A Dilemma in Auditing Systems

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I. Introduction

Private enterprises are motivated to cut costs in undertaking their activities. In other words, they are inherently motivated toward efficiency because of their motivation to pursue profit in the face of market volatility and the possibility of bankruptcy. On the other hand, this type of motivation towards efficiency is not necessarily incorporated in public organizations, as they are faced with neither the volatility of the marketplace nor the possibility of bankruptcy. Therefore, an external checking function is needed to ensure that the activities of public organizations (hereafter, generally termed "organizations") are executed efficiently. This function has been delegated to a particular accounting audit organization (hereafter, generally termed the "board"). The Board of Audit performs this function in Japan.[1]

Game theory, including principal agent theory, has recently been used to see how such auditing mechanisms work. If an agent organization increases efforts, the activities of the organization are executed at less cost. However, organizations do not want to increase efforts because doing so incurs costs. An organization is motivated to decrease efforts, particularly in the case where the efforts made by the organization are not disclosed. To cope with this point, the board is delegated to monitor such organizations retroactively to ensure that they work efficiently. Stricter monitoring encourages the organization to ensure that its activities are efficient, however this level of monitoring is more costly. It is therefore required to improve overall efficiency by taking into consideration three cost elements: the efficiency of the activities in the organization, the costs of such efforts, and the costs of the monitoring by the board.

Konishi [1999] analyzed audit mechanisms by using a game model. Within this model, the board of audit is most interested in the concern that the organization's activities are executed efficiently, which forms their delegated mission. However, in practice, the board has different concerns. Since the board itself is part of a bureaucratic organization, it also desires to maintain its existence and expand, if possible[2]. To achieve these objectives, it is necessary that the activities of the board be closely evaluated as to their effectiveness. The results of the board's activities should be measured by the degree that the board improves efficiency in the activities of an organization. The simplest index to represent this is excess expenditure identified by the board; i.e. the amount that exceeds the minimum expenditure needed for an organization to execute its assigned business. This excess expenditure is called the "indicated amount." The activities of the board are judged by the value of this indicated amount. Actually,

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1) In recent years, boards of audit have been expected to perform checks not only as to whether the activities of an organization have been executed at minimum cost (economic checks and efficiency checks), but also whether the organization has achieved its stated objectives (validity check). However, the major part of the actual board of audit activities belongs to the former function. Such trends in the Board of Audit in Japan were shown in the Board of Audit (2000) (Section 2, Chapter I)

2) Niskanen [1971]

in Japan, that the Board of Audit is interested in this matter is understandable in view of the fact that the indicated amount is emphasized in the Board of Audit's activity report. [3]

There is rising concern as to whether the board can perform its intended function if it takes interest in such an index. Because the board must increase the indicated amount to prove its efforts, the board prefers that the organization's activities have a certain degree of inefficiency. This seems to be a significant dilemma lurking in the auditing system.

In this paper, a simple game model is introduced, based on the assumption that the board is interested in increasing its total indicated amount, and the results of the model are shown. Based on the results, it is pointed out that measures to secure a certain degree of efficiency are present, even in systems that include such a dilemma.

This paper consists of the following sections. In Section 2, the dilemma suffered by the auditing system is described. Section 3 then presents various measures to secure a certain degree of overall efficiency despite such dilemma.

2. Model of the Auditing System

The amount of costs which an organization providing a public service requires to conduct its given business depends on how much of an effort the organization makes to cut such costs. If an organization does not make any special effort towards this end, the costs stay as high as F_0, and if it makes a special effort, this falls to F_1. However, the cost C is incurred in the form of labor and time if it does make such endeavors, and the board recognizes that if the organization performs an ideal level of activities, the business costs will fall to T ($F_0 > F_1 > T$). T can be regarded as the minimum cost of operations.

Whether an organization makes an effort or not cannot be judged unless the board commences an audit of the organization. How strictly the board conducts an audit is expressed by α ($0 \leq \alpha \leq 1$). This index can be regarded as the probability that the board will conduct an audit. The actual auditing incurs a cost in proportion to its probability. It is assumed that to audit at level α, the cost $G(\alpha)$ is required for labor and time ($G(0)=0$, $G'(0)=0$, $G'(\alpha) \geq 0$, $G''(\alpha) \geq 0$). It is also assumed that whether the organization has made efforts or not can be definitely identified through an audit. If the audit results show that the business costs exceed T, a penalty equivalent to the excess portion is levied on the organization. [4] This penalty includes not only the pecuniary one in which the excess portion is paid back, but also a non-pecuniary one in which securing future budgets is likely to become more difficult or its social reputation may decline due to disclosure of the auditing results. Naturally, there can be no penalty without an audit.

Now, let us look at the behavior of an organization facing such a situation.

2.1 Behavior of an organization
The behavior that an organization can select is to either "make an effort" or "make no effort," and the payoff for an organization (=cost of effort+penalty) depends upon whether an organization makes an effort or not and whether auditing is undertaken or not. The following list details the payoff [5].

	effort	no effort
audit	$F_1 - T + C$	$F_0 - T$
no audit	C	0

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3) Board of Audit (2000) Section 2, Chapter I.

4) Assuming that $F_1 > T$ to reflect the reality that something inappropriate is pointed out whenever the audit is conducted.

5) Simplification helps to clearly show the conclusion, although the assumption of a continuous range of effort levels is realistic, rather than limiting the effort level of an organization to two categories, i.e. "make an effort" and "make no effort."

It is assumed that an organization is risk neutral. Naturally, an organization does not make extra efforts without threat of an audit. When the degree of strictness (probability of being audited) is γ, the expected loss to an organization is:

In the case they made an effort $\qquad \gamma(F_1 - T) + C$

In the case they make no effort $\qquad \gamma(F_0 - T)$

An organization will make an effort if and only if (1) holds.

$\gamma(F_1 - T) + C \leq \gamma(F_0 - T)$ i.e.

(1) $\qquad \dfrac{C}{F_0 - F_1} \leq \gamma^*$

2.2 Optimum probability of audit

The total amount of the organization's business costs that exceed T and the costs of the efforts of both the organization and the board is defined as "social loss." In a case wherein the board is executing an audit at level γ, the social loss when an organization has made an effort can be given by:

(2) $W_1(\gamma) = F_1 - T + C + G(\gamma)$,

and if the organization has not,

(3) $W_0(\gamma) = F_0 - T + G(\gamma)$

Let us find the value of γ that gives the minimum social loss, taking into consideration the fact shown in 2.1 that an organization changes their effort level in accordance with γ. The minimum value of (2) at $\gamma = \gamma^*$ is $F_1 - T + C + G(\gamma^*)$, and the minimum value of (3) at $\gamma = \gamma^*$ is $F_0 - T$. Therefore, the value of γ that gives the minimum social loss is:

(4) $\qquad \begin{cases} \gamma^* & \text{if } F_0 - F_1 \geq C + G(\gamma^*) \\ 0 & \text{if } F_0 - F_1 < C + G(\gamma^*) \end{cases}$

The left hand side of each formula means the "social gain" (decrease of social loss) achieved through the efforts of the organization. The right hand side indicates the auditing costs necessary to induce the organization to make the effort. For the purpose of studying the auditing mechanism, we will use the case where an audit is socially desirable, i.e. the case where the first formula of (4) is satisfied.

2.3 Behavior of the Board of Audit

The probability of audit that gives minimum social losses has been found in 2.2. However, the board does not always choose such a probability. As we saw in Section 1, the activities of the board are measured by the indicated amount. Let the indicated amount represent the payoff for the board. To acquire the payoff, the board has to pay auditing cost G (γ). The board chooses the probability that gives the maximum net payoff equivalent to the difference between the payoff and the costs. For simplification, it is assumed that the board is risk neutral. Thus, the board chooses the probability that gives the maximum expected net payoff.

Based on (1), the expected net payoff of the board is

(5) $\gamma(F_1 - T) - G(\gamma)$

when an organization makes an effort under γ that satisfies $\gamma \geq \gamma^*$, whereas it is

(6) $\gamma(F_0 - T) - G(\gamma)$

when they do not make an effort under γ that satisfies $\gamma < \gamma^*$.

Let us find γ that maximizes (5) under $\gamma \geq \gamma^*$. Letting $G'(\gamma_1) = F_1 - T$, the best γ for the board is

(7) $\qquad \begin{cases} \gamma^* & \text{if } \gamma_1 \leq \gamma^* \text{ and} \\ \gamma_1 & \text{if } \gamma_1 > \gamma^*. \end{cases}$

Then we find γ that maximizes (6) under $\gamma < \gamma^*$. Letting $G'(\gamma_0) = F_0 - T$, the best γ for the board is

(8) $\qquad \begin{cases} \gamma = \gamma_0 & \text{if } \gamma_0 \leq \gamma^* \text{ and} \\ \gamma = \gamma^* & \text{if } \gamma_0 > \gamma^*. \end{cases}$

The value $\tilde{\gamma}^*$ is slightly smaller than γ^*. [6] The determination of γ_1 and γ_0 is shown in Fig. 1. It is clearly seen in Fig.1 that $\gamma_1 > \gamma_0$.
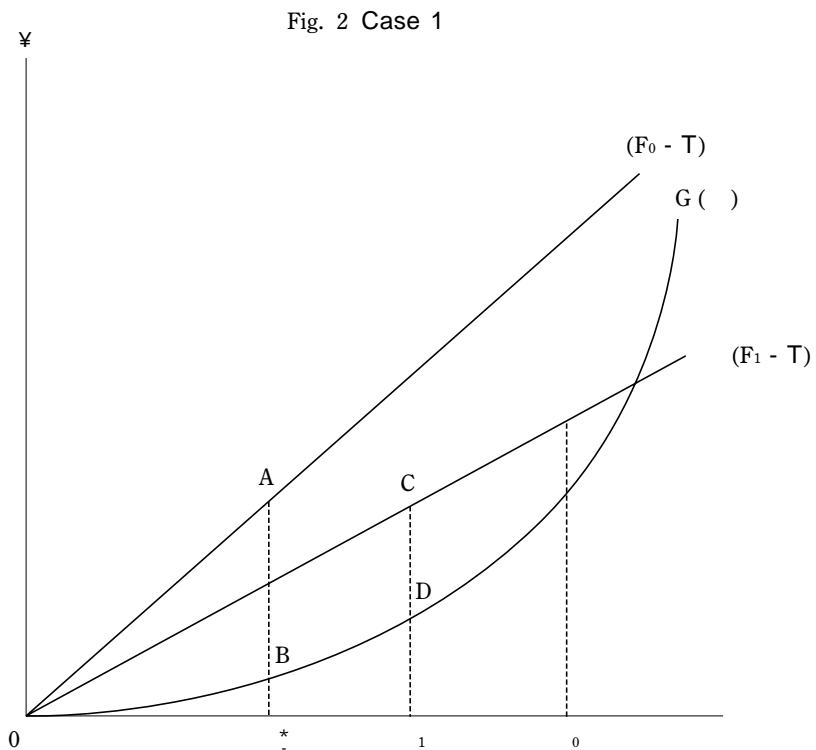
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6) Under the constraint of $\gamma < \gamma^*$, formula (6) does not have a maximum value, because the value of (6) becomes larger as γ gets closer to γ^* while maintaining $\gamma < \gamma^*$. Here, the assumption is made, sacrificing mathematical correctness, that the board chooses a certain $\tilde{\gamma}^*$ which is slightly smaller than γ^* so that an organization does not make an effort.

Fig. 1　Determination of α_0 and α_1

$(F_0 - T)$

$G(\alpha)$

$(F_1 - T)$

α_0　α_1　α_0
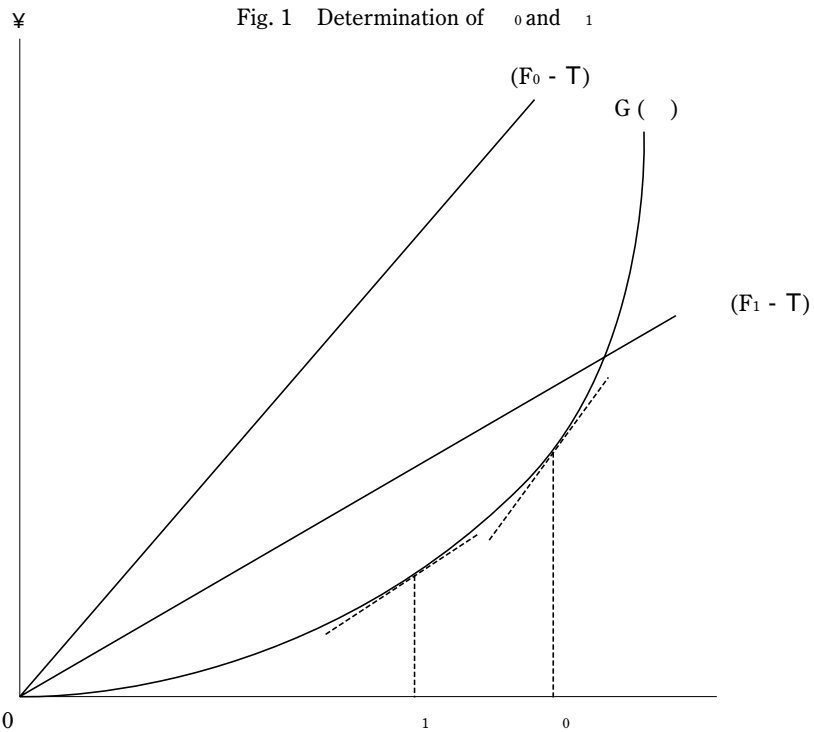
Let us determine α which the board chooses based on (7) and (8). For that purpose, three cases have to be distinguished according to relative value of α_1, α_0, and α^*.

Case 1　$\alpha^* < \alpha_1 < \alpha_0$

In this case, the value of α chosen by the board is determined according to the relative value of $\alpha^*(F_0 - T) - G(\alpha^*)$ (represented by the line AB in fig. 2) and that of $\alpha_1 (F_1 - T) - G(\alpha_1)$ (represented by the line CD in Fig. 2).

Fig. 2　Case 1

$(F_0 - T)$

$G(\alpha)$

$(F_1 - T)$

A　C

D

B

0　　　　　α_1　α_0

The board chooses α^* if

(9) $\alpha^*(F_0 - T) - G(\alpha^*) \geq \alpha_1(F_1 - T) - G(\alpha_1)$ [7].

Obviously α^* is not socially optimum. In order to secure a certain level of indicated amount, the board prefers an organization not make an effort, because the indicated amount becomes smaller if an organization makes an effort. For this purpose, a smaller value of α is favorable for the board. However, when the value of α is excessively small, the expected net payoff gained by the board becomes smaller. As a result, the largest of those α's where an organization does not make an effort is chosen by the board. This is a dilemma that arises due to the fact that the board takes a direct interest in increasing the indicated amount [8].

In the case where (9) does not hold, the board chooses α_1. An organization makes an effort under α_1, but α_1 is larger than α^* which is enough to motivate the organization to make an effort. The inequality $G(\alpha^*) \leq G(\alpha_1)$ means that higher auditing costs are incurred to let organizations make an effort.

Case 2 $\alpha_1 \leq \alpha^* \leq \alpha_0$

The board chooses α which brings a larger value of $\alpha^*(F_1 - T) - G(\alpha^*)$ and $\alpha^*(F_0 - T) - G(\alpha^*)$. It is α^* as shown in Fig. 3. The board chooses α^* which induces an organization to make no effort, because the indicated amount decreases if the board chooses α^* which induces an organization to make an effort. Here we can also see the consequence of the board taking an interest in the size of the indicated amount.

Fig. 3 Case 2
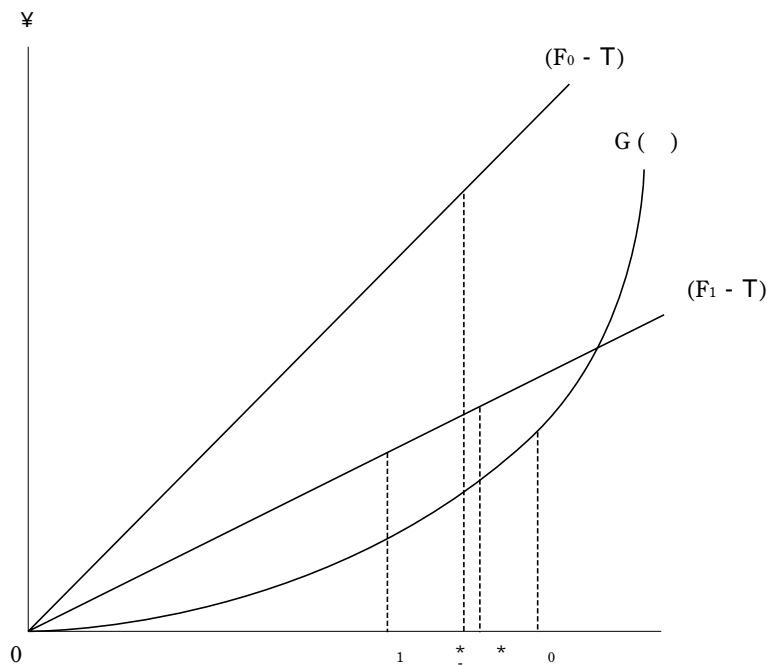
Case 3 $\alpha_1 \leq \alpha_0 \leq \alpha^*$

In this case, as can be seen from Fig. 4, the board secures the maximum expected payoff by selecting α_0 where an organization does not make an effort.

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7) α^* has to satisfy $\alpha^*(F_0 - T) - G(\alpha^*) \geq \alpha_1(F_1 - T) - G(\alpha_1)$

8) This dilemma arises also in securing the execution of laws or in governmental involvement in restoring a market failure in the private sector. For these topics, see Rose-Ackerman [1978], Mookherjee & Png [1995], and Acemoglu & Verdier [2000]. While these works explicitly introduced corruption between the board and the audited organizations, present paper shows that the dilemma can arise even when there is no such immoral factor.

Fig. 4 Case 3
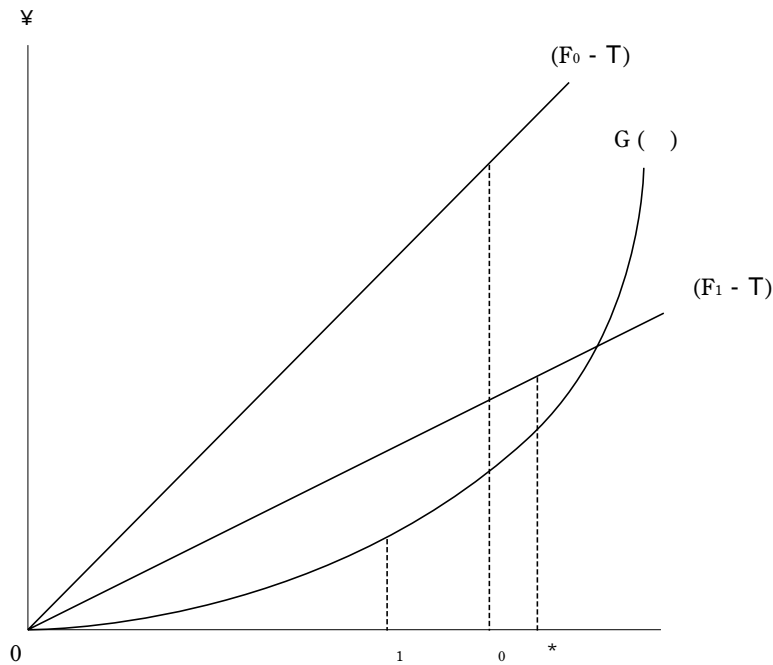
3. The Second Best Measures

The summaries shown below are the results arising from the above analysis.

	Case1		Case2	Case3
	(a)	(b) π_1		π_0
Probability level				
Whether an organization makes an effort or not	×		×	×
Expected net payoff of the board	R	R_1	R	R_0
Social losses	$W_0(\pi)$	$W_1(\pi_1)$	$W_0(\pi)$	$W_0(\pi_0)$

where

$R^* = \pi^*(F_0 - T) - G(\pi^*)$

$R_1 = \pi_1(F_1 - T) - G(\pi_1)$

$R_0 = \pi_0(F_0 - T) - G(\pi_0)$

Cases 2, 3 and 1(a) show that the board incurs activity costs, even when no effort is made by an organization, and hence the social losses become larger compared with the case of no audit. The existence of the auditing system itself affects the situation adversely. However, in case 1(b), the board induces the effort of an organization by selecting π_1. Naturally, this case does not mean that the minimization of social losses is realized, because even in that case, the probability level of auditing is π_1, which is larger than the socially optimum probability level of π^*.

Apparently, it seems that Case 1(b) brings a result close to the socially optimum solution when π^* is adequately close to π_1. However, it is not correct. $\pi^* < \pi_1$ results in $G(\pi^*) < G(\pi_1)$ and $\pi_1(F_1 - T) - G(\pi_1) < \pi^*(F_0 - T) - G(\pi^*)$. Therefore, the choice of π^* is favorable to the board. Considering $F_0 - T > F_1 - T - C$, the social losses are smaller in (b), and the board's choice is incompatible with achieving lower social losses.

The choice by the board is compatible with lower social losses only when π^* is adequately smaller than π_1. If

$*$ is adequately small, the board chooses $_1$ because $R^* \ R_1$. On the other hand, $(F_0 \ F_1)(1 \ *) \ G(\ _1) \ G(\ *)$ has to be satisfied for the social losses of (b) to be smaller than those of (a). If $F_0 \ F_1 \ G(\ _1)$, this condition is satisfied for an adequately small $*$. Considering $* \ C/(F_0 \ F_1)$, that $F_0 \ F_1 \ G(\ _1)$ and $*$ adequately small requires $F_0 \ F_1$ to be adequately large relative to $G(\ _1)$ and C. This requirement is likely to be met if a small effort of an organization leads to a great reduction in the business costs. In such a case, Case 1 rather than Case 2 or Case 3 is likely to be attained.

In summary, if the efforts made by an organization are particularly effective, the behavior of the board could serve to diminish social losses (although it does not bring about the exact minimization of social losses). On the other hand, if the efforts of an organization are not so effective, it is highly likely that the activities of the board are incompatible with minimizing social losses. However, if the efforts of an organization do not bring about significant results, the influence on social losses is not so serious, even if the function of the board is incomplete and the board fails to motivate the organization to make further efforts.

Conclusion

It seems to be very reasonable that performance auditing agents are evaluated using the indicated amount. When the board operates in line with such an evaluation method, however, the possibility arises that the social payoff is not served by the board's activities. Although the board is entrusted with reducing social losses. it tends to prefer, through evaluation system, a higher indicated amount which in turn implies larger social losses. However, if the motivation to reduce the indicated amount is given to the board, it will simply choose to make the audit probability level zero, and the auditing system will no longer work. This is the dilemma facing the current auditing system.

When faced with this seemingly pessimistic results, one may conclude that either organizations or the board should act not based on self-interest but on professional ethics to diminish the social losses. Naturally, staff's higher moral might reduce social losses, but it is not easy for an ordinary person to behave under strict moral constraints (by neglecting their self-interest) over a long period. This has been proved by experience that centralized planned economies failed to work well.

If the auditing system is abandoned because results are far from ideal, the power to reduce social losses disappears. Noting that there is room for an auditing system to function partially when $*$ is adequately small, it may be better attempt to secure such an environment. In the process of operating an auditing system, the methods that organizations should use to run a business with lesser costs might be identified. Further, a "validity test," which has recently been noted as a function of the board, might serve towards this end. And the introduction of an incentive system, whereby sufficient rewards can be obtained when an organization realizes an efficient business, could also contribute to this.

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