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The Bright Side of Private Benefits

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Abstract

In many cases, the cost of an agent acquiring information is lower than that for the principal. However, because of a private benefit difference between the principal's and agent's preferences, the principal often cannot fully utilize the agent's advantage. This paper considers the cost of motivating the agent to acquire information and inducing him/her to report it truthfully. As usual, the larger the private benefit, the larger the cost of eliciting true information. At the same time, the private benefit may reduce the cost of motivating information acquisition. Thus, there are cases in which an agent with a different preference is desirable.

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1 Introduction

With every technological advance the world grows more complicated. A decision maker, or 'principal,' may no longer have the time or skill to gather and process information on complex issues. Thus, the principal often hires an expert, or 'agent,' and delegates these tasks to him/her. This delegation of responsibility may result in some efficiency loss. Economists have long discussed this so-called 'agency cost,' which is generally assumed to derive from existing diversification in preferences between the principal and the agent. In the standard formulation of the problem, it is assumed that the agent is completely and correctly informed in all relevant details, which may be a reasonable approximation of reality in some settings. Under this assumption, the agency cost is simply the cost of eliciting true information from the agent, and is increasing in the degree of diversification. However, it may be more reasonable to assume that the agent is not omniscient, and must personally incur some cost to acquire valuable information. For example, an expert must study consumers' needs and the expected future profitability of goods carefully before giving advice on improving a firm's economic performance. The question then is, what kind of agent minimizes agency cost?

My paper presents an analysis of the properties of agency cost and their relation to the degree of difference between the preferences of a principal and an agent in the presence of information management concerns. A simple model with one principal and one agent is used. The principal hires the agent to investigate the potential profitability of a project, which may be either good or bad. A good project yields positive profits for the principal, while a bad project earns negative profits. There is, however, a divergence in preference between the principal and the agent such that the agent receives a private benefit whenever the project is undertaken. The information is assumed to be 'soft,' *i.e.*, unverifiable by the principal ex ante. Therefore the principal must design a contract that induces truth telling, since the agent has an incentive to bend the truth. The principal must further consider how to motivate the agent to acquire information, since obtaining information is costly for the agent and information about his/her activity is private.

The finding in this paper is that incorporating these information management concerns into the basic model changes the optimal contract. In the standard formulation, the cost of eliciting true information is always increasing in the size of the private benefit, because in the absence of other incentives to tell the truth, the agent always prefers to report that a project is 'good' regardless of his/her actual observation. When the private benefit is large, it is thus more difficult to induce the agent to report truthfully that a project is 'bad.' In this case, the private benefit has only a dark side.

However, when the cost of motivating information acquisition is considered, the bright and dark sides of the private benefit are revealed. Because the information is soft, without actually obtaining the relevant information, the agent can report a finding of 'good' or 'bad.' The larger the private benefit, the greater the agent's potential benefit from failing to obtain the information and giving the project an uninformed evaluation of 'good.' On the other hand, a large private benefit *reduces* the agent's incentive to submit an uninformed report that the project is 'bad' because such a report will result in the abandonment of the project, and thereby prevent the agent from receiving a private benefit. In the current model, the constraints of eliciting true information are satisfied whenever the constraints of motivating information acquisition are satisfied. Hence, the agency cost is simply the cost of motivating information acquisition. In summary, the dark side of the private benefit is to discourage an uninformed evaluation of 'good,' while the bright side is to discourage an uninformed evaluation of 'bad.' When the bright side of the private benefit overwhelms the dark side, an increase in the size of the private benefit reduces the agency cost.

The constraint to acquire information and not reach an evaluation of 'bad' is binding only when the private benefit is not too large. When the private benefit is large enough, the liquidity constraint is effective and this information acquisition constraint is no longer binding. The agency cost is therefore v-shaped, *i.e.*, decreasing when the private benefit is small and increasing when it is large.

In principle, the task of information acquisition is allocated to those whose cost is the smallest. If only an information transmission problem exists, then the task is delegated only to those whose private benefit is small. However, decentralization is not uncommon. For example, in 80% of large Japanese firms,[1] there are unique labor–management relations, called *Joint Labor Management Committees (JLMC).* Within a JLMC, which involves both management and union representatives, basic business policies for social and athletic activities sponsored by the firm are discussed. According to Inagami (1988), a JLMC serves as a place for information exchange about

[1]Source: Human Resource Management Survey of Japanese Firms.

basic management decisions; the issues concerning the employer (working hours, wages and layoffs) are discussed with employees, and employee representatives even participate in decision making. Aside from JLMCs, supervisors and employees discuss issues concerning the shop floor in *Shop Floor Committees (SFC)*.[2] SFCs are aimed at employee participation at the grass roots level, resolving issues of working conditions at the shop floor level. For example, if a labor representative requests air-conditioners for the shop floor, then this issue is discussed by the JLMC and the management decides whether to purchase air conditioners.

Kato and Morishima (2002) reported that participatory employment practices such as JLMCs and SFCs lead to significant productivity increases. The principal profits from delegating to the JLMC and SFC even if their interests are not aligned. This phenomenon can be explained by the finding in the current paper, that the agent with some private benefit minimizes the agency cost. Besides JLMCs and SFCs, other recently popular ideas such as outsourcing, business alliances, networks, team-based production systems and so on appear to be associated with further moves toward decentralization.

I further extend the analysis to incorporate a risk-averse agent. In this case, as in the risk-neutral case, the presence of a private benefit relaxes the information acquisition constraint preventing the agent from delivering a 'bad' report. The private benefit now differently affects the information acquisition constraint for delivering a report of 'good.' The previously described tightening of the constraint as in the risk-neutral case still occurs,

[2] About 40% of Japanese firms have an SFC.

but, at the same time, the concavity of the utility function relaxes the effect of the private benefit. Thus, the constraint is now effectively loosened, and a large private benefit has a more positive effect for the principal than in the risk-neutral agent case.

This paper is closely related to other studies on delegation. A stream of papers, such as Jensen and Meckling (1992), Dessein (2002) and Harris and Raviv (2005), discuss the cost of eliciting information and the cost of delegating decision making. Suppose that the agent possesses information inevitable for decision making. When the right to make a decision is delegated to the agent, there exists a cost such that the agent makes a biased decision for private benefit. Also, similar to the current model, when the principal gets advice from the agent there is a cost of eliciting true information. Delegation is optimal if the cost of delegation exceeds the cost of eliciting information. Another stream is represented by Aghion and Tirole (1997), who discussed the relation between motivation for information acquisition and allocation of decision rights. Because the delegated agent can choose his/her preferred decision, which may not be the principal's preferred choice, his/her marginal return from information acquisition is larger than that of the nondelegated agent; he/she has a stronger incentive to acquire information than the nondelegated agent. Thus, there is a trade-off between the incentive to exert effort in information acquisition and biased decisions from delegation. Delegation is preferred when the profit from the motivating agent is larger than the cost of a biased decision. In both streams of papers, unlike the current article, a private benefit in the preference always increases all agency costs: the cost of the agent making a biased decision, the cost of eliciting information and the cost of motivating information acquisition.

Also closely related are papers on the information acquisition and information revelation problem, for example Prendergast (1993), Lewis and Sappington (1997) and Cremer, Khalil and Rochet (1998a, b). Unlike the present analysis, these papers did not relate the agent's preferences to agency cost. Only Cremer, Khalil and Rochet (1998a) addressed the issue of agency cost and the agent's motivation. In their model, for some strictly positive range of information acquisition costs, the agent is deterred from acquiring information under the standard contract, so efficiency loss is increasing in the cost of information acquisition. However, when the cost of information acquisition is too high, the principal does not want the agent to acquire information even though the agent would prefer to do so. This creates an efficiency loss stemming from the prevention of information acquisition, which is decreasing in the cost of information acquisition. Thus, social welfare is nonmonotonic in the cost of information acquisition.

The rest of the paper is organized as follows. Section 2 lays out the basic model. Section 3 characterizes the optimal incentive scheme and discusses the costs and benefits of private benefits. Section 4 and 5 extend the analysis to include unverifiability of the state of nature and a risk-averse agent. Section 6 concludes.

2 The Model

Consider one principal and one agent. The principal and the agent are risk neutral. The principal has a potential project, which yields a positive profit when the project is good, or negative profit when it is bad. When the project is canceled, the principal receives zero profit. The profit of the project is represented by the state of nature $\theta \in \{g, b\}$; the project is good when the state of nature is g, and the project is bad when the state of nature is b. The state of nature is g with probability p, and b with probability $1 - p$. All parties share this common prior. The state of nature is verifiable ex post. However, the principal cannot personally determine ex ante whether the project is good or bad. The agent, on the other hand, is an expert and can acquire private information and correctly predict the realization of the state of nature ex ante.[3] To acquire this information, the agent must exert some effort, incurring a private cost of $\gamma > 0$. It is assumed that the principal cannot observe whether the agent has acquired information or not, nor what was observed when the information was acquired. Because information acquisition is costly, the agent has an incentive to deliver a report without acquiring information. Furthermore, the agent has an incentive to falsify the report and maximize his/her private benefit $v > 0$ if the project is carried out.

To solve these problems, the principal designs a contract that motivates the agent to acquire information and report the finding truthfully. Let $\tilde{\theta}$ be

[3] The model can be extended to the case in which the agent acquires private information with probability ϕ incurring private cost $\gamma(\phi)$, which is an increasing convex function. The result is an analogy of the current one.

the report made by the agent. This report is assumed to be verifiable ex post. It is also assumed that the principal has imperfect commitment power, *i.e.*, the principal can fully commit to the transfer rule but not to a decision on the project. In this situation, the ordinary revelation principle is not applicable. However, Bester and Strausz (2001) have shown that a version of the revelation principle is applicable, and the analysis can be restricted to the direct mechanism, $\tilde{\theta} \in \{g, b\}$. The transfer must be nonnegative because of limited liability.[4] Now, the transfer rule is represented by $t : \{g, b\}^2 \rightarrow \Re^+$, contingent on the agent's report and ex post verifiable variables. The transfer received by the agent must be sufficiently high to induce the agent to participate in the contract. The outside opportunity is normalized to 0.

3 The Optimal Incentive Scheme, and the Cost and Benefit of the Private Benefit

It is assumed that the principal earns a net profit from hiring the agent. The analysis is restricted to a separating equilibrium in which the principal undertakes the project only when he/she receives message g.

The optimal contract must satisfy incentive compatibility constraints in order to guarantee that the agent reports his/her observation truthfully. Also, the contract must motivate the agent to acquire information. There are

[4] Limits on penalties are common in practice. See Chung (1992) and Stole (1992) for an economic analysis on invalidation of a large penalty. If unbounded penalties were feasible, the principal could extract all rent from the agent and induce efficient behavior by setting $t(g|b)$ and $t(b|g)$ sufficiently small. This is a well-known solution for the moral hazard problem when the agent is risk neutral, legal liability is unlimited and the agent has no private information about the state of nature before contracting.

many possible behaviors for an agent who does not obtain any information. Here, it is assumed that the agent makes up the evidence and reports as if he/she had actually observed the state of nature. This fabricated report may be either 'good' or 'bad.' It is therefore necessary to consider constraints for both these cases.

Since the principal cannot commit to the project decision, the project is undertaken only if he/she believes that the state is good. Under incentive compatibility without loss of generality, the principal undertakes the project only if he/she receives message g.[5] Given this ex post optimality among contracts that satisfy incentive compatibility and induce information acquisition, the optimal contract is the one that minimizes the expected payment. The principal's problem is:

$$\min_{t(\cdot|\cdot)\geq 0} pt(g|g) + (1-p)t(b|b),$$

s.t.

$$t(g|g) + v \geq t(b|g), \tag{IC_g}$$

$$t(b|b) \geq t(g|b) + v, \tag{IC_b}$$

$$p\{t(g|g)+v\}+(1-p)t(b|b)-\gamma \geq p\{t(g|g)+v\}+(1-p)\{t(g|b)+v\}, \tag{IA_g}$$

$$p\{t(g|g) + v\} + (1-p)t(b|b) - \gamma \geq pt(b|g) + (1-p)t(b|b), \tag{IA_b}$$

$$p\{t(g|g) + b\} + (1-p)t(b|b) - \gamma \geq 0. \tag{IR}$$

[5] There exists another separating equilibrium such that the project is undertaken only if the message is b. However, this equilibrium is equivalent to the above one.

The IC_θ constraint is the truth-telling constraint for state θ. The $IA_{\tilde{\theta}}$ constraint is the information acquisition constraint ensuring that the agent does not benefit from delivering message $\tilde{\theta}$. IR is the participation constraint.

Lemma 1. *The optimal transfer rule is:*

$$\begin{aligned} t(g|g) &= \max\left\{\frac{\gamma}{p} - v, 0\right\}, \\ t(b|b) &= \frac{\gamma}{1-p} + v, \\ t(g|b) &= t(b|g) = 0. \end{aligned}$$

Proof. First, from the IA_g (and/or IA_b) constraint and limited liability, the IR constraint is always satisfied.

Second, I show that $t(g|b) = t(b|g) = 0$. Because these transfers appear only on the right-hand side of the inequality, the smaller they are the more relaxed the constraint. It is optimal to set them as small as possible, *i.e.*, at 0.

Third, substitute $t(g|b) = t(b|g) = 0$ into the constraints. Then the constraints can be rewritten as follows.

$$t(g|g) \geq -v, \tag{IC'_g}$$

$$t(b|b) \geq v, \tag{IC'_b}$$

$$t(b|b) \geq \frac{\gamma}{1-p} + v, \tag{IA'_g}$$

$$t(g|g) \geq \frac{\gamma}{p} - v, \tag{IA'_b}$$

Since $\gamma > 0$, the IA'_g constraint implies the IC'_b constraint, and the IA'_g constraint implies the IC'_b constraint. So only the IA' constraints are binding.

Finally, the limited liability constraint gives the remaining conditions.

□

The IA'_g constraint is a function of $t(b|b)$, not $t(g|g)$, because this constraint opposes a 'good' message. Suppose the state of nature is g and the agent sends message g, then the principal cannot know if the agent's message is correct because it is based on information actually acquired or is simply a correct guess. The principal can reward or punish the agent only when the state of nature is b. When the message is correct, the agent receives reward $t(b|b)$, or otherwise is punished and receives $t(g|b)$. The private benefit between $t(b|b)$ and $t(g|b)$ should be large enough to motivate information acquisition; however, $t(g|b)$ is bounded by limited liability. When γ is large, large motivation is necessary for the agent to acquire information, hence $t(b|b)$ is large. Because this motivation can be provided only when the state of nature is b, $t(b|b)$ is decreasing in $1-p$, which is the probability of realization of b. A similar argument holds for the IA'_b constraint and $t(g|g)$.

Proposition 1. *The principal's expected payment is decreasing in v when $p > \frac{1}{2}$ and $\frac{\gamma}{p} \geq v$. Otherwise, the payment is increasing in v.*

Proof. The result is obtained by calculating the principal's expected payment. There are two cases. For both cases, the optimal transfers are obtained from Lemma 1.

First, when $\frac{\gamma}{p} - v \geq 0$, the principal's expected payment is:

$$pt(g|g) + (1-p)t(b|b) = (1-2p)v + 2\gamma,$$

which is decreasing in v and e when $1 - 2p < 0$.

Second, when $\frac{\gamma}{p} - v < 0$, the payment is:

$$pt(g|g) + (1-p)t(b|b) = (1-p)v + \gamma,$$

which is increasing in v. □

This result seems contrary to conventional wisdom, which argues that since the agent prefers to report g regardless of the true situation, the principal needs to provide truth-telling incentives when the state of nature is b. By this argument, the larger the private benefit the more difficult it is to induce honesty, and therefore the greater the efficiency loss. However, this interpretation holds only when information acquisition is not costly for the agent. When the principal must motivate information acquisition, this intuition does not apply because the incentive constraints no longer bind; only the information acquisition constraints are effective.

The information acquisition constraints are influenced by private benefit in the following manner. The agent can deliver either message g or message b. He/she prefers to deliver message g, because he/she enjoys a private benefit of v when the project is undertaken. Hence, a large v increases the incentive to report g, and reduces the incentive to report b. This intuition is confirmed by the two information acquisition constraints. The right-hand side of the IA'_g constraint is increasing in v, while the right-hand side of the IA'_b constraint is decreasing in v. So a large v is desirable when the effect in the IA'_b constraint dominates the effect in the IA'_g constraint.

The effect in the IA'_b constraint is realized through $t(g|g)$ and the effect in the IA'_g constraint is realized through $t(b|b)$. When p is large and the effect through $t(g|g)$ dominates the effect through $t(b|b)$, the effect in the IA'_b constraint dominates the effect in the IA'_g constraint.

This is the case only when the incentive acquisition constraints are binding, *i.e.*, when $\gamma > 0$. When $\gamma = 0$, the IC_g constraint is not binding and, from the IC_b constraint, $t(b|b)$ is increasing in v.

Corollary 1. *When $\gamma = 0$, i.e., when motivation for information acquisition is not required, the principal always prefers an agent with a small private benefit v.*

One further comment is called for. Note that the source of the private benefit is either the principal's benefit, or some source outside the relationship. Suppose the principal loses v when the project takes place, *i.e.*, the source of the agent's private benefit is a loss to the principal. Then the total cost of implementation is:

$$(1-2p)v + 2\gamma + pv = (1-p)v + 2\gamma,$$

which is clearly nondecreasing in v. This shows that private benefit is desirable only when at least part of the private benefit comes from an outside source.

3.1 Comparative Statics

It has been shown that the principal's cost of implementation is nonmonotonic in the private benefit v. Here, I describe more carefully the relation between private benefit and the principal's cost. Holding all parameters but v constant, the figures below show how the principal's cost varies with the size of the private benefit.

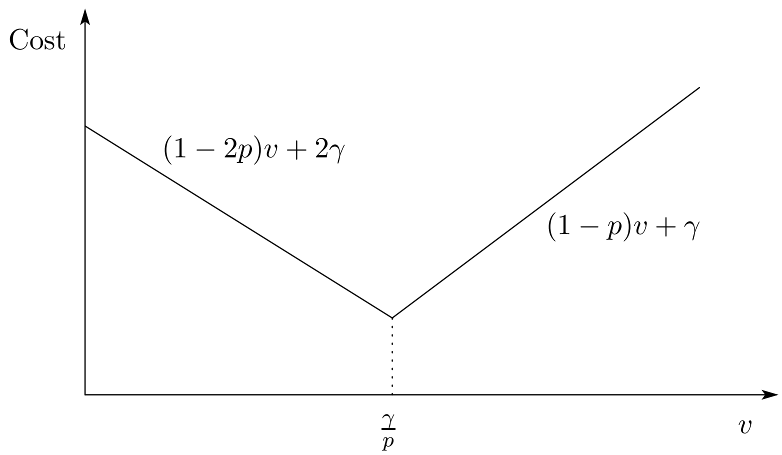

Figure 1: When $p > \frac{1}{2}$.

The figures make it clear that the cost is decreasing in private benefit only when private benefit is sufficiently small, or, specifically, when $v < \frac{\gamma}{p}$.

4 Unverifiability of the State of Nature

This section challenges the assumption I have made: ex post verifiability of the state of nature. The basic model is modified as follows: the realization of the state of nature can be verified when the project is undertaken, and can be verified with probability $1 > q > 0$ when the project is canceled, but is otherwise unverifiable. Given this ex post optimality, the principal undertakes the project only if he/she receives message g. In this situation, the transfers are $t(g|g)$, $t(g|b)$, $t(b|q)$, $t(b|b)$ and $t(b|\emptyset)$, where $t(b|\emptyset)$ is the transfer when the agent reports b and the principal cannot verify the state of nature. All transfers are nonnegative because of limited liability. The principal chooses the transfer rule that minimizes the expected payment subject to the constraints:

$$\min_{t(\cdot|\cdot)\geq 0} pt(g|g) + (1-p)\{qt(b|b) + (1-q)t(b|\emptyset)\},$$

s.t.

$$t(g|g) + v \geq qt(b|g) + (1-q)t(b|\emptyset), \tag{IC_g^v}$$

$$qt(b|b) + (1-q)t(b|\emptyset) \geq t(g|b) + v, \tag{IC_b^v}$$

$$\begin{aligned} &p\{t(g|g) + v\} + (1-p)\{qt(b|b) + (1-q)t(b|\emptyset)\} - \gamma \\ &\qquad \geq p\{t(g|g) + v\} + (1-p)\{t(g|b) + v\}, \end{aligned} \tag{IA_g^v}$$

$$\begin{aligned} &p\{t(g|g) + v\} + (1-p)\{qt(b|b) + (1-q)t(b|\emptyset)\} - \gamma \\ &\qquad \geq p\{qt(b|g) + (1-q)t(b|\emptyset)\} + (1-p)\{qt(b|b) + (1-q)t(b|\emptyset)\}, \end{aligned} \tag{IA_b^v}$$

$$p\{t(g|g) + b + e\} + (1-p)\{qt(b|b) + (1-q)t(b|\emptyset)\} - \gamma \geq 0. \tag{IR^v}$$

As in the basic model, the IR^v constraint is satisfied whenever the IA_g^v (and/or IA_b^v) constraint is satisfied. Both $t(g|b)$ and $t(b|g)$ are 0, and because they appear only on the right-hand side of the inequality, they can be minimized without violating the constraints. Substituting $t(g|b) = t(b|g) = 0$ into the constraints, I rewrite the equations as follows:

$$t(g|g) \geq (1-q)t(b|\emptyset) - v, \tag{$\widehat{IC}_g^v$}$$

$$qt(b|b) + (1-q)t(b|\emptyset) \geq v, \tag{$\widehat{IC}_b^v$}$$

$$qt(b|b) + (1-q)t(b|\emptyset) \geq \frac{\gamma}{1-p} + v, \tag{$\widehat{IA}_g^v$}$$

$$t(g|g) \geq (1-q)t(b|\emptyset) + \frac{\gamma}{p} - v. \tag{$\widehat{IA}_b^v$}$$

The $\widehat{IA}_g^v$ ($\widehat{IA}_b^v$) constraint shows that the $\widehat{IC}_b^v$ ($\widehat{IC}_g^v$) constraint is not binding when $\gamma > 0$. The $\widehat{IA}_g^v$ constraint is binding, otherwise one can decrease $t(b|b)$ or $t(b|\emptyset)$ without violating the constraints. Then, there are two possibilities, whether the $\widehat{IA}_b^v$ constraint is binding or not.

First, suppose the $\widehat{IA}_b^v$ constraint is not binding, then $t(g|g) = 0$. The expected payment of the principal is:

$$pt(g|g) + (1-p)\{qt(b|b) + (1-q)t(b|\emptyset)\} = \gamma + (1-p)v,$$

hence, it is increasing in v.

Next, consider when the $\widehat{IA}_b^v$ constraint is binding. Substituting the binding constraints into the principal's payment yields:

$$pt(g|g) + (1-p)\{qt(b|b) + (1-q)t(b|\emptyset)\} = (1-2p)v + 2\gamma + p(1-q)t(b|\emptyset).$$

It is optimal to choose $t(b|\emptyset) = 0$. Comparing the optimal payment for both cases, the $\widehat{IA}_b^v$ constraint is binding when $\frac{\gamma}{p} - v \geq 0$. In this case the expected payment is decreasing in v when $p > \frac{1}{2}$.

The above analysis shows that, when the principal can verify the state of nature with some positive probability, the result in the previous section is unchanged; the principal's expected payment may be decreasing in private benefit. When the principal cannot verify the state of nature, $q = 0$, the result is changed. Because the $\widehat{IA}_g^v$ constraint is still binding, $t(b|\emptyset) = \frac{\gamma}{1-p} + v$ and, from the $\widehat{IA}_b^v$ constraint, $t(g|g) = \frac{\gamma}{p} + \frac{\gamma}{1-p}$. The expected payment is increasing in v.

5 Risk-averse Agent

This section also extends the basic model. Now it is assumed that the agent's preference is to be risk averse. The utility of the agent is represented by $u(\cdot)$. Assume that $u'(\cdot) > 0$ and $u''(\cdot) < 0$. The principal behaves ex post optimally, and chooses the transfer rule that minimizes his/her payment subject to the IC_g and IC_b constraints and the following constraints:

$$pu(t(g|g)+v-\gamma)+(1-p)u(t(b|b)-\gamma) \geq pu(t(g|g)+v)+(1-p)u(t(g|b)+v), \tag{$IA_g^\dagger$}$$

$$pu(t(g|g)+v-\gamma)+(1-p)u(t(b|b)-\gamma) \geq pu(t(b|g))+(1-p)u(t(b|b)), \tag{$IA_b^\dagger$}$$

$$pu(t(g|g) + v - \gamma) + (1 - p)u(t(b|b) - \gamma) \geq u(0). \tag{$IR^\dagger$}$$

First, I show that the $IR^\dagger$ constraint is not binding. Since transfers are always positive, each element on the right-hand side of the $IA_g^\dagger$ (and/or $IA_b^\dagger$) constraints is greater than $u(0)$. Hence, the $IR^\dagger$ constraint is satisfied, because the left-hand side of the $IA_g^\dagger$ (and/or $IA_b^\dagger$) constraints, the expected utility of the agent from telling the truth, is larger than $u(0)$. Next, I show that $t(g|b)$ and $t(b|g)$ are 0. These terms appear only on the right-hand side of the constraints, and therefore should be set as small as possible by the principal. Substituting $t(g|b) = t(b|g) = 0$ into the constraints yields:

$$(1-p)\{u(t(b|b)-\gamma)-u(v)\}-p\{u(t(g|g)+v)-u(t(g|g)+v-\gamma)\} \geq 0, \quad (IA_g^\ddagger)$$

$$p\{u(t(g|g)+v-\gamma)-u(0)\}-(1-p)\{u(t(b|b))-u(t(b|b)-\gamma)\} \geq 0. \quad (IA_b^\ddagger)$$

Now consider the IC_g and IC_b constraints. These constraints are not binding. The proof proceeds by contradiction. First, suppose that the IC_g constraint is binding. Substituting it into the $IA_b^\ddagger$ constraint implies that the first term is negative, while the second term is positive, a contradiction. Similarly, substituting the IC_b constraint into the $IA_g^\ddagger$ constraint shows that the IC_b constraint is not binding. The above arguments imply that only the $IA_g^\ddagger$ and/or $IA_b^\ddagger$ constraints are effective.

The private benefit v relaxes the $IA_b^\ddagger$ constraint, just as in the risk-neutral case. In addition, v may relax the $IA_g^\ddagger$ constraint. When v increases, the first term of the constraint is decreasing, tightening the constraint. This effect has already been seen in the risk-neutral case. At the same time, the second term of the constraint, $u(t(g|g)+v)-u(t(g|g)+v-\gamma)$, is decreasing because $u(\cdot)$ is concave; the private benefit reduces the relative cost of acquiring information in the constraint.

The expected transfer that the principal pays may be increasing or decreasing in v. There is some difficulty in undertaking a complete analysis, so the analysis is restricted to some conditions.

Assumption 1. *The boundaries of the $IA_g^{\ddagger}$ and $IA_b^{\ddagger}$ constraints intersect only once.*

This assumption is met, for example, when $u(x) = -e^{-rx}$, where r is the risk aversion coefficient.

Lemma 2. *Let $\hat{t}(g|g)$ and $\hat{t}(b|b)$ be the point which the boundaries of the $IA_g^{\ddagger}$ and $IA_b^{\ddagger}$ constraints intersect. Then $\frac{\partial \hat{t}(g|g)}{\partial v} < 0$ and $\frac{\partial \hat{t}(b|b)}{\partial v} > 0$.*

Proof. Let $f(t(g|g), t(b|b), v)$ and $g(t(g|g), t(b|b), v)$ be the left hand side of the $IA_g^{\ddagger}$ and $IA_b^{\ddagger}$ constraints. Let write $f_1 = \frac{\partial f(t(g|g),t(b|b),v)}{\partial t(g|g)}$, $f_2 = \frac{\partial f(t(g|g),t(b|b),v)}{\partial t(b|b)}$ and $f_3 = \frac{\partial f(t(g|g),t(b|b),v)}{\partial v}$. Also, g_1, g_2 and g_3 are defined similarly. Then:

$$
\begin{aligned}
f_1 &= -p\{u'(t(g|g) + v) - u'(t(g|g) + v - \gamma)\}, \\
f_2 &= (1-p)u'(t(b|b) - \gamma), \\
f_3 &= -(1-p)u'(v) - p\{u'(t(g|g) + v) - u'(t(g|g) + v - \gamma)\}, \\
g_1 &= pu'(t(g|g) + v - \gamma), \\
g_2 &= -(1-p)\{u'(t(b|b)) - u'(t(b|b) - \gamma)\}, \\
g_3 &= pu'(t(g|g) + v - \gamma).
\end{aligned}
$$

¿From the implicit function theorem:

$$\begin{pmatrix} \frac{\partial \hat{t}(g|g)}{\partial v} \\ \frac{\partial \hat{t}(b|b)}{\partial v} \end{pmatrix} = - \begin{pmatrix} f_1 & f_2 \\ g_1 & g_2 \end{pmatrix}^{-1} \begin{pmatrix} f_3 \\ g_3. \end{pmatrix}$$

Because $u'(\cdot) > 0$ and $u''(\cdot) < 0$, first:

$$f_1 g_2 - f_2 g_1 = \{u'(t(g|g)+v) - u'(t(g|g)+v-\gamma)\}u'(t(b|b)) - u'(t(g|g)+v)u'(t(b|b)-\gamma) < 0,$$

then:

$$\begin{aligned} sign\left[\frac{\partial \hat{t}(g|g)}{\partial v}\right] &= sign[g_2 f_3 - f_2 g_3] \\ &= sign[(1-p)^2\{u'(t(b|b)) - u'(t(b|b)-\gamma)\}u'(v) \\ &\quad +p(1-p)u'(t(b|b))\{u'(t(g|g)+v) - u'(t(g|g)+v-\gamma)\} \\ &\quad -p(1-p)u'(t(b|b)-\gamma)u'(t(g|g)+v)] < 0, \end{aligned}$$

and

$$\begin{aligned} sign\left[\frac{\partial \hat{t}(b|b)}{\partial v}\right] &= sign[-g_1 f_3 + f_1 g_3] \\ &= sign[p(1-p)u'(t(g|g)+v-\gamma)u'(v)] > 0. \end{aligned}$$

□

Because the second term of the $IA_b^\ddagger$ constraint is positive, when v goes to 0, the first term of the constraint must be positive, then $t(g|g)$ must be large enough. Also, because the second element of the $IA_g^\ddagger$ constraint is positive, the first element of the constraint must be positive, then $t(b|b)$ must be large enough. Then $\hat{t}(g|g) > 0$ when v is small enough, and $\hat{t}(b|b) > 0$. From Lemma 2, there exists some $\tilde{v}$ such that $\hat{t}(g|g) > 0$ if and only if $v < \tilde{v}$.

Proposition 2. *Assume the agent is risk averse and $u'''(\cdot) > 0$. The principal's expected payment is decreasing in v when p is large.*

Proof. Case 1: when $v < \tilde{v}$ and $t(g|g) > 0$.

When $u'''(\cdot) > 0$, the $IA^{\ddagger}$ constraints are quasi-concave. Hence the first order approach is applicable. Let δ_g and δ_b, which are nonnegative, be Lagrange multipliers for the $IA_g^{\ddagger}$ and $IA_b^{\ddagger}$ constraint. The Lagrangian is as follows:

$$\begin{aligned}
&pt(g|g) + (1-p)t(b|b) \\
&- \delta_g[(1-p)\{u(t(b|b)-\gamma) - u(v)\} - p\{u(t(g|g)+v) - u(t(g|g)+v-\gamma)\}] \\
&\quad - \delta_b[p\{u(t(g|g)+v-\gamma) - u(0)\} - (1-p)\{u(t(b|b)) - u(t(b|b)-\gamma)\}].
\end{aligned}$$

The envelope theorem says that the principal's expected payment, C, is a function of v such that:

$$\frac{\partial C}{\partial v} = \delta_g[(1-p)u'(v) + p\{u'(t(g|g)+v) - u'(t(g|g)+v-\gamma)\}] - \delta_b p u'(t(g|g)+v-\gamma).$$

Because $t(g|g)$ is bounded, $u'(t(g|g)+v) - u'(t(g|g)+v-\gamma)$ is strictly negative. Then $\frac{\partial C}{\partial v}$ is negative when p is large enough.

Case 2: when $v < \tilde{v}$ and $t(g|g) = 0$.

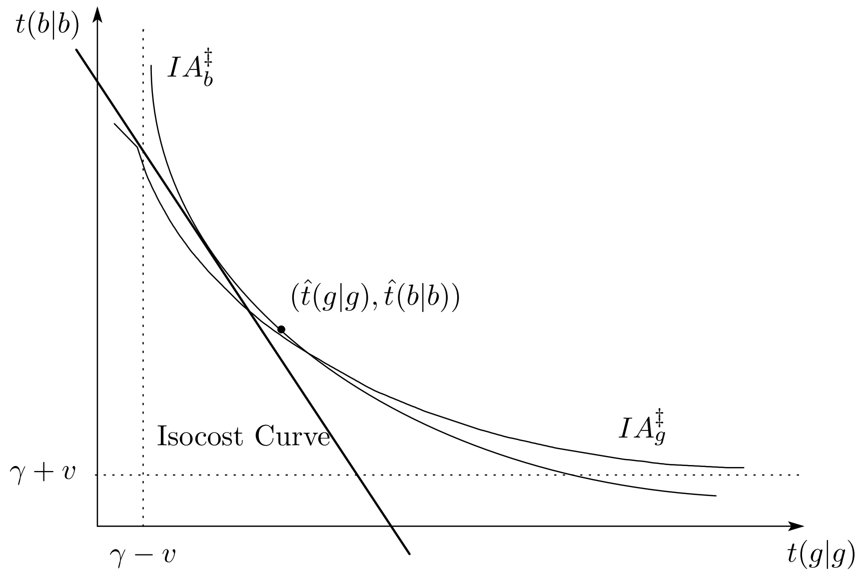

Figure 2: When v is small and p is large.

Next, assume the corner solution, $t(g|g) = 0$, then only the $IA_b^{\ddagger}$ constraint is effective. This is the case that p is large. Then $t(b|b)$ satisfies $p\{u(v-\gamma) - u(0)\} - (1-p)\{u(t(b|b)) - u(t(b|b)-\gamma)\} = 0$. By the implicit function theorem:

$$\frac{\partial t(b|b)}{\partial v} = \frac{pu'(v-\gamma)}{(1-p)\{u't(b|b) - u'(t(b|b)-\gamma)\}} < 0,$$

because $u' > 0$ and $u't(b|b) - u'(t(b|b)-\gamma) < 0$.

Case 3: when $v \geq \tilde{v}$.

When $v \geq \tilde{v}$, only the $IA_g^{\ddagger}$ constraint is binding. When the solution is a inner solution, the proof is straightforward from case 1, merely substituting $\delta_b = 0$. When the solution is a corner solution, the optimal payments are

$t(g|g) = 0$ and $t(b|b)$ satisfying the $IA_g^{\ddagger}$ constraint. This case $t(b|b)$ is:

$$\frac{\partial t(b|b)}{\partial v} = \frac{(1-p)u'(v) + p\{u'(v) - u'(v-\gamma)\}}{(1-p)u'(t(b|b)-\gamma)},$$

by the implicit function theorem. Because $u' > 0$ and $u'(v) - u'(v-\gamma) < 0$, $\frac{\partial t(b|b)}{\partial v} < 0$ when p is large enough. $\square$

In case 1, as in the risk-neutral case, the large private benefit relaxes the $IA_b^{\ddagger}$ constraint while tightening $IA_g^{\ddagger}$. These effects can seen from $\delta_g(1-p)u'(v) - \delta_b p u'(t(g|g) + v - \gamma)$ in the above equation. Thus when p is large, the effect on the former is greater than that on the latter. Also in the risk-averse case, the large private benefit relaxes the $IA_g^{\ddagger}$ constraint, due to the concavity of the agent's utility. This effect can be seen by $\delta_g p\{u'(t(g|g) + v) - u'(t(g|g) + v - \gamma)\}$. Thus this effect is also large when p is large. In sum, the large private benefit is desirable when p is large.

In Case 2, there is only the effect such that the large private benefit relaxes the $IA_b^{\ddagger}$ constraint, due to the concavity of the agent's utility. In Case 3, the effect relaxing the $IA_g^{\ddagger}$ constraint is large when p is large.

Proposition 2 suggests that there exists a case in which the principal's expected payment is decreasing in all v when the agent is risk averse and p is large enough.

6 Conclusion

I have shown that dissonance in preferences between the principal and the agent can reduce the total cost of information acquisition and transmission.

The cost of motivating the agent to acquire information and not submit an uninformed 'bad' evaluation is small when the private benefit is large, while the cost of preventing an uninformed 'good' evaluation is large. As a result, when the agent is risk neutral, the cost has a v-shaped relation to the private benefit, and a moderate level of the private benefit is cost minimizing. When the agent is risk averse, the private benefit reduces the relative cost of acquiring information on the constraint preventing an uninformed 'good' evaluation. The cost may be decreasing at all levels of the private benefit.

This finding provides a new rationale for recent movements toward delegation.

References

Aghion, Philippe and Jean Tirole (1997), "Formal and Real Authority in Organizations," *Journal of Political Economy* **105**, 1–29.

Bester, Helmut and Roland Strausz (2001), "Contracting with Imperfect Commitment and the Revelation Principle: The Single Agent Case," *Econometrica*, **69**, 1077–1098.

Crémer, Jacques, Fahad Khalil and Jean-Charles Rochet (1998a), "Contracts and Productive Information Gathering," *Games and Economic Behavior*, **25**, 174–193.

Crémer, Jacques, Fahad Khalil and Jean-Charles Rochet (1998b), "Strategic Information Gathering before a Contract is Offered," *Journal of Economic Theory*, **81**, 163–200.

Chung, Tal-Yeong (1992), "On the Social Optimality of Liquidated Damage Clauses: An Economic Analysis," *Journal of Law, Economics, and Organization*, **8**, 280–305.

Dessein, Wouter (2002), "Authority and Communication in Organizations," *Review of Economic Studies*, **69**, 811–838.

Harris, Milton and Artur Raviv (2005), "Allocation of Decision-Making Authority," *Review of Finance*, **9**, 353–83.

Inagami, Takeshi (1988), *Japanese Workplace Industrial Relations*, Japan Institute of Labour, Industrial Relations Series No. 14, Tokyo.

Jensen, Michael C. and William H. Meckling (1992), "Specific and General Knowledge, and Organizational Structure," in *Contract Economics*, ed. by Werin, Lars and Hans Wijkander, 251–274, Blackwell, Oxford.

Kato, Takao and Motohiro Morishima (2002), "The Productivity Effects of Participatory Employment Practices: Evidence from New Japanese Panel Data," *Industrial Relations*, **41**, 487–520.

Lewis, Tracy R. and David E. M. Sappington (1997), "Information Management in Incentive Problems," *Journal of Political Economy*, **105**, 796–821.

Prendergast, Canice (1993), "A Theory of 'Yes Men'," *American Economic Review*, **83**, 757–770.

Stole, Lars A. (1992), "The Economics of Liquidated Damage Clauses in Contractual Environments with Private Information," *Journal of Law, Economics, and Organization*, **8**, 582–606.