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Corporate Tax Evasion with Agency Costs

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I. Introduction

Recent high-profile cases of corporate accounting fraud and tax evasion have generated substantial changes in the rules governing corporate governance and accounting, and in the process spawned an extensive debate regarding changes in tax rules and the enforcement of existing tax law.[1] In the accounting sphere, the Sarbanes-Oxley bill passed on July 31, 2002 established a regulatory board appointed by the SEC to oversee the accounting industry, created new legal standards for prosecuting corporate wrongdoing, required top management to certify their firms' financial statements and internal controls, set forth long prison sentences for executives convicted of fraud, and gave new protections to corporate whistle blowers.[2] And, corporate tax noncompliance is by no means a trivial issue. In 1998, a year in which (federal) corporate tax receipts were $204.2 billion, the IRS has estimated that corporate underreporting was $37.5 billion.[3] Recently an IRS contractor estimated the tax revenue loss from abusive tax shelters in 1999 to be between $14.5 to $18.4 billion, which is 50 percent higher than the level for 1993.[4] In spite of these recent policy developments and the apparent increases in corporate tax evasion, there is little theoretical guidance as to the impact of alternative penalty structures, or the appropriate structure of penalties, for either accounting misconduct or tax evasion.

This paper examines corporate tax evasion in the context of the contractual relationship between the shareholders of a firm and the chief financial officer (CFO), who determines the firm's deductions from taxable corporate income. The CFO is assumed to possess private

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[1] Throughout the paper we use the term "evasion" to refer to corporate tax reporting behavior that would, if discovered, be subject to civil or criminal sanctions.
[2] In the tax area, the Internal Revenue Service announced in 2002 that it will reallocate more enforcement resources toward wealthy taxpayers suspected of hiding income from their businesses, partnerships, and investments.
[3] Underreporting is only one of the three components of the total tax gap, the other two being nonfiling and underpayment. There is no estimate for corporate nonfiling, and underpayment is a quite different issue.
[4] U.S. General Accounting Office (2003, p. 13). The GAO (2003, p.1) defines abusive shelters to be "very complicated transactions promoted to corporations and wealthy individuals to exploit tax loopholes and provide large, unintended tax benefits."

information regarding the extent of legally permissible reductions in taxable income, and may also inflate the size of the firm's tax shield through illegal evasion. The incentives of the CFO to engage in tax evasion are affected by the nature of her compensation arrangement. Using a costly state falsification framework, we characterize formally the optimal (informationally-constrained) incentive compensation contract for the CFO and, in particular, how the form of that contract changes in response to alternative enforcement policies imposed by the taxing authority. We find that penalties imposed on the CFO directly are more effective in reducing evasion than are those imposed on shareholders, and that the optimal contract may adjust to offset, at least partially, the incentives generated by increased sanctions against illegal evasion.

A key difficulty in achieving a solid theoretical understanding of the determinants of corporate tax evasion is the flexible contractual relationship that affects the behavior of the corporate managers. In a corporation, the shareholders, or the Board of Directors acting on the shareholders' behalf, will structure the compensation packages of managers to provide incentives for them to act in the interest of shareholders. Consider, for example, the compensation contract for the officer in charge of corporate taxes. It is in the shareholders interest for the tax director to reduce the company's effective tax burden, net of any costs of doing so, which would include any expected penalties incurred due to detected tax evasion. To align incentives, it may be appropriate for the tax officer's salary to depend (inversely) on the effective tax rate achieved. Designing this contract is complicated by the fact that the tax director is likely to have private information about the availability of legal avenues for tax reduction, and may also lower the effective tax rate through illegal tax evasion. If detected by the taxing authority, however, such illegal evasion my generate costs to both the tax officer and the corporation.

There is abundant evidence that the focus of corporate tax departments has changed to that of passive compliance with the tax laws to active, aggressive, and often arguably illegal tax planning. *Fortune* magazine recently reported that "with encouragement from shelter hustlers, a new attitude is spreading: that the corporate tax department is a profit center all its own, and that a high effective tax rate is a sign of weakness. 'A potential client once said he would hire the firm if we could get their tax rate down, because it was higher than their competitors' and they were embarrassed,' says one accountant."[5] The idea of tax departments changing from being tolerated as necessary cost centers to being counted on as innovative profit centers is consistent with evidence from a 2001 survey of corporate tax departments in the manufacturing sector.[6] Of the various measures used to evaluate the performance of tax departments, the most often cited was the savings, or value added, they provided: 86 percent cited this performance measure, up from 75 percent in 1997. Of those 86 percent, 63 percent said that this measure affected the compensation of tax department personnel. The effective tax rate relative to goal was cited as a measure used to evaluate performance by 58 percent, up from 48 percent in 1997; of those that use the effective tax rate to evaluate performance, 58 percent said it affects compensation. The number of mentions of each of three possible performance measures that included the word "accuracy" declined substantially between 1997 and 2001.[7]

The government, acting in the interest of the taxpayers generally, is another party with a clear stake in tax compliance. The Internal Revenue Service formulates an enforcement policy regarding tax evasion and fraud with the objective of maximizing its perception of the public interest. The goal of a benevolent government would be, *ceteris paribus*, to minimize the real

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[5] Novack (1998).
[6] Hollingsworth (2002, pp. 67-8).
[7] See Douglas, Ellingsworth, and McAndrews (1996) for an earlier survey of tax department executives that finds that effective tax rates are one of the most frequently used formal performance measurements.

resources used up in the compliance process, and would value revenue collections at a shadow price reflecting the fact that they represent transfers rather than the creation of resources. The enforcement policy will likely involve penalties, directed either at the company or the corporate officer, for detected noncompliance.

The modern literature on tax evasion began with Allingham and Sandmo (1972), who model (individual) taxpayers as completely amoral, deciding whether and how much to evade taxes in the same way they would approach any risky decision or gamble, as an expected utility maximizing choice. Successful tax evasion benefits the taxpayer because it saves on taxes, but detected tax evasion results in a penalty. Optimal tax evasion, from the individual's standpoint, depends on the (assumed to be fixed) chance of getting caught and penalized, the size of the penalty for evasion, and the individual's degree of risk aversion. Thirty years of subsequent analysis has extended this model in a number of dimensions, including allowing an endogenous probability of detection, analyzing evasion jointly with the labor supply decision, incorporating sources of uncertainty other than the chance of audit, and general equilibrium considerations.

The overwhelming majority of tax evasion research has followed Allingham and Sandmo by addressing tax evasion decisions made by individuals. There is, to be sure, a much smaller literature that addresses tax compliance by firms, the basic framework of which is the Allingham-Sandmo setup with a unitary decision-maker.[8] The new twist in this strand of the literature is to examine how the tax rate, probability of detection and penalty rate affect the two choices of evasion (usually expressed as the fraction of sales concealed from an output tax) and output, when there is a costly concealment technology. Some of the models in this tradition assume that the firm is risk-averse, while in others the firm is assumed to behave in a risk-neutral

[8] This literature is nicely reviewed in Cowell (2004).

way.[9] More recently, Chen and Chu (2002) investigate corporate tax evasion with a standard principal-agent model in which a risk-neutral owner of a firm hires a risk-averse manager.[10] They focus on the efficiency loss due to the separation of management and control, and do not address the relative efficacy of penalties on the principal and agent, a key focus on the model we present below.

Aside from Chen and Chu (2002), all of the preceding literature assumes that the firm owner, or residual claimant, makes the tax reporting decision with no agency considerations.[11] This assumption makes sense when one is analyzing small, closely-held businesses. However, in a large, publicly-held corporation, decisions about taxes (and accounting) are not made by the shareholders directly but, rather, by their agents, whether that is the chief financial officer or the vice president for taxation. In order to align the incentives of the decision makers and the shareholders, the corporation has the incentive to tie the agent's compensation to observable outcomes that affect after-tax corporation profitability.

In this setting the insights generated by the Allingham-Sandmo model may not apply. For example, if penalties for evasion apply to the agent, the principal can alter its compensation

[9] In the latter case, Lee (1998) shows that profit taxes need not be neutral in the presence of tax evasion. The firm may be operating in a perfectly competitive model, or be a monopoly; in the latter case, under some conditions, there can be overshifting, where the product price rises more than the increase in tax.

[10] The basic framework is that of Holmstrom (1979) in which the owner (principal) designs a wage contract to incentivize the manager (agent) to engage in (privately) costly effort that increases firm profit. The traditional model is modified to permit the owner to engage in tax evasion. Their primary conclusion is that, when the manager is penalized for (detected) tax evasion, the optimal wage contract results in an inefficient (relative to the second-best benchmark in which evasion is not possible) level of managerial effort. This distortion arises because of the maintained assumption that the manager's compensation cannot be based on the owner's chosen level of evasion, since such a contract would be predicated on an illegal act and, therefore, would not be enforceable in court. Desai, Dyck, and Zingales (2003) analyze another interaction between corporate taxation and corporate governance. They posit that unreported income is more easily expropriated by managers, and show that in this situation a higher tax rate may increase the level of managerial diversion, while stronger tax enforcement may reduce it.

[11] A literature in the law and economics field investigates the socially optimal division of sanctions on corporations and individual employees for social harms generally. For example, Kraakman (1984) emphasizes the possibility that the corporation's assets are inadequate to pay for the harm. Polinsky and Shavell (1993) argue that the total magnitude of public sanctions may exceed the sanctions that a firm can impose on its employees.

contract with the agent, possibly offsetting the intended consequences of the IRS policy. More generally, enforcement strategies directed at the tax director and at the corporation itself may have different impacts on corporate behavior. Because each of these policies is available to the government,[12] it is valuable to know whether there is a theoretical reason to prefer one to the other. The model we develop below provides a framework for analyzing this and other related questions.

The paper proceeds as follows. We begin in the next section by providing a formal characterization of the contract that the shareholders will want to offer to the tax officer within the corporation. Our model draws on the costly state falsification framework that was first considered by Lacker and Weinberg (1989), and developed by Crocker and Morgan (1998) to characterize the optimal insurance contracts in a setting where claimants can engage in fraudulent behavior to inflate their apparent losses.[13] Next, we show how the form of that

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[12] The U.S. tax law has provisions that impose criminal and civil penalties on both the corporation and corporate officers. Individuals who sign false tax returns may be subject to criminal penalties under Code section 7206(1). Section 7206(1) imposes criminal liability in the case of a willfully false declaration. Because sections 6062 and 6065 combine to require a corporate officer to sign the corporation's tax return under penalties of perjury, section 7206(1) means that a corporate officer may face criminal liability for signing a tax return that is inaccurate if the officer knows the return is inaccurate and intends to violate the law in signing the return. Criminal tax prosecutions are, however, fairly rare. In fiscal year, there were 512 such prosecutions, about half of the 1993 total.

Separate Internal Revenue Code provisions impose civil liability for violations of tax reporting rules. Section 6694 provides for monetary penalties for return preparers who file returns (i) showing an understatement of tax liability that has no realistic possibility of being sustained on the merits or (ii) with the willful attempt to understate tax liability or the reckless or intentional disregard of tax rules. Sections 6700 and 6701 impose penalties for promoting abusive tax shelters and aiding and abetting understatements of tax liability. Section 6707 imposes civil fines on persons who are required but fail to register or disclose tax shelter transactions. Corporate officers in theory could be subject to any of these penalties, but the penalties are more likely to be imposed on outside professionals.

More broadly, taxpayers that understate their tax liability may be subject to penalties for the understatement. Section 6662 of the Code imposes a penalty on taxpayers for, among other things, any "substantial understatement" of income tax. For corporate taxpayers a substantial understatement typically is an understatement that exceeds 10 percent of the tax required to be shown on the return for the year in question. The penalty for a substantial understatement is 20 percent of the amount of the understatement. The substantial understatement penalty can therefore be significant, but the penalty is not imposed on corporate officers, but rather on corporations themselves.

[13] In the insurance environment, the optimal indemnity contract results in underpayment of claims at the margin, and reflects a tension between the benefits of underpayment (reduced incentives of the insured to expend resources in claims inflation) and the costs (less income smoothing for the risk averse insured). Fraud has value in the optimal

contract will change in response to IRS enforcement policies, and examine to what extent that response may counteract the intention of the IRS. We do this first in a fairly general setting in which the tax officer has access to a costly concealment technology and then, in the following section, in the context of a specific parameterization of the problem. We find that, as a consequence of the informational asymmetry enjoyed by the CFO, penalties levied directly on the tax officer are more likely to be effective in reducing tax evasion than penalties directed at the corporation's shareholders. The intuition behind this "non-equivalency" result is that the incentive effects of sanctions levied on the shareholders are imperfectly transmitted to the tax officer through a second-best compensation contract, so that penalties directly applied to the tax officer have more impact. A final section contains concluding remarks.

II. The Model

We consider an environment in which the risk-neutral owners of a firm (the "shareholders") contract with the vice president for taxation or chief financial officer ("CFO") to manage the firm's tax liability.[14] The CFO, who is also risk-neutral, is assumed to possess

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contract because it provides a mechanism by which the informationally constrained insurer can sort the claimants based on their underlying private information (that is, the magnitude of the loss actually suffered).

Crocker and Morgan also consider a model of contracting between a risk neutral principal, and a risk neutral agent who may engage in costly state falsification. The precise setting considered is that of sharecropping, where the absentee landlord (principal) contracts with the sharecropper (agent) over the division of a crop. Costly state falsification arises because the sharecropper can, at some resource cost to himself, hide part of the crop from the absentee landlord. In this setting, the incentives to engage in falsification may be mitigated by "flattening" the sharecropping contract (as a function of the observed crop), which reduces the marginal return to the sharecropper of falsification. This strategy, however, hinders the principal's ability to extract surplus from the relationship, since the optimal contract must respect the sharecropper's bankruptcy constraint. As a result, the optimal contract reflects a tradeoff between mitigating falsification (which increases total surplus) and surplus extraction by the principal. In a taxation setting, the Crocker and Morgan model is equivalent to the problem facing a risk-neutral taxing authority attempting to maximize the revenue yield from a risk-neutral taxpayer who may expend resources in hiding income through tax evasion. Our concern in this paper, however, is different, as it concerns the modeling of the employment relationship between the shareholders of the firm, and the administrative officer handling the firm's tax avoidance strategy, who has the ability to evade taxes through costly state falsification.

[14] One can imagine a more complicated model in which the shareholders hire the CEO, who in turn hires the CFO, with the CFO possessing information that is hidden to the CEO and the CEO possessing information that is hidden to the shareholders.

private information regarding the level of permissible legal reductions in taxable income, x.[15] The shareholders know only that the actual value of x is distributed according to the density f, and the cumulative distribution F, on the interval $[\underline{x}, \bar{x}]$. While x is not observable to the shareholders, they do know the actual reductions in taxable income, R, claimed by the CFO, who may engage in tax evasion by claiming illegal deductions, R-x.[16] Such tax evasion may result in penalties levied on either the shareholders of the firm, on the CFO personally, or on both, in a fashion that we will describe below.

A compensation agreement between the shareholders and the CFO is a contract $C \equiv \{S, R\}$ consisting of the payment S and the level of deductions from taxable income R, both of which may be conditioned upon x if certain incentive conditions are satisfied.[17] We may write the profit accruing to shareholders as

$$\Pi(C \mid x) \equiv I - t(I - R) - S - \alpha h(R - x) \tag{1}$$

where I is the (observable) income of the firm before either avoidance or evasion, t is the corporate tax rate, and αh embodies the expected costs to shareholders of illegal tax evasion.[18] The payoff to the CFO is denoted

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[15] The assumption of risk neutrality of the CFO is one key difference between this model and the one offered by Chen and Chu (2002), whose results require risk aversion on the part of the firm's manager. We consider the risk-neutrality case not as a simplifying assumption but, rather, to demonstrate that explicit differences in risk preferences between the principal and the agent *are not necessary* in order for a rational agent to engage in tax evasion.

[16] To be precise, the distinction between x and R-x is that the latter are subject to penalties and the former are not. Note that, in reality, even taxable income and tax payment are not generally known to shareholders of large public corporations who do not have access to the tax returns themselves; the financial statements do not reveal this information. See Hanlon (2003) for a discussion of this issue. What is essential for this model is that there are contractable elements of tax reporting behavior.

[17] Note that we are ultimately interested in the form of the optimal CFO compensation contract, $S(R)$. Since this is an environment with private information, however, we will proceed in the usual fashion to characterize the optimal "truth-telling" contract $\{S(x), R(x)\}$ that satisfies the incentive constraint (3) below, from which $S(R)$ may be recovered by inverting R to obtain x, and substituting the result into S.

[18] Note that we are assuming that the level of permissible reductions, x, is independent of income I. This assumption is innocuous since we have also assumed that I has been realized (so any production has already occurred) prior to the CFO is making the tax evasion decision. We also address here the point made first by Yitzhaki (1974) that if the penalty is proportional to the tax evaded rather than, as here, the income evaded, the implications of the effect of a

$$V(C|x) \equiv S - \beta g(R - x) \tag{2}$$

where βg are the expected costs to the CFO of engaging in tax evasion. We assume that, for each party, to commit no illegal tax evasion ($R=x$) is costless, and that the penalties for such evasion are increasing in the amount of evasion, R-x.[19]

Assumption 1: $h(0) = g(0) = h'(0) = g'(0) = 0$; and $h', g', h'', g'' > 0$ for $R-x > 0$.

In the analysis that follows, we will assume that the penalties for tax evasion are symmetric, so $g(.) = h(.)$ This assumption allows us to focus our attention on the implications of differential *severity* of the two types of penalties, and not be distracted by issues of the optimal functional form of the penalty structure. Moreover, we will interpret the parameters α and β , each of which is, without loss of generality, restricted to be in the unit interval $[0, 1]$, to be "enforcement parameters" that are ultimately selected by the taxing authority.[20]

Since this is an environment of private information, the revelation principle (Myerson, 1979) implies that any implementable contract must satisfy the incentive constraint

$$V(S(x), R(x) \mid x) \geq V(S(\hat{x}), R(\hat{x}) \mid x) \tag{3}$$

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tax rate change on evasion are qualitatively different. The effect of the tax rate on evasion is not, though, a focus of this research. We abstract from the fact that S would generally be deductible from the taxable income of the firm and taxable to the tax officer. (Penalties are not, though, deductible business expenses.) Finally, note that the penalty functions could be generalized, so that for example $h(R\text{-}x)$ could be $h(I, R, x)$. This would allow, *inter alia*, the expected cost to depend on the ratio of evasion to true income, leading to a prediction that bigger firms would evade more. Our basic conclusions would be neither affected nor enriched by this generalization. See Slemrod (2001) for a discussion of the importance of the functional form of the cost function, or the technology of tax avoidance and evasion, for understanding the impact on behavior of changes in the tax rate.

[19] This is a setting of *costly state falsification* because the CFO has possesses an *immutable* informational asymmetry (the knowledge of the actual value taken by x), and can "misrepresent" the allowable tax deductions (by selecting $R > x$) by incurring the private cost βg. This is in contrast to the *costly state verification* approach that was first developed by Townsend (1979). In that setting, the uninformed agent can perform a (privately costly) audit to obtain the private information.

[20] One interpretation would be to think of α (β) as being the probability that tax evasion is detected and the penalty h (g) is levied on shareholders (the CFO). The size of the parameters α and β is determined by the level of (costly) enforcement activities selected by the taxing authority. The relative effectiveness of these two tools is the object of our analysis below. Note that we also abstract from whether it is optimal for the tax enforcement agency to condition the probability of detection (that is, the parameters α and β) on the reported income of the corporation.

for every $x, \hat{x} \in [\underline{x}, \bar{x}]$ in order to generate truthful revelation by the CFO. When this incentive constraint is satisfied, a CFO who possesses the private information x would always prefer the contract $\{S(x), R(x)\}$ over the alternatives $\{S(\hat{x}), R(\hat{x})\}$ for every $\hat{x} \neq x$. This obtains when the first-order condition for a contract to be incentive-compatible is satisfied, which is given by

$$\frac{dV(S(\hat{x}), R(\hat{x}) | x)}{d\hat{x}} = V_S S' + V_R R' = 0 \tag{4}$$

at $\hat{x} = x$. Total differentiation of V with respect to x, and substituting from (4), yields the result that

$$\frac{dV}{dx} = V_x. \tag{5}$$

An efficient contract between the shareholders and the CFO is a solution to the problem that maximizes the expected payoff to the shareholders

$$\underset{S(x),R(x)}{Max} \int_{\underline{x}}^{\bar{x}} \Pi(S(x), R(x)|x) f(x) dx \tag{6}$$

subject to the incentive compatibility constraint (3) and a participation constraint for the CFO, which requires

$$V(S(x), R(x)\ |x) \geq 0 \tag{7}$$

for every $x \in [\underline{x}, \bar{x}]$. [21]

[21] This constraint requires that the contract respect the participation constraint for any possible private information, x, that the CFO may have. As an alternative, one could impose the weaker constraint $\int_{\underline{x}}^{\bar{x}} Vf dx \geq 0$, so that the CFO, prior to receiving her private information, expects to satisfy the participation constraint (7). Such an approach would permit the attainment of full information optimal levels of tax evasion (see the discussion below), since the firm could be effectively "sold" to the CFO, and all the expected surplus extracted by a lump sum transfer to the shareholders. The problem with this approach is that, since $V_x > 0$, the resulting contract would provide the CFO with the incentive to exit the agreement for lower values of the private information parameter, x.

Before proceeding to characterize the optimal contract in this informationally-constrained environment, it is insightful to consider first the baseline case in which there is no incentive problem caused by private information. This would be the case were the shareholders to observe x and select their preferred level of R, subject to the participation constraint (7). In this case, the tax reporting behavior would not be constrained by the incentive condition (3), and the compensation of the CFO would be a lump-sum payment that satisfied the participation constraint (7). Under these circumstances, tax evasion behavior would maximize shareholder profit Π for every x, subject to (7), and the resulting *full information* optimal amount of tax evasion is characterized by the condition

$$t = (\alpha + \beta)g'(R - x). \tag{8}$$

We shall denote a solution to (8) by $R^*(x)$.

In the environment considered in this paper, however, the selection of R must be delegated to the CFO, who possesses private information regarding the legally permissible deductions from taxable income, x. Since the actual value of x is unknown to the shareholders, the full information outcome violates the incentive constraint (3) and, therefore, cannot be achieved. To see this, note that, since evasion generates costs to the CFO, with the lump-sum contract described above the CFO would engage in no evasion at all. Alternatively, the shareholders could induce the CFO to choose R^* by offering the compensation plan $S(R) = tR - \alpha h(R - x)$, which is the net gain to the shareholders from evasion, but such an approach would drain all of the surplus from the shareholders and leave them with after-tax profits of only $(1-t)I$.[22] The shareholders could do better by offering the optimal incentive-compatible contract that

[22] Of course, any contract of the form $S(R)=tR-\alpha h-K$, where K is a (lump sum) constant would induce the CFO to choose the full information optimal level of tax evasion. Substituting this contract into the CFO utility yields $V = tR-$

we characterize in the analysis below, but under such a contract R^* is generally not attainable. The optimal incentive-compatible contract maximizes the expected after-tax payoff to the shareholders, subject to the condition that the contract must be incentive-compatible, and that the CFO must receive at least her reservation level of utility in any state of the world, x.

The Hamiltonian expression associated with the problem of maximizing (6) subject to (3) and (7) may be written as

$$H = \Pi(S, R|x)\, f + \phi(x) V_x ,$$

where we define the state variable to be $V(x) \equiv V(S(x), R(x)|x)$, the control variable to be $R(x)$, and $\phi(x)$ to be the costate variable for the equation of motion V_x.

Theorem 1: An optimal contract must satisfy the following (necessary) conditions:

(a) $f[t\text{-}(\alpha + \beta)g'] + \phi\beta g'' = 0$; and

(b) $S(x) = \beta g + \int_{\underline{x}}^{x} \beta g'(R(m) - m)dm$,

where $\phi = F\text{-}1$.

Proof: The Pontryagin conditions for a maximum are $H_R = 0$ and $\dot{\phi} = \partial H / \partial V$, which yield

$$f(\Pi_S \frac{\partial S}{\partial R} + \Pi_R) + \phi(V_{xR} + V_{xS} \frac{\partial S}{\partial R}) = 0 \text{ ; and} \tag{9}$$

$$\dot{\phi} = -(f \Pi_S + \phi V_{xS}) \frac{\partial S}{\partial V} , \tag{10}$$

$(\alpha+\beta)g(R\text{-}x)\text{-}K$, and the utility maximizing choice of R satisfies V_R=0. Since $\frac{dV}{dx} = V_R R_x + V_x = V_x > 0$, constraint (7) implies that the maximum value that can be taken by K is the surplus generated at $\underline{x}$, and the CFO would retain all of the incremental surplus for larger values of x. As we shall see below, the optimal contract in this setting is necessarily second-best, so that the shareholders are better off by sacrificing a little bit of efficiency at the margin in order to extract more of the surplus from the CFO.

respectively. Since, by definition, $V(S, R|x) - V \equiv 0$, we know that $\partial S/\partial R = -V_R/V_S$ and $\partial S/\partial V = 1/V_S$. Taking the appropriate derivatives from (1) and (2), and substituting the results, yields $\dot{\phi} = f$, and $f[t - (\alpha + \beta)g'] + \phi g'' = 0$. Since the transversality condition is $\phi(\bar{x}) = 0$, we obtain $\phi = F\text{-}1$, which yields (a).

Finally, the total surplus from the contract, which is $I(1\text{-}t) + tR - (\alpha + \beta)g$, is divided between the shareholders and the CFO. The shareholders' portion of the surplus is then written as

$$\Pi(S,R\,|\,x) = I(1-t) + tR - (\alpha+\beta)g - \int_{\underline{x}}^{x} V_x(m)dm. \tag{11}$$

Noting that $V_x = \beta g'$, and substituting from (1), yields (b).

QED

Part (a) of the theorem characterizes the optimal reductions in taxable income, R, as a function of the permissible deductions, x. Since the costate variable ϕ represents the shadow cost of the constraint imposed by the informational asymmetry, in the absence of any private information about x we would have $\phi = 0$ and the optimal contract would result in the full information level of tax evasion characterized by (8). When the CFO enjoys an informational advantage regarding the permissible level of deductions, however, ϕ is nonzero and the resulting contract is necessarily second-best.

The conditions of the theorem characterize an optimum as long as the contract is implementable, which in this setting requires that $R'(x) \geq 0$.[23] While the monotonicity of R is not

[23] A contract is implementable if $\frac{\partial}{\partial x}\left(\frac{V_R}{V_S}\right)\frac{dR}{dx} \geq 0$ (Guesnerie and Laffont (1984), Theorem 1). Taking the appropriate derivatives yields the implementability condition $\beta g'' R' \geq 0$, which requires that $R' > 0$.

guaranteed, the following conditions that place restrictions on the higher-order derivatives of g and on the hazard rate, $f/(1\text{-}F)$, are sufficient for this result.[24]

Assumption 2: $g''' \geq 0$ and $\dfrac{d}{dx}\left\{\dfrac{f}{1-F}\right\} \geq 0.$

Under this assumption, the function $R(x)$ is necessarily invertible, and we will use the notation $x(R)$ to indicate this inverse function. The optimal incentive contract, as a function of the observed reductions in taxable income, is $S(x(R))$, which we will denote as $S(R)$ in the discussion that follows. The optimal incentive contract $S(R)$ is depicted in Figure 1.

The amount of reported deductions from taxable income, R, varies with x, as does the compensation, S, received by the CFO. Since $V_x > 0$, the participation constraint is binding only at $\underline{x}$, and is slack for larger values of x. The CFO receives a level of compensation higher than her reservation wage if she inherits a large draw of x, because the shareholders cannot distinguish between a favorable tax situation due to circumstances out of the CFO's control from a favorable tax situation due to the CFO's willingness to incur costs. At the lowest possible draw of x, the CFO receives no more than her reservation wage, so (7) holds with equality at $\underline{x}$.[25]

The shareholders' after-tax return is also state-dependent, and is highest when $x = \bar{x}$. As is generally the case in these types of problems, there is no distortion in the contract at $\bar{x}$ (so $R(\bar{x}) = R^*(\bar{x})$), but $R(x) < R^*(x)$ for every $x < \bar{x}$ because of the incentive constraint (3), so that the full information outcome is achieved only when $x = \bar{x}$. Finally, the incentive constraint

[24] See Fudenberg and Tirole (1991), pp. 263-267 for a discussion of those sufficiency conditions. The first condition ($g''' \geq 0$) corresponds to their assumption (A8), while the second is referred to in the literature as a "monotone hazard rate." In the absence of Assumption 2, optimal contracts may still be characterized by using the "ironing" technique that was first discussed in Mussa and Rosen (1978), and described in detail by Guesnerie and Laffont (1984).

[25] Note that we are formally modeling the efficient contract in a single-period environment in which there is only uncertainty regarding a single "draw" of the informational parameter, x. This approach would, however, be equally applicable to a multi-period setting in which the CFO received a new value of x in each period, drawn independently from the distribution F.

guarantees that, when presented with the incentive contract $S(R)$, a CFO of type x prefers the contractual allocations $\{S(x),\ R(x)\}$ over all the alternatives. Put differently, an x-type's indifference curve $\overline{V}(x)$ is tangent to $S(R)$ at $R(x)$ for every $x \in [\underline{x}, \overline{x}]$, as depicted in Figure 1.

We seek to characterize the impact of alternative penalties levied by the taxing authority on the structure of the CFO compensation arrangement, S, as a function of the observed reductions in taxable income, R. Accordingly, the impact of changes in the enforcement parameters α and β on the shape of the compensation profile $S(R)$ is of interest. We begin by presenting a preliminary result.

Lemma: $S'(R) = \beta g'(R\text{-}x(R))$.

Proof: From part (b) of the theorem, an application of Leibnitz's Rule yields

$$\frac{dS}{dx} = \beta g'(R(x)-x)\frac{d}{dx}(R(x)-x) + \beta g'(R(x)-x) = \beta g'(R-x)\frac{dR}{dx}. \tag{13}$$

Then, after recognizing that $\frac{dS}{dx} = \frac{dS}{dR}\frac{dR}{dx}$, substitution generates the desired result.

QED.

We now present our main result, which characterizes the impact of the taxing authority's enforcement parameters on the level of tax evasion, R, and on the form of the optimal CFO compensation package, $S(R)$.

Theorem 2: Under Assumptions (1) and (2), a solution to problem (6) has the following characteristics.

(a) $\frac{\partial R(x)}{\partial \beta} < \frac{\partial R(x)}{\partial \alpha} < 0;$

(b) $\frac{\partial}{\partial \alpha}(S'(R)) = -\beta g''\left[\frac{\partial x(R)}{\partial \alpha}\right] < 0;$

(c) $\frac{\partial}{\partial \beta}(S'(R)) = g' - \beta g''\left[\frac{\partial x(R)}{\partial \beta}\right];$

(d) $S''(R) = \beta g''\left[1 - \frac{dx(R)}{dR}\right] > 0.$

Proof: Recalling that $\phi = F$-1, and total differentiation of Theorem 1 (a), yields

$$dx(\Delta_1 + \Delta_2) - d\alpha(fg') - d\beta[fg' - \phi g''] - dR(\Delta_1) = 0, \tag{14}$$

where

$\Delta_1 \equiv (\alpha + \beta) fg''(R - x) - \phi g'''(R - x)\beta$; and

$\Delta_2 \equiv f'[t - (\alpha + \beta)g'] + f\beta g''$.

Solving Theorem 1(a) for $t - (\alpha + \beta)g'$, and substituting the result into Δ_2, yields

$$\Delta_2 = \beta g''\left[\frac{f'(1-F)}{f} + f\right].$$

Both Δ_1 and Δ_2 are positive under Assumption 2. From (14), by setting dx and $d\beta$ equal to zero, we obtain

$$\frac{dR}{d\alpha} = \frac{fg'(R-x)}{-\Delta_1}, \tag{15}$$

while setting dx and $d\alpha$ equal to zero yields

$$\frac{dR}{d\beta} = \frac{fg'(R-x) - \phi g''(R-x)}{-\Delta_1}, \tag{16}$$

from which part (a) of the Theorem follows directly. To obtain parts (b) and (c) of the Theorem, first recall that the Lemma implies $S'(R) = \beta g'(R\text{-}x(R))$, and differentiating with respect to α and β yields the expressions on the right-hand sides. Also, note that setting $dR = d\beta = 0$ in (14) implies

$$\frac{dx}{d\alpha} = \frac{fg'(R-x)}{\Delta_1 + \Delta_2} > 0\,; \tag{17}$$

while $dR = d\alpha = 0$ yields

$$\frac{dx}{d\beta} = \frac{fg'(R-x) - \phi g''(R-x)}{\Delta_1 + \Delta_2} > 0\,, \tag{18}$$

so that part (b) of the Theorem is negative, and the sign of part (c) is indeterminate.

Finally, part (d) of the Theorem follows directly from differentiation of *S'*(*R*) with respect to *R*, and noting that

$$\frac{dx}{dR} = \frac{\Delta_1}{\Delta_1 + \Delta_2}\,. \tag{19}$$

QED

Increasing either the shareholder or the CFO penalty will reduce tax evasion since, for every level of permissible reductions (x), the deductions claimed by the CFO (R) decline as α and β are increased. Moreover, part (a) of the Theorem indicates that a penalty levied on the CFO through the enforcement parameter β is more effective in reducing tax evasion than would be an equivalent penalty assessed on the shareholders through α. This *non-equivalency* result, which does not depend on the particular function forms of f or g, is a direct consequence of the CFO's private information. This can be seem most easily by observing that equations (15) and (16) differ only when ϕ is nonzero. In contrast, were this a full information setting so that the incentive constraint (3) did not apply, then ϕ would be zero and the penalties (α and β) would have a symmetric effect on tax evasion.

The intuition behind this result is that the binding incentive constraint (3) results in a CFO compensation contract $S(R)$ that is necessarily second-best. In this setting, the ability of the optimal contract to influence the actions of the CFO is hindered by the fact that the contract must also elicit, in an incentive-compatible fashion, the private information regarding the permissible level of deductions from taxable income. As a result, the incentive effects of any sanctions levied on the shareholders by α are imperfectly communicated to the CFO through the incentive-compatible contract, so that the penalty β directly applied to the CFO is more effective.[26]

This result has normative implications for IRS enforcement policies targeting tax evasion. While determining the optimal level of evasion from a societal perspective would require the evaluation of a social welfare function that included the social costs of evasion and enforcement as well as the social benefit from tax revenues, Theorem 1(a) does provide guidance regarding the cost-minimizing way of achieving the resulting enforcement targets.[27] On the one hand, were the enforcement parameters to have the same constant marginal resource costs, so that $c'(\alpha) = c'(\beta) = \overline{c}$, then the policy prescription would be to use only the more effective CFO penalty. On the other hand, were the enforcement parameters to exhibit increasing marginal costs, so that $c''(\cdot) > 0$, then the cost-minimizing enforcement policy would be to use both α and β. The precise mix, of course, would depend on the marginal costs and marginal effectiveness of each policy tool.

Part (b) of the Theorem states that increasing the penalties for tax evasion on shareholders by increasing α has the effect of flattening the optimal compensation contract, as

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[26] Put differently, the optimal contract is *incomplete*, so that incentives (such as those resulting from sanctions being imposed on the shareholders) are imperfectly transmitted through the agreement. The contractual incompleteness in our model is a direct artifact of the private information possessed by the CFO regarding the level of permissible deductions, x. Of course, contractual incompleteness could enter this relationship in other ways, involving different types of hidden information, or hidden actions, that permit manipulation by the CFO of observable variables that impact on compensation. To the extent that the non-equivalency of penalties in our model is a consequence of an incomplete contract between the shareholders and the CFO, we would expect that other sources of contractual incompleteness may generate similar non-equivalency results. Alternatively, we would expect equivalency of penalties in environments with complete contracts.

[27] Note that in this paper we have examined the optimal level of tax evasion from the perspective of the CFO and the shareholders, and have not considered the larger question of the socially optimal level of tax evasion. The latter would, of course, require an examination of both the costs and the benefits of raising tax revenues.

shareholders reduce the incentive of the CFO to engage in evasion. This is the mechanism by which the reduction in evasion is achieved.

Part (c) of the Theorem demonstrates that the effect of increasing CFO penalties through β on the slope of the optimal compensation arrangement is indeterminate, although we demonstrate in an example below that more precise results can be obtained using specific functional forms for g and f. Finally, part (d) of the Theorem indicates that the optimal compensation contract S is a strictly *convex* function of the observed reductions in taxable income, R. As a result, the compensation contract exhibits progressivity in the sense that the CFO is paid at the margin a bonus, $S'(R)$, which is increasing in the level of deductions from taxable income, R. This reflects the fact that evasion costs, g, are increasing in the amount of evasion, so that incentivizing the CFO to increase evasion requires increasing bonuses, at the margin. The following result is straightforward.

Corollary: If g is quadratic and f is uniform, then $S''(R) = \left[\dfrac{\beta^2}{\alpha + 2\beta}\right] g''$.

Since g'' is constant in the case of a quadratic function, it is easy to demonstrate that the convexity of $S(R)$ is increasing (decreasing) in β (α). Consequently, the optimal contract becomes more progressive in response to increases in the penalty β, resulting in larger bonuses (at the margin) to incentivize the CFO.

III. An Example

For the purposes of this example, we will assume that x is uniformly distributed on the interval $[0, t]$, so $F(x) = x/t$ and $f(x) = 1/t$. In addition, we will assume that the penalty for tax evasion is quadratic and increasing in the amount of illegal evasion, such that $g(R\text{-}x)=(R\text{-}x)^2/6$.

Then, by (8), we know that $R^*(x)=x+3t/(\alpha+\beta)$, so that the optimal amount of evasion, $R - x$, is $3t/(\alpha+\beta)$. Not surprisingly, the full-information optimal level of evasion is independent of the actual value of x, is higher when the tax rate is higher, and is lower when the expected costs of evasion are higher. From Theorem 1 (a), we obtain

$$R(x) = R^*(x) - \frac{\beta(t-x)}{\alpha+\beta} = x + (3t - \beta(t-x))/(\alpha+\beta) \tag{20}$$

which implies that $R(x) < R^*(x)$ for every $x < t$, as depicted in Figure 2. In all but the corner situation where $x=t$, evasion is lower in the informationally-constrained situation.

Note also that $R'(x)$ is monotonic, which was assured because Assumptions (1) and (2) are satisfied by f and g, so that the conditions of Theorem 1 are sufficient to characterize an optimum. Furthermore,

$$V_x = \frac{\beta}{3}\left[\frac{t(3-\beta)+\beta x}{\alpha+\beta}\right] > 0 \tag{21}$$

for $\beta \leq 1$, so that the participation constraint holds with equality (strict inequality) for $x = 0$ ($x > 0$).

Condition (b) of Theorem 1 implies that

$$S(x) = \frac{\beta\left[t(3-\beta)+\beta x\right]^2}{6(\alpha+\beta)^2} + \frac{\beta\left[t(3-\beta)x + \beta x^2/2\right]}{3(\alpha+\beta)}. \tag{22}$$

Solving (20) for x and substituting the result into (22) yields $S(R)$, and by differentiation we obtain

$$S'(R) = \frac{\beta[\beta(R-t)+3t]}{3(\alpha+2\beta)} > 0, \tag{23}$$

since $R \geq t$ for $\alpha, \beta \leq 1$. Differentiation of (23) with respect to the parameters α and β yields[28]

$$\frac{d}{d\alpha}[S'(R)] = -\frac{\beta(3t+\beta(R-t))}{3(\alpha+2\beta)^2} < 0 \text{; and} \tag{24}$$

$$\frac{d}{d\beta}[S'(R)] = \frac{2\beta^2(R-t)+\alpha(2\beta(R-t)+3t)}{3(\alpha+2\beta)^2} > 0\,. \tag{25}$$

Expressions (24) and (25) indicate that increasing the tax evasion penalty on shareholders (increasing α) results in a flatter compensation contract. In contrast, increasing the penalty borne by the CFO (increasing β) generates a *steeper* compensation contract that provides *larger* bonuses at the margin to the CFO for reducing taxable income. In essence, the response by the shareholders to larger penalties levied on the CFO for tax evasion in this example is to adjust the compensation arrangement to sharpen the incentives for the CFO to engage in such evasion. Put differently, an increase in β generates a restructuring of $S(R)$ that partially offsets the disincentive for the CFO to engage in tax evasion.

Finally, we can also examine the effects of the policy tools (α and β) on the amount of illegal tax evasion. Letting $e^* \equiv R^* - x$ denote the amount of evasion that results from the *full information* contract, it is straightforward to demonstrate that

$$de^*/d\alpha = de^*/d\beta = -3t/(\alpha+\beta)^2 < 0 \tag{26}$$

so both tools are equally effective at deterring evasion in the absence of an informational asymmetry. Alternatively, letting $e \equiv R - x$ denote the amount of evasion that results from the optimal *informationally-constrained* contract, we find that

$$de/d\alpha = (-3t + \beta(t-x)) / (\alpha+\beta)^2 > de^*/d\alpha \text{; and} \tag{27}$$

$$de/d\beta = (-3t - \alpha(t-x)) / (\alpha+\beta)^2 < de^*/d\beta \tag{28}$$

[28] The results that follow may also be obtained through a direct application of the conditions identified in Theorem 2.

so the β (α) tool becomes more (less) effective as a result of the informational asymmetry. Put differently, since $de/d\alpha$ - $de/d\beta$ =(α+β)(t-x) > 0 for every $x < t$, it follows that β has a larger effect on evasion than does α.[29] A penalty levied directly on the CFO will be more effective at reducing evasion than an otherwise-equivalent penalty levied on the shareholders.

IV. Conclusions and Future Research Directions

Tax evasion by large, public corporations is apparently widespread, and the appropriate policy response is widely debated. One set of responses is to change the tax code to facilitate detection and successful prosecution of certain classes of evasion. Another possible response is to strengthen the penalties—on the corporation or on the corporate officers--for those acts of evasion that are detected. Existing economic theory offers little guidance to policy makers. There is, to be sure, a large positive and normative literature about tax evasion, but nearly all of it pertains to individuals. The small literature that addresses firms focuses on the joint output-evasion decision, and ignores the separation of ownership and control that characterizes such corporations.

This paper begins the task of developing an economic theory of corporate tax evasion that addresses the fact that corporate tax officers will either have explicit compensation contracts in which their success at tax minimization is rewarded, or will have this success reflected implicitly via performance review procedures. Our results suggest that, in this setting, the effect of policies depends on whether the corporation or the officer is penalized, and the extent to which the corporation can offset any penalty regime by restructuring its compensation contract with the tax officer. From the tax agency's point of view, penalties assessed on the tax officer are more effective tools against evasion because they exacerbate the conflict between the

[29] Recall that both $de/d\alpha$ and $de/d\beta$ are negative, so the absolute value of the latter is greater than that of the former.

shareholders and the tax officer, resulting in what is a less efficient outcome for the two taken together, but that reduces evasion more than the same penalty assessed on the corporation. The normative implications of this finding are fairly straightforward. If implementing the two penalties has equal and constant marginal social costs, then our results suggest using only the agent penalty. If they have equal cost functions but increasing marginal costs, our results suggest using both penalties, but using the agent penalties more. More generally, the results push the optimal enforcement policy toward favor agent penalties more than would be true if they were equally effective in combating corporate tax evasion.

We can think of several fascinating and important questions that can be addressed using the framework we introduce here. One is the effect of the differing horizons of the typical CEO and the typical tax officer. Given the often several-year lag between a tax report and the completion of an audit, it is common that by the time a penalty is assessed the CEO is no longer with the firm; this introduces another conflict of interest to the tax evasion decision. Another is the effect of public disclosure of corporate taxable income and tax payments. Although the advocates of this favor it because they think it will, through public pressure and corporate embarrassment, reduce tax avoidance, the model we have outlined here suggests that there is an offsetting effect. Note, though, that public disclosure also implies disclosure of the effective tax rate of a firm's *competitors.* For this reason it may facilitate the benchmarking of the performance of the CFO, and enable more effective compensation contracts, which would increase evasion and force down effective tax rates.[30] Finally, this type of model can be extended to address accounting misrepresentation in addition to tax evasion, for which the enforcement agency is the Securities and Exchange Commission, rather than the Internal Revenue Service.

[30] We thank Dan Silverman for suggesting this extension.

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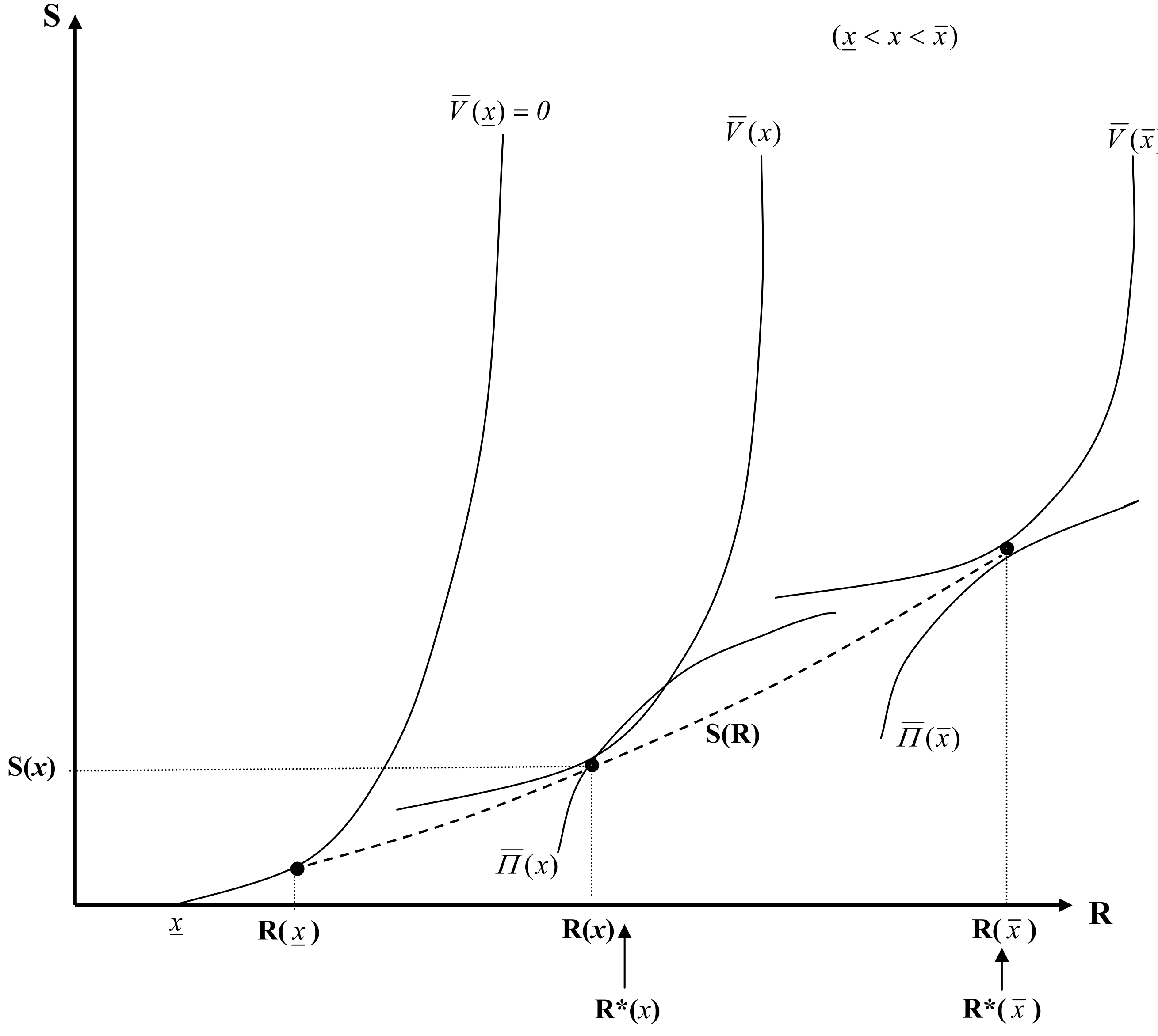

S(R): The Optimal CFO Bonus Scheme

Figure 1

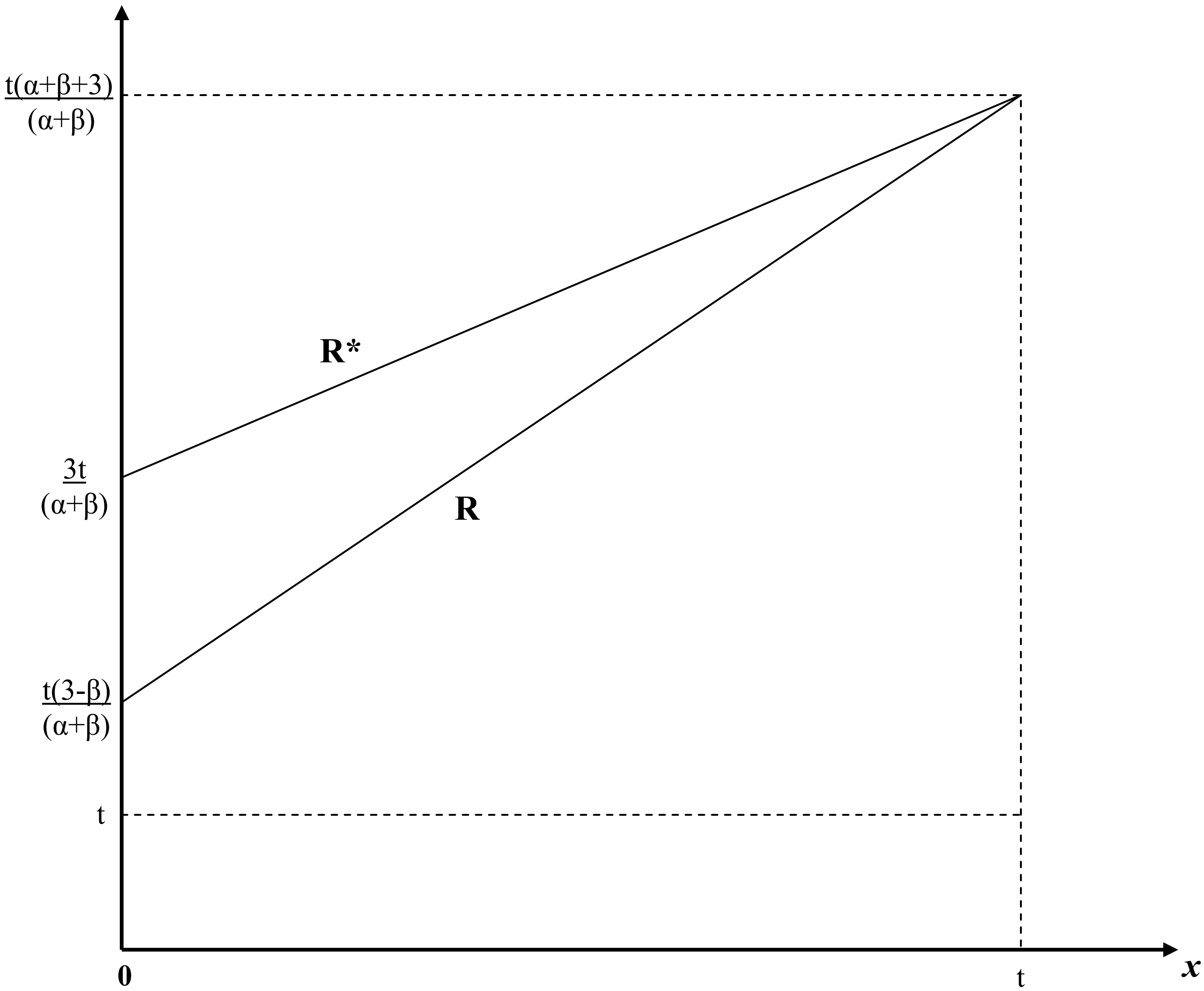

Figure 2