Capital structure and earnings manipulation*

Anton Miglo†

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†Associate professor of economics and finance, University of Bridgeport, School of Business, Bridgeport, CT, ph. (203) 576-4366, email: amiglo@bridgeport.edu.

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Abstract. We consider an optimal contract between an entrepreneur and an investor, where the entrepreneur is subject to a double moral hazard problem (one being the choice of production effort and the other being earnings manipulation). Since the entrepreneur cannot entirely capture the results of his effort, investment is below the optimal level and production effort is socially inefficient. The opportunity to manipulate earnings protects the entrepreneur against the risk of a low payoff when production is unsuccessful. Ex-ante, this provides an incentive for the entrepreneur to increase investment and improve effort.

Key words: earnings manipulation, intertemporal substitution, design of securities, property rights, double moral hazard

JEL classification codes: G32, D92, D82

1 Introduction

The corporate scandals of last decade have raised heated debates regarding the earnings manipulations by firms' insiders. Existing literature usually focuses on earnings misreporting.[1] In contrast, we consider earnings manipulation (EM) to be a transfer of funds between periods. This transfer does not create any social value (in contrast to productive effort). EM can be conducted by using either accounting methods (discretionary accruals) or real actions.[2] Some typical examples include delaying the approval of important decisions, inefficient investments, borrowing in order to manipulate financial results, inefficient discount policy etc.[3] Recent empirical papers on EM suggest that the focus of research should be shifted from earnings misreporting towards EM especially towards EM with real actions (Graham et al (2005), Huang et al (2008)). In the present paper, we consider a model where EM arises as a part of the equilibrium relationships between firms' insiders and outsiders. The model is able to generate several predictions regarding EM.

In their well-known paper Degeorge et al (1999) present a theoretical model involving EM by a manager with a bonus-like contract. The authors show that the manager's incentive to manipulate earnings depends on the values of the latent (pre-managed) earnings, the manager's bonus, and the magnitude of the social loss from EM. The manager's decision also relies on whether predictions of future profits are certain or risky.

In contrast, the model in the present paper contains a double-moral hazard problem (one being the choice of production effort and the other being the EM decision). Second, we compare different contractual arrangements

[1] For empirical evidence about earnings misreporting see, among others, Dechow, Sloan and Sweeney (1996) and Erickson, Hanlon and Maydew (2003). For theoretical papers see Cornelli and Yoscha (2003), Crocker and Slemrod (2005) and Johnsen and Talley (2005).

[2] For accounting manipulations see, among others, Payne and Robb (1997) and Burgstahler (1997). The latter considers a model where earnings are shifted via accounting methods with an assumption that marginal benefits of higher earnings are large when earnings are in middle range.

[3] Other examples include allowance for bad debt, cutting expenses on research and development, managing pension plans, and delay in maintenance expenditures and other important decisions (see Bartov (1993), Degeorge, Patel and Zeckhauser (1999), Roychowdhury (2006) and Graham et al (2005)).

between an investor and an entrepreneur as well as their impact on the entrepreneur's effort. This is important given that several recent papers analyze the links between financing structures and EM (see, for instance, Richardson et al (2007), Hodgson and Stevenson-Clarke (2000) and Jensen (2004)). Finally, we compare the model's predictions with EM and without EM. To our knowledge there are not many papers analyzing the link between capital structure and EM. A notable exception is Trueman and Titman (1988). The authors argue that EM can be used by managers to smooth earnings and to improve the firm's credit rating in order to obtain better conditions for future debt financing. In contrast, in our paper we analyze how existing capital structure may affect insiders' incentives for EM.

We analyze a model where a firm needs external financing. The firm's value consists of current (first-period) earnings and the going concern value. The financing contract includes cash payments and an allocation of rights on the firm's going concern value - both being contingent on the magnitude of the firm's current earnings.[4] The contract may affect the value of the parties cooperation because of the impact it has on the entrepreneur's incentives to provide productive effort and engage in EM. For instance, if the going concern value represents a new firm and the party responsible for decision-making is the sole owner of this new firm, this party will be interested in shifting the value of the original business to the new firm (even if it is socially inefficient).

As mentioned above, we compare two situations. In the first, the entrepreneur chooses only a costly productive effort - assuming that the entrepreneur cannot be involved in EM. In the second, the entrepreneur is subject to a double-moral hazard problem which includes the choice of productive effort and the EM decision. It is shown that the parties expected payoffs can be higher in the second case. The following demonstrates the intuitions behind this result. Consider debt financing. If current earnings are below the face value of debt, the firm is bankrupt and the entrepreneur gets nothing. Since the entrepreneur's effort is costly, the socially optimal level of effort in the first-period involves a trade-off between the firm's expected earnings in the first period and the cost of effort. However, for the entrepreneur this trade-off is biased (compared to the socially optimal level) because of bankruptcy risk. In the case of bankruptcy, the entrepreneur loses a large amount of earnings

[4]See, among others, Kaplan and Stromberg (2003) for contingencies in financing contracts.

in the second period which are not contractible.[5] As a result, he will usually provide a higher than socially optimal level of effort. However, if he is able to transfer earnings between periods, and the firm's going concern value is relatively high, the entrepreneur can increase current earnings by reducing the firm's going concern value. This allows the firm to avoid bankruptcy and make a positive profit. This in turn increases his ex-ante incentive to provide a socially optimal level of effort. This argument works even if the cost of EM is relatively high.

Graham et al (2005) recently found that EM via real activities manipulation is used more frequently than accounting fraud and misreporting. The management and prevention of EM becomes an important focus of an efficient corporate governance structure, firms' investors and government authorities. The position of aforementioned parties depends primarily on whether they are able to detect these manipulations and secondarily on their opinion of whether these manipulations are useful or not. With regard to the former note, Huang et al (2008) argue for example that Chinese regulation has been successful because it is able to detect real manipulations. With regard to the latter note, a possible strategy is to move in the direction of a zero-tolerance policy via internal control, strict regulation and European style-corporate governance codes. For example, a manager can be fired or even charged when found conducting business in such a way. This paper points out that such a policy will not always lead to an improvement in production efficiency of corporations due to a double-moral hazard problem. The key is to understand the nature of managerial moral hazard which depends on firms' specific conditions including industrial conditions. If the firm operates in an environment with a high degree of contract incompleteness, where long-term projects and earnings are difficult to verify by third parties, some degree of earnings manipulation can be tolerable. On the other hand other industries can definitely benefit from zero-tolerance policy.

The rest of this paper is organized as follows: Section 2 describes the model; Section 3 explains optimal contracting without EM; Section 4 discusses optimal contracting when the entrepreneur is subject to a double moral hazard problem which includes EM. A comparison of the outcomes is presented in Section 5. The case with a risk-averse entrepreneur is analyzed in Section 6. Section 7 discusses the model's robustness and possible extensions. Section 8 discusses the model's implications with regard to empirical

[5] Based on incomplete contracts literature (see, for example, Hart, 1995).

evidence and Section 9 presents the conclusion.

2 Model

Consider a firm that has to make an investment $b > 0$. The firm's owner/entrepreneur (E) needs external financing from an outside investor (I). E and I are risk neutral. If the investment is made, the firm's performance depends on E's effort $e \in [0, 1]$. The cost of effort is e^2. The interim first-period cash flow r_0 equals 1 with probability e and 0 otherwise. The company's assets which remain at the end of first period may yield a revenue of 2 in the second period.[6] E may engage in EM. The firm's final first-period profit is $r = r_0 - a$, where a is a profit correction arising from intertemporal substitution (EM takes place if $a \neq 0$). If $a \neq 0$, the firm's going concern value at the end of first period is thus $v = 2 + a - c$, where c is the cost of EM, $0 < c < 2$.[7] EM is socially inefficient ($a^* = 0$, where a^* denotes the socially optimal a). To insure that earnings are non-negative in each period we assume that

$$c - 2 \leq a \leq r_0 \tag{1}$$

E observes r_0 and chooses a. I cannot observe e and a. The first-best level of effort e^* maximizes the firm's expected value to the entrepreneur. The expected value can be written as $E[r + v - e^2 - b] = e + 2 - e^2 - b$. Obviously, $e^* = 1/2$. We assume that the project's net present value is positive, i. e.

$$E_{e=1/2, a=0}[r + v - e^2] = 9/4 > b \tag{2}$$

The game is as follows:

1. Securities are issued and sold for an amount b. The investment is made.
2. E chooses e.
3. r_0 is realized, E chooses a.

[6] For simplicity it is assumed that the firm's going concern value does not depend on e. The model can easily be generalized by allowing this. As far as we can see, no intuitions will be affected by this change. The specific value is chosen arbitrarily although it assures that the going-concern value of the firm is large enough compared to current earnings.

[7] The cost of EM includes mostly the time E spends on creating the "technology" for EM (like creating a special purpose vehicle (firm) to hide losses in the case of Enron). This is not necessarily linked to the magnitude of EM. The model can be generalized by allowing different cost functions.

4. r and v become known. The parties get their payoffs according to the securities issued.

A security is a contract between E and I that specifies payments to each party in each scenario. When choosing which securities to issue, E maximizes the expected value of his net earnings (payoff on the securities minus the cost of effort). On the one hand, the contract should provide E with the optimal incentive to choose e and a. On the other hand, the expected value of I's payoff must cover the investment cost, b, in order for I to accept the contract.

A complete contract contingent on the firm's going concern value is impossible to write. This stems from the idea that the insiders have a larger degree of freedom and they are more difficult to control regarding long-term projects than short-term projects.[8] This intuition appears in Hart (1995, p.23) and is based on the idea of impossibility to describe all states of nature in the future. Obviously, this task is much more complicated in the long-term than in the short-term. As a result of outsiders' inability to control the firm's action in the long-term, the decision-maker can divert a fraction of the firm's value for his own interests. The managers' actions which may reduce/increase the firm's value and increase/decrease the value of managers' benefits are numerous. These include developing family business using firms resources, giving a job to family members, disutility from working with undesirable but efficient person, making subjective decisions regarding firm's investments in charity, advertising etc. An example of long-term projects which have these problems are projects involving research. Since a research result is extremely difficult to control and to verify, the researcher can spend time on working in the interests of another company or family interest instead of focusing on firm's shareholders' interests.

Therefore we assume that E is not able to offer I a complete contract contingent on the firm's total value. As we discuss below, if this were possible, the problem of EM would not exist. The solution of the game described above would be such that E will never manipulate earnings. This means $a = 0$.

Lemma 1. *If complete contracts are possible,* $a = 0$.

The proofs of all lemmas and propositions are put in the Appendix.

The intuition is following. EM does not increase the firm's total value. When the parties write a contract with payoffs contingent on the firm's total

[8] The model can be easily generalized by allowing some degree of discretion with regards to short-term earnings as well or by allowing partial verifiability of long-term earnings. The results will hold as long as the degree of entrepreneur's capacity to steel long-term earnings is higher than that in the short-term.

value this will not provide an incentive for EM. Furthermore, for any contract which is not contingent on the firm's total value and that triggers EM by E, a better contract exists which is contingent on firm's total value. This contract should pay E the same amount of earnings or slightly better as he would earn under first contract. Then E will chose the same level of effort but the overall payoff to the parties will be higher because it will not involve EM.

3 Optimal contracting without earnings manipulation

A complete contract contingent on the firm's going concern value is impossible to write. Thus, we assume that E can only offer a complete contract contingent on first-period earnings r, and that E (the party in control) can capture the firm's going concern value (similar to Hart, 1988). E then remains in control when the firm does not default. This leads to the following security design in the model which depends on the first-period sharing rule and the contingencies for shifting control in the second period.[9]

Equity financing (denote this strategy by s). In this case, I gets a fraction k of the firm's earnings in the first period, $0 < k \leq 1$. E's payoff is $(1-k)r+v$ and I's payoff is kr.

Debt (denote this strategy by d). The firm issues debt with face value D which matures at $t = 1$. If $r < D$ (default), I gets the first-period earnings and the firm's going concern value. E gets nothing. If $r \geq D$, E's first-period earnings are $r-D$. He also obtains the firm's going concern value. Therefore, E's total payoff is $r - D + v$ and I's total payoff is D.

Consider an optimal contract when E does not manipulate earnings under any circumstance. This may be the case when the government puts in place a well developed system of corporate controls, which makes it highly probable that EM will be discovered. If the penalties for manipulating earnings are very high, E cannot justify taking the risk. E's problem can be written as

[9] In Section 7 we discuss different security designs.

follows (problem P1).

$$\begin{gathered} max_{s,d} EV_E \text{ subject to} \\ e = \arg\max_e EV_E \\ 0 \leq e \leq 1 \\ EV_I \geq b \end{gathered}$$

where V_E and V_I denote the payoffs of E and I respectively.

To solve P1 we will decompose it into two sub-problems. We first consider each financing strategy separately and will summarize the results in Proposition 1. For strategy e, we expect that in cases when the firm undertakes the project, E's effort is below the first-best level of effort. This is because he bears the full cost of the effort while the results of the effort must be shared with I (in the spirit of Jensen and Meckling, 1976).

Lemma 2. *1) if $b > 1/8$, s is not feasible; 2) If $b \leq 1/8$ and s is chosen,*

$$e = (1 - k)/2 \tag{3}$$

$$k = \frac{1 - \sqrt{1 - 8b}}{2} \tag{4}$$

Intuitively, if b is too large, the fraction of equity that must be given to I is large enough to prevent E from providing an effort level which will generate enough income to compensate I. The crucial point here is the non-contractibility of second-period earnings. As a result, the investor's payoff relies heavily on the part of earnings that are verifiable, that strongly decreases E's incentive to provide a high effort. By contrast, if earnings in both periods are verifiable, all projects with positive net-present values would be undertaken. Also note that according to (3), E's effort is less than 1/2 (the first-best effort) which confirms our expectations regarding strategy s.

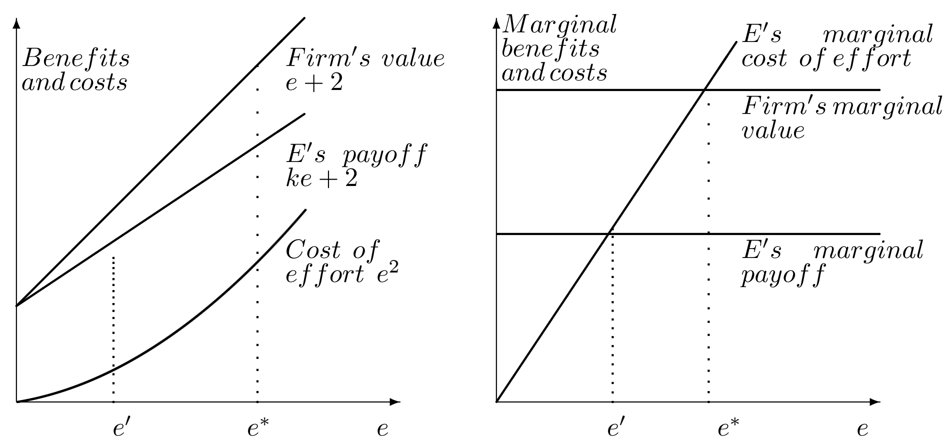
Now consider d.

Lemma 3. *1) If $b > 1$, d is not feasible; 2) if $b \leq 1$ and d is chosen*

$$D = b \tag{5}$$

An explanation for Lemma 3 is as follows. If b is larger than the maximal first-period earnings, setting the debt face value below that maximal level of earnings is not sufficient to ensure that the investor is repaid at least b. If debt face value is higher than the maximal first-period earnings, the entrepreneur has nothing to gain and does not provide any effort. Therefore, if $b > 1$, the investment will not be undertaken. When $b \leq 1$, the investment takes place and E's effort in this case is above the first-best level. E loses control of the firm if debt is not paid back to creditors. Hence he delivers the level of effort that provides higher than socially optimal probability of the project's success in the first period. He does this to make sure that he stays on control of the firm.

Figure 1 illustrates intuitions behind Lemmas 2 and 3. In Figure 1a e^* maximizes the difference between firm's value and E's cost of effort and e' maximizes the difference between E's payoff and E's cost of effort. As shown in Figure 1b when $e = e^*$, marginal increase in firm's value equals E's marginal cost of effort and when $e = e'$, marginal increase in E's payoff equals E's marginal cost of effort. Since E's marginal payoff is less than firm's marginal value we have $e' < e^*$. Analogously Figures 1c and 1d illustrate why $e'' > e^*$.



a b

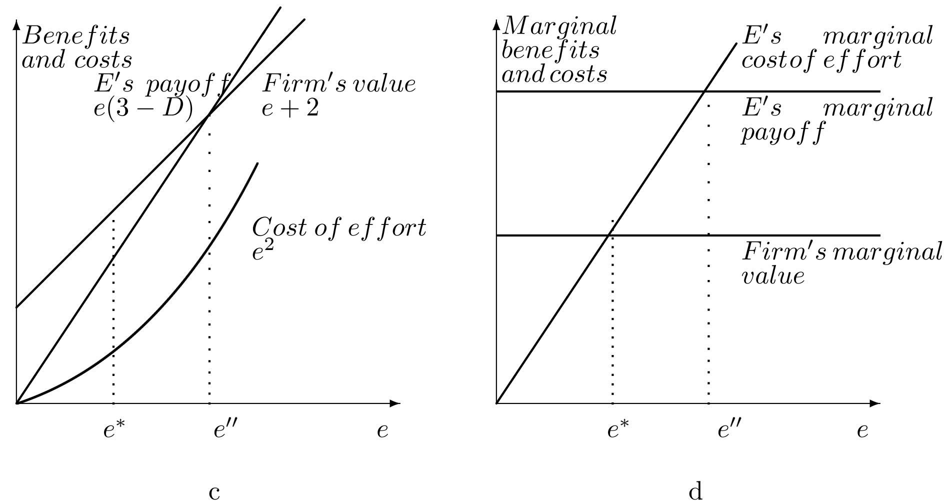


Figure 1. Optimal effort under strategy s (a and b); d (c and d).

Proposition 1. *1) If the $b \leq 1/8$, s is the optimal strategy. 2) If the $1/8 < b \leq 1$, d is optimal; 3) if the $1 < b$, the project will not be undertaken.*

The project will be undertaken if and only if $b < 1$. Thus, there is less inefficiency under small values of b than under high values of b. Given that E's portion of total profit increases, E will provide a greater effort when the b is lower. Also, when b approaches zero, E's effort approaches the first-best as follows from (4) and (3).[10] The same does not happen with strategy d because E is concerned about keeping the firm's control and thus delivers higher than optimal level of effort even if debt face value is relatively small. Consequently, s is the optimal strategy under small values of b. Finally, note that Innes (1990) analyzes a similar environment (where the entrepreneur's effort is costly and EM is not allowed) with only one period (in terms of our model this means $v = 0$) and demonstrates that debt is the best financing method.

[10] If $b \to 0$ then $k \to 0$ and $e \to 1/2$.

4 Optimal contracting with earnings manipulation

Now suppose that E can manipulate earnings. E's problem (P2) can be written as follows:

$$\begin{gathered} max_{s,d} EV_E \text{ subject to} \\ a = \arg\max_a V_E \\ e = \arg\max_e EV_E \\ EV_I \geq b \\ 0 \leq e \leq 1 \\ c - 2 \leq a \leq r_0 \end{gathered}$$

As in the previous section, we begin by considering each financing strategy separately. In the case of strategy s, after observing latent earnings, E may be interested in using EM by shifting earnings from the first period to the second period. The reason being a large opportunity "to steal" money from future earnings of the firm given that they are difficult to control by I. In addition, E is not facing any risk of bankruptcy under strategy s. The trade-off for E will be between capturing benefits in the second period and the value loss caused by EM. The cost of EM has a significant role to play here: if it is sufficiently high, E will not be engaged in EM and vice versa.

Lemma 4. *1) s is feasible if and only if $b \leq 1/8$ and*

$$\frac{1 - \sqrt{1 - 8b}}{2} < c \tag{6}$$

2) if s is chosen, the k is determined by (4).

As expected, the value of c is important for the results of Lemma 4. If it is low, then E will be engaged in EM that will sharply reduce I's final earnings. To make strategy s a possible way of financing, c must be sufficiently high.

Now consider strategy d. Intuitively, E may be interested in shifting EM upward. This can be the case if latent earnings are low. Otherwise E loses control of the firm and gets nothing in the second period. We also expect that E's effort can be more efficient than in the case without EM. The opportunity to manipulate earnings protects E against the risk of a low payoff when the results of production are low. This provides an incentive for E to improve effort.

Lemma 5. *Consider strategy d. Let $c \leq 1$. 1) If $2 - c/2 < b$, $D = K$, where*

$$K = \frac{5 - c - \sqrt{17 + c^2 - 2c - 8b}}{2} \tag{7}$$

2) If $2 - c/2 > b > 2 - c$, $D = 2 - c$. 3) If $2 - c > b$, $D = b$. Now, let $c > 1$. 1) If $b > 2$, d is not feasible; 2) If $2 > b > 1 + c/2$, $D = K$; 3) If $1 + c/2 > b$, $D = 1$.

The main result of Lemma 5 is that, in contrast to Lemma 3, debt financing is possible even when b is relatively high. Without EM, a high b would lead to a high debt face value which destroys E's incentive to provide productive effort. With the possibility of EM, E can make profit even if the debt face value is large and current earnings are low.

To illustrate Lemma 5, consider the case when $c = 1/2$ and $b < 1$. According to Lemma 5, $D = b$ in this case. Given the intermediate profit r_0 and action a, E's payoff is:

$$0, \text{ if } r_0 - a < D \tag{8}$$

$$r_0 - D + 2, \text{ if } r_0 - a \geq D \text{ and } a = 0 \tag{9}$$

$$r_0 - D + 2 - c, \text{ if } r_0 - a \geq D \text{ and } a \neq 0 \tag{10}$$

This means that if the firm defaults on its debt ($r_0 - a < D$), E gets nothing. Otherwise, he gets the firm's first-period residual earnings plus the firm's going-concern value minus the cost of manipulation. Comparing (8)-(10) for given values of c, b and D we get the following. If $r_0 = 1$, $a = 0$ is optimal. If interim earnings are above the threshold, the optimal strategy for E is not to manipulate earnings. E's payoff is $3 - b$ by (9). If $r_0 = 0$, the optimal a satisfies $a \leq r_0 - D$ and $2 + a - c \geq 0$. If these conditions are satisfied, E's earnings remain the same regardless of a. Thus, for simplicity, we will assume $a = r_0 - D = -D$. E's payoff is $3/2 - b$ by (10). The choice of e maximizes

$$e(3 - b) + (1 - e)(3/2 - b) - e^2 \tag{11}$$

This means that, with probability e, E gets the current earnings of $1 - b$ and the firm's going concern value 2 and with probability $(1 - e)$ he receives the firm's going concern value 2 reduced by the amount of EM b and the cost of EM $c = 1/2$. The maximum of (11) is attained when $e = 3/4$. By (11), E's expected payoff is $33/16 - b$ in this case.

Note that the level of effort ($e''' = 3/4$) is closer to the first-best level ($e^* = 1/2$) than in the case without EM. Figure 2 illustrates this result. In Figure 2a e^* maximizes the difference between firm's value and E's cost of effort; e'' maximizes the difference between E's payoff and E's cost of effort in the case without EM; and e''' maximizes the difference between E's payoff and E's cost of effort with EM. The slope of the line describing E's expected payoff (given by equation (11)) is less than that without EM (see (17)). As shown in Figure 2b when $e = e^*$, marginal increase in firm's value equals E's marginal cost of effort; when $e = e''$, marginal increase in E's payoff equals E's marginal cost of effort in the case without EM; and when $e = e'''$, marginal increase in E's payoff equals E's marginal cost of effort in the case with EM. Since E's marginal payoff in the case with EM is less than in the case without EM we have $e''' < e''$.

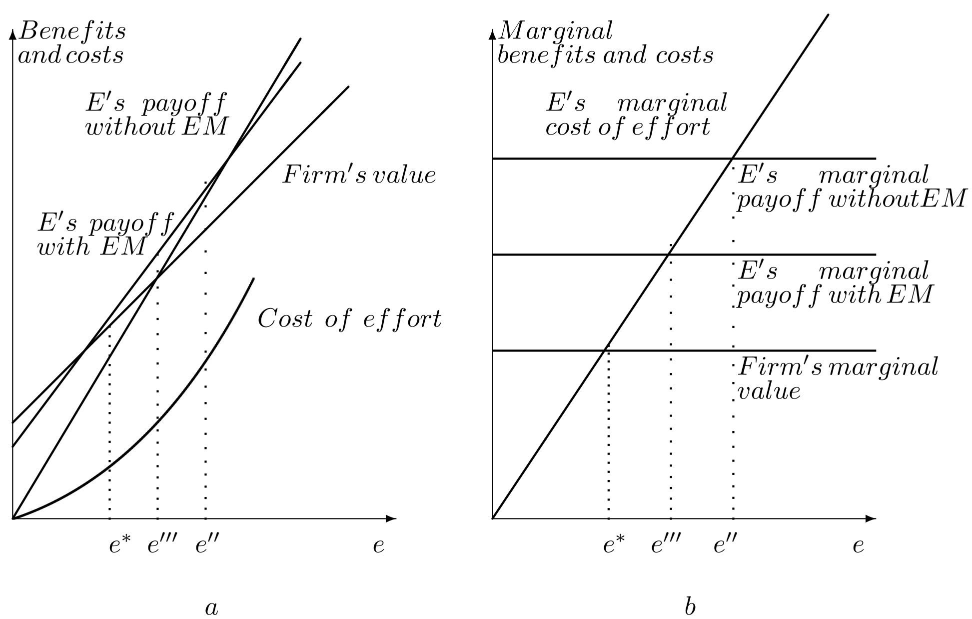


Figure 2. Optimal effort under strategy d with EM.

As was mentioned above, E's expected payoff is $33/16 - b$ in this case. This is higher than in the case without EM. It follows from Lemma 3 that, for the case $b < 1$, it would be $2 - b$.

It follows from Lemma 5 that if b is relatively low and the cost of EM is relatively low, debt is risk-free. The face value of debt is low and E is able to manipulate earnings to attain the threshold to avoid bankruptcy. If the b is relatively large and the cost of EM is relatively high, debt is not feasible (EM is not possible). Otherwise, E delivers some reasonable level of effort which implies some positive probability of default making debt risky. Lemmas 4 and 5 lead to the following proposition.

Proposition 2. *If $b \leq 1/8$, s is optimal if $c > \frac{1-\sqrt{1-8b}}{2}$ and d is optimal if $c \leq \frac{1-\sqrt{1-8b}}{2}$. If $1/8 < b \leq 2$, d is optimal. If $b > 2$, d is optimal if $c \leq 1$, and the project will not be undertaken if $c > 1$.*

Proposition 2 is intuitive. First, if b is large, s is not feasible - as discussed in the case without EM. Thus, debt is the optimal financing choice if the cost of EM is low. For other values of b, we have the following. A low c is detrimental to s because it creates opportunities for E to engage in EM, thereby shifting the firm's value away from I's. d is almost always accompanied by EM, so reducing the cost of EM is beneficial for debt financing.

Corollary 1 considers the effect of changes in b on the optimal choice of contract. It is shown that when the c is relatively small, firms with a high b issue debt while firms with the same c but a lower b issue equity. If b is relatively small, E will finance the project by issuing stock. The firm's going concern value will fully cover the investor's investment. The entrepreneur will keep 100% of current period earnings which will mitigate the moral hazard problem. If b is large, then financing in this way may not be feasible. Therefore, debt becomes optimal.

Corollary 1. *If $\frac{1-\sqrt{1-8b}}{2} \geq c$, d is optimal. If $\frac{1-\sqrt{1-8b}}{2} < c \leq 1$, s is optimal if $b \leq 1/8$, and d is optimal if $b > 1/8$. If $c > 1$, s is optimal if $b \leq 1/8$, d is optimal if $1/8 < b \leq 2$, and no contract is feasible if $b > 2$.*

Corollary 2. *Earnings manipulation can appear in equilibrium. Earnings manipulation is more probable as c decreases and b increases.*

5 Can earnings manipulation enhance a firm's value?

Now we compare firms that are involved in EM (Section 4) with those that are not (Section 3). If the amount of investment is large ($b > 1$), a firm that does not manipulate earnings will not undertake projects with positive value. In contrast, a firm that manipulates earnings will undertake the same projects. If the amount of investment is low and EM is not possible, financing with equity is optimal. If a firm can manipulate earnings, equity may still be optimal. However, the cost of EM must be high - otherwise the entrepreneur will "convert" current earnings into inefficient long-term projects making the issuance of equity unfeasible (ex-ante). In the latter case, debt becomes optimal. This will usually be accompanied by EM: the entrepreneur will try to achieve the threshold to avoid bankruptcy. It follows that there is a trade-off in social efficiency between the benefits from EM improving the entrepreneur's effort and the costs of EM.

Proposition 3. *If $1 < b \leq 2$, firms that manipulate earnings have a higher value than firms that do not. Otherwise, firms that manipulate earnings have a higher value if and only if the cost of manipulation is low.*

6 Risk-averse entrepreneur

Since E is risk-neutral in the basic model, usual trade-off between incentives and risk-sharing does not arise. This section analyzes the case when E is risk-averse. Intuitively, for the case without EM the main ideas should hold. Under strategy s, E's marginal payoff is still below the firm's marginal value because of impossibility to benefit entirely from the results of his effort and also because of disutility from risk aversion. So, E's choice of effort is below the first-best level. Under strategy d, E's marginal benefit is greater than the firm's marginal value because E loses too much if short-term earnings are low. This effect will be multiplied by E's risk aversion. The optimal level of effort will higher than the first-best level. When EM is allowed, E's level of effort should be closer to the first best. This is analogous to the main result in the basic model. However, if the degree of risk-aversion is too high E might prefer to not to decrease the level of effort in order to minimize of risk of bankruptcy to minimum. This makes a difference with the case when E is risk-neutral. Below we develop these insights.

Suppose, E's expected utility is given by $Eu_E V_E = EV_E - \gamma Var V_E$, $\gamma \geq 0$. The case $\gamma = 0$ corresponds to one in the basic model. Consider the case $\gamma > 0$. Lemma 3 holds. Indeed, E's choice of e maximizes $EV_E - \gamma Var V_E$. $V_E = r_0 - D + 2 - e^2$ if $r_0 = 1$ and $V_E = 0 - e^2$ otherwise. Thus the expected value and variance of V_E is

$$EV_E = e(3 - D) - e^2$$

$$Var V_E = (3 - D)^2 e(1 - e)$$

E's choice of e maximizes $e(3-D)-e^2-\gamma(3-D)^2e(1-e)$. The maximand of this expression is $e'' = \frac{3-D-\gamma(3-D)^2}{2-2\gamma(3-D)^2}$. Since $D \leq 1$ (otherwise E gets nothing) and $\gamma > 0$ we have $e'' > 1$ which implies $e = 1$. I's payoff is D. Therefore, when $D = b$ it is optimal. This only works if $1 \geq b$. If $1 < b$ and $D \leq 1$, I's payoff is not sufficient to cover the initial investment. If $D > 1$, E provides no effort since he gets a payoff of zero and thus I gets nothing.

To illustrate Lemma 5, consider the case when $c = 1/2$ and $b < 1$. According to Lemma 5, $D = b$ in this case. Making similarly to the case with risk-neutral E on p. 10 we get that if $r_0 = 1$, $a = 0$ is optimal. If interim earnings are above the threshold, the optimal strategy for E is not to manipulate earnings. E's payoff is $3 - b$. If $r_0 = 0$, the optimal $a = -D$. E's payoff is $3/2 - b$. We thus have:

$$EV_E = e(3-b) + (1-e)(3/2-b) - e^2$$

$$VarV_E = 9/4e(1-e)$$

The choice of e maximizes

$$e(3-b) + (1-e)(3/2-b) - e^2 - \gamma 9/4e(1-e) \tag{12}$$

The maximum of (12) is attained when $e^{av} = \frac{3/2-9/4\gamma}{2-9/2\gamma}$. Comparing e^{av} with the level of effort without EM e''' we find that if γ is sufficiently small ($\gamma < 2/9$), e^{av} is closer to the first-best level ($e^* = 1/2$) than in the case without EM. Otherwise, there is no difference. So in order for our main result to hold, the degree of risk aversion should not be too high.

7 Model discussion

Suppose that it is possible to write an enforceable contract contingent on the firm's total value. Then, for any contract found in Section 4 there exists an alternative contract contingent on the firm's total value that will provide E with a higher payoff. To illustrate this, consider the case $c < 1$ and $b < 2-c$. If a firm can engage in EM, the optimal contract is analogous to the one described in Proposition 2. E's effort is $e = 1/2$ and the parties expected payoffs are:

$$EV_E = 9/4 - b - c \tag{13}$$

and $EV_I = b$. $D = b$ is optimal. E manipulates earnings regardless of r_0. When $r_0 = 0$ he receives $2-b-c$ and when $r_0 = 1$ he receives $3-b-c$. Now suppose the parties write a contract where E gets $2 - b$ if the firm's total value is 2 or less and $3 - b$ if the firm's total value is greater than 2. The optimal effort maximizes E's expected payoff $e(3-b)+(1-e)(2-b)-e^2$. $e = 1/2$ is optimal. Also, $a = 0$ because any $a > 0$ will only reduce the firm's total value. E's expected payoff is $9/4 - b$ which is greater than (13). I's expected payoff is $1/2(3-(3-b))+1/2(2-(2-b)) = b$. Therefore, we have a better contract which does not involve EM.

Now suppose that in addition to using pure equity or pure debt financing the firm can use mixed financing. In this case, the main idea holds. Under any financing the entrepreneur's effort in the scenario without EM will be above the first-best level (similar to pure debt financing result). To see this note that E's choice of e maximizes EV_E, where $V_E = (1-k)(r_0-D)+2-e^2$, if $r_0 = 1$ and $V_E = 0 - e^2$ otherwise (the k denotes the fraction of equity belonging to the investor). Thus, $EV_E = e((1-k)(1-D)+2)-e^2$. The maximand of this expression is $e'' = \frac{(1-k)(1-D)+2}{2}$. We have $e'' > 1$ which implies $e = 1$. An opportunity to manipulate earnings can optimize the entrepreneur's effort like in the case with pure debt financing.

Further suppose that the firm can issue convertible debt. This is similar to standard debt described in the model except that I can purchase a fraction of the firm's shares when it is solvent. However, since E remains in control, he will cream-off the firm's going concern value. Hence, the modeling is similar to standard debt.

Long-term debt is not considered in the basic model (in the spirit of incomplete contract literature) because it cannot be enforced. Since the creditors do not have property rights on the remaining assets, the owners will capture the firm's entire going-concern value.

One can make additional assumptions about the first and second period sharing rules based on a continuous earnings distribution function or different control shifting scenarios. These scenarios may yield some new results. For instance, one can assume that E can capture only a fraction of the firm's going concern value. In this case, the set of possible financing strategies can be significantly larger than in the basic set-up. However, the main idea that EM can improve productive effort will not be affected given that one keeps the assumption about contract incompleteness.

8 Empirical evidence and policy implications

We have shown that EM can be a part of the equilibrium relationship between firms' insiders and outsiders. This holds even if the cost of EM is relatively high (as follows from Proposition 2). Investors accept some degree of EM because this increases the insiders' incentive to provide a high level productive effort.

From Proposition 3, if the cost of EM is relatively low, EM can be socially efficient. EM can enhance a firm's value when compared to the case without EM. If the cost of EM is relatively high, the opportunity to engage in EM either does not affect firms' values (when they do not use EM in equilibrium) or is detrimental to firms' values (when firms engage in EM in equilibrium). Some recent evidence in the study by Jiraporn et al (2008) is consistent with this prediction although they are not specifically focused on real manipulations. So additional research is required here.

EM should more frequently be observed in industries characterized by incomplete contracts. If complete contracts can be written, the parties can write a contract contingent on the firm's overall earnings which eliminates the possibility of EM. Thus, firms in industries which are characterized by a high degree of technological or market uncertainty (such as software, internet, biomedical etc.) are more likely to be engaged in EM.

As implied by Corollary 2, EM should more frequently be observed among less profitable firms (high b). This prediction is consistent with Burgstahler and Dichev (1997).

Firms which manipulate earnings issue more debt (Lemmas 4 and 5). This is consistent with Richardson, Tuna and Wu (2002) and Hodgson and Stevenson-Clarke (2000) where firms which have excessive debt are more likely to be involved in EM.

It follows from Corollary 1 that firms with a higher b (and lower profitability respectively) issue debt more often than firms with a lower b. This is consistent with a very important corporate finance phenomenon: the negative correlation between debt and profitability (see, among others, Titman and Wessels (1988), and Rajan and Zingales (1995)).

According to our analysis in Section 7, EM should more frequently be observed for cases when the degree of E's risk aversion is not too large. This is consistent with previous results in Degeorge et al (1998).

Since EM can be socially efficient, the question of its regulation depends on the industry and any parameters related to the firm's projects. If the cost of EM is relatively low, putting in place an expensive public system of EM prevention cannot be efficient: entrepreneurs will invest less funds in socially efficient projects and will not provide high levels of productive effort. According to our analysis (proof of Proposition 3), such a system should target average-profit firms (when the cost of EM is relatively high) or high-profit firms (when the cost of EM is in the intermediate range).

9 Conclusion

Graham et al (2005) pointed out that EM through real actions has been used more often than accounting manipulation and misreporting. Existing literature usually considers EM to be a negative social phenomenon and suggests measures for its elimination. In the present paper, we argue that a zero tolerance policy towards EM may be socially inefficient. We analyze a model where an entrepreneur needs external financing for a profitable investment project and his productive effort is not observable by outsiders. The security design should provide the entrepreneur with the optimal incentive to provide productive effort. The equilibrium level of effort is not socially optimal and in some cases, the entrepreneur does not undertake socially efficient projects. Following this, we analyze the case where in addition to productive effort the entrepreneur can be engaged in EM that reduces the firm's total value. EM consists of transferring cash flow between periods. Our main finding is that the existence of EM can lead to increased output (including the entrepreneur's effort and the amount of investment) and therefore, improved social efficiency. It is shown that EM should be observed more often among firms with low profitability, low costs of EM, and extensive debt financing. A public system of EM prevention should target average-profit firms (when the cost of EM is relatively high) or high-profit firms (when the cost of EM is in the intermediate range). These insights hold for industries characterized by a high degree of contract incompleteness.

Appendix

Proof of Lemma 1. The proof is by contradiction. Suppose in contrast that the solution of the game is such that in some situations $a \neq 0$. The firm issued a security which pays $V_I(r, v)$ to I. This means that if the first-period earnings equal r and the second-period earnings equal v, I gets $V_I(r, v)$. Also assume that E chooses the level of effort e_c and when $r_0 = 0$, E chooses a_0

and when $r_0 = 1$, E chooses a_1. By assumption either a_0 or a_1 or both differ from 0.

The parties expected payoffs are EV_E and EV_I. When $r_0 = 0$, I receives $V_I(-a_0, 2+a_0)$ and when $r_0 = 1$ he receives $V_I(1-a_1, 2+a_1)$. When $r_0 = 0$, E receives $x = 2 - V_I(r - a_0, v + a_0) - L_0$ and when $r_0 = 1$ he receives $y = 2 - V_I(1 - a_1, 2 + a_1) - L_1$, where $L_0 = c$ if $a_0 \neq 0$ and 0 otherwise; $L_1 = c$ if $a_1 \neq 0$ and 0 otherwise. The optimal effort e maximizes E's expected payoff $ey + (1-e)x - e^2$. Now suppose the parties write a contract where I gets $V_I(-a_0, 2 + a_0) + L_0 - \varepsilon$, $\varepsilon > 0$ if the firm's total value is 2 or less and $V_I(1 - a_1, 2 + a_1) + L_1 - \varepsilon$ if the firm's total value is greater than 2. $a = 0$ because any $a > 0$ will only reduce the firm's total value and the payment to E. The optimal effort maximizes E's expected payoff $ey + (1 - e)x + \varepsilon - e^2$. Thus $e = e_c$ is optimal. E's expected payoff is higher by ε and I's expected payoff is greater than under initial contract if ε is sufficiently small. Therefore, we have a better contract which does not involve EM. So an equilibrium contract with EM does not exist. *End proof.*

Proof of Lemma 2. If s was chosen, $EV_E = E[(1 - k)r + 2 - e^2] = (1 - k)e + 2 - e^2$. Hence the optimal level of effort is

$$e' = (1 - k)/2 \tag{14}$$

This is below the first-best level of effort: E gets only a fraction of the firm's profit but absorbs all the costs. I's expected payoff is

$$EV_I = E[kr] = ke = k(1 - k)/2 \tag{15}$$

The optimal k maximizes E's expected payoff, EV_E, under the condition that EV_I is not less than b. From (14) we get:

$$EV_E = (1 - k)^2/4 + 2 \tag{16}$$

From (15), I's payoff is maximized when $k = 1/2$ which implies that maximal possible EV_I is equal to 1/8. Thus, strategy s is feasible only if $b \leq 1/8$. Since from (16), E's payoff is decreasing in k, the optimal k can be found by equalizing (15) and b which produces (4). *End proof.*

Proof of Lemma 3. E's choice of e maximizes EV_E. $V_E = r_0 - D + 2 - e^2$ if $r_0 = 1$ and $V_E = 0 - e^2$ otherwise. Thus

$$EV_E = e(3 - D) - e^2 \tag{17}$$

The maximand of this expression is $e'' = \frac{3-D}{2}$. However, since $D \leq 1$ (otherwise E gets nothing) we have $e'' > 1$ which implies $e = 1$. I's payoff is D. Therefore, when $D = b$ it is optimal. This only works if $1 \geq b$. If $1 < b$ and $D \leq 1$, I's payoff is not sufficient to cover the initial investment. If $D > 1$, E provides no effort since he gets a payoff of zero and thus I gets nothing. *End proof.*

Proof of Proposition 1. From Lemma 2, if s is chosen, $b \leq 1/8$ and E's expected payoff is

$$EV_E = \frac{17 + \sqrt{1 - 8b} - 4b}{8} \tag{18}$$

If d is chosen, $b \leq 1$ and

$$EV_E = 2 - b \tag{19}$$

Proposition 1 follows from comparing (18)-(19) for different values of b. *End proof.*

Proof of Lemma 4. Consider strategy s. Given the intermediate profit r_0 and action a, E's payoff is:

$$(1-k)r_0 + 2, \text{ if } a = 0 \tag{20}$$

$$(1-k)(r_0 - a) + 2 + a - c, \text{ if } a \neq 0 \tag{21}$$

Let Δ be the difference between (20) and (21). We have $\Delta = c - ka$. If $r_0 = 0$, then, from (1), $a \leq 0$. Thus $\Delta > 0$ and $a = 0$ is optimal. E will not increase current earnings since he receives the firm's total going concern value and only a part of the firm's current earnings. If $r_0 = 1$, then, from (1), $a \leq 1$. (21) is maximized when $a = r_0$ and it equals $3 - c$. Also (20) equals $3-k$. Thus, if $k < c$, $a = 0$ is optimal. If $k > c$, the optimal $a = r_0$ (when the cost of EM is relatively low, E will increase the firm's going concern value). (If E is indifferent between $a = 0$ and $a = r_0$, he chooses $a = 0$. It happens if $k = c$)

If strategy s is chosen, I's payoff is kr. If $k > c$, then it follows from the above paragraph that I's payoff is 0 (this cannot be an equilibrium outcome). If

$$k < c \tag{22}$$

E does not manipulate earnings regardless of r_0. E's expected payoff thus is $e(3-k) + (1-e)2 - e^2$ (i.e. with probability e, $r_0 = 1$ and E gets $(1-k)r_0 + 2 = 3 - k$ and with probability of $1 - e$, $r_0 = 0$ and E gets 2). E's payoff is maximized when $e = (1-k)/2$. Analogously to Lemma 2, we find that this only works if $b \leq 1/8$ and the optimal k is given by (4). From (4) and (22), this contract only works if the condition (6) holds. *End proof.*

Proof of Lemma 5. Similarly to (8)-(10) we get the following. If $r_0 \geq D$, $a = 0$ is optimal. The same holds if $r_0 < D$ and $2 + r_0 - D - c < 0$. Otherwise, the optimal a satisfies $a \leq r_0 - D$. If this condition is satisfied, E's earnings remain the same regardless of a. Thus, for simplicity, we will assume $a = r_0 - D$. Finally, we have:

$$\begin{cases} a = 0 \text{ if either } r_0 \geq D \text{ or } r_0 < D \text{ and } 2 + r_0 - D - c < 0 \\ \quad a = r_0 - D, \text{ if } r_0 < D \text{ and } 2 + r_0 - D - c \geq 0 \end{cases} \tag{23}$$

We consider the case $c < 1$ and $b < 1$. The proof for other cases is similar and it is available upon demand. First, consider the choices of a and e. Three situations are possible. Suppose that $2 - c \geq D > 1$. By (23), in this case $a = r_0 - D$, $\forall r_0$. E chooses e which maximizes his expected payoff: $e(3 - D - c) + (1 - e)(2 - D - c) - e^2$. Thus, $e = 1/2$ and

$$EV_I = D. \tag{24}$$

Now consider $2 - D - c < 0$. Again by (23), $a = D - 1$ if $r_0 = 1$ and $a = 0$ if $r_0 = 0$. The choice of e maximizes $e(3 - D - c) - e^2$. Thus,

$$\begin{aligned} e &= e'' \text{ if } 3 - D - c > 0 \\ e &= 0 \text{ if } 3 - D - c \leq 0 \end{aligned} \tag{25}$$

where $e'' = (3 - D - c)/2$ (note that $e'' < 1$ because $2 > 3 - D - c$). The case $e = 0$ is not interesting because E's payoff is 0 and thus debt is never the optimal contract. In the first case, I's payoff is

$$(3 - D - c)D/2 + (-1 + D + c) \tag{26}$$

$$EV_E = (3 - D - c)^2/4 \tag{27}$$

If $1 \geq D$ (and $2 - D - c > 0$ because $c < 1$), by (23), $a = D$ if $r_0 = 0$ and $a = 0$ if $r_0 = 1$. The choice of e maximizes $e(3 - D) + (1 - e)(2 - D - c) - e^2$. Thus, $e = (1 + c)/2$. Therefore,

$$EV_I = D. \tag{28}$$

Now we turn to the analysis of the choice of optimal contract.

Three different situations are possible depending on the magnitude of D. Consider

$$2 - D - c \geq 0 \tag{29}$$
$$1 < D \tag{30}$$

By (23), (29) and (30), $a = r_0 - D$, $\forall r_0$. This means that E will manipulate earnings regardless of r_0 (the condition (30) implies that even if the firm performs well, the interim earnings are below the debt face value; and (29) ensures that the going-concern value is high enough to allow an increase in first-period earnings to repay debt even if the $r_0 = 0$). The choice of e maximizes E's expected payoff: $e(3 - D - c) + (1 - e)(2 - D - c) - e^2$. Thus, $e = 1/2$ and

$$EV_E = 5/4 - \varepsilon - c \tag{31}$$

where $\varepsilon = D - 1 > 0$. I's payoff is D.

Now consider the case when $1 \geq D$ (and $2 - D - c > 0$ because $c < 1$). Here, the firm is solvent if $r_0 = 1$, and E can increase first-period earnings to avoid bankruptcy if $r_0 = 0$. The choice of e maximizes $e(3 - D) + (1 - e)(2 - D - c) - e^2$. Thus, $e = (1 + c)/2$. I's payoff is D. Since E's payoff decreases in D, optimal $D = b$.

$$EV_E = 9/4 - b - c/2 + c^2/4 \tag{32}$$

Finally, consider

$$2 - c - D < 0 \tag{33}$$

By (23) and (33) we have, $a = r_0 - D$ if $r_0 = 1$, and $a = 0$ if $r_0 = 0$. The choice of e maximizes

$$e(3 - D - c) - e^2 \tag{34}$$

This means that, with probability e, E gets the current earnings of 0 and the firm's going concern value 2 reduced by the amount of EM $(D - 1)$ and the cost of EM. The maximand of (34) is $e'' = (3 - D - c)/2$. Thus,

$$\begin{aligned} e &= e'' \text{ if } 3 - D - c \geq 0 \\ e &= 0 \text{ if } 3 - D - c < 0 \end{aligned} \tag{35}$$

(Note that $e'' < 1$ because $2 > 3 - D - c$). The case $e = 0$ is not relevant because E's payoff is 0 (recall that $a = 0$ if $r_0 = 0$) and thus debt is never the optimal contract. I's expected payoff is

$$EV_I = (3 - D - c)D/2 + (-1 + D + c) \tag{36}$$

This means that debt holders receive D (when $r_0 = 1$) with probability e'' and they receive the firm's going concern value 2 with probability $1 - e'' = (-1 + D + c)/2$ (when $r_0 = 0$). From (34),

$$EV_E = (3 - D - c)^2/4 = (1 - \gamma)^2/4 \tag{37}$$

where $\gamma = D - 2 + c > 0$.

Comparing (31), (32), and (37) we find that if $c < 1$ and $b < 1$, $D = b$ is optimal. E's expected payoff is $9/4 - b - c/2 + c^2/4$. *End proof.*

Proof of Proposition 2. Consider $b \leq 1/8$. Suppose $c > 1$. If s is chosen, E's payoff is $\frac{17+\sqrt{1-8b}-4b}{8}$ by (18) and Lemma 4. If d is chosen, E's payoff is $(2-c)^2/4$ (see the proof of Lemma 5). The former is not less than 33/16 (this value is attained when $b = 1/8$) and the latter is not greater than 1/2 (this value is attained when $c = 0$). Thus, s is optimal. Consider $\frac{1-\sqrt{1-8b}}{2} < c \leq 1$. If s is chosen, E's payoff is $\frac{17+\sqrt{1-8b}-4b}{8}$. If d is chosen, E's payoff is $9/4 - b - c/2 + c^2/4$. Again, the payoff from s is higher. To see this, note that the payoff from d decreases in c. When $c = \frac{1-\sqrt{1-8b}}{2}$, the payoff from s is still larger. Thus, it is also larger under other values of c. Consider $\frac{1-\sqrt{1-8b}}{2} \geq c$. s is not feasible, d is feasible and thus is optimal.

Consider $1/8 < b \leq 2$. s is not feasible. d is feasible and thus is optimal.

Consider $2 < b$. s is not feasible. If $c > 1$, no contract is feasible. If $c \leq 1$, d is feasible and thus is optimal. *End proof.*

Proof of Corollary 1. Follows directly from Proposition 2. *End proof.*

Proof of Corollary 2. From Proposition 2, if, for instance, $c < 1$ and $b > 2 - c$, the equilibrium outcome is financing by debt and, if $r_0 = 1$, the firm will manipulate earnings. Also, from Proposition 2, for a given b, debt financing is optimal when c is relatively low. In most cases, debt financing, in contrast to equity financing, will be accompanied by earnings manipulation (see the proof of Lemma 5). From Corollary 1, the same holds for high values of b. *End proof.*

Proof of Proposition 3. Let V_{EM} denote the value of firms that can manipulate earnings and let V_N denote the value of firms that cannot manipulate earnings. As follows from Proposition 1, if $b > 1$ and earnings manipulation is not allowed, the firm does not invest and thus $V_N = 0$. According to Proposition 2, if $1 < b \leq 2$ or if $b > 2$ and $c < 1$, firms that can engage in EM will use debt financing and invest in the project. The value of these firms will be positive. Consider $1/8 < b \leq 1$. According to Proposition 1, $V_N = 2 - b$. If $c \leq 1$, $V_{EM} = 9/4 - b - c/2 + c^2/4$ (from the proof of Proposition 2). This expression decreases in c when $c \leq 1$. The minimal value, $2-b$, is attained when $c=1$. Therefore, the value of firms that can engage in EM is greater than or equal to the value of firms that are not involved in EM. If $c>1$, $V_{EM}=(2-c)^2/4$. This is less than $2-b$. Therefore, firms that do not manipulate earnings have a higher value. If $1/8 \geq b$, $V_N = \frac{17+\sqrt{1-8b}-4b}{8}$. If $c > \frac{1-\sqrt{1-8b}}{2}$, firms that manipulate earnings have the same value as firms that do not. If $c \leq \frac{1-\sqrt{1-8b}}{2}$, $V_{EM} = 9/4 - b - c/2 + c^2/4$. Consider $\Delta = V_{EM} - V_N$. This expression decreases in c. When $c=0$, $\Delta > 0$. When $c = \frac{1-\sqrt{1-8b}}{2}$, $\Delta < 0$. The proposition follows from the continuity of Δ in c. *End proof.*

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