Jullien (2000) introduces a type-dependent reservation utility (only for the agent) that is not based on a default action. Assuming full participation, he shows that, in the optimal contract, the participation constraint is binding for an interval of types (Proposition 3, p.13). Similarly, we find an interval of types who receive no informational rent. However, unlike Jullien (2000), we find that the optimal contract action for these types is unresponsive to the state (and equal to the default action).

2 Model

2.1 Preliminaries

Following Krishna and Morgan (2008), we formulate the Crawford and Sobel (1982) framework in a principal (P) - agent (A) setting. In order to have a closed-form expression of the optimal contract, we restrict attention to the well-known uniform quadratic case. The payoffs of both parties depend on the state of nature $\theta \in [0,1]$ and the action $y \in \mathbb{R}$. The agent perfectly observes θ while the principal does not know θ, and her prior is uniform on $[0,1]$. The utility function of the principal is $u^P(y,\theta) = -(y-\theta)^2$ while that of the agent is $u^A(y,\theta,b) = -(y-\theta-b)^2$ where $b \in [0,1]$ is a common-knowledge bias parameter. For any given θ, the ideal action for the agent (respectively, the principal) is $y^A(\theta) = \theta + b$ (respectively, $y^P(\theta) = \theta$). $y^A(\theta)$ is the action that the agent would choose if the principal delegates decision power to him.

We assume that the principal can use monetary transfers to extract the agent's private information. We suppose that the preferences of the two parties are quasi-linear with respect to transfers. Thus, if a payment t is made to the agent, then the net payoff of the principal from action y in state θ is $-(y-\theta)^2 - t$ while the net payoff of the agent is $-(y-\theta-b)^2 + t$.

We study a standard setting in which the principal has perfect commitment power, that is, she can write a contract that specifies both the action and the transfer as functions of the information sent by the agent. Due to perfect commitment, the revelation principle applies and we can restrict attention to direct contracts. A direct contract (y,t) specifies, for each $\theta \in [0,1]$, an action $y(\theta)$ and a transfer $t(\theta)$. Standard arguments ensure that under perfect commitment, necessary and sufficient conditions for incentive compatibility (IC) require that (i) y is nondecreasing and (ii) $t'(\theta) = 2(y(\theta)-\theta-b)y'(\theta)$ at all points θ where y is differentiable (see, for instance, Salanié 1997).

2.2 The individual rationality constraint

The agent can refuse the contract that the principal proposes. The principal commits to taking the default action $\bar{y}$ in case of refusal, i.e., an action the principal can take without using the agent's private information. For simplicity, we assume that the principal selects the default action according to his prior belief about the state of nature[6]. Thus, we have $\bar{y} = \underset{y}{\operatorname{argmax}} \int_0^1 -(y-\theta)^2 d\theta = \frac{1}{2}$. Moreover, we assume that the agent is inextricably involved in the relationship even if he rejects the contract. Consequently, in this case the agent obtains his reservation utility level $\bar{u}^A(\theta,b) = -(\frac{1}{2}-\theta-b)^2$ while the principal obtains the reservation utility level $\bar{u}^P(\theta) = -(\frac{1}{2}-\theta)^2$.

We consider a standard timeline of the interaction. First, Nature draws the state θ which is privately observed by the agent. Second, the principal proposes a contract (y,t) to the agent. Third, the agent accepts or rejects this contract. If the agent accepts it, he then reveals the state θ, the action $y(\theta)$ is implemented and he receives a transfer $t(\theta)$. Otherwise, the principal takes the default action $\bar{y} = \frac{1}{2}$ and the agent receives no transfer.

Without loss of generality, we characterize the optimal contract under full participation assumption. When the agent rejects the contract, the default action $\bar{y} = \frac{1}{2}$ is implemented and no transfer occurs. This outcome is equivalent to setting $(y(\theta), t(\theta)) = (\frac{1}{2}, 0)$.

[6]We discuss this assumption, which is not crucial for our main result, in the last paragraph of the paper.

The principal can include this outcome in the contract to ensure the participation of all agent types. Consequently, the individual rationality constraint has to be satisfied state by state so that

$$u^A(y(\theta), \theta, b) + t(\theta) \geq \bar{u}^A(\theta, b)$$

or equivalently

$$t(\theta) \geq \bar{u}^A(\theta, b) - u^A(y(\theta), \theta, b) = -\left(\frac{1}{2} - \theta - b\right)^2 + (y(\theta) - \theta - b)^2 \tag{1}$$

for all $\theta \in [0, 1]$. This constraint allows for negative transfers when $u^A(y(\theta), \theta, b) > \bar{u}^A(\theta, b)$. However, these negative transfers cannot be arbitrarily large because the RHS term of inequality (1) is bounded over the interval $[0, 1]$. The individual rationality constraint can be rewritten as follows :

$$\begin{aligned} U(\theta) &= u^A(y(\theta), \theta, b) + t(\theta) - \bar{u}^A(\theta, b) \geq 0 \\ &= \left(\frac{1}{2} - \theta - b\right)^2 - (y(\theta) - \theta - b)^2 + t(\theta) \geq 0 \end{aligned}$$

where $U(\theta)$ is the informational rent of the agent. Due to the incentive compatibility constraint, the marginal rent is given by

$$U'(\theta) = 2\left(y(\theta) - \frac{1}{2}\right).$$

As we show below, the sign of the marginal rent allows us to determine the properties of the optimal contract. In particular, we find that informational rent is nonmonotonic and vanishes for intermediate values[7] of θ.

3 The failure of the delegation principle

If the agent's true type is θ and an outcome $(y(\theta), t(\theta))$ is implemented, the principal's payoff is $u^P(y(\theta), \theta) - t(\theta)$. Using the definition of the agent's informational rent U, we can write $u^P(y(\theta), \theta) - t(\theta) = \Phi(y(\theta), \theta, b) - U(\theta)$ where

$$\Phi(y(\theta), \theta, b) = \left(\frac{1}{2} - \theta - b\right)^2 - (y(\theta) - \theta - b)^2 - (y(\theta) - \theta)^2.$$

The optimal contract is the solution of the following control problem $(\mathcal{P})$:

$$\max \int_0^1 (\Phi(y(\theta), \theta, b) - U(\theta))\, d\theta \tag{2}$$

subject to the law of motion

$$U'(\theta) = 2\left(y(\theta) - \frac{1}{2}\right) \tag{3}$$

and the participation constraint

$$U(\theta) \geq 0 \tag{4}$$

[7]This property has previously been identified by Jullien (2000).

where U is the state variable and y is the control variable. We start by noticing that, in the optimal contract, the information rent $U(\theta)$ cannot be strictly positive for all types. In other words, the participation constraint is necessarily binding for at least one type. More specifically, we establish the following lemma that shows that the set of types who receive no information rent is a (possibly degenerate) interval.

Lemma 1. *In the optimal contract, there exist θ_1 and θ_2 with $0 \leq \theta_1 \leq \theta_2 \leq 1$ such that $U(\theta) = 0$ if and only if $\theta \in [\theta_1, \theta_2]$.*

Proof. First, we show that the set $U^{-1}(0) = \{\theta | U(\theta) = 0\}$ is nonempty. Assume it is empty and let $\underline{U} = \min_{\theta \in [0,1]} U(\theta) > 0$. Let $\tilde{U}$ be defined as $\tilde{U}(\theta) = U(\theta) - \underline{U}$. $\tilde{U}$ also satisfies the participation constraint and the law of motion. However, the principal strictly prefers $\tilde{U}$ to U thereby contradicting optimality.

Second, we show that $U^{-1}(0)$ is an interval. Let[8] $\theta_1 = \min U^{-1}(0)$ and $\theta_2 = \max U^{-1}(0)$. If $\theta_1 = \theta_2$, then $U^{-1}(0)$ is a degenerate interval and the lemma holds. If $\theta_1 < \theta_2$, we need to show that $U^{-1}(0) = [\theta_1, \theta_2]$. Assume that $U(\theta) > 0$ for some type $\theta \in (\theta_1, \theta_2)$. This implies the existence of two types θ' and θ'' such that $\theta_1 < \theta' < \theta < \theta'' < \theta_2$ satisfying the following inequalities: $U'(\theta') > 0$ and $U'(\theta'') < 0$. From equation 3, it follows that $y(\theta') > \frac{1}{2}$ and $y(\theta'') < \frac{1}{2}$. However, this violates the incentive compatibility constraints which require y to be nondecreasing. □

From Lemma 1, the law of motion (equation (3)) and the fact that y is nondecreasing, we derive the following properties of the optimal menu of contracts.

Corollary 1. *The optimal contract is such that*

$$\begin{cases} y(\theta) < \frac{1}{2} \text{ and } U'(\theta) < 0 \text{ if } 0 \leq \theta < \theta_1 \\ y(\theta) = \frac{1}{2} \text{ and } U'(\theta) = 0 \text{ if } \theta_1 \leq \theta \leq \theta_2 \text{ and } \theta_1 < \theta_2 \\ y(\theta) > \frac{1}{2} \text{ and } U'(\theta) > 0 \text{ if } \theta_2 < \theta \leq 1 \end{cases}$$

Proof. Consider a type θ such that $0 \leq \theta < \theta_1$. By definition of θ_1, we have $U(\theta_1) = 0$ and $U(\theta) > 0$. Therefore there exists θ' such that $\theta < \theta' < \theta_1$ and $U'(\theta') < 0$. Equation (3) implies that $y(\theta') < \frac{1}{2}$. Given that $\theta < \theta'$ and y is nondecreasing, we get $y(\theta) \leq y(\theta') < \frac{1}{2}$. Using equation (3), we conclude that $U'(\theta) < 0$. An analogous argument can be used to show that $y(\theta) > \frac{1}{2}$ and $U'(\theta) > 0$ if $\theta_2 < \theta \leq 1$.

Assume $\theta_1 < \theta_2$ and consider a type θ in $[\theta_1, \theta_2]$. Lemma 1 implies that U' is zero in (θ_1, θ_2). Equation (3) and the continuity of y imply the continuity of U'. Therefore, U' must also be zero at θ_1 and θ_2. Consequently, equation (3) implies that $y(\theta) = \frac{1}{2}$ for any θ in $[\theta_1, \theta_2]$. □

Corollary 1 establishes that the action $y(\theta)$ coincides with the default action $\bar{y} = \frac{1}{2}$ for $\theta \in [\theta_1, \theta_2]$. This implies that the optimal contract cannot involve delegation on this interval since delegation yields the ideal action for the agent $y^A(\theta) = \theta + b$. In order to show that it does not involve delegation on the other two intervals, we study the properties of the solution of the control problem $\mathcal{P}$. The generalized Hamiltonian of $\mathcal{P}$ is $L = \Phi - U + 2\mu\left(y - \frac{1}{2}\right) + \lambda U$ and the resulting Pontryagin conditions are: there exist a costate variable μ and a nonnegative multiplier λ that satisfy

[8] The fact that U is continuous over $[0,1]$ guarantees that $\underline{U}$, θ_1 and θ_2 are well-defined.

$$\mu' = -\frac{\partial L}{\partial U} = 1 - \lambda \tag{5}$$

$$0 = \frac{\partial L}{\partial y} = \frac{\partial \Phi}{\partial y} + 2\mu = -2(y - \theta - b) - 2(y - \theta) + 2\mu \tag{6}$$

$$0 = \lambda U \tag{7}$$

and the transversality condition are $\mu(0) = \mu(1) = 0$.

The delegation principle states that the principal should delegate decision making to the informed agent, at least when their preferences are sufficiently aligned. For instance, Krishna and Morgan (2008) find that when this is the case, i.e., for small bias values ($b \leq 1/3$), it is optimal to delegate decision making to the agent for θ in $[b, 1-2b]$. However, as we show below, the delegation principle fails in our setting. We find that, regardless of the level of preferences alignment, there exists no interval of types such that it would be optimal to delegate decision making to the agent.

Proposition 1. *Delegation is never optimal.*

Proof. Assume that there exists a bias level b and a nonempty open interval $(\theta', \theta'') \subset [0, 1]$ such that it is optimal to delegate decision making to the agent. This implies that $y(\theta) = \theta + b$ for every θ in (θ', θ''). Thus y is not constant on this interval and Corollary 1 implies that $(\theta', \theta'') \cap [\theta_1, \theta_2] = \emptyset$. Consequently, $U(\theta) > 0$ for any θ in (θ', θ''). Equation (7) implies that $\lambda(\theta) = 0$ over this interval which in turn implies that $\mu'(\theta) = 1$ using equation (5). However, by differentiating equation (6) under the assumption that $y(\theta) = \theta + b$, we get $\mu'(\theta) = 0$ which contradicts the previous statement. □

Proposition 1 establishes that the delegation principle fails under fairly reasonable assumptions, namely when *(i)* the principal is committed to taking an action even if the agent rejects the proposed contract and *(ii)* the principal can extract surplus from the agent. It is worth noting that the optimal contract does not entail arbitrarily large transfers from the agent to the principal. In other words, the delegation principle does not fail because the principal disregards the decision that has to be made and focuses on extracting surplus from the agent. Such an outcome is not implementable because the agent can always reject the contract and let the principal implement the default action which would give him the (finite) reservation utility $\bar{u}^A(\theta, b) = -(\frac{1}{2} - \theta - b)^2$. In the remainder of this section, we explicitly characterize the optimal contract.

Proposition 2. *The optimal contract is given by y and U such that*

$$y(\theta) = \begin{cases} \frac{3}{2}\theta + \frac{b}{2} & \text{if } 0 \leq \theta < \frac{1-b}{3} \\ \frac{1}{2} & \text{if } \frac{1-b}{3} \leq \theta \leq \frac{2-b}{3} \\ \frac{3}{2}\theta + \frac{b-1}{2} & \text{if } \frac{2-b}{3} < \theta \leq 1 \end{cases} \quad \text{and } U(\theta) = \begin{cases} \frac{1}{6}(3\theta + b - 1)^2 & \text{if } 0 \leq \theta < \frac{1-b}{3} \\ 0 & \text{if } \frac{1-b}{3} \leq \theta \leq \frac{2-b}{3} \\ \frac{1}{6}(3\theta + b - 2)^2 & \text{if } \frac{2-b}{3} < \theta \leq 1 \end{cases}$$

Proof. From Lemma 1, we get that for any $\theta \notin [\theta_1, \theta_2]$, $U(\theta) > 0$ which implies that $\lambda(\theta) = 0$ using equation (7). It follows from equation (5) that $\mu'(\theta) = 1$. Consequently, the differentiation of equation (6) implies that *(i)* $y'(\theta) = 3/2$ for all $\theta \notin [\theta_1, \theta_2]$. Moreover, we know that *(ii)* y is constant and equal to $\frac{1}{2}$ over the interval $[\theta_1, \theta_2]$ (see Corollary 1).

By substituting the transversality conditions into equation (6), we get *(iii)* $y(0) = b/2$ and $y(1) = 1 + b/2$. The combination of observations *(i)*, *(ii)* and *(iii)* yields

$$y(\theta) = \begin{cases} \frac{3}{2}\theta + \frac{b}{2} & \text{if } 0 \leq \theta < \theta_1 \\ \frac{1}{2} & \text{if } \theta_1 \leq \theta \leq \theta_2 \\ \frac{3}{2}\theta + \frac{b-1}{2} & \text{if } \theta_2 < \theta \leq 1 \end{cases}$$

with $1/2 = (3\theta_1 + b)/2 = (3\theta_2 + b - 1)/2$ (by continuity of y). Thus $\theta_1 = (1-b)/3$ and $\theta_2 = (2-b)/3$. By integrating the law of motion (equation (3)) and using the fact that $U(\theta_1) = U(\theta_2) = 0$, we get $U(\theta) = -\int_\theta^{\theta_1}(3x + b - 1)dx$ for θ in $[0, \theta_1]$ and $U(\theta) = \int_{\theta_2}^{\theta}(3x + b - 2)dx$ for θ in $[\theta_2, 1]$ which yields the expression of U. □

We know that $t(\theta) = U(\theta) + (y(\theta) - y^A(\theta))^2 - (\bar{y} - y^A(\theta))^2$ where $\bar{y} = 1/2$ is the default action and $y^A(\theta) = \theta + b$ is the ideal action for the agent. Given that the informational rent $U(\theta)$ is always non-negative, the transfer $t(\theta)$ is necessarily non-negative if $(y(\theta) - y^A(\theta))^2 - (\bar{y} - y^A(\theta))^2 \geq 0$. Surplus extraction from the agent (i.e., $t(\theta) < 0$) requires $(y(\theta) - y^A(\theta))^2 - (\bar{y} - y^A(\theta))^2$ to be strictly negative. This necessary (but not sufficient) condition is true if and only if the ideal action for the agent $y^A(\theta)$ is farther away from the default action $\bar{y}$ than from the optimal contract action $y(\theta)$, i.e., if and only if the agent prefers $y(\theta)$ to $\bar{y}$. We illustrate this observation with the following numerical example: Let $b = 0.5$. In this case, $\theta_1 \approx 0.167$ and $\theta_2 = 0.5$. For $\theta' = 0.1 \in [0, \theta_1]$, $y^A(\theta') = 0.6$, $y(\theta') = 0.4$ so that the agent prefers $\bar{y}$ to $y(\theta')$ and $t(\theta') \approx 0.037$. For $\theta'' = 0.7 \in [\theta_2, 1]$, $y^A(\theta'') = 1.2$, $y(\theta'') = 0.8$ so that the agent prefers $y(\theta'')$ to $\bar{y}$ and $t(\theta'') = -0.27$.

In this article, we assume that the default action is determined so as to maximize the principal's *ex-ante* expected payoff (i.e., $\bar{y} = 1/2$). However, it is possible to consider that the principal chooses $\bar{y}$ so as to maximize her *ex-post* expected payoff, i.e., after the contract is rejected. In this case, the principal has to take into account the information that can be learned from the rejection of the contract by the agent. Given that the optimal contract is designed so as to ensure the agent's participation in all states of nature, rejection happens only off-equilibrium. Thus, the default action needs to be such that there exists an off-equilibrium belief that makes it optimal. For a given default action $\bar{y}$, the optimal contract has a similar structure to that of Proposition 2 and is such that $y(\theta) = \bar{y}$ for $\theta \in [\theta_1, \theta_2]$ where $\theta_1 = \max\{\frac{2\bar{y}-b}{3}, 0\}$ and $\theta_2 = \frac{2\bar{y}+1-b}{3}$. Only types in $[\theta_1, \theta_2]$ are indifferent between accepting and rejecting the contract. Thus, after rejection, the support of the principal's belief has to be a subset of $[\theta_1, \theta_2]$. The default action needs to coincide with the *ex-post* expectation of agent types after a contract rejection. Therefore, $\bar{y}$ has to be in $[\theta_1, \theta_2]$ or equivalently, $0 \leq \bar{y} \leq 1 - b$. For instance, $\bar{y} = 1/2$ can be justified *ex-post* for b in $[0, 1/2]$.

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