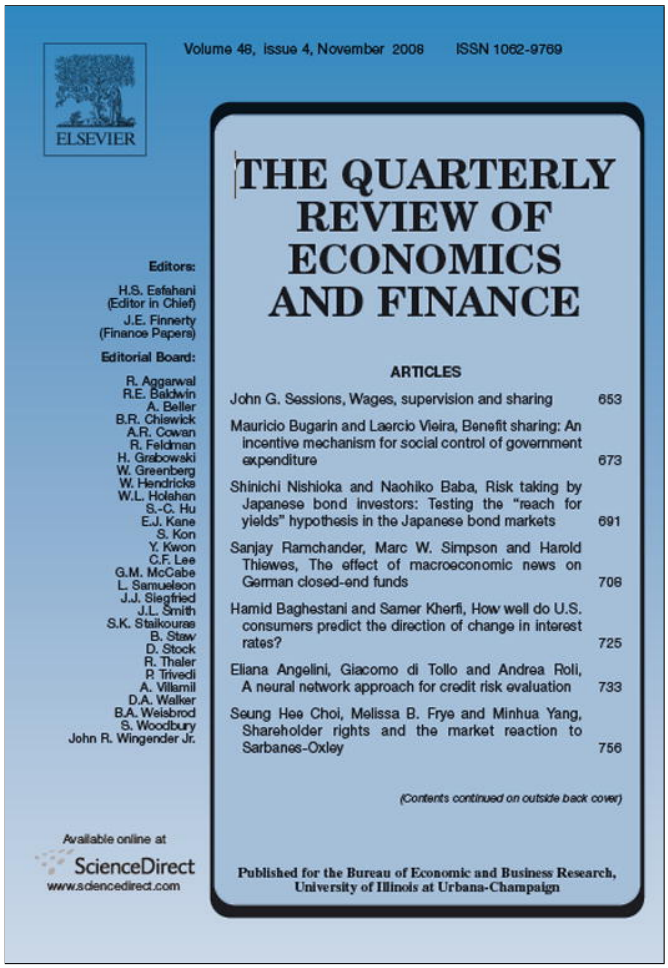

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Benefit sharing: An incentive mechanism for social control of government expenditure

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Abstract

The present paper analyzes the incentives individual members of society face to contribute to a nation's efforts in controlling corruption. A Principal-Agent model is constructed, leading to the following results. First, although individual agents do have an interest in devoting a portion of their resources to the nation's control effort, the opportunity cost of the effort and a free rider problem blocks the spontaneous provision of individual support to corruption control. Second, to cope with those incentives, a new welfare improving mechanism is proposed, which aligns individual incentives with those of society at no extra cost to the government.

JEL classification: D73; H50; H61

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1. Introduction

The efficient use of public resources is one of the fundamental factors underlying the distinct development paths forged by nations that were initially at a comparable stage of technological development. To be sure, investments in unfinished projects, waste, and the diversion and mismanagement of public resources have a devastating effect not only on a country's public

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accounts but also on its GDP growth rate.[1] Mauro (1995), for example, presents a 67-country econometric analysis, in which "corruption is found to lower investment, thereby lowering economic growth". Similarly, Habib and Zurawicki (2002) provides an 89-country econometric analysis which concludes that corruption reduces foreign direct investment as well. A specific country study presented in Bugarin, Gomes and Ellery (2005) suggests that Brazil wasted approximately 20% of its gross capital accumulation in the last 5 decades of the 20th century.

The high social cost associated with the inefficient use of public resources has driven societies around the world to assume a far more active role in controlling public resources and in demanding punishment of those individuals involved in corruption and the diversion of resources. To cite a landmark example, the impeachment of former Brazilian President Fernando Collor de Mello in 1992,[2] which was only made possible by the significant pressure exerted by society,[3] represented a milestone in the effort to raise social awareness in that country.

Civil society's participation in detecting and monitoring the diversion of public resources is of great importance to a country. First, because it represents a form of civic action that fosters a spirit of national unity centered on the common good. Second, because it carries the potential of frightening corrupt individuals, who face the risk of punishment, and, in this way, deters them from engaging in illicit activities.

Social involvement by average citizens, however, requires dedication and resources, and, moreover, it also competes with their everyday activities such as work and leisure. Given the cost of devoting oneself to social control, citizens have a natural tendency to delegate to the government the responsibility for controlling the Public Administration. Therefore, in the current context, it may be the case that the Federal Government is not taking advantage of the effort civil society might well be willing to invest in controlling the public administration, were it not for the high cost of this activity.

The purpose of the present article is to study the incentives society faces with respect to its participation in the control of public expenditures, and to determine how this participation can be promoted. The second section sets forth the basic ideas of the proposed model. As a benchmark for future comparisons, Section 3 develops and solves the optimization problem of an agent who is unaware of his potential for participating in the collective control effort. The following section determines the optimal choice for an agent when he recognizes his role in the control process, although here he receives no government encouragement to become involved. This case

[1] There is no theoretical unanimity about the effects of corruption on economic development. One trend of the literature highlights the inefficiency-reduction role of corruption as it allows for a Coasian negotiation between the bureaucrat who owns the property rights of public resources and private agents that can benefit from those resources. In a society dominated by a rigid bureaucracy such negotiation may lead to a second best instead of a third best allocation. In Huntington's (1968) words: *"In terms of economic growth, the only thing worse than a society with a rigid, over-centralized, dishonest bureaucracy is one with a rigid, over-centralized, honest bureaucracy"*. A second trend of the literature notices the symbiotic relationship that may arise between corruption and the bureaucratic structure and concludes that instead of reducing the inefficiency of a rigid bureaucracy, corruption may in fact induce such rigidity, so that the bureaucrat can benefit from the resulting negotiation process. In that case corruption reduces economic growth by keeping an inefficient bureaucracy. Clearly, the authors of this article agree with this last analysis of the effects of corruption. For an excellent review of that literature see Bardhan (1997).

[2] "In May of 1992, Brazilian President Fernando Collor was accused by his own brother, Pedro, of leading a broad corruption network" (Hinojosa & Perez-Linan, 2002). This accusation led to his final impeachment in December of that year.

[3] "On September 29, 1992, the chamber of deputies voted 343-34 to impeach Fernando Collor, while more than 100,000 people demonstrated against the president in front of Congress" (Hinojosa & Perez-Linan, 2002). See also Ramalho (2004).

highlights the fact that there are limited incentives for civil society to exercise a significant role, to the extent that a natural tendency exists for society to delegate all of the responsibility for control to the government bodies. Recognizing the reduced stimulus for spontaneous social involvement, Section 5 analyzes an alternative mechanism that induces civil society to invest its own resources in control without resulting in any additional cost to the State. Section 6 reviews the theory of Legislative oversight in the light of the proposed incentive mechanism. The following section compares that mechanism with others that are actually in use or have been proposed in order to avert behavior that will be harmful to society, and concludes that if incentives are set properly then individuals' private effort can be used in large scale to control public expenditure. Finally, Section 8 concludes the study.

2. Basic ideas of the model

All citizens make use of the public goods and services provided by the State and, as a result, expect the State to use its resources in an efficient and competent manner in order to provide, within the established budgetary constraints, the largest possible volume of goods and services. However, considering the problem of incentives associated with the Public Administration, there occurs large-scale waste of resources, squandered through fraud, overcharging, corruption, and unfinished projects.

Citizens are aware of that waste, feel victimized by it, and have a natural inclination to participate in the control of the Public Administration, denouncing the irregularities they uncover. However, for this contribution to be truly effective, it is essential that these agents devote time and effort to the control process. On the other hand, there are costs to the agents for devoting time and effort to safeguarding the public assets, given that they could use the same resources to obtain a higher private return whether by working more or making better use of their leisure time. This phenomenon is known as the "opportunity cost" of control, which requires giving up individual return in order to control wasting public goods.

Thus, an impasse emerges: if the expected social return for the time devoted to control is very low in comparison to the private return that the agent obtains when he devotes himself to his work or leisure activities, his preference will be to transfer all the responsibility for the control of the Public Administration to the government.

Moreover, there is a free rider problem in which an agent who expects that his colleague will devote time and effort to control ends up relying on the other individual without contributing to the general control effort. However, if everyone thinks along those same lines, nobody contributes to the control process. This is a quite common phenomenon in the economics of the public sector, which explains why the voluntary provision of public goods tends to generate a quantity of goods that is much lower than the socially optimal one.

Both of the problems enumerated above, the opportunity cost of control and the free rider problem, drive civil society to distance itself from the control effort, leaving the responsibility for the control of the public administration exclusively in the hands of the formal control institutions. To resolve this problem and actually be able to count on society's participation in the control effort, incentive mechanisms must be created that, in some way, compensate the civil organizations for their efforts.

A possible mechanism proposed in this article consists in awarding financial compensation to institutions that prove to be instrumental in the recovery of diverted public resources. In this case, a portion of the recovered resources would be used for compensation, resulting in no cost to the government. It is important to stress that this does not involve the injudicious distribution of scarce

public resources, which would be highly inappropriate, particularly given the current context in which most governments have endeavored to remain within tight and responsible budgetary constraints. To the contrary, the idea is to create more latitude within the existing budgetary constraints by introducing a mechanism that would allow for the recovery of those resources that would otherwise be irrevocably lost. The compensation awarded to those institutions that made possible the recovery of those resources would be derived in whole, and exclusively, from the recovered amount.[4] Note furthermore that the reward to the instrumental agent could be made in kind but also as tax credits, for example, or other mechanisms that would not necessarily imply direct payment to the agent but would have an equivalent incentive effect.[5]

3. The basic model and the representative agent's decision without social involvement

3.1. The government

The government has at its disposal a budget in the amount of B monetary units that is to be used to provide public goods and services to society. However, public administrators may divert parts of budget B using several mechanisms such as overcharging, ghost contracts, illicit transfers, etc. Let δ be a percentage of the total budget that is diverted. Thus, only the amount $(1-\delta)B$ is actually converted into public goods and services that generate a return to society. The value δB corresponds to the amount of the public budget that is lost.

3.2. The public control institutions

The role of the public control institutions is to detect[6] the diversion δB. However, the control process does not always allow for the identification of the diverted resources in time to recover the lost amount. This model estimates that the official bodies are able to recover the diverted amount with a probability $\pi_0 \in [0,1]$. The probability π_0 is an exogenous parameter of the model and, to a certain degree, represents the level of development of the national control system: the larger π_0 is, the more efficient the control bodies are, insofar as they will be able to provide for the recovery of the diverted resources with greater frequency.

3.3. Society

Society is modeled by a representative agent, who derives satisfaction from three basic activities: the consumption of private goods (clothing, food, semidurable and durable goods, etc.), leisure (sports, the arts, performances, rest, etc.), and the consumption of the goods and services provided by the State (healthcare, education, social security, national security, law enforcement, etc.). In the pages that follow, *public goods* are referred to generically as the entire range of goods

[4] In this study, the concept "recovered amount" is broad, encompassing resources that are detected even before becoming effectively diverted.

[5] The authors are grateful to Mirta Bugarin for this insight.

[6] To be sure, the duties of the official control bodies are far more complex, ranging from the prevention of diversions, whenever possible, to the detection and recovery of the diverted resources. This model focuses on the task of detecting the diversion of resources; however, Section 8 shows that an additional function of the proposed model is a long-term reduction in the diversion of resources, meaning that it has a preventive effect.

and services provided by the State, even though from the standpoint of economic theory this designation is not wholly accurate.[7]

Thus, one can characterize the agent's utility as a function $U(c, l, b)$, in which c corresponds to private consumption, l corresponds to leisure time, and b corresponds to the consumption of public goods. This model assumes $b = B/n$, in which n is the total population. Hence, the consumption of public goods for a representative agent is measured in terms of per-capita consumption of the effectively implemented budget.

The agent is endowed with a unit of time and must decide how to allocate it among three basic activities: work, leisure, and control. Work provides income that is used to purchase the agent's private consumption. Leisure provides no income; however, the time devoted to that activity generates satisfaction for the agent. Finally, the time devoted to control can contribute to the recovery of the diverted resources, so that the agent receives a larger offering of the public goods provided by the State. The agent may or may not recognize the strategic opportunity of contributing to the nation's control effort. This first basic model assumes that the agent does not recognize that opportunity and ascribes all the responsibility for the control of the public administration to the official institutions. In the next sections, that hypothesis will be relaxed.

3.4. The agent maximization problem

The utility function for the agent is presented more precisely below.

$$U(c, l, b) = \alpha u(c) + \beta v(l) + \gamma[\pi_0 w(b) + (1 - \pi_0)w((1 - \delta)b)]$$

Therefore, it is assumed that agent's utility is additively separable in private consumption, leisure, and the consumption of public goods. The function u represents the specific utility associated with the consumption of private goods (c); the function v computes the satisfaction associated with leisure (l), and the function w expresses the utility derived from the (individual) consumption public goods. Note that the consumption of public goods is a random variable that takes the value b with a probability π_0 (when the diverted resources are recovered), and takes the value $(1 - \delta)b$ with a probability $1 - \pi_0$ (when those resources are not recovered). It is for that reason that the expected value of the satisfaction derived from the consumption of public goods is considered in the utility equation. The present model assumes that the functions u and v and w are strictly increasing, concave, and differentiable, and that in addition, u and v are strictly concave; thus, the greater the consumption of private goods, leisure time, and the consumption of public goods, the greater the agent's satisfaction; however, the added satisfaction derived from each additional unit of private consumption or leisure decreases, to the extent that the agent already benefits from a large quantity of that consumption or amount of leisure time.

Finally, the positive parameters α, β and γ (where $\alpha + \beta + \gamma = 1$) represent the relative weight the satisfaction derived from each of the different activities has in the agent's utility function. Thus, if α is significantly large in comparison to the other parameters, the agent will give more value to the consumption of private goods, while attaching relatively less value to leisure and the consumption of public goods. Similarly, if γ is significantly large, the agent will ascribe more value to the consumption of goods and services provided by the State and, as a consequence,

[7] In economic theory, a *pure public good* is any good having two basic characteristics, *non-exclusion* (the costs to exclude an agent from consuming that good are extremely elevated) and *non-rivalry* (the consumption of that good by an agent does not affect its consumption by other agents), regardless of who is responsible for providing the good. Thus, national defense is a typical example of a pure public good while education is a publicly provided private good.

could potentially concern himself more with the losses resulting from the unrecovered diverted resources.

When the agent does not believe that he can contribute to the government's control effort, his decisions on how to allocate his time will be reduced to choosing how much time to devote to work and how much to leisure. Thus, the agent's maximization problem can be written as follows.

$$\begin{cases} \max\limits_{h,l} \alpha u(c) + \beta v(l) + \gamma[\pi_0 w(b) + (1-\pi_0)w((1-\delta)b)] & \mathrm{P}_1 \\ \text{s.t.} \quad h + l \leq 1 & (1) \\ c \leq sh & (2) \end{cases}$$

Restriction (1) in the maximization problem states that the agent in endowed with one unit of time (which can be considered as the total number of available hours) that can be allocated among work and leisure activities. The parameter s in restriction (2) is the wage rate, so that if the agent devotes h units of time to work, he will warrant a total wage sh that may then be applied towards his private consumption.

3.5. The agent's optimal choice

Given that the functions u and v are strictly increasing, the restrictions (1) and (2) are binding. Therefore, one can replace l with $1-h$ and c with sh, thereby converting the original problem into a concave program in a single variable. The first-order conditions yield the following solution.

$$s\alpha u'(sh) = \beta v'(1-h) \quad \text{and} \quad l = 1-h \tag{3}$$

The solution to the first equation corresponds to the optimal value h, which generates the optimal value l for the second equation. Note that the greater the satisfaction generated by private consumption (α) vis-à-vis leisure (β), the more time the agent will devote to work. By the same token, the greater the relative satisfaction derived from leisure activities, the more time that will be devoted to those activities.

3.6. Example

In order to present a closed-form expression for the problem's solution, assume that the utilities u and v take the usual logarithmic form: $u(c) = \log(c)$ and $v(l) = \log(l)$. Therefore, the optimal allocation of time by the agent is given by $h = (\alpha/\alpha + \beta)$ and $l = (\beta/\alpha + \beta)$.

4. The agent's decision with social involvement but without incentives

4.1. Social involvement

The model presented in the previous section assumes that the representative agent delegates exclusive responsibility for controlling the public administration to the public institutions. However, the diverted public resources reduce the agent's utility by reducing the per-capita value of b to $(1-\delta)b$. Nonetheless, if the agent contributes to the effort to increase the probability of recovery of the diverted resources, he will increase his own utility.

This section assumes that the agent can affect the probability of recovery of the diverted resources if he invests a portion of his time in control. More specifically, let t be the time the agent

devotes to control. The agent, then, will be instrumental in bringing to light the diversion and recovering the public resources with probability $\pi(\pi_0,t) \in [0,1]$, where π is a twice differentiable concave function satisfying the following conditions:

$$\pi(\pi_0, t) \in [0, 1 - \pi_0], \quad \forall \pi_0 \in [0, 1], \quad \forall t \in [0, 1] \tag{i}$$

$$\pi(\pi_0, 0) = 0, \quad \forall \pi_0 \in [0, 1] \tag{ii}$$

$$\frac{\partial \pi}{\partial \pi_0} < 0 \tag{iii}$$

$$\frac{\partial \pi}{\partial t} > 0 \tag{iv}$$

$$\frac{\partial^2 \pi}{\partial t \partial \pi_0} < 0 \tag{v}$$

Condition (i) simply states that π is an incremental probability, i.e., the total probability of recovering diverted public resources when there is social involvement is $\pi_0 + \pi(\pi_0,t) \in [0,1]$. Condition (ii) states that if the agent does not dedicate any effort into social control, the probability of recovering diverted resources does not change: $\pi_0 + \pi(\pi_0,0) = \pi_0$. Condition (iii) states that the more efficient are the public authorities (the larger π_0), the lower the probability the agent will be instrumental. Condition (iv) states that the more time the agent dedicates to social control, the higher the probability he becomes instrumental in recovering diverted resources. Finally, condition (v) captures the idea of substitutability of public and private effort: the more efficient the public authorities, the lower the marginal effect of private effort.

4.2. The new problem of the agent

When the agent recognizes the strategic opportunity of social involvement, the problem becomes the allocation of time among three activities: work, leisure, and social control. The new formal problem is presented below.

$$\begin{cases} \max\limits_{h,l,t} \alpha u(c) + \beta v(l) + \gamma[[\pi_0 + \pi(\pi_0, t)]w(b) + [1 - \pi_0 - \pi(\pi_0, t)]w((1 - \delta)b)] & \mathrm{P}_2 \\ \text{s.t.} \quad h + l + t \leq 1 & (4) \\ c \leq sh & (5) \end{cases}$$

The restrictions of this problem are the same as in the previous problem, although care must be taken to include the time t expended on control in Eq. (4).

Once again, on the basis of the monotonicity properties of the functions u, v, and now π, the restrictions will be binding. However, as opposed to the previous problem, it is not possible to ensure the existence of an interior solution: $0 < h, l, t < 1$. In fact, we argue in the next section that, in general, the solution to the problem will involve no spontaneous provision of social control, i.e., $t = 0$.

4.3. The diminutive likelihood of spontaneous provision of social control

If an interior solution exists, then we can solve for the first-order conditions. Let $\Delta w(b) = w(b) - w((1-\delta)b)$, then these conditions imply:

$$\begin{cases} t = 1 - h - l & (6) \\ s\alpha u'(sh) = \gamma \dfrac{\partial \pi}{\partial t}(\pi_0, t)\Delta w(b) & (7) \\ \beta v'(l) = \gamma \dfrac{\partial \pi}{\partial t}(\pi_0, t)\Delta w(b) & (8) \end{cases}$$

Note that it follows from Eqs. (7) and (8) that $s\alpha u'(sh) = \beta v' l)$, which corresponds to the same expression as in the previous solution (3), with the difference now that the restriction $h + l = 1$ is no longer valid.

It follows from the above equations and from condition (v) that the higher the efficiency of the official control bodies (π_0), the less stimulus society will have to invest its time in social control. Hence, the model suggests that society's participation in the control efforts will decrease as the formal institutions become more effective. Moreover, the lower the civil agent's capability, which is measured by the probability of success in bringing to light the illicit diversions (the derivative $\partial\pi/\partial t(\pi_0,t)$), the lower his incentive to participate in social control. Suppose, for example, that v' is bounded away from 0 (i.e., there exists $\varepsilon > 0$ such that $v'(l) > \varepsilon$, $\forall l \in [0,1]$), then if $\partial\pi/\partial t(\pi_0,t)$ is small, condition (8) will never be satisfied.[8] The fact that one does not usually observe high levels of involvement of society in the social control effort suggests that this is the case, as illustrated in the following parameterization of the agent's problem.

4.4. Example

In order to illustrate the previous argument, consider the closed form $u(c) = \log(c)$, $v(l) = \log(l)$ and let $\pi(\pi_0,t) = k(t/\pi_0)$, where $k < \pi_0(1 - \pi_0)$ is a constant that measures the agent's competence in uncovering illicit diversions. Then, the greater k is, the more "productive" the agent will be, insofar as there will be a greater probability of recovering the diverted resources. On the other hand, as discussed above, the larger π_0, the lower the probability the agent will be instrumental. Note that because of the restriction imposed on parameter k, society can never have total certainty that the diverted resources will be recovered, even if the agent devotes all of his time to control: $\pi_0 + \pi(1) < 1$.

Then, conditions (6)–(8) produce the following solution to the problem:

$$h = \frac{\alpha\pi_0}{\gamma k \Delta w(b)}, \quad l = \frac{\beta\pi_0}{\gamma k \Delta w(b)}, \quad t = 1 - \frac{(\alpha+\beta)\pi_0}{\gamma k \Delta w(b)} \tag{9}$$

Therefore, for this solution to work it must be the case that:

$$(\alpha + \beta)\pi_0 < \gamma k \Delta w(b) \tag{10}$$

Recall that $\Delta w(b) = w(b) - w((1-\delta)b)$ corresponds to the gain obtained by the agent from the recovery of the diverted sum δB. Given that $b = B/n$, the right hand side of (10) is likely to be very small. Moreover, if γ is small compared to $\alpha + \beta$, meaning that the agent cares more about private

[8] More precisely, (8) will never be satisfied when $(\partial\pi/\partial t(\pi_0,t)) < (\beta\varepsilon/\gamma\Delta w(b))$ for all $t \in [0,1]$.

consumption and leisure than about public goods, and if the effectiveness of the agent's effort (the parameter k) is reduced, then (10) is likely not to occur, so that there will be no spontaneous provision of social control.

Note, further, that if one were to extrapolate a larger number of private agents for the basic model, a free rider problem would emerge. In the context of this analysis, the free rider problem can be described as follows: if there are several agents, one of them will make use of the benefits (the recovery of diverted resources) deriving from the efforts of the others (the time invested in social control) without, however, having to devote any of his time to that activity; in other words, an agent can free ride on the effort of the others. Consequently, if an agent expects that others will devote themselves to social control, he will choose $t = 0$. However, if all agents act in this way in anticipation of benefiting from the efforts of the others, none will invest in social control.[9] This phenomenon represents a major difficulty to any attempt to induce society to participate in social control activities in the real world. Therefore, if free riding opportunities were included in the present model, the likelihood of a solution without spontaneous social involvement ($t = 0$) would increase. On the other hand, it will become clear in the next section that the benefit sharing mechanism reduces the free riding effect since it offers a private personal gain to an agent that is instrumental in recovering diverted public resources.[10]

In conclusion, in spite of the fact that spontaneous social control is a feasible choice from a theoretical standpoint, one argues that society will tend to delegate all of the responsibility for government control to the official bodies. The next section presents an alternative mechanism, the basic purpose of which is to stimulate social control by means of an adequate incentives system, without imposing additional costs on the government.

5. A mechanism for stimulating civil society's participation in social control

5.1. The model with incentives

This section considers the case where the agent has no interest in investing a portion of his time in spontaneous social control. In other words, the solution to problem P_2 is not interior, thereby requiring that $t = 0$. The government recognizes the incentive problem and, realizing that it involves a typical *principal-agent* situation, takes the role of a *principal* to construct a mechanism that motivates the agent to devote himself to social control. The mechanism works in the following manner: if the agent is instrumental in recovering the diverted public resources δB, then a percentage λ of the resources will immediately revert to the agent himself, while the remaining percentage $(1 - \lambda)$ is returned to the treasury.

Therefore, this entails a risk-sharing partnership between the *principal* and the *agent,* insofar as the process of social control involves a cost to the agent (the opportunity cost of devoting his time to this activity) as well as risk: the possibility of failure (the agent not being able to detect the diversion, the probability of which is $1 - \pi(\pi_0, t)$). To stimulate the agent's participation, the government offers him a portion of the return should he succeed. Mechanisms of this nature are widely used both in theoretical models – and comprising the essence of the principal-agent model – and in practical situations. One of the more common and long-standing examples of this

[9] This involves a phenomenon commonly witnessed in situations related to the voluntary provision of public goods, which results in the inadequate provision of those goods. In the current context, social control can be seen as a public good, given that its return reverts entirely to the benefit of society as a whole.

[10] The authors are grateful to an anonymous referee for pointing out the fundamental role of free riding.

principle can be found in the contracts between farmers and landowners, in which the landowner (the *principal*) provides the land while the farmer (the *agent*) shares the return of his labor with the landowner: the harvest.[11]

5.2. The new agent problem

Given this new mechanism, the agent problem, $P_3(\lambda)$, can be rewritten as follows:

$$\begin{cases} \max\limits_{h,l} \alpha[\pi(\pi_0,t)u(c+\lambda\delta B)+(1-\pi(\pi_0,t))u(c)]+\beta v(l) \\ \qquad +\gamma[\pi_0 w(b)+\pi(\pi_0,t)w((1-\lambda\delta)b)+[1-\pi_0-\pi(\pi_0,t)]w((1-\delta)b)] \\ \text{s.t.} \quad h+l+t\le 1 \qquad (11) \\ \qquad c\le sh \qquad (12) \end{cases}$$

In the expression above, the term $c+\lambda\delta B$ corresponds to the increase in the consumption the agent will merit if he is instrumental in the recovery of the diverted resources, the probability of which is $\pi(\pi_0,t)$. The solution $t(\lambda)$ for this new problem, which depends wholly on the parameter λ, is analyzed below.

5.3. Analysis of the solution

The agent's objective-function can be rewritten as:

$$\alpha u(c)+\beta v(l)+\alpha\pi(\pi_0,t)[u(c+\lambda\delta B)-u(c)]+\gamma[\pi_0 w(b)+\pi(\pi_0,t)w((1-\lambda\delta)b) +[1-\pi_0-\pi(\pi_0,t)]w((1-\delta)b)]$$

In comparison to the objective function of problem P_1, the following extra terms appear: $\alpha\pi(\pi_0,t)[u(c+\lambda\delta B)-u(c)]$ and $\gamma\pi(\pi_0,t)[w((1-\lambda\delta)b)-w((1-\delta)b)]$. The latter term is positive if and only if $t>0$. In order to assess the effect of the former term on the agent's decision, the expression is broken down into two parts: $\alpha\pi(\pi_0,t)$ and $u(c+\lambda\delta B)-u(c)$.

Because the utility function u is strictly increasing, the expression $u(c+\lambda\delta B)-u(c)$ is positive. In addition, since the parameter B corresponds to the total amount of the public budget, the term $\lambda\delta B$ is potentially very large if compared to the agent's income c. Thus, the net gains in the utility of the agent who receives financial compensation, $u(c+\lambda\delta B)-u(c)$, is potentially high and will be even more substantial as the parameters δ and λ become larger.

However, to make use of the expected gain in utility it is necessary that $\pi(\pi_0,t)>0$, or, in other words, that $t>0$, i.e., that the agent devote some of his time to social control.

Comparing to the situation in which the agent invests nothing in social control, one can conclude from the continuity of the utility functions u and v that a small reduction in h or in l (which makes $t=1-h-l$ positive) will only slightly alter the values of $u(c)=u(sh)$ and $v(l)$. However, it will significantly alter the value of $\alpha\pi(\pi_0,t)[u(c+\lambda\delta B)-u(c)]$, which increases from zero ($t=0$) to a large positive value. Thus, we can conclude on the basis of the continuity of the functions involved that the problem will more likely have an interior solution, that is, $t>0$.

[11] Adam Smith [1797] (2000) was one of the first researchers to analyze that sharecropping arrangement, a topic that still today inspires a significant quantity of theoretic and empirical research. For a recent reference, see Laffont and Martimort (2002). Next section presents a more precise comparison between the benefit sharing model and the basic moral hazard models.

Therefore, the proposed mechanism will stimulate the agent to invest his time in social control. The topic below shows that the proposed mechanism will also be of interest to the government.

5.4. The government problem

The proposed model stimulates the representative agent to invest a portion of his time in social control activities. Consequently, the probability of recovering the diverted resources increases from π_0 to $\pi_0 + \pi(\pi_0,t)$.

Consider now the government. Given that its main role is to provide public goods, one may define its utility as the total quantity of public resources actually invested in public goods and services. Therefore, it is possible to make a formal comparison of the effect of the new mechanism on the government's welfare.

Start with a situation in which the agents have no incentive to invest in spontaneous social control. In that case $t = 0$ and the government's utility is:

$$U_0 = (1 - \delta)B + \pi_0 \delta B$$

The first term in the expression above corresponds to the amount applied to public goods when the diverted resources δB are not recovered, while the second sum corresponds to the value that is recovered by the official control institutions, the probability of which is π_0.

Consider now the government implements the mechanism, wherein $\lambda \in (0,1)$ is the apportionment parameter. Furthermore, let $t(\lambda)$ be the time the agent allocates to social control, given the parameter λ. The government's utility then becomes:

$$U_\lambda = (1 - \delta)B + [\pi_0 + (1 - \lambda)\pi(\pi_0, t(\lambda))]\delta B$$

The difference between U_λ and U_0, the term $(1 - \lambda)\pi(\pi_0,t(\lambda)\delta B$, corresponds to the increase in the provision of public goods and services originating in the recovery of the diverted resources arising from the agent's efforts; given that the incremental probability of this recovery is $\pi(\pi_0,t(\lambda))$ and that it is subject to the apportionment λ, one arrives at the expression above.

One can thus establish that the proposed mechanism leads to an increase in the total expected value of public investment, increasing, in this way, the government's utility, provided that $t(\lambda) > 0$. Note that the incentive is implemented at no cost to the government, since the payment is made through the use of resources that would not be available had they not been recovered with the agent's participation.

Also note that the gain occurs for any value of λ, provided that:

(i) The parameter λ is sufficiently high to ensure that $t(\lambda) > 0$; and
(ii) The parameter λ is smaller than 1, because otherwise all of the recovered resources would be transferred to the private agent.

Moreover, the smaller that λ is, the larger the government's return will be. Thus, the government would prefer to choose a very small value for that parameter. On the other hand, if the value were too low, the agent will invest little time in social control, thus reducing the probability $\pi(t(\lambda))$. Consequently, the government problem can be written, using the *principal-agent* structure, as:

$$\begin{cases} \max\limits_{\lambda}(1 - \delta B) + [\pi_0 + (1 - \lambda)\pi(\pi_0, t(\lambda))]B \\ \text{s.t.} \quad t(\lambda) \in \arg \max\limits_{t} P_3(\lambda) \end{cases} \tag{P$_4$}$$

The formulation presented above expresses the fact that the government will choose the factor λ when it knows that, for each value of λ, the agent will solve his maximization problem $P_3(\lambda)$, thereby producing the choice $t(\lambda)$. For example, on the basis of the earlier discussion, if $\lambda = 0$ then $t(\lambda) = 0$, but if $\lambda > 0$ then $t(\lambda) > 0$.

Note that, in equilibrium, the government will obtain the highest possible return when choosing the value λ that induces an optimal participation of society in the control process. Also note that the government problem can be viewed as a typical moral hazard problem in which there are two possible states of nature (state 1: the diverted resources are recovered, state 2: they are not recovered) and the likelihood of each state depends on the costly effort t of the agent (the probabilities $\pi(\pi_0,t)$ for recovery, and $1 - \pi(\pi_0,t)$ for no recovery). The restriction $t(\lambda) \in \arg \max_t P_3(\lambda)$ can be viewed both as a participation constraint (the agent participates if $t(\lambda) > 0$) and an incentive compatibility constraint that induces the agent to choose the effort level t that maximizes the government's utility function.

6. Legislative oversight: police patrols, fire alarms and benefit sharing

One of the central elements of research in the Executive-Legislative relations is Congressional oversight, defined in Ogul and Rockman (1990) as "legislative supervision and monitoring of the executive". The earlier literature suggested that Congress in the U.S. was neglecting its oversight responsibility by not spending enough effort to oversee administrative compliance with legislative goals.[12] However, McCubbins and Schwartz (1984) argue that what appears to be neglect really reflects a preference for a more effective form of oversight over a less effective one.

According to the authors, the earlier literature focused on a form of control called *police-patrol oversight* in which "Congress examines a sample of executive-agency activities, with the aim of detecting and remedying any violations of legislative goals".

The authors suggest, however, that the literature is missing a second important method called *fire-alarm oversight* in which "Congress establishes a system of rules, procedures, and informal practices that enable individual citizens and organized interest groups to examine administrative decisions, to charge executive agencies with violating congressional goals, and to seek remedies from agencies, courts, and Congress itself".

This second method has three main advantages over the first one. First, it focuses Congress' efforts in the problems that really matter to the constituents that have set the alarm. In the authors' words: "Justly or unjustly, time spent putting out visible fires gains one more credit than the same time spent sniffing for smoke".

Second, since under a police-patrol policy only a small fraction of executive-branch actions can be monitored, that method is likely to miss violations that harm a congressman's potential supporter. Finally, under a fire-alarm policy, "much of the cost is borne by the citizens and interest groups who sound the alarms and by the administrative agencies and courts".

The basic conclusion of McCubbins and Schwartz (1984) is that Congress chooses a potentially more efficient but reactive oversight policy (the fire-alarm method) rather than a potentially costlier and less efficient proactive oversight policy (the police-patrol method).

[12] See the vast literature cited in McCubbins and Schwartz, 1984.

In spite of the elegance of the treatment, theoretical and empirical works have not been conclusive in validating the fire-alarm policy approach.[13] One of the reasons of interest for the present article is precisely the fact that "much of the cost is borne by the citizens and interest groups who sound the alarms". Indeed, the alarm will only be sounded if the citizens placing the complaints find that redressing the situation compensates the incurred costs. Although the focus of the legislative oversight is to prevent the Executive from changing policy from its original legislative intent,[14] one may argue that corruption is one particular way to change a policy at the implementation stage that hurts the politicians' constituencies. In the case of corruption, the gains of recovering diverted resources may be so much diluted in society, that a cost-benefit analysis will lead citizens not to sound the alarm, as it has been shown earlier in this study.

Therefore, one can view the benefit-sharing mechanism as a complement to the implementation of the fire-alarm policy in the specific case of controlling wasteful use of public resources. In other words, the benefit-sharing mechanism may contribute to making the fire-alarm policy more effective, by aligning the incentives of those who may sound the alarm and the oversight institution. As a consequence, with the new mechanism one may expect that a much wider group of citizens will accept to bear the costs associated with that policy.

7. Related mechanisms in theory and practice

In spite of the originality of the proposed mechanism, which requires sharing with civil society the benefits of the recovered resources, the ideas of the present model can be related to mechanisms that are already being used in several countries or that have been proposed in the literature.

In the case of private firms' collusion, a most important mechanism concerns the leniency programs that allow agreements between the government and a company involved in cartel activities with other firms. Leniency legislation started in the USA in 1978 and had its scope greatly extended in 1993. Since then, other countries have passed leniency laws such as the European Union in 1996, Korea in 1997, England, Germany, Canada and Brazil in 2000. The leniency agreements have the following basic characteristics. When the government suspects that companies are involved in cartel activities it can sign a contract with one of the firms involved that reduces or even eliminates all applicable fines and other legal charges to the firm that cooperates with the investigation.[15] The leniency laws have resulted in impressive numbers both in terms of the punishments and in terms of the amounts of the fines. To cite two illustrative examples, the Antitrust Division of the U.S. Department of Justice has collected over 1.1 billion dollars in fines in fiscal year 1999; moreover, the famous case of the vitamin cartel, where Rhöne-Poulenc cooperated with justice signing a leniency agreement, resulted in the incarceration for 5 months of the President of Hoffman-LaRoche, a Swiss resident in addition to a personal fine of 150 thousand dollars.[16]

[13] See, for example, Balla (1998) for a discussion on the reasons why reactive oversight may be limited in its ability to enhance political control.

[14] We thank an anonymous referee for pointing out that the scope of fire alarms in much wider than controlling corruption.

[15] For the American case see Paul (2000) or Lectric Law Library (08/10/1994). For a comparison between the American and the European Community leniency laws, see Feess and Walzl (2003). For the Brazilian case see Considera, Correa, and Guanais (2001).

[16] See Paul (2000).

Table 1
Claims for reward filed and allowed (IRS informants)

Year	Number of claims filed	Number of claims allowed in full or in part	Percentage allowed in full or in part (%)	Taxes recovered as result of informant information (US$)
1989	11,754	519	4.42	72,030,630
1990	10,757	635	5.90	126,619,786
1991	9907	732	7.39	58,370,096
1992	10,966	671	6.12	83,710,270
1993	11,393	829	7.28	172,072,960
1994	9063	669	7.38	586,605,110
1995	7996	681	8.52	96,435,097
1996	9430	650	6.89	102,676,478
1997	7152	187	2.61	68,417,053
1998	6687	737	11.02	83,871,049
Total	95,105	6310	6.63	1,450,808,529

Source: Cooter and Garoupa (2001).

Therefore, leniency contracts seem to be an effective mechanism that creates incentives for companies involved in cartel activities to come forward in exchange for amnesty of its own liability. It is noteworthy that, to avoid abuses, the law states that a company shall not be the leader in the organization of the cartel in order to be able to sign a leniency agreement. Moreover, only the first company to come forward is entitled to amnesty under most leniency laws.

If one compares the leniency legislation with the benefit sharing mechanism proposed here, it becomes clear that the former is more demanding on the part of government in the sense that it gives amnesty to a company involved in unlawful activities, whereas the latter only rewards those who are instrumental in recovering diverted public resources.

When it comes to incentives within the public administration, the Revenue System usually have the most sophisticated mechanisms. When an auditor fines a company for tax evasion part of the fine reverts to himself as a mechanism for avoiding collusion between evader and auditor.[17] That mechanism brings an additional benefit to the auditor that compensates him for the opportunity cost of his dedicated and uncorrupted work, just as the shared benefit compensates society for the opportunity cost of the time spent in social control. In addition, the U.S. Internal Revenue Service rewards citizens who provide significant information on tax fraud by giving them a percentage of the total tax recovered, usually 10%.[18] Following Table 1 from Cooter and Garoupa (2001) presents some evidence on the amounts recovered due to that mechanism.

Still in the realm of tax evasion, a more radical mechanism has been recently proposed in the literature. The mechanism tells a company that has corrupted an auditor that she can come forward and its tax evasion will be forgiven. In fact the corrupted auditor shall be liable for that evasion and will be jailed in case he cannot compensate the government for that lost revenue. According to the author of the proposal, the mechanism is equivalent to sending to all companies the following letter.[19]

[17] See, for example, Besley and MacLaren (1993).
[18] See Cooter and Garoupa (2001).
[19] Ordañez (2002).

Table 2
U.S. treasury recoveries from qui tam suits

Fiscal year	Number of suits	U.S. treasury recoveries (US$)
1987	33	200,000
1988	60	355,000
1989	95	15,000,000
1990	82	40,000,000
1991	90	72,000,000
1992	119	134,000,000
1993	131	173,000,000
1994	221	379,000,000
1995	279	244,000,000
1996	363	127,000,000
1997	530	625,000,000
1998	417	331,000,000
1999	483	458,000,000
Total	2924	2,598,555,000

Source: Cooter and Garoupa (2001).

> "Dear Evader: If you did not pay your taxes and were discovered by an auditor, TRY TO CORRUPT HIM BY PAYING HIM A BRIBE, and then come to us, confess your evasion and report the corruption. By doing so you will help us to catch corrupt auditors and in return we will transfer the obligation of your present and past taxes and fines to them. Help us to catch corrupt auditors and we will forgive your evasion."

Finally, one implementation that is very close to our theoretic mechanism is the so called "qui tam" status in the U.S., which allows private citizens "to sue on behalf of the federal government in cases involving false claims on the Unites States".[20] The term is a short for the original Latin sentence "qui tam pro domino rege quam pro sic ipso in hoc parte sequitur", which means "who as well for the king as for himself sues in this matter". The status has its origin in medieval English practices and was first implemented in the U.S. as the False Claims Act of 1863, which was later strengthened in 1986. Under the 1986 legislation, a plaintiff suing on behalf of the government can receive between 15 and 25% of the recovery when the government decides to intervene or between 25 and 35% of the recovery without government intervention.[21] Table 2 below, also from Cooter and Garoupa (2001), shows how the strengthened legislation has been effective in inducing citizens to invest their effort in recovering government money, as predicted in our theoretical analysis.

The short review presented here shows that there exists a rich literature with various mechanisms that are already in use in order to induce agents to cooperate with the government's effort to control damaging behavior to society. However, the existing mechanisms are only used in very specific situations. The main message of the present article is that if only incentives are set properly, then private involvement can be used in large scale to fight wasteful use of public resources.[22]

[20] The discussion presented here is based on Cooter and Garoupa (2001).
[21] See Depoorter and De Mot (2004).
[22] We are grateful to an anonymous referee for this comment.

8. Conclusion

The formal analysis of the proposed mechanism highlights the government's strategic opportunity to induce civil society to engage into the social control process, and, in this way, reduce the diversion of public resources. It is an inexpensive mechanism for the government that does not result in the *ex ante* disbursement of any resources, since disbursement is restricted to those situations in which diverted resources are recovered.

However, the implementation such a mechanism is clearly subject to a series of adjustments given the adverse incentives it may cause. In general, care should be taken each time the government decides to exercise its role as a *principal* to induce society into adopting a specific pattern of conduct. For purposes of the particular case considered in this study, some of the difficulties that must be resolved to ensure the mechanism's success need to be pointed out.

First, the concept of the agent's "instrumentality" in recovering the resources must be made clear. Indeed, there is an unintended, although expected, adverse incentive created by the new mechanism: since there is a reward to exposing diverted public resources, agents may want to make irresponsible claims in order to get a "piece of the cake".[23] A mere accusation lacking solid substantiation should not, even if later borne out, be sufficient to guarantee access to the recovered resources. A pre-established level of minimum requirements with respect to evidence and other legal instruments should be required to avoid an avalanche of baseless accusations or false claims. That problem is shared by other similar mechanisms, such as the leniency programs for which a firm can only receive the benefit "if the [government authority] does not already have enough evidence to secure the conviction of the corporation or individual at the time the agreement is proposed.[24]"

Second, law enforcement and the Judicial System must be prepared to impose the applicable penalties and execute the recovery of the diverted resources. It is essential that these institutions have considerable flexibility and act quickly in order to make sure that the share owed to the private agent is transferred to him, so that he feels genuinely stimulated to invest his time in social control.

Third, precautions should be taken to avoid the formation of coalitions between official control and organized civil institutions, whereby the public sector first discovers the diverted resources but proceeds to pass the information on to non-governmental organizations in order to obtain, via rent seeking, part of the return that the latter entity is slated to receive. Conversely, the benefit sharing mechanism should be carefully designed in order not to jeopardize the public authorities' efforts. As Cunnungham and Grabosky (2004) put in the context of environment regulation, "[. . .] it is important that public interest groups should not be tempted to abuse their position as defender of social interest, that there should not be opportunities for excess or to override carefully devised regulatory compliance strategies".[25]

These are complex matters. However, they are typical situations that occur when the government decides to intervene in the social equilibrium. Furthermore, the success of a few specific mechanisms described in this article, in particular the *qui tam* legislation in the U.S., suggests that several countries have been able to circumvent those difficulties is very specific situations.

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[23] The authors are grateful to an anonymous referee for presenting the point in those terms.

[24] Considera et al. (2001).

[25] The authors are grateful to an anonymous referee for pointing out this additional difficulty of the proposed mechanism as well as the cited reference.

Considering the originality of the proposed mechanism, one can only speculate about its long-term effects. However, it seems clear that there will be some specialization of the non-governmental institutions that devote themselves to social control, since experience and the presence of some form of professional structure will have the effect, potentially, of elevating the probability for success (the parameter k in the example) of such an institution. Thus, a great deal of competition can be expected initially, when many organizations will seek to obtain the resources associated with the recovery of diverted resources; however, this initial euphoria should give way to a subsequent stage marked by a balance among more specialized institutions.

Another trend that be can expected is that as the probability that diverted resources will be detected increases – provided it is accompanied by rigorous penalties for those involved – corrupt individuals will feel more threatened and, consequently, the percentage δ of diverted resources will tend to decrease. But then, the government will be maximizing the volume of resources it applies to public goods and services and, by the same token, the sums shared with non-governmental organizations will reduce: the very fear of being exposed by a society highly involved in social control – in addition to regular government control – will serve as an important factor in inhibiting the diversion of resources (the δ parameter in the model), further increasing the government's return on the implementation of such a mechanism.

The extension of the model in order to endogenize the decision of how much to deviate and to explore the dynamic effects of the benefit-sharing mechanism is a suggestion for future research.

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