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Tamada, Yasunari and Tsai, Tsung-Sheng
National Tsing Hua University

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The Allocation of Decision-Making Authority when Principal has Reputation Concerns

Yasunari Tamada[a] Tsung-Sheng Tsai[b]

Keio University *National Tsing Hua University*

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Abstract

This paper analyzes the allocation of decision-making authority when the principal has reputation concerns. The principal can either keep the authority, or delegate it to the agent, who has better information. An outside evaluator who forms the principal's reputation cannot observe who makes the decision. The key feature of this paper is that the principal can influence her reputation through her delegation policy. With reputation concerns, we show that the principal tends to keep too much the authority from the evaluator's point of view, even though sometimes her information is not good enough for her to make the decision on her own.

Keywords: Decision-making authority, delegation, reputation concerns.

JEL classification: D23, D82, L14

[a]Faculty of Economics, Keio University, 2-15-45 Mita, Minato-ku, Tokyo, 108-8345, Japan. Tel/Fax: +81-3-5427-1326. Email: tamada@econ.keio.ac.jp

[b]Corresponding author. Department of Economics, National Tsing Hua University, Hsinchu, 30013, Taiwan. Tel: 886-3-5731197. Fax: 886-3-5629805. Email: tstsai@mx.nthu.edu.tw

"The buck stops here."

— Harry S. Truman, 33rd President of the U.S.

1 Introduction

It is often said that some political leaders or CEOs are too aggressive in maintaining a great deal of responsibilities. Why do they prefer to make the decision on their own, even though their subordinates may do better? Research in behavioral economics emphasizes that high-rank executives have the tendency to keep all the responsibilities due to their overconfidence and overoptimism of the outcomes led by their actions or skills.[1] However, if they cares about the quality of the decision making, they should have a more competent agent take more responsibilities. Thus, the important question that has been asked is: "when and how much should the principal delegate the decision-making authority to the agent?" and researchers have provided some good reasons for that.[2] This paper tries to analyze this issue in a different direction: when the principal (she) has reputation concerns, even though the agent (he) has better information in making the correct decision, a principal may still want to keep the decision-making authority rather than delegate it in order to manipulate her reputation. In other words, if the market or the outside evaluator believes that all the decisions are done by her subordinate, the principal cannot have any influence on her reputation through the decision making. Therefore, by making a statement and a behavior such as "the buck stops here," or "I take the full responsibility," the principal should have the intention to increase her reputation.

Consider the situation where both the principal and the agent can be either good or biased, which is private information to themselves. The principal wishes to be perceived

[1] For a survey, see Camerer and Malmendier (2007).

[2] The literature in political science has been paying much more attention to the optimal "degree of delegation" in controlling the agency problem. For example, Epstein and O'Halloran (1994) show that when Congress has appropriate administrative procedures, including *ex ante* delegation and *ex post* veto, it delegates a large amount of authority, regardless of the differences in policy preferences. Epstein and O'Halloran (1999) observe that Congress retains its authority the most in issues related to budgets, rules, and ways and means, but delegates authority to the Executive the most in the areas of agricultural and public works, and armed services. Gailmard (2002) introduces the bureaucrat's subversion into Epstein and O'Halloran's (1999) model, which results in less delegation.

as a good type, who has the same preference in the decision making as an outside evaluator. The evaluator forms the reputation that enters the principal's utility function. For example, in order to be reelected, a politician has the incentives to behave more accountable, even though he may have his own interests. When the principal can determine the allocation of authority, she can either make the decision on her own, or she can delegate the decision making authority to the agent, who has better information regarding the true state of the world. However, the agent may be biased and choose his preferred policy which may not be appropriate for the true state. Importantly, the evaluator may not be able to observe who makes the decision, and the reputation is formalized based on the realized outcome regarding whether or not the decision is appropriate for the state, and the belief regarding who the decision maker is. The main point here is that the principal can manipulate her reputation through the delegation policy.

Consider a benchmark case where the allocation of authority is determined by the evaluator, and the principal's type is public information. In this case, the allocation of authority can be contingent on the principal's type. Then if the principal is good, the evaluator prefers the agent's authority if the agent is more likely to be unbiased, or the principal's information is sufficiently inaccurate. On the other hand, if the principal is biased, the evaluator always prefers the agent's authority. This result basically resonates the literature in the theory of delegation. When the principal has the control right to determine the allocation of authority, we first consider the case where she has no reputation concerns. Then the good principal will choose the delegation policy which is also the best for the evaluator, but the biased principal will always keep the authority. Therefore, there is an efficiency loss when the principal has the control right over the allocation of authority, in the sense that the biased principal will abuse the control right and keep too much the authority.

Consider the principal has reputation concerns when she determines the allocation of authority. If the evaluator believes that it is more likely the principal who makes the decision, the principal will be more responsible for the credit and blame in the decision making. Thus, if the principal decides to keep the authority, the decision will influence her reputation more strongly. On the other hand, if the evaluator believes that it is more likely the agent who makes the decision, her reputation is less sensitive to the decision making, but the quality of decision making may be better if she decides to delegate the authority. That is, the principal can utilize the delegation policy to manipulate both her *ex post* reputation and the decision making.

Reputation concerns provide the good principal the incentives to keep excessive authority from the evaluator's point of view. There occurs a so-called "stopping the buck" phenomenon: when her information is sufficiently accurate, and the evaluator correctly believes that she is responsible for the decision making, the principal tends to keep the authority and make the right decision, in which way she can affect her reputation more effectively because she has the confidence to do it right. On the other hand, the biased principal prefers to keep the authority even without reputation concerns; but with reputation concerns, she will choose the appropriate decision sometimes rather than always choose her favorite policy. However, even though her decision making can be improved, the evaluator still prefers the agent's authority when the principal's information is relatively inaccurate. That is, both types of the principal tend to keep the authority too often from the evaluator's point of view. Therefore, the principal's reputation concerns lead to an inefficient allocation of authority.

Our paper contributes to the theory of delegation, which has been an important issue in organization theory. Aghion and Tirole (1997) point out that one reason for a principal to delegate the authority to her agent is to take advantage of the agent's expertise. However, since their interests do not align, the control cannot be perfect. The principal thus faces a trade-off between a loss of control and a loss of information in determining the optimal allocation of decision-making authority. If the principal delegates the authority, the agent has the incentive to acquire information, so that the quality of information can be better, but the difference in preferences between them may still lead to a biased decision. When communication between them is possible, Dessein (2002) obtains an interesting insight in that delegation can always be better than any informative communication. Harris and Raviv (2005) consider the case where the principal also has private information and show that the principal prefers delegation to communication when the agent's information is relatively important. More recently, Alesina and Tabellini (2007, 2008) study the socially optimal allocation of a task (or tasks) between an elected politician and a bureaucrat who has career concerns. In our paper, we allow the allocation of authority to be determined by the principal instead by a social planner.

Our work is also closely related to Levy (2004) and Morris (2001), although delegation is not an option in their models. Levy (2004) considers that the principal cares about both the appropriate decisions and her reputation, and can consult with the agent before making the decisions. She shows that the more competent the principal, the less she will consult with the agent. In order to show that she is better than the agent, she will take an action that contradicts the agent's advice, and thus in equilibrium, there will be too many contradictions, i.e., the "anti-herding" behavior. Morris (2001) analyzes the situation of "political correctness," which means that, in order to be distinguished from the biased agent, the good agent has the tendency to recommend a policy that contradicts to his information but may make him look good by suggesting it.[3] Our paper also argues that because of the reputation concerns, the good principal has the tendency to keep the authority and make the right decision, even though sometimes her information suggests that the agent should make the decision.

2 Model

There are three parties in this game: a principal, an agent, and an outside evaluator. We can interpret the principal as a politician or a CEO, the agent as a bureaucrat or a division manager, and the evaluator as the median voter or the stakeholder.

When the principal can determine the allocation of authority, she can either keep the decision-making authority, or delegate the authority to the agent. The party who has the decision-making authority chooses an action, $x \in \{0, 1\}$. The outcome depends on the

[3]Other researchers care about the agent's career concerns, which has been recognized as a reason for information loss and inefficient decision making. See, for example, Ottaviani and Sørensen (2006), and Scharfstein and Stein (1990).

action and the state of the world, $\theta \in \{0, 1\}$, where each state occurs with probability 1/2. We assume that the socially desirable, or appropriate, action from the evaluator's point of view is characterized by $x = \theta$. The principal can observe an informative but noisy signal regarding the state of the world, which is denoted by $s \in \{0, 1\}$, where $s = \theta$ with probability $q \in (1/2, 1)$. The agent has better information than the principal, in that he can receive the *perfect* signal, i.e. the realized θ. Moreover, the evaluator can also observe the realized θ and the implemented action x; however, he may not be able to observe the allocation of authority, the *ex ante* signals that the principal and the agent receive, nor the principal's and agent's types.

The type of both the principal and the agent can be either good (unbiased) or biased, in the sense that the good type prefers the appropriate decision, and the biased type always prefers $x = 1$, *when there are no reputation concerns*.[4] The type of the principal and the agent is private information to themselves. There are, however, the common prior beliefs that the principal is good with probability $\mu_p \in (0, 1)$ and biased with probability $1 - \mu_p$, and that the agent is good with probability $\mu_a \in (0, 1)$ and biased with probability $1 - \mu_a$. Accordingly, μ_p can be interpreted as the principal's *ex ante* reputation.

We assume that the principal receives a utility from both the action and her *ex post* reputation, which is defined as the evaluator's *ex post* belief about the principal being the good type. Namely, the good principal's utility function is[5]

$$U_p^G(x, \theta, \hat{\mu}_p) = -|x - \theta| + \gamma \hat{\mu}_p, \tag{1}$$

where $\hat{\mu}_p$ denotes the principal's *ex post* reputation and $\gamma > 0$ is its relative importance. The biased principal, who intrinsically prefers $x = 1$, has the utility function:

$$U_p^B(x, \theta, \hat{\mu}_p) = -|x - 1| + \gamma \hat{\mu}_p. \tag{2}$$

[4] Since the signal is informative here, a decision is "appropriate" if $x = s$, which of course may not be "correct" *ex post*.

[5] This could be derived from a two-period model: in the first period, a decision is made by the person who has the authority. In the second period, observing the realized decision and the true state, the evaluator forms the *ex post* reputation, and the principal receives a payoff from his reputation. This treatment is similar to, for example, Holmström and Ricart i Costa (1986) and Morris (2001).

The agent has no reputation concerns. Thus, the good agent's utility function is

$$U_a^G(x, \theta) = -|x - \theta|, \tag{3}$$

and the biased agent's utility function is

$$U_a^B(x, \theta) = -|x - 1|. \tag{4}$$

Finally, the evaluator's utility function is $U_e(x, \theta) = -|x - \theta|$.

It can be seen that although the evaluator only cares about the correct decision making, there is another role that he plays, which is not reflected in his objective function: the evaluator has to evaluate the posterior reputation of the principal, which enters her utility function. This treatment is adapted by, for example, Levy (2004).

We assume that information regarding θ is soft so that the agent cannot verify it, and the principal cannot elicit the agent's private information *via* some revelation mechanisms. Furthermore, we assume that communication between the principal and the agent is costly enough to prohibit information transmission between them through a cheap-talk game. The only variable specified in the contract is the allocation of decision-making authority. It is either the *principal's authority*, where the principal can decide x, or the *agent's authority*, where the decision-making authority is delegated to the agent, and the principal cannot overrule the agent's decision.

The timing of the game is as follows: (1) The principal chooses the allocation of decision-making authority. (2) Under the principal's authority, the principal observes a signal s. Under the agent's authority, the agent observes θ. (3) Given the allocation of authority, the party who has the formal authority chooses x. (4) The evaluator observes the realized θ and x, and updates the principal's reputation (from μ_p to $\hat{\mu}_p$).

3 The Socially Determined Allocation of Authority

In this paper, the social welfare is evaluated from the evaluator's point of view. For the evaluator, there are two main sources of inefficiency in terms of the decision making: (i) the principal's type is unknown to the evaluator; and (ii) the agent's type is unknown.

Thus, if the principal has the authority, not only the biased principal intrinsically prefers $x = 1$ which is inappropriate when $s = 0$, but the good principal may also distort the decision making because of her reputation concerns. On the other hand, when the authority is delegated to a biased agent, he always choose $x = 1$, which is wrong when $s = 0$. Moreover, there can be additional inefficiency in the allocation of authority for the evaluator when the principal has the control right over the delegation policy, in that the principal may allocate excessive authority to one of the parties.

In this section, we consider the benchmark case where the allocation of authority is determined by the society or the evaluator, not by the principal. The evaluator can know who the decision maker is and so there is no inefficiency related to the principal's delegation policy. We will analyze two cases: In the first case, the principal's type is public information and therefore, she has no reputation concern. This also implies that the allocation of authority can be contingent on the principal's type. In the second case, the principal's type is private information, and thus, the principal can affect her *ex post* reputation through the action she chooses. In either case, we will remain to assume that the agent's type is private information as in the usual principal-agent model.

3.1 When the Principal's Type is Public Information

First of all, if the agent has the decision-making authority, it is obvious that the good agent will choose $x = \theta$, and the biased agent will choose $x = 1$ regardless of θ. As a result, the evaluator's expected utility is $-(1/2)(1-\mu_a)$, which is the probability that the agent is biased and makes wrong decision.

Next, consider that the principal has the authority. When the principal is a good type, whose has the exactly same preference as that of the evaluator, she yields the evaluator an expected utility of $-(1-q)$, since the good principal makes the right decision with probability q. Accordingly, we can define

$$\bar{q} \equiv \frac{(1+\mu_a)}{2}, \tag{5}$$

so that the evaluator is indifferent between the good principal's authority and the agent's authority at $q = \bar{q}$. Thus, the efficient allocation of authority between a good principal and the agent has a simple form: the principal should have the authority if $q \geq \bar{q}$, and the agent should have the authority otherwise, that is, the good principal should have the authority if her information is sufficiently accurate. Moreover, since $\bar{q}$ is lower when the probability of the agent being unbiased is lower, the good principal should have the authority more likely when the agent is more likely to be biased.

On the other hand, suppose that the principal has the authority and she is biased type. She will always choose $x = 1$, which yields the evaluator an expected utility of $-1/2$. Clearly, this is always less than that under the agent's authority, $-(1/2)(1 - \mu_a)$. We therefore have the following proposition:

Proposition 1. *Suppose that the principal's type is public information and the allocation of authority is determined to maximize the evaluator's welfare. Then:*

1. *if the principal is a good type, the evaluator prefers the principal's authority if and only if $q \geq \bar{q}$, where $\bar{q} \equiv (1 + \mu_a)/2$;*

2. *if the principal is a biased type, the evaluator always prefers the agent's authority.*

This proposition echoes the previous literature, such as Aghion and Tirole (1997) and Dessein (2002) regarding the reasons to delegate the decision-making authority to the agent. If the principal is good, then the main trade-off between the principal's and the agent's authority is typically the loss of information versus the loss of control; that is, the agent's authority is more preferable when the agent's information is relatively precise (q is close to 1/2) and the agent's type is less likely biased (μ_a is close to 1). However, if the principal is biased, she always prefers a certain action, and so the evaluator prefers the agent's authority because the agent has some chance to be good.

3.2 When Principal's Type is Private Information

In this case, the allocation of authority cannot be contingent on her type, so that the biased principal actually has a chance to make the decision under the principal's authority. As we will show later, because of her reputation concerns, the decision making by the biased principal's can be partially improved.

Principal's Authority

Under the principal's authority, the principal makes the decision based on the signal s that she receives. With no reputation concerns, the good principal always chooses $x = s$, and the biased principal always chooses $x = 1$. With reputation concerns, however, the good principal may have the incentive to make a wrong decision in order to be distinguished from the biased one; that is, she may choose $x = 0$ when she observes $s = 1$. On the contrary, the biased principal may choose $x = 0$ even when she observes $s = 0$, in order to mimic the good type and enhance her reputation. This situation is similar to the phenomenon of "political correctness" analyzed in Morris (2001), in which case a good expert may try to send a recommendation that leads to a wrong action because of signaling motivations.

There may exist many equilibria.[6] In order to proceed with an interesting discussion regarding how reputation concerns matter, we will focus on the equilibrium in which the good principal always chooses $x = s$, and the biased one chooses $x = 1$ when $s = 1$, but $x = 0$ with some probability when $s = 0$. One reason for the focus on this equilibrium is that this case produces the most efficient decision making for the evaluator, where the good principal always chooses the appropriate policy, and the biased principal chooses the appropriate decision with some positive probability, but not always, as will be seen in what follows. The following assumption is made to ensure that such an equilibrium exists:

Assumption 1. $\gamma < \frac{(2q-1)(1-\mu_p q)(1-\mu_p(1-q))}{(1-\mu_p)(1-\mu_p+2\mu_p q(1-q))}$.

This assumption means that the level of the principal's reputation concerns is not too large. Ideally, we wish reputation concerns to play an important, but not an overwhelming, role in the analysis.[7] Under this assumption, we characterize the equilibrium by means of the following proposition:

[6] For example, the good principal may choose $x = 0$ when $s = 1$, in order to be distinguished from the biased principal. However, we can show that among all the possibilities, the equilibrium that we are focusing on can produce the best quality in decision making, which is the reason we call this the "most efficient" case. See the discussion in Section 5.

[7] If γ is too large, then reputation concerns will dominate and eliminate the incentives to make the correct decision. Both types will choose whichever action that can render a higher reputation, so that

Proposition 2. *Suppose that Assumption 1 holds. Then, under the principal's authority, there exists an equilibrium in which:*

1. *The good principal always chooses $x = s$.*

2. *The biased principal always chooses $x = 1$ if $s = 1$, and chooses $x = 0$ with probability $\nu^* < 1$ if $s = 0$.*

Proof. See the Appendix.

To understand this result, at first we have to compute the *ex post* reputations, $\hat{\mu}_p(x, \theta, \nu^*)$, under this equilibrium. When the evaluator observes x and θ, based on the equilibrium strategy ν^*, the values of $\hat{\mu}_p(x, \theta, \nu^*)$ are

$$\hat{\mu}_p(0, 0, \nu^*) = \frac{\mu_p}{\mu_p + (1 - \mu_p)\nu^*}, \tag{6}$$

$$\hat{\mu}_p(1, 1, \nu^*) = \frac{\mu_p q}{\mu_p q + (1 - \mu_p)(q + (1 - q)(1 - \nu^*))}, \tag{7}$$

$$\hat{\mu}_p(1, 0, \nu^*) = \frac{\mu_p(1 - q)}{\mu_p(1 - q) + (1 - \mu_p)(1 - q\nu^*)}, \tag{8}$$

$$\hat{\mu}_p(0, 1, \nu^*) = \frac{\mu_p}{\mu_p + (1 - \mu_p)\nu^*}. \tag{9}$$

We can show the following relationship:

$$\hat{\mu}_p(0, 0, \nu^*) = \hat{\mu}_p(0, 1, \nu^*) \geq \mu_p \geq \hat{\mu}_p(1, 1, \nu^*) \geq \hat{\mu}_p(1, 0, \nu^*). \tag{10}$$

The equalities hold if and only if $\nu^* = 1$. When $\nu^* < 1$, two implications can be drawn from this relationship. First, taking the right action yields higher *ex post* reputation than when taking the wrong action. Second, when choosing action $x = 0$, the principal renders *ex post* reputation not only higher than that from $x = 1$, but also higher than her *ex ante* reputation, even when it is a wrong policy. The effect is the opposite for the action $x = 1$. This gives both principals the incentives to choose action $x = 0$ when they care about reputation.

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they either always take the same action when keeping the authority, or always delegate the authority (which can happen when γ is large than $1/\mu_p$). In this case, no matter whether the decision is made correctly or not, the reputation is the same as the prior μ_p, and reputation concerns play no role.

Therefore, in this equilibrium, since the good principal prefers action $x = 0$ if $s = 0$ without reputation concerns, she has even more incentives to select the appropriate action. If $s = 1$, then she might wish to choose $x = 0$ because of the reputation concerns; however, under Assumption 1, she will still choose $x = 1$. On the other hand, the biased principal may choose $x = 0$ when $s = 0$, even though she prefers $x = 1$; however, she will not always do so (i.e., $\nu^* < 1$). The reason is simple. Given the good principal's appropriate decision-making, if the biased principal chooses $\nu^* = 1$, then the evaluator cannot distinguish the good type from the biased one, which will reduce the *ex post* reputation to its prior level. The biased type can then choose $x = 1$ without damaging her reputation (i.e. $\nu^* = 0$), which, however, cannot be consistent with the evaluator's belief. Therefore, it must be the case that $\nu^* < 1$.

Agent's Authority

As shown in the previous subsection, the evaluator's expected utility under the agent's authority is $-(1 - \mu_a)/2$.

The Evaluator's Choice of Allocation of Authority

From the evaluator's view, the optimal decision is $x = \theta$. When $\theta = 1$, $x = 1$ is implemented with probability 1 under the agent's authority, but with probability $q + (1 - q)(1 - \mu_p)(1 - \nu^*)$ under the principal's authority. Since the agent has better information, the agent's authority is always better than the principal's authority when $\theta = 1$. On the other hand, when $\theta = 0$, $x = 0$ is implemented with probability μ_a under the agent's authority, and with probability $q(\mu_p + (1 - \mu_p)\nu^*)$ under the principal's authority. In this case, since the delegated agent may be biased, the principal's authority can be better than the agent's authority even though the agent has more precise information. Therefore, the evaluator faces a trade-off between utilizing more precise information from the agent and obtaining more appropriate decision making from the principal.

The evaluator's expected utility under the principal's authority (denoted by P) becomes

$$EU_e(P) = -\frac{1}{2}\{1 - q[\mu_p + (1 - \mu_p)\nu^*]\} - \frac{1}{2}\{1 - [q + (1 - q)(1 - \mu_p)(1 - \nu^*)]\}, \quad (11)$$

and under the agent's authority (denoted by A)

$$EU_e(A) = -\frac{1}{2}(1-\mu_a). \tag{12}$$

It can be easily seen that $EU_e(P) \geq EU_e(A)$ if and only if $q \geq \hat{q}$, where

$$\hat{q} \equiv \frac{1}{2}\left(1 + \frac{\mu_a}{\mu_p + (1-\mu_p)\nu^*}\right). \tag{13}$$

Therefore, we have the following proposition:

Proposition 3. *Under Assumption 1, suppose that the principal's type is private information and the allocation of authority is determined to maximize the evaluator's welfare. Then the evaluator prefers the principal's authority if and only if* $q \geq \hat{q}$, *where* $\hat{q} = [1 + \mu_a/(\mu_p + (1-\mu_p)\nu^*)]/2$ *and* ν^* *is the probability that the biased principal chooses* $x = 0$ *when* $s = 0$ *in the equilibrium under the principal's authority.*

Similar to Proposition 1, the evaluator prefers the agent's authority when the agent's information is relatively precise (q is close to 1/2) or when the agent is more likely to be a good type than the principal is (μ_a is relatively larger than μ_p). Moreover, we offer a new factor regarding the principal's reputation concerns that can also affect the delegation policy. With no reputation concerns, $\nu^* = 0$ in equilibrium, so the evaluator prefers the principal's authority if $q \geq (1 + \mu_a/\mu_p)/2$. Since the threshold $\hat{q}$ is decreasing in ν^*, reputation concerns increase the rationality of the principal's authority: the evaluator prefers the principal's authority more if the biased principal makes the appropriate decision more likely. This result is summarized in the following remark:

Remark 1. *Suppose that the principal's type is private information and the allocation of authority is determined to maximize the evaluator's welfare. Then the principal's authority is more preferable when the principal's reputation concerns are more important.*[8]

It would be interesting to compare the result in the case of the principal's type being private information to that in the public information case. The following remark summarizes the results in this section:

[8] When ν^* is interior, ν^* solves $1 = \gamma\big[(1-q)(\hat{\mu}_p(0,1,\nu^*) - \hat{\mu}_p(1,1,\nu^*)) + q(\hat{\mu}_p(0,0,\nu^*) - \hat{\mu}_p(1,0,\nu^*))\big]$. One can check that when γ is larger, ν^* is also larger. This implies that if γ is larger, the right-hand side of equation (13) will be smaller, which follows that the principal's authority is more preferable.

Remark 2. *Suppose that the allocation of authority is determined to maximize the evaluator's welfare. Then when the principal's type is her private information, the evaluator prefers the good principal to have the authority less likely, and the biased principal to have the authority more likely, compared to the case where her type is known.*

It is because $\hat{q} > \bar{q}$, compared to the public information case, the evaluator prefers the good principal to have the authority less likely, in the sense that the principal has to be more accurate to have the authority. This is intuitive: because the principal's type is unknown, under the principal's authority, the biased principal has a chance to make the decision, which can be inappropriate sometimes. Thus, the evaluator prefers the principal's authority less compared to that when he knows her type. This also implies that the principal's private information leads to an efficiency loss regarding the good principal's allocation of authority. On the other hand, when the principal's type is unknown, the biased principal, when she has the authority, will choose the appropriate action with some probability due to her reputation concerns. This can improve efficiency in terms of the decision making. To see this, remember that in the known type case, the agent always has the authority, which yields the evaluator an expected payoff of $-(1-\mu_a)/2$. However, in the unknown type case where the principal has the authority and she is indeed biased, the evaluator's expected utility will be $-[1-\nu^*(2q-1)]/2$. Thus, the evaluator is better off when the biased principal has the authority if and only if $q \geq [1+\mu_a/\nu^*]/2$ ($> \hat{q}$). As a result, if q or ν^* is sufficiently large, efficiency can be improved under the principal's authority when she is a biased type, but will decrease when she is a good type, and therefore, the overall effect is ambiguous. Nevertheless, it can be seen that when ν^* or q is sufficiently small, the evaluator's welfare in the known type case will certainly higher than that in the unknown type case.

4 Principal's Delegation Policy

In this section, we consider the case where the principal can choose the allocation of authority but the evaluator may not be able to observe it. Because of unobservability, the principal cannot affect her reputation directly through her delegation policy. Rather, the evaluator has to form a belief in who actually makes the decision, and in equilibrium, this belief must be consistent with the principal's choice of allocation. If the evaluator falsely believes that the agent makes the decision while it is actually done by the principal, the principal can use the delegation policy and the chosen decision to manipulate her reputation, which would result in a higher payoff than in the equilibrium.

Namely, let α^G (resp. α^B) be the probability that the good (resp. the biased) principal keeps the decision-making authority, and $\hat{\alpha}^G$ (resp. $\hat{\alpha}^B$) is the evaluator's belief regarding α^G (resp. α^B). Thus, the evaluator believes that the decision-making authority belongs to the principal with probability $\mu_p \hat{\alpha}^G + (1 - \mu_p)\hat{\alpha}^B$, and to the agent with probability $1 - (\mu_p \hat{\alpha}^G + (1 - \mu_p)\hat{\alpha}^B)$. Denote $(\alpha^{G*}, \alpha^{B*})$ as the equilibrium pair, which should satisfy the following two requirements:

1. For a given belief $(\hat{\alpha}^G, \hat{\alpha}^B)$, it is optimal for the good principal to keep the authority with probability α^{G*}, and for the biased principal to keep the authority with probability α^{B*}.

2. The evaluator's belief must be correct in the equilibrium. That is, $(\hat{\alpha}^G, \hat{\alpha}^B)$ is the same as $(\alpha^{G*}, \alpha^{B*})$ in the equilibrium.[9]

In order to understand the effect of the principal's reputation concerns on her delegation policy, we first consider the case when there is no reputation concern. The following result is immediately:

Proposition 4. *Suppose that the principal has no reputation concern and she can decide the allocation of decision-making authority. Then the good principal will keep the authority if and only if $q \geq \bar{q}$, and the biased principal will always keep the authority.*

Proof. Since the good principal has the same preference as the evaluator, she will choose the same one as in the socially determined case when the principal is known as a good

[9] In the definition of our equilibrium concept, we assume that the evaluator will form a belief regarding the principal's choice of mixed strategies. This is a direct application of the usual treatment in the literature of career concerns, in which it is assumed that the evaluator will conjecture the player's choice of a certain action (usually a pure strategy) and the belief is consistent with the actual one chosen on the equilibrium path.

type (i.e., Proposition 1). On the other hand, the biased principal always wants to choose her favorite policy, $x = 1$. There is always a loss to her to delegate because there is a chance that the agent may be good, so that $x = 0$ may be chosen. □

This proposition shows the principal's intrinsic liking of the allocation of authority when she has the control right over it. With no reputation concerns, the good principal will never abuse her control right over the delegation policy, but the biased principal will always abuse the control right by keeping the authority, and choose her most preferred policy. This is obviously not efficient because the evaluator prefers the agent's authority if she knows the principal is biased. Therefore, even when there is no reputation concern, letting the principal have the control right over the allocation of authority will lead to some efficiency loss since the biased type keeps too much the authority.

Now we consider the effect of the principal's reputation concerns on the delegation policy. We will focus on the equilibrium which shares the same property as that analyzed in the previous section: under the principal's authority, the good principal always chooses $x = s$, and the biased principal always chooses $x = 1$ when $s = 1$, but chooses $x = 0$ with probability ν when $s = 0$. Again, under the agent's authority, the good agent always chooses $x = \theta$ and the biased agent always chooses $x = 1$. In this equilibrium, given the realized θ and x, the evaluator's belief $(\hat{\alpha}^G, \hat{\alpha}^B)$, and the equilibrium strategy ν, the principal's *ex post* reputations $\hat{\mu}_p(x, \theta, \nu, \hat{\alpha}^G, \hat{\alpha}^B) \equiv \tilde{\mu}_p(x, \theta, \nu)$ can be computed as follows:

$$\tilde{\mu}_p(0, 0, \nu) = \frac{\mu_p[\hat{\alpha}^G q + (1 - \hat{\alpha}^G)\mu_a]}{\mu_p[\hat{\alpha}^G q + (1 - \hat{\alpha}^G)\mu_a] + (1 - \mu_p)[\hat{\alpha}^B q\nu + (1 - \hat{\alpha}^B)\mu_a]}, \tag{14}$$

$$\tilde{\mu}_p(1, 1, \nu) = \frac{\mu_p[\hat{\alpha}^G q + (1 - \hat{\alpha}^G)]}{\mu_p[\hat{\alpha}^G q + (1 - \hat{\alpha}^G)] + (1 - \mu_p)[\hat{\alpha}^B (q + (1 - q)(1 - \nu)) + (1 - \hat{\alpha}^B)]}, \tag{15}$$

$$\tilde{\mu}_p(1, 0, \nu) = \frac{\mu_p[\hat{\alpha}^G (1 - q) + (1 - \hat{\alpha}^G)(1 - \mu_a)]}{\mu_p[\hat{\alpha}^G (1 - q) + (1 - \hat{\alpha}^G)(1 - \mu_a)] + (1 - \mu_p)[\hat{\alpha}^B (1 - q\nu) + (1 - \hat{\alpha}^B)(1 - \mu_a)]}, \tag{16}$$

$$\tilde{\mu}_p(0, 1, \nu) = \frac{\mu_p \hat{\alpha}^G}{\mu_p \hat{\alpha}^G + (1 - \mu_p)\hat{\alpha}^B \nu}. \tag{17}$$

The next proposition is the key result of this paper. We characterize the optimal delegation policy for both the good and the biased principals. Basically, the biased principal has an incentive to mimic the good one, and the good principal wishes to be distinguished. Interestingly, we show that both types of the principal will tend to keep the decision-making right excessively, compared to the socially determined level.

Proposition 5. *Consider the equilibrium where the good principal always chooses $x = s$, and the biased principal always chooses $x = 1$ when $s = 1$, but $x = 0$ with probability ν^{**} when $s = 0$ under the principal's authority. Then the good principal keeps the authority if and only if her signal is sufficiently accurate, and the biased principal always keeps the authority. Both types keep too much the authority from the evaluator's point of view.*

The proof is composed of three lemmas as follows. To be succinct, we denote by $\mathcal{E}(\nu^{**})$ the equilibrium profile under the principal' authority in which the good principal always chooses $x = s$, and the biased principal always chooses $x = 1$ when $s = 1$, but $x = 0$ with probability ν^{**} when $s = 0$.

4.1 The Good Principal's Delegation Policy

As stated before, when the principal's type is known as a good type, the society prefers her to have the authority if and only if $q \geq \bar{q}$, where $\bar{q}$ is the critical value defined in (5), which is also the best delegation policy when she has no reputation concerns. However, when she has reputation concerns, her delegation policy is affected by the relative benefits between making the correct decision and her reputation. The following lemma and Figure 1 characterize the good principal's delegation policy.

Lemma 1. *Given $\mathcal{E}(\nu^{**})$, the good principal chooses $\alpha^{G*} = 1$ if and only if $q \geq \tilde{q}$, where $\mu_a \leq \tilde{q} \leq \bar{q}$.*

Proof. See the Appendix.

The intuition for this result is as follows. If the evaluator believes that the good principal is very likely to keep the authority, the principal will be more responsible for the credit and blame from the decision making. Since the agent may be biased with some probability, delegation (given that the evaluator believes the principal is in charge) can hurt her *ex post* reputation seriously if a wrong policy is implemented. However, if her

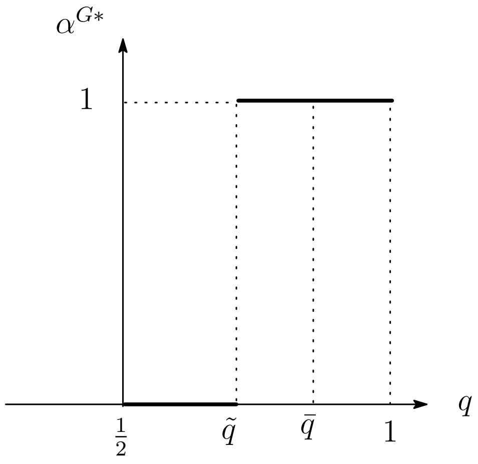

Figure 1: The good principal's equilibrium α^{G*}

information is sufficiently precise, the good principal has the confidence to make the right decision, and therefore she prefers to keep the authority so that she can influence her reputation more effectively. Thus, the evaluator's belief is confirmed in equilibrium. On the contrary, if the principal's information is less precise, and the evaluator believes that it is more likely that the agent has the authority, the *ex post* reputation is indeed close to the prior belief, and thus cannot be affected significantly by the principal's decision making. Hence, it is more important for the good principal to make the right decision than to increase her reputation, and so she prefers delegation. Again, this will confirm the evaluator's belief in equilibrium.

The idea behind the proof is based on the fact that the gains in the *ex post* reputations from choosing action $x = 0$, $\tilde{\mu}_p(0, 1, \nu) - \tilde{\mu}_p(1, 1, \nu)$ and $\tilde{\mu}_p(0, 0, \nu) - \tilde{\mu}_p(1, 0, \nu)$, are increasing in $\hat{\alpha}^G$ at $q = \bar{q} > \mu_a$. Because the biased principal always has some chance to choose action $x = 1$, this increases the good principal's incentive to keep the authority and choose the action $x = 0$ in order to be distinguished from the biased one. However, it can be beneficial only if the evaluator believes that the good principal is very likely to keep the authority and the information is accurate enough.

From this result, we can see that if the principal can decide the delegation policy, since $\tilde{q} \leq \bar{q}$, the principal's reputation concerns result in the authority being excessively allocated to the principal, in the sense that, compared to the case where the allocation is socially determined and her type is known, or to the case where the delegation policy is determined by the principal but she has no reputation concerns, the level that she keeps the authority is greater than the optimal one from the evaluator's point of view.

This interesting result is related to the "political correctness" phenomenon addressed by Morris (2001), in that a good principal has the incentives to choose the "appropriate" decision *too often* in order to be distinguished from the biased type. Likewise, a phenomenon of "stopping the buck" happens in this paper: when the good principal has accurate enough information, she has a strong incentive to keep the authority and make the right decision because she has the self confidence. However, this indeed leads to some efficiency loss from the evaluator's point of view, because sometimes the information the principal possesses is not accurate enough for her to make the decision on her own.

4.2 The Biased Principal's Delegation Policy

The next lemma describes the biased principal's optimal delegation policy.

Lemma 2. *Given $\mathcal{E}(\nu^{**})$, the biased principal always chooses $\alpha^{B*} = 1$.*

Proof. See the Appendix.

This lemma states that the biased principal always keeps the authority in the equilibrium. The intuition is as follows. According to the *ex post* reputations defined in (14)-(17), by two ways the biased principal can increase the gain in reputation when choosing $x = 0$ (or the cost from choosing $x = 1$): he can either delegate the authority more likely (i.e., a lower $\hat{\alpha}^B$), or keep the authority but decrease the probability of making the appropriate decision (i.e., a lower ν). However, there is another cost from delegation: with probability μ_a that the agent is good, a preferred action $x = 1$ will not be chosen if the biased principal delegates the authority. As we have seen in Proposition 4, even without reputation concerns, the biased principal has the tendency to keep the authority. Therefore, she would rather keep the authority and choose the appropriate decision sometimes than delegate the authority.

However, compared to the case where the principal's type is public information and the allocation of authority is socially determined, in which case the biased principal never has the authority, the biased principal will keep too much the authority. To see this, first note that in contrast to known type case, the biased principal may choose the appropriate decision sometimes when $s = 0$, which means that the quality of decision making is improved. In this case, the evaluator's expected utility under the principal's authority will be $-[1 - \nu^{**}(2q - 1)]/2$ for a given ν^{**}, and that under the agent's authority is $-(1 - \mu_a)/2$. Thus, the evaluator prefers the biased principal to keep the authority if and only if $q \geq [1 + \mu_a/\nu^{**}]/2$ $(> \bar{q} \geq \tilde{q})$. That is, the biased principal should delegate the authority to a greater extent than the good principal does. However, according to this lemma, the biased principal will always keep the authority in equilibrium, and so even though the decision making made by the biased principal can be improved, she still keeps too much the authority from the evaluator's point of view.

4.3 The Principal's Decision Making

The following lemma considers the principal's optimal decision making, which is characterized by $\mathcal{E}(\nu^{**})$.

Lemma 3. *Suppose that the good principal chooses $\alpha^{G*} = 1$ if and only if $q > \tilde{q}$, and that the biased principal always chooses $\alpha^{B*} = 1$. Then, if Assumption 1 holds, there exists an equilibrium $\mathcal{E}(\nu^{**})$.*

Proof. See the Appendix.

This lemma states that, given the delegation policies described in Lemmas 1 and 2, the equilibrium profile $\mathcal{E}(\nu^{**})$ does exist. The idea is to show that choosing action 0 still renders higher *ex post* reputations. Under Assumption 1, the good principal will always choose the appropriate action, and the biased principal will choose the appropriate action when $s = 1$, but only with some probability ν^{**} when $s = 0$. We can see that, compared to Proposition 4, the good principal's decision making has no difference, but the biased principal's decision making can be improved due to her reputation concerns, because she may choose $x = 0$ with some probability when $s = 0$.

To sum up, comparing Proposition 5 with Propositions 1 and 4, we find that:

1. Reputation concerns provide the good principal the incentives to keep too much the authority.

2. The biased principal prefers to keep the authority even without reputation concerns, but with reputation concerns, her decision making can be improved. However, even so, the biased principal still keeps too much the authority.

It is also interesting to compare the results in this section to that in section 3.2, where the allocation of authority is socially determined but the principal's type is unknown. The principal has reputation concerns in both situations; the only difference is whether or not the evaluator can observe who makes the decision. If the principal can determine the allocation of authority, her choice of delegation policy can somehow reflect the information regarding her type, and therefore, the allocation of authority may be more efficient compared to the case where the evaluator cannot observe the type of the principal. However, as we mentioned before, letting the principal have the control over the allocation of authority has already caused some loss in efficiency. In fact, comparing Proposition 5 with Proposition 3, the conclusion is ambiguous in terms of the efficiency in the allocation of authority.

In terms of the decision making, we have the following remark:

Remark 3. $\nu^{**} \leq \nu^{*}$.

This remark claims that, compared to the case where the allocation of authority is determined by the evaluator, the probability that the biased principal will choose $x = 0$ when $s = 0$ becomes smaller. The reason for this is that, according to Proposition 5, the good principal will sometimes delegate the authority, and therefore the cost (i.e. the loss in *ex post* reputation) from choosing $x = 1$ to the biased principal will decrease because the blame is partially shifted to the biased agent. Thus, compared to the case where the evaluator knows (or believes) that it is the principal who makes the decision (i.e.,

$\hat{\alpha}^G = \hat{\alpha}^B = 1$), the biased principal has a weaker incentive to choose the appropriate decision when $s = 0$. In particular, if the evaluator believes that the good principal always delegates the authority (i.e., $\hat{\alpha}^G = 0$), the biased principal will always choose $x = 1$ ($\nu^{**} = 0$) when she keeps the authority, in which case she will completely share the blame with the agent. Behaving more appropriately or masquerading the good principal will not affect her reputation, so that she will become completely biased when $s = 0$.

This result can be interpreted as a example of "passing the buck." When the evaluator knows that it is the principal who makes the decision, the principal will take all the credit or blame. So if she chooses her preferred policy, it may hurt her reputation badly, and thus she will behave more appropriately. However, if the evaluator cannot observe the allocation of authority, as long as the evaluator believes that she is not completely responsible for the decision and outcome, she can partially shift the blame to the agent, who has some probability of being biased, and can therefore be in a better position to choose her ideal policy.

5 Extensions

5.1 Observable Allocation of Authority

In this paper, it is assumed that the evaluator cannot observe who the decision maker is. If instead, the allocation of authority can be observable by the evaluator, then the delegation policy becomes a signaling device regarding the type of the principal. In this case, the principal's reputation is updated based on two signals: the quality of decision making and the choice of delegation.

It is possible that the evaluator only use one of the signals. If he only considers the delegation policy as the signal, then the game becomes a typical signaling game. In this case, we can show that there are two types of equilibria. When the reputation concerns are large, then the equilibrium is a pooling one: both types delegate the authority. When the reputation concerns are intermediate, the equilibrium is a semi-separating one: the biased principal always keeps the authority and the good principal keeps the authority only with some probability. The latter case is indeed similar to the case in Section 4, and it remains valid that both types of the principal keep too much the authority. If the evaluator use both signals, then we need to consider a multi-dimensional signaling game. The complete analysis is beyond the scope of the paper.

5.2 Other Equilibria

Under Assumption 1, in addition to the one described in Proposition 2, there may exist another non-pooling equilibrium where: (1) the good principal chooses $x = 0$ if $s = 0$ with probability 1, and $x = 1$ if $s = 1$ with probability $\nu_G^* < 1$; and (2) the biased principal chooses $x = 1$ if $s = 1$ with probability 1, and $x = 0$ if $s = 0$ with probability $\nu_B^* < 1$. There is no other non-pooling equilibrium.[10] Therefore, the good principal may sometimes make the wrong decision on purpose, which is similar to the situation raised in Morris (2001). In terms of the quality of decision making, the one proposed in Proposition 2 is apparently more efficient than any other.

When other equilibria are under consideration, for example, when Assumption 1 is relaxed so that the principal has a larger reputation concern, the *ex post* reputations become less sensitive to whether the policy is right or wrong. In this case, we think that there remains a tendency to retain too much authority, because the principal, especially the good type, can manipulate their reputations both through delegation policy and decision making (i.e., ν_G).

5.3 The Agent's Reputation Concerns

So far, the agent basically plays no important role in the analysis. In the case where the agent also has reputation concerns, the biased agent may choose the right decision when he is delegated. Delegation becomes better for the decision making and so the principal may delegate the authority more likely. However, there may occur another distortion in the good agent's decision making, because he wants to be distinguished from the biased

[10] The proof is available upon request.

agent. The analysis will certainly become much more complicated but is worth of pursuing in the future.

6 Concluding Remarks

In this paper, we investigate how the principal allocates the decision-making authority when she has reputation concerns. We argue that the principal keeps too much the authority from the evaluator's point of view. Especially, there occurs a so-called "stopping the buck" phenomenon: when her information is sufficiently accurate, the good principal will try to keep the authority and make the right decision rather than delegate the authority to the agent, even though sometimes from the evaluator's point of view, her information is not accurate enough to make the decision on her own.

Our attention is restricted to some specific equilibrium in which the good principal always chooses the right policy. A more general analysis of the optimal delegation policy with all possible equilibria may be called for. In particular, the good principal may have an incentive to choose a wrong decision in order to differentiate herself from the biased one. However, our haunch is that the tendency to retain too much authority still remains. A general model that incorporates the agent's reputation concerns or delegation policy as a signaling device is also interesting and worth pursuing.

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Appendix

Proof of Proposition 2. The proof is composed of the following Lemmas 4 and 5:

Lemma 4. *Suppose that the biased principal chooses $x = 1$ when $s = 1$, and $x = 0$ with probability $\nu^* < 1$ when $s = 0$. Then, under Assumption 1, the good principal always chooses $x = s$.*

Proof. When $s = 0$, if the good principal chooses $x = 0$, she obtains $\frac{1}{2}q\gamma\hat{\mu}_p(0,0,\nu) + \frac{1}{2}(1-q)[-1+\gamma\hat{\mu}_p(0,1,\nu)]$. If she instead chooses $x = 1$, she obtains $\frac{1}{2}q[-1+\gamma\hat{\mu}_p(1,0,\nu)] + \frac{1}{2}(1-q)\gamma\hat{\mu}_p(1,1,\nu)$. Then according to (10) and $q > 1/2$, it is easy to see that she will always choose $x = 0$.

When $s = 1$, if the good principal implements $x = 0$, then her expected utility becomes $\frac{1}{2}q[-1+\gamma\hat{\mu}_p(0,1,\nu)] + \frac{1}{2}(1-q)\gamma\hat{\mu}_p(0,0,\nu)$. If she chooses $x = 1$ instead, her expected utility is $\frac{1}{2}q\gamma\hat{\mu}_p(1,1,\nu) + \frac{1}{2}(1-q)[-1+\gamma\hat{\mu}_p(1,0,\nu)]$. Then if

$$2q - 1 \geq \gamma\big[q(\hat{\mu}_p(0,1,\nu) - \hat{\mu}_p(1,1,\nu)) + (1-q)(\hat{\mu}_p(0,0,\nu) - \hat{\mu}_p(1,0,\nu))\big], \tag{A.1}$$

she will choose $x = 1$. According to (6)-(9), $\hat{\mu}_p(1,0,\nu)$ and $\hat{\mu}_p(1,1,\nu)$ are increasing in ν, and $\hat{\mu}_p(0,1,\nu)$ and $\hat{\mu}_p(0,0,\nu)$ are decreasing in ν. Thus, if $\nu = 0$, $\hat{\mu}_p(0,1,\nu) - \hat{\mu}_p(1,1,\nu)$ and $\hat{\mu}_p(0,0,\nu) - \hat{\mu}_p(1,0,\nu)$ reach their largest values, which are equal to $\frac{1-\mu_p}{1-\mu_p q}$ and $\frac{1-\mu_p}{1-\mu_p(1-q)}$, respectively. Thus, under Assumption 1, and $q > 1/2$, (A.1) is satisfied. □

Lemma 5. *Suppose that the good principal always chooses $x = s$. Then, under Assumption 1, the biased principal always chooses $x = 1$ if $s = 1$, and $x = 0$ with probability $\nu^* \in [0,1)$ if $s = 0$.*

Proof. Suppose that $s = 1$ is observed. If the biased principal chooses $x = 1$, she obtains $\frac{1}{2}q\gamma\hat{\mu}_p(1,1,\nu) + \frac{1}{2}(1-q)\gamma\hat{\mu}_p(1,0,\nu)$. If she instead chooses $x = 0$, she obtains $\frac{1}{2}q[-1+\gamma\hat{\mu}_p(0,1,\nu)] + \frac{1}{2}(1-q)[-1+\gamma\hat{\mu}_p(0,0,\nu)]$. Thus, she chooses $x = 1$ if

$$1 \geq \gamma\big[q(\hat{\mu}_p(0,1,\nu) - \hat{\mu}_p(1,1,\nu)) + (1-q)(\hat{\mu}_p(0,0,\nu) - \hat{\mu}_p(1,0,\nu))\big]. \tag{A.2}$$

Note that (A.1) implies (A.2). Thus, the biased principal will always choose $x = 1$ if $s = 1$.

Suppose that $s = 0$ is observed. If she chooses $x = 1$, then her expected utility becomes $\frac{1}{2}q\gamma\hat{\mu}_p(1,0,\nu) + \frac{1}{2}(1-q)\hat{\mu}_p(1,1,\nu)$. If she chooses $x = 0$, her expected utility is

$\frac{1}{2}q[-1+\gamma\hat{\mu}_p(0,0,\nu)]+\frac{1}{2}(1-q)[-1+\gamma\hat{\mu}_p(0,1,\nu)]$. If

$$1 < \gamma\big[(1-q)(\hat{\mu}_p(0,1,\nu)-\hat{\mu}_p(1,1,\nu))+q(\hat{\mu}_p(0,0,\nu)-\hat{\mu}_p(1,0,\nu))\big],$$

she will always choose $x=0$, i.e. $\nu=1$. However, if so, all the posterior beliefs are equal to μ_p, so that the above inequality cannot hold. Therefore, it must be the case that $\nu^* < 1$. That is,

$$1 \geq \gamma\big[(1-q)(\hat{\mu}_p(0,1,\nu)-\hat{\mu}_p(1,1,\nu))+q(\hat{\mu}_p(0,0,\nu)-\hat{\mu}_p(1,0,\nu))\big] \tag{A.3}$$

must hold in equilibrium, which is always satisfied under Assumption 1. □

Proof of Proposition 5. Before proceeding our analysis, we first note that the following important relationships have to be satisfied for the equilibrium $\mathcal{E}(\nu)$ to be supportable:

$$\tilde{\mu}_p(0,0,\nu) \geq \mu_p \geq \tilde{\mu}_p(1,0,\nu) \ \text{ and } \ \tilde{\mu}_p(0,1,\nu) \geq \mu_p \geq \tilde{\mu}_p(1,1,\nu). \tag{A.4}$$

If (A.4) does not hold, the good principal may choose $x=1$ even when $s=0$ when she has the authority, which is not the equilibrium we are focusing on. (A.4) will hold if

$$\hat{\alpha}^G(q-\mu_a) \geq \hat{\alpha}^B(q\nu-\mu_a) \ \text{ and } \ \hat{\alpha}^G \geq \hat{\alpha}^B\nu. \tag{A.5}$$

In the following proofs, we will compute the principal's payoffs based on the belief $(\hat{\alpha}^G,\hat{\alpha}^B)$ and ν that satisfy (A.5), and then verify that the equilibrium $(\alpha^{G*},\alpha^{B*})$ indeed can satisfy (A.5).

Proof of Lemma 1. Given the evaluator's belief $(\hat{\alpha}^G,\hat{\alpha}^B)$, if the good principal keeps the authority in the equilibrium (i.e. $\alpha^G=1$), the expected payoff is

$$\begin{aligned} &\tfrac{1}{2}\big\{q\gamma\tilde{\mu}_p(0,0,\nu)+(1-q)\left[-1+\gamma\tilde{\mu}_p(1,0,\nu)\right]\big\} \\ +\ &\tfrac{1}{2}\big\{q\gamma\tilde{\mu}_p(1,1,\nu)+(1-q)\left[-1+\gamma\tilde{\mu}_p(0,1,\nu)\right]\big\}. \end{aligned} \tag{A.6}$$

When she delegates the authority (i.e. $\alpha^G=0$), her expected utility is

$$\frac{1}{2}\big\{\mu_a\gamma\tilde{\mu}_p(0,0,\nu)+(1-\mu_a)[-1+\gamma\tilde{\mu}_p(1,0,\nu)]\big\}+\frac{1}{2}\gamma\tilde{\mu}_p(1,1,\nu). \tag{A.7}$$

Thus, the good principal keeps the authority if and only if

$$\begin{aligned} &2q-1-\mu_a+\gamma\big\{(q-\mu_a)[\tilde{\mu}_p(0,0,\nu)-\tilde{\mu}_p(1,0,\nu)] \\ &+(1-q)[\tilde{\mu}_p(0,1,\nu)-\tilde{\mu}_p(1,1,\nu)]\big\}>0. \end{aligned} \tag{A.8}$$

There are two cases to consider. First, suppose that $q < \mu_a$. Then (A.8) can be rewritten as $(q-\mu_a)\{1+\gamma[\tilde{\mu}_p(0,0,\nu)-\tilde{\mu}_p(1,0,\nu)]\}-(1-q)\{1-\gamma[\tilde{\mu}_p(0,1,\nu)-\tilde{\mu}_p(1,1,\nu)]\}$, which is always negative according to (A.4) and Assumption 1. This implies that, the good principal will always delegate the authority when $q < \mu_a$.

Now suppose that $q \geq \mu_a$. Since both $\tilde{\mu}_p(0,0,\nu)-\tilde{\mu}_p(1,0,\nu)$ and $\tilde{\mu}_p(0,1,\nu)-\tilde{\mu}_p(1,1,\nu)$ are positive according to (A.4), when $q \geq \frac{1+\mu_a}{2} = \bar{q}$, the left-hand side of (A.8) is positive (since $2q-1-\mu_a \geq 0$), and so she will keep the authority with probability 1.

According to the following Lemma 2, in equilibrium, $\alpha^{B*} = 1$. Thus, the evaluator's belief must be $\hat{\alpha}^B = 1$. Based on this belief, for any $\hat{\alpha}^G$, we can show two facts: (i) $\tilde{\mu}_p(0,0,\nu) - \tilde{\mu}_p(1,0,\nu)$ is increasing in q, and $\tilde{\mu}_p(0,1,\nu) - \tilde{\mu}_p(1,1,\nu)$ is decreasing in q; (ii) $\tilde{\mu}_p(0,0,\nu) - \tilde{\mu}_p(1,0,\nu)$ is always larger than $\tilde{\mu}_p(0,1,\nu) - \tilde{\mu}_p(1,1,\nu)$. These two facts imply that the left-hand side of (A.8) is increasing in q.

Moreover, one also can check that $\tilde{\mu}_p(0,1,\nu) - \tilde{\mu}_p(1,1,\nu)$ is increasing in $\hat{\alpha}^G$, and if $q \geq \mu_a$, $\tilde{\mu}_p(0,0,\nu) - \tilde{\mu}_p(1,0,\nu)$ is also increasing in $\hat{\alpha}^G$. Suppose that (A.8) holds as an equality when $\hat{\alpha}^G = 1$. Then, when the evaluator believes $\hat{\alpha}^G < 1$, the left-hand side is smaller than 0 given the same ν, which further implies that $\alpha^{G*} < 1$.

According to the above analysis, we can conclude that there exists a $\tilde{q}$, where $\bar{q} \geq \tilde{q} \geq \mu_a$, such that the good principal with $q > \tilde{q}$ will keep the authority with probability 1, and with $q \leq \tilde{q}$ she will delegate the authority with some positive probability. Namely, $\tilde{q}$ is the type where (A.8) holds as an equality when $\hat{\alpha}^G = 1$, that is, the type who is indifferent in keeping and delegating the authority.

Proof of Lemma 2. Given the evaluator's belief $(\hat{\alpha}^G, \hat{\alpha}^B)$, the biased principal's expected payoff from keeping the authority (i.e. $\alpha^B = 1$) in this equilibrium is

$$\begin{aligned} &\tfrac{1}{2}\big\{q\,[\nu(-1+\gamma\tilde{\mu}_p(0,0,\nu)) + (1-\nu)\gamma\tilde{\mu}_p(1,0,\nu)] + (1-q)\gamma\tilde{\mu}_p(1,0,\nu)\big\} \\ +\;\; &\tfrac{1}{2}\big\{q\gamma\tilde{\mu}_p(1,1,\nu) + (1-q)\,[\nu(-1+\gamma\tilde{\mu}_p(0,1,\nu)) + (1-\nu)\gamma\tilde{\mu}_p(1,1,\nu)]\,\big\}. \end{aligned} \tag{A.9}$$

If the biased principal always delegates the authority (i.e. $\alpha^B = 0$), her expected utility is

$$\frac{1}{2}\big\{\mu_a(-1+\gamma\tilde{\mu}_p(0,0,\nu)) + (1-\mu_a)\gamma\tilde{\mu}_p(1,0,\nu)\big\} + \frac{1}{2}\gamma\tilde{\mu}_p(1,1,\nu). \tag{A.10}$$

If $\alpha^{B*} = 1$, then it must be the case that

$$\begin{aligned} &\mu_a\big\{1-\gamma[\tilde{\mu}_p(0,0,\nu)-\tilde{\mu}_p(1,0,\nu)]\big\} - \\ &\nu\big\{1-\gamma\big[q(\tilde{\mu}_p(0,0,\nu)-\tilde{\mu}_p(1,0,\nu)) + (1-q)(\tilde{\mu}_p(0,1,\nu)-\tilde{\mu}_p(1,1,\nu))\big]\big\} > 0. \end{aligned} \tag{A.11}$$

Now consider the biased principal's decision regarding ν. Suppose that the biased principal receives a signal $s = 0$. If she chooses $x = 1$, then her expected utility becomes $\frac{1}{2}q\gamma\tilde{\mu}_p(1, 0, \nu) + \frac{1}{2}(1 - q)\tilde{\mu}_p(1, 1, \nu)$. If she chooses $x = 0$, her expected utility is $\frac{1}{2}q[-1 + \gamma\tilde{\mu}_p(0, 0, \nu)] + \frac{1}{2}(1 - q)[-1 + \gamma\tilde{\mu}_p(0, 1, \nu)]$. Thus, she chooses $x = 0$ with $\nu > 0$ if and only if

$$1 \leq \gamma\big[(1 - q)(\tilde{\mu}_p(0, 1, \nu) - \tilde{\mu}_p(1, 1, \nu)) + q(\tilde{\mu}_p(0, 0, \nu) - \tilde{\mu}_p(1, 0, \nu))\big]. \tag{A.12}$$

In other words, $\nu\{1 - \gamma\big[q(\tilde{\mu}_p(0, 0, \nu) - \tilde{\mu}_p(1, 0, \nu)) + (1 - q)(\tilde{\mu}_p(0, 1, \nu) - \tilde{\mu}_p(1, 1, \nu))\big]\} \leq 0$ (including the case $\nu = 0$), which is the second term in (A.11). Also according to Assumption 1, the first term in (A.11) is always positive. Therefore, given any belief $(\hat{\alpha}^G, \hat{\alpha}^B)$ that satisfies (A.5), the left-hand side of (A.11) is always positive, that is, (A.11) holds. It follows that $\alpha^{B*} = 1$.

It remains to show that the equilibrium $(\alpha^{G*}, \alpha^{B*})$ can also be a correct belief by the evaluator. That is, $(\hat{\alpha}^G, \hat{\alpha}^B) = (\alpha^{G*}, \alpha^{B*})$ must satisfy (A.5). When $\alpha^{G*} = 0$, since $\alpha^{B*} = 1$, (A.5) is satisfied only when $\nu^{**} = 0$. This is true according to following Lemma 3. When $\alpha^{G*} = 1$ (which occurs when $q \geq \tilde{q} \geq \mu_a$), then (A.5) is obviously satisfied since $\nu^{**} < 1$. If $0 < \alpha^{G*} < 1$, in which case the principal is indifferent between keeping and delegating the authority, then (A.5) is satisfied as long as $\nu^{**} \leq \alpha^{G*}$. Since α^{G*} is free to choose (while ν^{**} is determined by (A.12) holding as an equality), there must exist some α^{G*} so that it is true. Therefore, $(\alpha^{G*}, \alpha^{B*})$ can constitute as an equilibrium.

Proof of Lemma 3 and Remark 3. We can apply the similar methodology of Proposition 2 to Lemma 3 and show that there exists an equilibrium $\mathcal{E}(\nu^{**})$ under Assumption 1.

To prove Remark 3, we first note that ν^* corresponds to the solution where $\hat{\alpha}^G = \hat{\alpha}^B = 1$ (i.e. when the evaluator believes that the principal always keeps the authority), and that if $1 > \nu^* > 0$, ν^* solves $\gamma\big[(1 - q)(\hat{\mu}_p(0, 1, \nu) - \hat{\mu}_p(1, 1, \nu)) + q(\hat{\mu}_p(0, 0, \nu) - \hat{\mu}_p(1, 0, \nu))\big] = 1$ in (A.3).

We notice that $\tilde{\mu}_p(0, 1, \nu) - \tilde{\mu}_p(1, 1, \nu)$ is increasing in $\hat{\alpha}^G$, and if $q \geq \mu_a$, $\tilde{\mu}_p(0, 0, \nu) - \tilde{\mu}_p(1, 0, \nu)$ is increasing in $\hat{\alpha}^G$ as well. Suppose that $q \geq \mu_a$. Since now $\hat{\alpha}^G \leq 1$, the gain in the reputation is smaller than that in the previous section, given the same ν. In particular, since the value on the right-hand side of (A.12) is decreasing in ν, this implies that $\nu^{**} \leq \nu^*$ when $q \geq \mu_a$.

Suppose that $q < \mu_a$. Then according to Lemma 1, $\alpha^{G*} = 0$ in equilibrium. Thus, we can impose $\hat{\alpha}^G = 0$ and $\hat{\alpha}^B = 1$ into (A.12). The right-hand side is always less than 1 if $\nu^{**} = 0$, according to Assumption 1. Since $\tilde{\mu}_p(0,1,\nu) - \tilde{\mu}_p(1,1,\nu)$ and $\tilde{\mu}_p(0,0,\nu) - \tilde{\mu}_p(1,0,\nu)$ are both decreasing in ν, $1 > \gamma\big[(1-q)(\tilde{\mu}_p(0,1,\nu) - \tilde{\mu}_p(1,1,\nu)) + q(\tilde{\mu}_p(0,0,\nu) - \tilde{\mu}_p(1,0,\nu))\big]$ is always the case for any $\nu > 0$. It follows that the biased principal will choose $\nu^{**} = 0$ when $\hat{\alpha}^G = 0$. This is also the only case that can satisfy (A.5).