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The Capital Market Effects of Rewarding Auditors for Detecting Fraud

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Abstract

Recent research argues that auditors may be motivated to improve audit quality if regulators reward auditors for detecting fraud. I analyze the effects of such a reward system on the capital market by using a model of three players: an investor, a firm manager, and an auditor. I show that when the regulator starts to reward auditors for detecting fraud, (i) total investment by firms, (ii) firm ownership by outside investors, (iii) audit resource investment, and (iv) managers' welfare increase. These results are in favor of rewarding auditors for detecting fraud.

The Online Appendix is available at https://www.aea-j.org/journals_and_books/journal_al/.

Keywords: auditing; fraud detection; reward

1 Introduction

Designing the right system for auditors is fundamental to heighten audit quality. Peecher, Solomon, and Trotman (2013) observe that auditors today operate around the minimum audit quality level that the regulations prescribe. They claim that regulators should consider a way to explicitly

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reward auditors to heighten audit quality to the extent that the market demands. In particular, they propose a system that rewards auditors for detecting fraud. In this paper, I analyze the capital market effects of introducing such a system.

Rewarding auditors for detecting fraud may provide benefits to the capital market. In recent years, auditors have faced increasing responsibility for detecting financial statement fraud (e.g., AICPA 2002; PCAOB 2007). This change reflects expectations in the capital market that financial statement auditors should play a larger role in detecting and deterring fraud. Regulators can satisfy this demand if they can motivate auditors to detect and deter fraud more effectively. As Peecher, Solomon, and Trotman (2013) note, one possible way to do so is by introducing a system that rewards auditors for detecting fraud.

Auditors seem to get few explicit rewards other than audit fees. They only obtain implicit rewards. The market for audit services believes that large or specialist audit firms supply highquality audits, providing them reputation and audit fee premiums (Carson 2009; Francis and Wang 2008; Choi, Kim, Liu, and Simunic 2008). These audit firms may lose their clients if the market considers that their audit quality is unsatisfactory. Hence, rewards in the form of reputation and audit fee premiums motivate auditors to improve audit quality (DeAngelo 1981). Regulators may be able to heighten audit quality by introducing a system that explicitly rewards auditors.

Numerous studies show the incentive benefits of rewards. In business studies, bonuses are shown to motivate workers (e.g., Merchant and Manzoni 1989; Christ, Sedatole, and Twory 2012). In psychology, rewards are shown to improve creativity in specific problem-solving situations (see Byron and Khazanchi 2012 and the references therein). Based on these studies, one might expect positive consequences of rewarding auditors.

Nevertheless, predicting the effects of introducing a reward system on the capital market is difficult without a formal analysis. For example, introducing a reward for detecting fraud will create an expectation in the capital market that auditors will try to detect fraud more eagerly than before. Therefore, it will deter managers from committing fraud. On the other hand, if auditors expect so, they will decrease the amount of audit resource investment to reduce costs. In this case, managers will be motivated to commit fraud, because their fraud will be unlikely to be detected. Hence, introducing a reward system both discourages and encourages auditors' decision to invest resources and managers' decision to commit fraud. Similarly, the reward on auditors may encourage or discourage investors' decisions to invest. Investors will invest more if they predict that the auditors will behave more actively and the managers will refrain from committing fraud. On the contrary, investors will invest less if they expect that auditors will reduce audit resource investment and managers will commit fraud with high probability.

This paper extends a model of Newman, Patterson, and Smith (2005) (hereafter NPS) to study the impacts of a reward system. NPS base their model on Shleifer and Wolfenzon's (2002) model of investor protection. NPS develop a model of the capital market with three players: an investor, an auditor, and a firm insider (a manager).[1] The insider decides the proportion of the firm sold to outside investors. The insider can transfer or divert some of the firm's resources out of the firm for his benefit.[2] Furthermore, in NPS's formulation, auditors represent a mechanism for detecting insiders' expropriation. NPS's model captures aspects of the capital market. Managers (insiders) may harm investors by diverting some of the firms' resources and concealing the information about this diversion. Auditors try to detect and deter this management misbehavior. I base my analysis on the formulation of NPS, but extend the setting to include a new variable that represents the strength of a reward on auditors. In my model, when the regulator starts to reward auditors for detecting fraud, (i) total investment by firms, (ii) firm ownership by outside investors, (iii) audit resource investment, and (iv) managers' welfare increase.

My results are consistent with those of NPS except for one aspect. NPS studies the capital market effects of penalties on auditors and corporate managers. I show that many of the insights in NPS continue to hold for a reward system. In particular, I show that players in the capital market are affected similarly for increasing auditor reward and increasing auditor penalties. There is, however, a difference between my results and NPS's. In NPS, greater auditor penalties increase audit fees. Contrary to this result, I show that a reward system on auditors will have an indefinite effect on audit fees.

The remainder of the paper is organized as follows. Section 2 develops a model, and Section 3 identifies the equilibrium strategies of the game. Section 4 investigates the capital market effects of introducing a reward system for auditors' fraud detection. The study concludes in Section 5. All proofs are relegated to the online appendix.

2 Model

2.1 The Newman, Patterson, and Smith (2005) Formulation

NPS consider three players: a manager ("an insider" in NPS's terminology), an investor, and an auditor. The regulator in this world is a system that imposes penalties without considering its payoff-maximization.

NPS assume that the manager is endowed with a fixed amount of wealth, W. He obtains external investment capital, I_M, from the investor and pays an audit fee, F, to the auditor. Hence, the

[1] *Insiders* in NPS's setting represent managers or controlling shareholders. Their terminology is consistent with the investor protection literature, which focuses on the conflict between minority shareholders and a controlling shareholder, who is typically a top manager (Johnson, La Porta, Lopez-de-Silanes, and Shleifer, 2000).

[2] NPS call this process expropriation, which is commonly used in the investor protection literature. Examples of expropriation include insiders' engaging in theft or fraud, obtaining excessive executive compensation, and transferring assets from firms to themselves at nonmarket prices (Johnson et al. 2000).

total investment by the manager is $I = I_M + W - F$. The manager has an investment opportunity with a known rate of return, $g > 0$, on the funds invested, I. Hence, the total amount of return is $\Pi = (1+g)I$.

The manager chooses the proportion λ of the firm owned by the external investor. This proportion determines the shares of the total return between the manager and the investor. The manager can also divert or expropriate some of the firm's resources, and NPS let δ denote this ratio. If no detection occurs, the manager obtains $\delta\Pi$ from diversion, and distributes the remaining portion of the return between the investor and himself according to the proportion λ of the firm owned by the investor. In this case, the manager obtains $(1-\delta)(1-\lambda)\Pi$ in addition to $\delta\Pi$, and the investor obtains $(1-\delta)\lambda\Pi$. If the manager is detected diverting, he has to return the amount diverted and pay a penalty. NPS assume that the penalty function is linearly increasing in the diversion rate, so the penalty is $b\delta$, where $b > 0$ represents the strength of the penalty and is exogenously determined by the regulator. If detection occurs, the manager obtains $[(1-\lambda) - b\delta]\Pi$, and the investor obtains $\lambda\Pi$.

The manager tries to attract an investor by hiring an auditor, who detects and deters diversion. NPS assume that the auditor detects the manager's diversion with probability $q(x) = 1 - \exp(-x)$, where x is the amount of resource investment in the audit. Hence, the probability of detection is 0 if audit resource investment is 0. As the amount of audit resources increases, the probability of detection approaches 1.

The manager obtains the share $\delta + (1-\delta)(1-\lambda)$ of the total amount of return Π if he is not detected, and the share $(1-\lambda) - b\delta$ if he is detected. Hence, the manager's expected payoff, EUM, is:

$$\begin{aligned} EUM &= \{(1-q(x))[\delta + (1-\delta)(1-\lambda)] + q(x)[(1-\lambda) - b\delta]\}\Pi \\ &= [e^{-x}(1-\lambda+\delta\lambda) + (1-e^{-x})(1-\lambda-b\delta)](1+g)I. \end{aligned} \tag{1}$$

The investor, on the other hand, obtains the portion $(1-\delta)\lambda$ of the total amount of return Π if the manager is not detected, and the portion λ of it if he is detected. Thus, the investor's expected payoff, EUV, is:

$$EUV = [(1-q(x))(1-\delta)\lambda + q(x)\lambda]\Pi. \tag{2}$$

NPS assume that the investor chooses whether to invest in the manager's firm or in the market portfolio, which returns an interest rate i. In equilibrium, the following equality holds:

$$EUV = (1+i)I_M. \tag{3}$$

NPS assume that the auditor's cost is a function of the audit resource investment, x, and is $C(x) = kx^2/2$, where $k > 0$ is a fixed parameter of audit cost. If the auditor fails to detect the investor's resource diversion, the regulator punishes her. Some diversions by managers are subsequently discovered by means other than an external audit, while others are never discovered. Hence, NPS use the notion of expected penalty. NPS assume that the auditor's penalty function is linearly increasing in the diversion rate. Hence, the expected penalty is $a\delta$, where $a > 0$ represents the strength of the penalty and is exogenously determined by the regulator.

The auditor earns an audit fee, F, and pays a cost of auditing, $C(x)$. If she fails to detect diversion, she incurs a penalty. Thus, the auditor's expected payoff in the NPS's model, EUA_N, is:

$$EUA_N = F - C(x) - (1 - q(x))a\delta.$$

NPS assume that the auditor operates in a competitive market and obtains an expected profit of 0. Thus, after she chooses the amount of audit resource investment, x, the following equality must hold:

$$EUA_N = 0.$$

2.2 Extension of Newman, Patterson, and Smith (2005) to Include a Reward for Auditors

I consider a system in which the regulator rewards the auditor when she detects the manager's diversion. To this end, I introduce a new variable, $v \geq 0$, which represents the strength of the reward on the auditor. The regulator can exogenously change the value of v. I assume that the reward is linearly increasing in the diversion rate. When the auditor detects diversion of the size δ, she will obtain $v\delta$.

In my model, the auditor earns an audit fee, F, and pays a cost of auditing, C. If she detects the manager's diversion, she obtains a reward. If she fails to do so, she incurs a penalty. Thus, the auditor's expected payoff, EUA, is:

$$\begin{aligned} EUA &= F - C(x) - (1 - q(x))a\delta + q(x)v\delta \\ &= F - \frac{kx^2}{2} - e^{-x}a\delta + (1 - e^{-x})v\delta. \end{aligned} \tag{4}$$

Note that if the reward does not exist, or if I set $v = 0$, my setting becomes identical to that of NPS.

As in NPS, I assume that the auditor operates in a competitive market. Thus, in equilibrium, the following equality must hold:

$$EUA = 0. \tag{5}$$

2.3 The Game and the Parameter Assumptions

As in NPS's setting, the solution concept I employ is a subgame perfect Nash equilibrium, which requires a Nash equilibrium in every subgame of the game (see Mas-Colell, Whinston, and Green 1995 for a discussion):

First stage: The manager chooses the total investment level, I, and the proportion of the firm sold to the external investor, λ.
Second stage: The auditor chooses audit resource investment, x, and the manager chooses the diversion rate, δ.

For simplicity, I assume that the market interest rate, i, is equal to 0. Furthermore, to rule out the possibility of boundary solutions for δ and λ and to ensure that the audit fee, F, is larger than the cost, C, I make the following assumptions:

Parameter assumptions (PA):

$$1)\ k < \frac{(a+v)b}{(1+b)\log\dfrac{1+b}{b}},$$
$$2)\ W > \frac{ka}{bg(a+v)},$$
$$3)\ g < \frac{(a+v)(b+1)}{k} - 1, g < \frac{1}{1-\dfrac{k}{a+v}\log\dfrac{1+b}{b}},\ \text{and}$$
$$4)\ v < ab.$$

PA (1), a sufficient condition for $\delta < 1$, requires that k, the audit cost parameter, be small. PA (1) requires that the auditor work efficiently, at least to some extent. PA (2) and (3) together ensure that the equilibrium value of λ stays in the interior of $[0,1]$. PA (2) requires that the manager have sufficiently large wealth. PA (3) requires that the rate of return from the firm's investment be not too large.[3] Further, by PA (4), I restrict my attention to the strength of reward, v, small enough relative to the penalty parameters, a and b. PA (4) is sufficient for the audit fee, F, to be larger than the cost of auditing, C, in equilibrium. If I drop this assumption, the auditor may make a profit primarily by detecting diversion and receiving rewards, not by obtaining audit fees. Nevertheless, I preclude this possibility.

3 Equilibrium Strategies

3.1 Second Stage Equilibrium Strategies

I derive the equilibrium strategies by the same steps as NPS. In the second stage of the game, the players take the proportion of the firm owned by the external investor, λ, and total investment, I, as given. The manager maximizes his expected payoff, EUM, by choosing the diversion rate, δ. At

[3] There is an error in NPS's parameter assumption about g. NPS only assume $g < a(1+b)/k - 1$, which can be retrieved by assuming $v = 0$ in my model. NPS fail to assume $g < 1/(1 - k/a\log((1+b)/b))$.

the same time, the auditor maximizes her expected payoff, EUA, by choosing the amount of audit resource investment, x. Proposition 1 states the equilibrium strategies in the second stage of the game.

Proposition 1 *The second-stage Nash equilibrium is attained when the amount of audit resource investment, x^*, and the manager's diversion rate, δ^*, are:*

$$x^* = \log \frac{\lambda + b}{b}, and \tag{6}$$

$$\delta^* = \frac{\lambda + b}{(a+v)b} k \log \frac{\lambda + b}{b}. \tag{7}$$

From the auditor's zero-profit condition (5), the second-stage equilibrium strategies in Proposition 1 determine the equilibrium amount of audit fee, F^*:

$$F^* = C(x^*) + (1 - q(x^*))a\delta^* - q(x^*)v\delta^*.$$

From the assumptions $C(x) = kx^2/2$ and $q(x) = 1 - \exp(-x)$ and the results of Proposition 1, this expression can be restated as:

$$F^* = \frac{k}{2} x^{*2} + kx^* - \frac{vkx^* e^{x^*}}{a + v}. \tag{8}$$

Furthermore, from Proposition 1, I can observe the partial effects of the change in the reward on the second stage strategies. Lemma 1 helps compare the partial and total effects of the reward on the players' strategies in Section 4.

Lemma 1 *In the second stage, where the proportion λ of the firm sold to investors and total investment, I, are constant:*

1) audit resource investment, x, is unaffected by the change in the strength of the reward on auditors, v, and

2) the diversion rate, δ, decreases as the strength of the reward on auditors, v, increases.

In the first stage of the game, the proportion of the firm sold to investors, λ, and total investment, I, may change in v. These changes may influence audit resource investment, x, and the diversion rate, δ. I discuss the total effects of the reward on these variables in Section 4.

Under the second-stage equilibrium strategy, the manager's expected payoff, EUM, can be stated as in Proposition 2.

Proposition 2 *The manager's expected payoff, EUM, in the second-stage equilibrium is:*

$$EUM^* = (1-\lambda)(1+g)I. \tag{9}$$

Proposition 2 implies that in the second-stage equilibrium, the manager's expected payoff, EUM, changes as the proportion of the firm sold to investors, λ, and total investment, I, change.

3.2 First Stage Equilibrium Strategies

Using the same steps as NPS, I now derive the first stage strategies. In the first stage of the game, the manager chooses the proportion of the residual rights owned by external investors, λ. In addition, from (3) and the assumptions $I = I_M + W - F$, $\Pi = (1+g)I$, and $i = 0$, I can express the equilibrium amount of total investment, I, as:

$$\begin{aligned} I^* &= \frac{W - F^*}{1 - \lambda(1+g)[1-(1-q(x^*))\delta^*]} \\ &= \frac{W - F^*}{1 - \lambda(1+g)\left(1 - \dfrac{kx^*}{a+v}\right)}. \end{aligned} \tag{10}$$

Notice that x^* is a function of λ by (6), and so is F^*, which is a function of x^* by (8). Thus, the equilibrium total investment, I^*, is a function of λ. This relationship means that the manager chooses I by choosing λ.

The first-stage equilibrium strategy is determined solely by the manager's choice of the proportion λ of the residual rights owned by investors to maximize his expected payoff, EUM.
Recall that by Proposition 2, the manager's expected payoff takes the form of (9). From the manager's first-order condition, $dEUM/d\lambda = 0$, the following equality holds:

$$\begin{aligned} &(1+g)\left((1-\lambda)\frac{dI}{d\lambda} - I(\lambda)\right) = 0, \text{ or} \\ &(1-\lambda)\frac{dI}{d\lambda} - I(\lambda) = 0. \end{aligned} \tag{11}$$

The expression (11) implies that $dI/d\lambda$ is positive, because both $I(\lambda)$ and $(1-\lambda)$ are positive. Intuitively, if the manager chooses a greater value of the share of the firm sold, λ, he offers a greater proportion of the investment return to the investor, and the manager earns less from the firm investment. To compensate for this decrease in payoff, the manager increases the total investment, I.

4 Analysis

In this section, I consider how each player's strategy changes when the regulator starts to reward auditors for detecting fraud.

4.1 Share of the Firm Sold

First, I state the effect of introducing a reward on the proportion of the firm owned by external investors, λ. Recall that in the first stage of the game, the manager chooses the share of the firm sold, λ. Therefore, the change in this variable plays a central role in the first-stage effects. The following proposition describes the change in λ.

Proposition 3 *Share of the firm sold, λ, increases as the strength of the reward, v, increases.*

As the regulator starts to reward the auditor for detecting fraud, the capital market expects that the system will help control fraud, and ownership of the firm will be diluted. Ceteris paribus, the investor prefers larger λ, because he gains a larger share of the firm's profit. Nevertheless, I have to investigate the changes in other variables to evaluate the effects of the reward policy.

4.2 Total Investment

I can express the effects of the reward on the total investment as:

$$\frac{dI}{dv} = \frac{\partial I}{\partial v} + \frac{\partial I}{\partial \lambda}\frac{d\lambda}{dv}, \tag{12}$$

where $\partial I/\partial v$ is the direct effect and $(\partial I/\partial \lambda)(d\lambda/dv)$ is the indirect effect. The expression $\partial I/\partial \lambda$ is identical to $dI/d\lambda$ in the condition (11) in its meaning, so it is positive. I also have $d\lambda/dv > 0$ from Proposition 3. The direct effect $\partial I/\partial v$ is positive. Therefore, both direct and indirect effects are positive. I state the result in Proposition 4:

Proposition 4 *Total investment, I, increases as the strength of the reward, v, increases.*

Thus, I predict that as the regulator introduces or strengthens the reward on auditors, firms' total investment will increase. As the regulator starts to reward auditors, countervailing effects may arise on audit fees and diversion rates. Nevertheless, the system will lead to the net effect of increasing the total investment.

4.3 Audit Resource Investment

I state the following proposition about the effect of introducing the reward system on audit resource investment:

Proposition 5 *The audit resource investment, x, increases as the strength of the reward, v, increases.*

From Lemma 1, the amount of audit resources invested stays the same as the regulator strengthens the reward when the share of the firm sold, λ, and total investment level, I, are fixed. Now I take these variables as endogenous and examine the indirect effect of the reward. I can express the direct and indirect effects as:

$$\frac{dx}{dv} = \frac{\partial x}{\partial v} + \frac{\partial x}{\partial \lambda}\frac{d\lambda}{dv}, \tag{13}$$

where $\partial x/\partial v$ is the direct effect and $(\partial x/\partial \lambda)(d\lambda/dv)$ is the indirect effect. The direct effect is zero from Lemma 1. From proposition 3, $d\lambda/dv$ is positive. Moreover, by differentiating (6) with respect to λ, I obtain $\partial x/\partial\lambda > 0$. The reward causes dilution of the share of the firm, and it in turn increases the audit resource investment.

An increase in audit resource investment, x, will increase detection probability, $q(x)$, and audit cost, $C(x)$. As the regulator starts to reward auditors for detecting fraud, auditors operate more effectively to detect fraud. On the other hand, they will incur greater costs because they will improve their performance by increasing the input of resources.

4.4 Diversion Rate and Audit Fee

Recall that in Lemma 1, the diversion rate, δ, decreases as the regulator strengthens the reward on auditors, v, if I set constant the proportion of the firm sold, λ, and total investment, I. I decompose the total effect of the reward into the direct and indirect effects:

$$\frac{d\delta}{dv} = \frac{\partial\delta}{\partial v} + \frac{\partial\delta}{\partial\lambda}\frac{d\lambda}{dv}, \tag{14}$$

where $\partial\delta/\partial v$ is the direct effect and $(\partial\delta/\partial\lambda)(d\lambda/dv)$ is the indirect effect. From Lemma 1, the direct effect is negative. The indirect effect is positive, because $d\lambda/dv$ is positive from Proposition 3, and so is $\partial\delta/\partial\lambda$. Therefore, I conclude that the total effect is indefinite.

The effect of the reward on the audit fee, F, is also indefinite. The total effect can be decomposed as:

$$\frac{dF}{dv} = \frac{\partial F}{\partial v} + \frac{\partial F}{\partial\lambda}\frac{d\lambda}{dv}, \tag{15}$$

where $\partial F/\partial v$ is the direct effect and $(\partial F/\partial\lambda)(d\lambda/dv)$ is the indirect effect. The direct effect is negative, but the indirect effect is indefinite. Hence, I cannot conclude either the direct or indirect effect dominates.

4.5 Manager's Expected Payoff

I obtain the following result about the manager's payoff:

Proposition 6 *The manager's expected payoff, EUM, increases as the strength of the reward on auditors,* v*, increases.*

Intuitively, the result of Proposition 6 agrees with that of Proposition 4. Because the manager's total investment, I, increases as the regulator introduces the reward system, it is reasonable that the manager's expected payoff, defined in (1), increases. Although the manager may increase or decrease the diversion rate, δ, he will become better off when the regulator starts to reward auditors.

4.6 Discussion

I summarize that starting to reward auditors for detecting fraud will increase (i) total investment by firms, (ii) firm ownership by outside investors, (iii) audit resource investment, and (iv) managers' welfare. These effects are qualitatively the same as those of strengthening the auditor's penalty α in NPS's model.

In my model, however, an increase in v has an indefinite effect on the audit fee, F (Section 4.4). In NPS, an increase in α leads to an increase in F. Intuitively, α increases F because auditors are motivated to increase audit resource investment, x, to avoid getting penalized. Hence, they must charge a larger audit fee. The same effect arises as the regulator starts to reward auditors. Auditors must (1) *increase* the audit fee because they increase audit resource investment to get rewarded by detecting fraud. Nevertheless, rewarding auditors has another effect on the audit fee. Given a reward, auditors operate profitably — but this profit is taken because the market for audit services is competitive. Consequently, auditors are forced to (2) *decrease* the audit fee to attract clients. Given the countervailing effects (1) and (2), the total effect of a reward on the audit fee is unclear.

Despite this ambiguous effect on the audit fee, I predict that regulators can cause positive economic effects on investors and firm managers by rewarding auditors. These effects are expected to complement those of a penalty.

5 Conclusions

This study analyzes the effects of rewarding auditors for detecting fraud. The results show that starting to reward auditors for detecting fraud will increase (i) total investment by firms, (ii) firm ownership by outside investors, (iii) audit resource investment, and (iv) managers' welfare.

This research has a number of limitations. For example, I assume that the auditor operates in a competitive market, and an investor is indifferent between investing in the firm and the market portfolio. I also make a number of simplifying assumptions such as the exponential detection function, the quadratic audit cost function, and the linear reward function.

Despite these limitations, my analysis provides insights into a possible institutional framework. I take three players in the capital market into consideration. I show that introducing a reward for auditors' fraud detection will have positive economic impacts on the capital market.

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