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Anti-Corruption Strategy in Hierarchical Structure

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Abstract

In this paper, I shall focus on hierarchical structure in administration and clarify the effectiveness and desirability of endogenous "investigation" as an anti-corruption strategy through the use of the principal-agents-client model. Assuming the role of principal who cannot observe the behavior of the other corruptible players is to design incentive schemes in order to deter corruption in administration, in the case of endogenous investigation as well as monitoring, hierarchical structure with investigation welfare dominates the welfare of hierarchical structure without investigation, especially even when both structures fail to achieve any compliance by the client.

* I appreciate helpful comments from Ajit Mishra (Bath University). I am responsible for any remaining errors.

1. Introduction

The purpose of this paper is related to designing anti-corruption strategies as an incentive scheme under the Principal-Agent-Client relationship. In other words, there are two types of independent agents which implement "monitoring" for client's law compliance and "investigation" for agents' law compliance, respectively. The principal, from the standpoint of anti-corruption and economic welfare, designs an incentive scheme for the two agents and client.

Figure 1 summarizes the Principal-Agent-Client (hereinafter "PAC") relationship to be discussed in this paper.

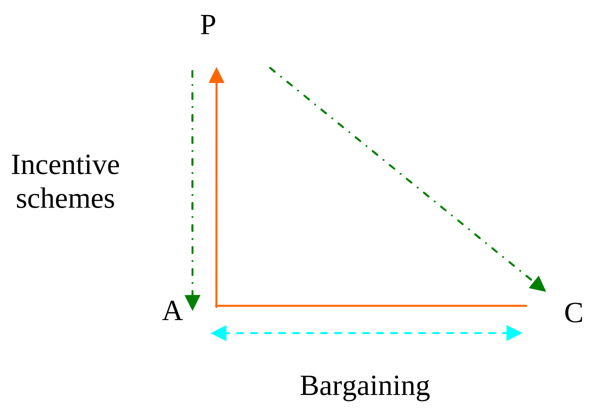

Figure 1

Here, P, A, and C represents the principal, agent, and client, respectively. The arrow from P to A stands for P's behavior towards A. The solid line from A to P and that from C to P represents transfer of information. The dotted line from A to C denotes A's provision of legal and illegal services to C. The dotted line from C to A denotes C's provision of legal and illegal compensations to A. Behavioral information between A and C is the concerned parties' private information, which is non-observable to P.

In this paper, the PAC relationship is distinguished from the "Principal-Agent-Client relationship" suggested by Klitgaard (1988) in regards to the following two points: (1) P's behavior is limited to design of incentive schemes to A and C and (2) C's behavioral information is communicated to P through A, eliminating any information transfer from C to P, such as accusation.

The main issue of this paper is to incorporate an independent agent into the PAC relationship shown in Figure 1 as an actor of "investigation" and to clarify the roles and policy implications that it has in anti-corruption strategies. Thus, as is indicated in Figure 2, a traditional agent, hereinafter, is referred to as A_1 to be distinguished from A_2, a newly introduced agent. In addition, pertaining to corruption between A_1 and C, communication to P is allowed only through A_2 to eliminate any information transfer from C to P.

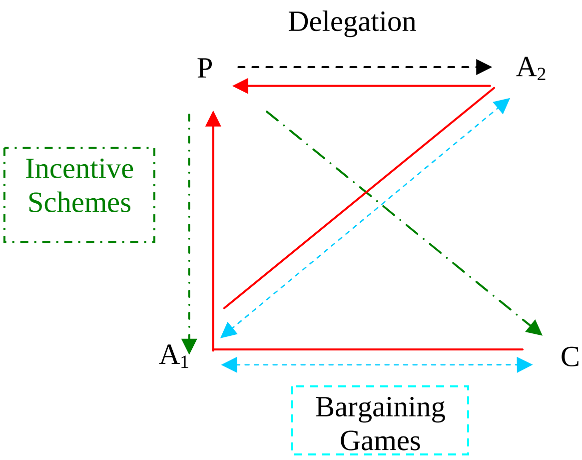

Figure 2

Hereinafter, hierarchical structures in Figure 1 and Figure 2 are represented as H0 and H1, respectively. Mishra (2006) insists that H_1 dominates H0 under noncompliance equilibrium related to C. This paper will generalize the proposition under noncompliance equilibrium related to C and show that H1 can achieve both welfare improvement and corruption reduction.

This paper is structured as follows: The next section analyzes the case in which enforcement is given exogenously as a benchmark to illustrate investigation is effective in preventing corruption. Section 3 uses endogenous enforcement to derive incentive schemes for both H0 and H1.

Furthermore, Section 4 compares anti-corruption effects and welfare between organizational structures. Finally, Section 5 summarizes the conclusion and refers to some future outlook.

2. The Model

Events in H0 are as follows:

i) C selects noncompliance to laws (hereinafter, “cheating”). Cheating brings private benefit x . In relation to x , assume that there is uniform distribution on $[0, X]$.

ii) A_1 implements monitoring. With probability p , A_1 can verify cheating.

iii) Bribe bargaining between C and A_1.

iv) If bargaining is successful, A_1 accepts bribe b without reporting anything to P. If bargaining is not successful, A_1 reports cheating to P.

Based on the report from A_1, P pays compensation r to A_1 and imposes penalty f on C.

Particularly, in regards to Stage iii, bribe decision between C and A_1 is characterized by the Nash bargaining solution, the solution to the following question:

$$\underset{b}{Max}(b-r)^{\alpha}(f-b)^{1-\alpha} \ s.t \ \ b-r>0 \ and \ \ f-b>0.$$

By defining the Nash product of this question as $\phi(b)=(b-r)^{\alpha}(f-b)^{1-\alpha}$ and differentiating this equation, the following equation is obtained:

$$\begin{aligned}\phi'(b) &= \alpha(b-r)^{-(1-\alpha)}(f-b)^{1-\alpha}-(1-\alpha)(b-r)^{\alpha}(f-b)^{-\alpha} \\ &= \frac{\alpha(f-b)^{1-\alpha}}{(b-r)^{1-\alpha}}-\frac{(1-\alpha)(b-r)^{\alpha}}{(f-b)^{\alpha}} \\ &= \frac{\alpha(f-b)-(1-\alpha)(b-r)}{(b-r)^{1-\alpha}(f-b)^{\alpha}}\end{aligned}$$

Assuming $\phi'(\cdot)=0$ and taking constraints into account, $b=\alpha f+(1-\alpha)r$ is obtained. Therefore, if incentive scheme (r, f) is given, the equilibrium value of a bribe is defined uniquely depending on bargaining power (allocation). Here, following Mishra (2002 and 2006), assume that particularly, bargaining power allocation is uniform between C and A_1. Now, the following equation is formed:

$$b = (f + r)/2 \qquad (1)$$

It would be reasonable that A_1 accepts a bribe in the case of $r < b$. Hence, considering Formula (1), the condition of A_1's bribe acceptance can be expressed as follows:

$$r < f \qquad (2)$$

On the other hand, C faces bribe bargaining in probability p. Therefore, it is reasonable for C to offer a bribe in the case of $p(r + f)/2 < x$. If solving this in respect to f, the following expression is obtained:

$$f < \frac{2x}{p} - r \qquad (3)$$

Events in H1 are the same as H_0's events (i)-(iv), incorporating A_2's investigation and bribe bargaining between agents into these events (in this sense, every agent is corruptible and only the principal is benevolent). In other words, the following events subsequently take place:

v) A_2 implements investigation. A_1's bribe acceptance is proved in probability p'.

vi) Bribe bargaining between A_1 and A_2.

vii) If bargaining is successfully completed, A_2, in exchange for a bribe, will not report anything to P. On the other hand, if bargaining fails, A_2 will report A_1's bribe acceptance to P.

v) Based on report from A_1, P pays compensation r to A_1 and imposes penalty f on C (same as v of H_0). In addition, based on report from A_2, P imposes penalty g on A_1. Here, with respect to the latter case, for the simplification purpose, eliminate penalty on C, forfeit of a bribe, and compensation paid to A_2.

In H1, A_1, considering event (vi), goes into bribe bargaining with C. In other words, with respect to (vi), by defining the Nash product as $\psi = (g-b)^{\beta} b^{1-\beta}$ and seeking the solution in the same manner as the previous section, $b = g/2$ is obtained. If taking this solution into consideration and defining the Nash product of the bargaining question between C and A_1 as $\omega = (b - r - p'g/2)^{\alpha} (f-b)^{1-\alpha}$, the following formula is obtained:

$$b = \frac{f+r}{2} + p'g/4 \tag{4}$$

Therefore, the condition of C's bribe acceptance is $p\left(\frac{f+r}{2} + p'g/4\right) < x$. Hence, by solving this expression pertaining to f, the following expression is obtained:

$$f < \frac{2x}{p} - r - p'g/2 \tag{5}$$

On the other hand, net expected payoff to A_1 from bribe acceptance is $\frac{f+r}{2} - p'g/4$. Therefore, the condition of A_1's bribe acceptance is as follows:

$$r + \frac{p'g}{2} < f \qquad (6)$$

In order to compare organizational structures from the standpoint of an incentive scheme, the analysis results provided above are illustrated. i and ii in Figure 3 denote a set of incentive schemes (r, f) in H0 and H1, respectively.

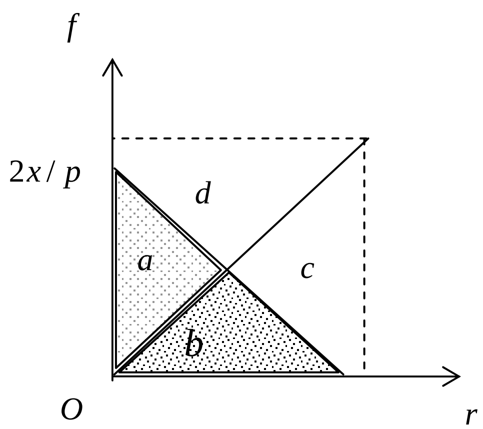

Figure 3-i

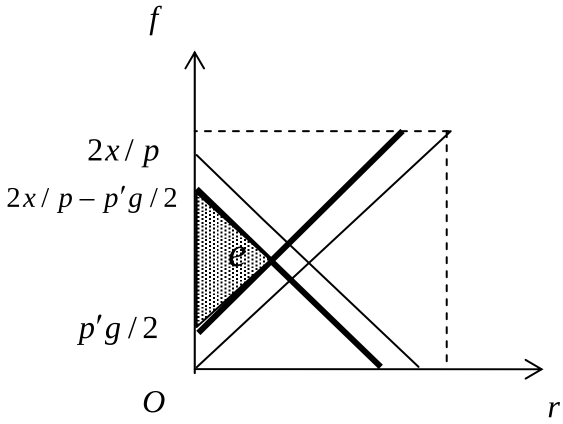

Figure 3-ii

First, in regards to i, a corruption takes place in an incentive scheme belonging to Area a. No corruption occurs in Area b, c, or d (in other words, incentives are given only to one of the related parties in Area b and c, and incentives are given to neither of the related parties in Area d).

On the other hand, with respect to ii, a corruption takes place in an incentive scheme belonging Area e, which is a proper subset of a. b and a are in the congruence relation. Therefore, by introducing (p', g), a set of (r, f), in which corruption is realized, shrinks. Hence, the following proposition is formed:

Proposition 1: If is (p, p') exogenous (even if A_2 is corruptible), a commitment to investigation" is an effective anti-corruption strategy.

In the next section and following sections, a case in which "monitoring" and "investigation" are costly will be examined. At equilibrium, the sum of the costs, combined with the externality of cheating (as an equilibrium strategy), comprises social costs.

Now, we should consider the next issue: compatibility of H1 with the mutually-related policy purpose of welfare improvement and anti-corruption. In this point, the following proposition precedes this paper:

"H1 welfare dominates H0, especially when the latter fails to achieve any compliance by the individual."(Mishra (2006, p.202))

In other words, for the case in which the occurrence of cheating is assured in equilibrium, H1 is more desirable than H0.

With respect to this proposition, depending on the level of g, opposite results are generated in some cases. Hence, this paper reveals that "social desirability" of an organizational structure should be classified into cases from the standpoint of g. This analysis makes it possible to provide a clear answer to the question whether H1 is compatible with the associated policy purpose: welfare improvement and anti-corruption.

3. Anti-corruption strategy

Hereinafter, assume that A_1's and A_2's behaviors are endogenous. In other words, following Mishra (2002 and 2006), define the probability of monitoring (investigation) as the function of A_1's (A_2) effort level, $e \in [0, E]$. Particularly, this probability equals to e / E .

First, with respect to H0, consider a two-period game in which endogenous monitoring exists. In other words, in the first period, C selects cheating in probability c. Then, A_1 selects the effort level and implements monitoring in probability p . A_1 cannot observe C's behavior in advance. Therefore, virtually, the first period is a simultaneous-move game. In the second period, each related party goes into bargaining. The bargaining is successful in probability h . Successful bargaining is accompanied by transfer from C to A_1.

Figure 4 indicates a game tree related to the two-stage game in H0. Here, the left end of the node is C and the remainder is A_1. In addition, the dotted line indicates an information set. Compensation is regarded as the remuneration of the fulfillment of the duties of service.

Hereinafter, C's and A_1's (expected) payoffs are represented as Π_C and Π_1, respectively.

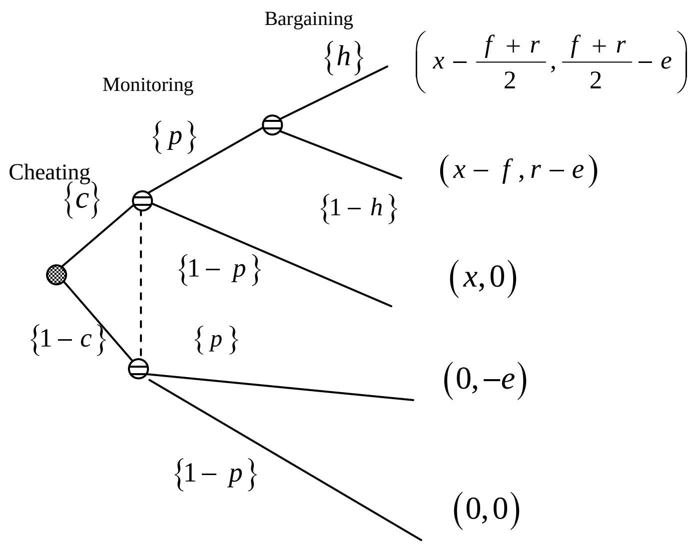

Figure 4

C's and A_1's objective functions are defined as follows:

$$\begin{aligned} \Pi_C &= cph\left(x - \frac{f+r}{2}\right) + cp(1-h)(x-f) + c(1-p)x \\ &= c\left(x - p\left(h\left(\frac{f+r}{2}\right) + (1-h)f\right)\right) \end{aligned} \quad (7)$$

and

$$
\begin{aligned}
\Pi_1 = &\ cph\left(\frac{f+r}{2} - pE\right) + cp(1-h)(r - pE) - (1-c)\,p\,(pE) \\
&= c\left(h\left(\frac{f+r}{2}\right) + (1-h)r\right)p - pE
\end{aligned}
\tag{8}
$$

In order to seek an equilibrium strategy, the question of the second period is solved first. As a result, A_1 (given c and p) determines law compliance h. Based on Formula (8), the following expression is obtained:

$$
\frac{\partial \Pi_1(c, p, h)}{\partial h} = cp\left(\frac{f-r}{2}\right) > 0 \tag{9}
$$

Hence, assuming $f > r$, $h = 1$ is derived.

Then, the question of the first period is solved.

Assuming $\partial \Pi_C(c, p, 1) / \partial c = 0$, solve p. As a result, $p = \frac{2x}{f+r} (= x/b)$ is obtained. Therefore, the optimal effort level is $e = \frac{2xE}{f+r}$.

In addition, $e \le E$ has to be formed. Therefore, $x \le \frac{f+r}{2}$ is derived.

On the other hand, assuming $\partial\Pi_1\left(c, p, 1\right)/\partial p = 0$, solve c. As a result, $c = \frac{2E}{f+r}\left(= E/b\right)$ is obtained. To maintain $c \le 1$, $E \le \frac{f+r}{2}$ has to be formed. Here, f is presumed to be bounded. Hence, b is bounded. Therefore, $p \in \left(0,1\right]$, $c \in \left(0,1\right]$ is derived.

The result of the analyses above provides the following Nash equilibrium:

Lemma:

i) In the case of $x > E$:

$$b \in \begin{Bmatrix} (0,E) \\ (E,x) \\ (x,\infty) \end{Bmatrix} \Rightarrow (c,p,h) = \begin{Bmatrix} (1,1,1) \\ \left(\frac{2E}{f+r},1,1\right) \\ \left(\frac{2E}{f+r},\frac{2x}{f+r},1\right) \end{Bmatrix} \quad (10)$$

ii) In the case of $x < E$:

$$b \in \begin{Bmatrix} (0,x) \\ (x,E) \\ (E,\infty) \end{Bmatrix} \Rightarrow (c,p,h) = \begin{Bmatrix} (1,1,1) \\ \left(1, \dfrac{2x}{f+r}, 1\right) \\ \left(\dfrac{2E}{f+r}, \dfrac{2x}{f+r}, 1\right) \end{Bmatrix} \qquad (11)$$

Particularly, if $x = E = k$, the following expression is formed:

$$b \in \begin{Bmatrix} (0,k) \\ (k,\infty) \end{Bmatrix} \Rightarrow (c,p,h) = \begin{Bmatrix} (1,1,1) \\ \left(\dfrac{2E}{f+r}, \dfrac{2x}{f+r}, 1\right) \end{Bmatrix}$$

Thus, with no regard to the relationship of x or E , if the value of $b\left(=\dfrac{f+r}{2}\right)$ is small enough (at the first stage of the game) prior to the circumstance in which the duties of service are violated after bribe bargaining, the pair of an equilibrium strategy is a corner solution. If is large enough, it is an interior solution.

Then, analyze H1.

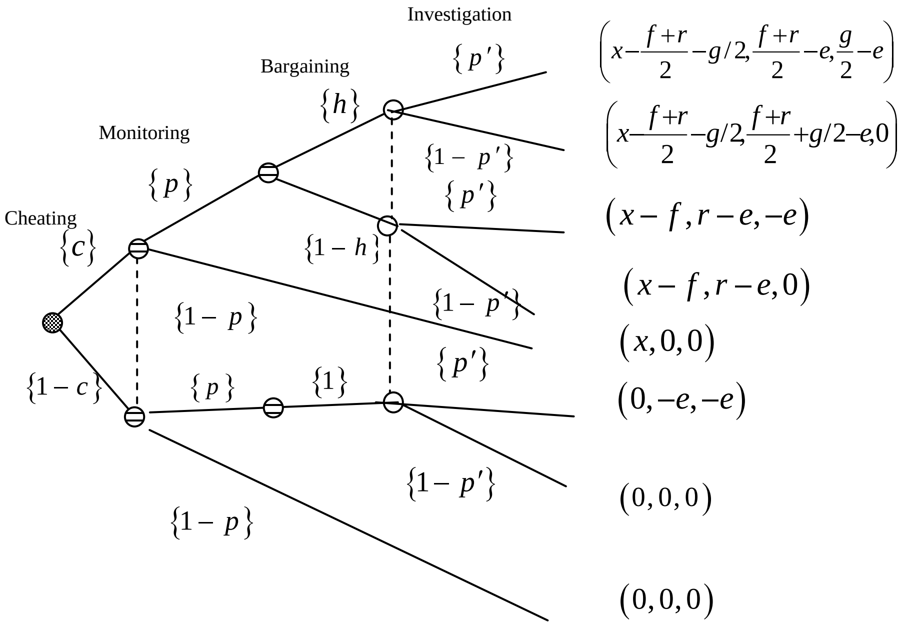

Figure 5

First of all, C selects cheating in probability c to obtain private payoff x. Next, A_1 implements auditing at the effort level e. Bargaining between A_1 and the tax evader is successful in probability h and fails in probability $1-h$. Successful bargaining will result in transfer from C to A_1. Finally, A_2 implements investigation in effort level e. C's, A_1's and

A_2's objective functions and payoffs are defined as the following net benefits:

First, C's expected payoff can be represented in the following expression:

$$\begin{aligned}\Pi_C &= cph\left(x-\frac{f+r}{2}-p'g/4\right)+cp(1-h)(x-f)+c(1-p)x \\ &= c\left(x-p\left(h\left(\frac{f+r+p'g/2}{2}\right)+(1-h)f\right)\right)\end{aligned} \tag{12}$$

A_1's expected payoff is as follows:

$$\Pi_1 = c\left(h\left(\frac{f+r+p'g/2}{2}-\frac{p'g}{2}\right)+(1-h)r\right)p-pE \tag{13}$$

A_2's expected payoff is as follows:

$$\begin{aligned}\Pi_2 &= cphp'(g/2-p'E)-cp(1-h)p'(p'E)-(1-c)pp'(p'E) \\ &= cphp'g/2-p'E\end{aligned} \tag{14}$$

Given p', A_1 chooses p (or e) and h. In other words, once committed to auditing effort, in probability p, A_1 encounters a tax evader with probability c. Then, A_1 engages in bribe bargaining at a risk of h being uncovered in probability p', chooses cheating in probability h, and receives compensation in probability 1-h. Here, cheating means that A_1 accepts a bribe from the tax evader and offers a bribe to A_2.

Considering that p' is given, A_1 determines $\left\{p^*, h^*\right\}$ that maximizes the following value:

$$\Pi_1\big|_{p':given} = c\left(h\left(\frac{f+r+p'g/2}{2}-\frac{p'g}{2}\right)+(1-h)r\right)p - pE \qquad (15)$$

By partially differentiating this with respect to h, the following expression is obtained:

$$\frac{\partial \Pi_{\mathbf{1}}\big|_{p':given}}{\partial h} = c\left(\left(\frac{f+r+\frac{p'g}{2}}{2}-\frac{p'g}{2}\right)-r\right)p \qquad (16)$$

Assume $\frac{\partial \Pi_{\mathbf{1}}|_{p':given}}{\partial h}=0$ to solve p'. Then, $p'=\frac{2(f-r)}{g}$ is obtained.

By substituting this value to C's objective function and differentiating with respect to c, the following expression is obtained:

$$\frac{\partial \Pi_{\mathbf{C}}|_{p'=p'^*}}{\partial c}=x-p\left(h\left(\frac{f+r+\frac{p'^*g}{2}}{2}\right)+(1-h)f\right) \qquad (17)$$

If assuming $\frac{\partial \Pi_{\mathbf{C}}|_{p'=p'^*}}{\partial c}=0$ to solve p, $\frac{p'^*g}{2}=f-r$ is obtained.

Therefore, $p^*=x/f$ is formed.

On the other hand, the following expression is formed:

$$\frac{\partial \Pi_{\mathbf{1}}|_{p'=p'^*}}{\partial p}=c\left(h\left(\frac{f+r+\frac{p'^*g}{2}}{2}-\frac{p'^*g}{2}\right)-(1-h)r\right)-E \qquad (18)$$

Therefore, assume $\frac{\partial \Pi_{\mathbf{1}}|_{p'=p'^*}}{\partial p}=0$ to solve c. Then, $c^*=E/r$ is obtained. In addition, the following expression is formed:

$$\frac{\partial \Pi_2|_{h:given}}{\partial p'} = \frac{c^* p^* hg}{2} - E \qquad (19)$$

Hence, if assuming $\frac{\partial \Pi_2|_{h:given}}{\partial p'} = 0$ to solve h, $h^* = \frac{2rf}{xg}$ is obtained. By summarizing the results described above, the following formula is obtained:

$$\left(c^*, p^*, h^*, q^*\right) = \left(\frac{E}{r}, \frac{x}{f}, \frac{2rf}{xg}, \frac{2(f-r)}{g}\right)$$

Here, based on the analyses provided above, the equilibrium value of h between organizational structures is compared. The result is as follows: In H0, complete cheating ($h^* = 1$) takes place in Area $e' + e$ shown in Figure 6. In contrast, in H1, an incentive scheme belonging to Area e makes it possible to achieve $h^* < 1$.

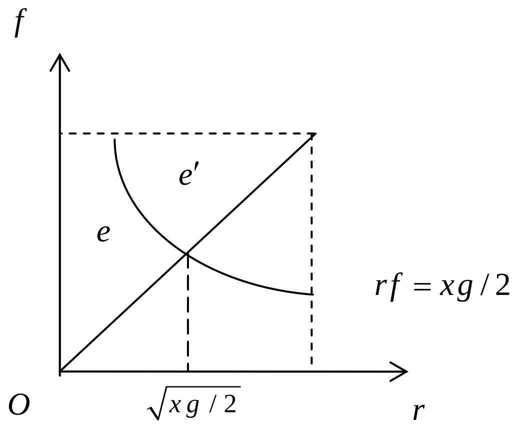

Figure 6

Therefore, the following proposition is formed:

Proposition 2: If a monitoring strategy (p, p') is endogenous (even if A_2 is corruptible), investigation is an effective anti-corruption strategy.

4. Welfare analysis

The previous sections have indicated that investigation is effective in preventing corruption. In this section, welfare analysis is made. For the simplification purpose, social costs related to c^* are normalized to $K > 1$ and social costs are defined as $Kc^* + e^*$. Define the economic welfare equilibrium value as W in H0 and as W^* in H1. Hereinafter, the case with $\frac{f+r}{2} < x$ and $E > r$ is to be analyzed. In this case, C's equilibrium strategy is a pure strategy ($c^* = 1$).

In the case of $\frac{f+r}{2} < x$ and $E > r$, the following two cases can be considered for A_1: (1) an equilibrium strategy is a pure strategy and (2) making no effort is reasonable in the case of $E > r$. These cases are examined sequentially below. First, with respect to Point (1), in the case of $x < E$ and $b \in (0, E)$, $c^* = 1$ is formed. A set of incentive schemes which maintain $c^* = 1$ is represented as the upper side of the 45° line, the lower side of $f = -r + 2E$, and the common triangle area in the figure below (based on the presumption of $f > r$). Here, p is a corner solution ($p^* = 1$) in the square area enclosed with dotted lines while it is an interior solution in the triangle area enclosed with solid lines.

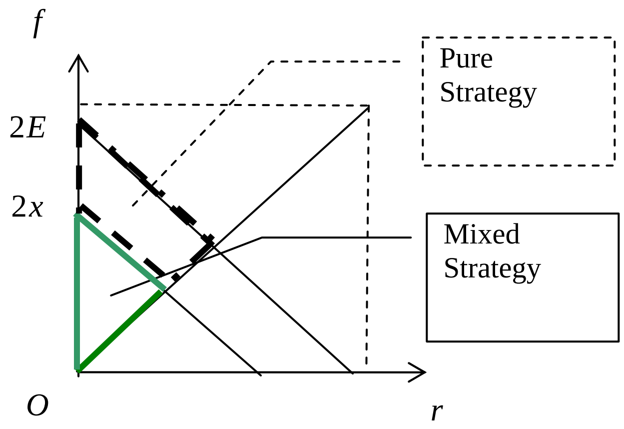

Figure 7

Next, in regards to Point (2),

$\partial \Pi_1 / \partial e = c\left(h\left(\frac{f + r + p'g/2}{2} - \frac{p'g}{2} \right) + (1-h) r \right) / E - 1$ is formed.

Therefore, in the case of $c\left(h\left(\frac{f + r + p'g/2}{2} - \frac{p'g}{2} \right) + (1-h) r \right) > E$, Π_1 is an increasing function of e. Modifying this condition to $\left(1 - \frac{h}{2}\right) cr + \left(\frac{hf - p'g/2}{2} \right) c > E$ shows that there is a possibility of positive effort in the lower area of the falling diagonal line from top left to bottom right in the figure below.

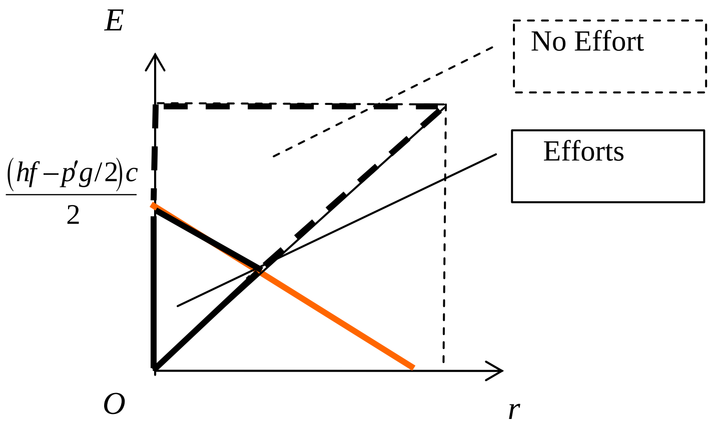

Figure 8

Here, there is an area which satisfies $E > r$.

Based on the discussion above, in the case of $\frac{f+r}{2} < x$ and $E > r$, A_1's equilibrium strategy can be a mixed strategy.

Considering $c = c^* = 1$, economic welfare in H0 and H1 is as follows:

$$W = -K - \frac{2xE}{f+r} \tag{20}$$

and

$$W^{*} = -K - \frac{xE}{f} - \frac{2\left(f-r\right)E}{g} \qquad (21)$$

Based on $f > r$, $W^{*\prime}\left(g\right) > 0$ and $W^{*\prime\prime}\left(g\right) > 0$ are formed.

If seeking $\hat{g}$ which satisfies $W^{*} = W$, the following expression is obtained:

$$\hat{g} = \frac{2\left(f+r\right)f}{x} > 0 \qquad (22)$$

Therefore, if $\left(f, r\right)$ which satisfies $f > r$ is given, H1 dominates H0 only in the case of $g > \hat{g}$.

In addition, based on $\frac{\partial \hat{g}\left(f, r, x\right)}{\partial x} < 0$, with respect to the given $\left(f, r, g\right)$, the more the client's private benefits (from cheating) are, the more desirable H1 is.

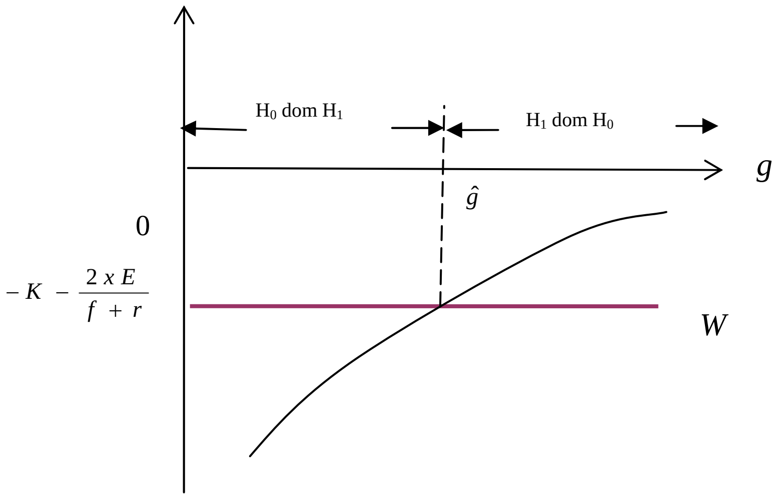

Figure 9

By defining $h(g) \equiv 2rf \,/\, xg$, the following formula is obtained:

$$h(\hat{g}) = \frac{2rf}{x\left(\frac{2(f+r)f}{x}\right)} = \frac{r}{f+r} \qquad (23)$$

Assuming $h(\hat{g}) = 1$, $f = 0$ is formed. Therefore, with respect to arbitrary $g \in (0, \hat{g}]$, equilibrium is established and any area with a possibility of anti-corruption disappears. The results are summarized in Proposition 3.

Proposition 3: In the case of $g \le \hat{g}$, there is a trade-off relationship between anti-corruption and economic welfare.

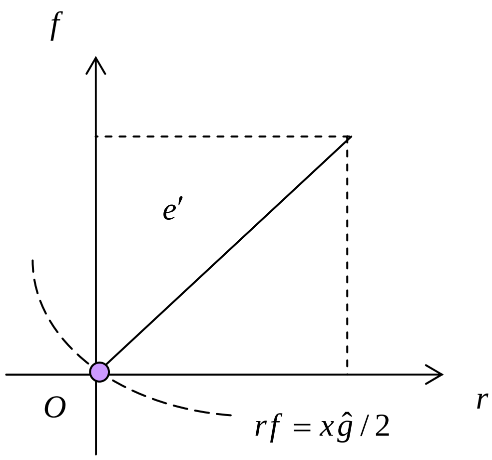

Figure 10

Based on Proposition 3, with respect to $g \in (0, \hat{g}]$, equilibrium is established and H0 dominates H1. However, $h^* = 1$ is formed for an arbitrary incentive scheme. On the other hand, with respect to $g \in (\hat{g}, \infty)$, there is an incentive scheme, (r, f) in which H1 dominates H0 and $h^* < 1$ is formed. Therefore, Proposition 4 is formulated.

Proposition 4: In the case of $g > \hat{g}$, for investigation, it is possible to balance anti-corruption and economic improvement.

5. Conclusion

This paper has primarily provided normative viewpoints in regards to designing anti-corruption strategies under endogenous monitoring strategies. In other words, in order to keep a balance between anti-corruption and economic welfare improvement, relatively high penalties should be set for civil servants engaged in investigation.

Finally, with respect to decentralization of administrative systems, I will explain one remaining issue in this paper. As a hedge against corruption, there is an argument about functional specialization as a context of administrative reforms.

Tax administrative services include a variety of actions, such as preparatory investigation, on-site audit, or investigation of third party contact. According to McLaren (2003), there are two administrative reform trends: geographical specialization (or decentralization) and functional specialization. The former refers to the delegation of operating authority to generalists who controls small sections (Das-Gupta and

Mookherjee: 1998). The latter means that specialists for each job duty cover extensive geographical areas.

Theoretically, this is the kind of the PAC relationship in which the second agent monitors the client. Das-Gupta and Mookherjee (1998) state that from the standpoint of coordinating specialists and information sharing, information infrastructure arrangement is costly, and therefore, the international trend is functional specialization although the introduction of ICT into administrative services creates binding constraints on functional specialization in some cases. This phenomenon is considered to indicate the necessity of regional enforcement theory.

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