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OPTIMAL ACCOUNTING REGULATION WHEN FIRMS DISTORT RESOURCE ALLOCATIONS TO BOOST EARNINGS

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Abstract

This paper examines the optimality of an accounting regulation that restricts accrual earnings management (AM). When firm owners employ real earnings management (RM) as a substitute, they distort the firm's resource allocation to boost earnings. Consequently, as RM is determined earlier in the fiscal period, RM disincentivizes managers more directly than AM. This induces the owners to choose AM over RM. However, the level of AM chosen is ex ante too high because managers' rational inferences on AM harm their incentives. Then, optimal accounting regulation is to lower AM to some ex ante efficient level, which does not induce RM.

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Optimal Accounting Regulation When Firms Distort Resource Allocations to Boost Earnings*

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March 10, 2011

Abstract

This paper examines the optimality of an accounting regulation that restricts accrual earnings management (AM). When firm owners employ real earnings management (RM) as a substitute, they distort the firm's resource allocation to boost earnings. Consequently, as RM is determined earlier in the fiscal period, RM disincentivizes managers more directly than AM. This induces the owners to choose AM over RM. However, the level of AM chosen is ex ante too high because managers' rational inferences on AM harm their incentives. Then, optimal accounting regulation is to lower AM to some ex ante efficient level, which does not induce RM.

Keywords: optimal accounting regulation; accrual earnings management; real earnings management; time inconsistency

JEL classification: D86; G34; M48

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1. Introduction

This paper examines the optimal stringency of accounting regulation when firms employ accrual earnings management (AM) and real earnings management (RM) as substitutes. In brief, the purpose of AM is to manipulate revenue and expense estimates through soft accounting regulation, including formalistic regulatory supervision, careless auditing, and flexible accounting standards (e.g., more optimistic estimates of bad debt expenses and less restrictive expensing/capitalizing of R&D expenditure). As this type of manipulation is through cosmetic actions, it does not affect cash flows. In contrast, the rationale for RM is to influence short- or long-term cash flows through changes in real operations or resource allocation (e.g., reductions in sales prices and cuts in R&D expenditure). As justified later, this paper assumes that accounting regulation, including regulator and auditor scrutiny and accounting standards, can restrict AM but not RM.

While most empirical studies on earnings management have focused on AM, firms often use RM as a substitute in managing earnings. Some recent research shows that AM and RM are indeed substitutes, and that reducing the flexibility of accounting standards tends to decrease use of the former in favor of the latter.[1] For example, when accounting standards do not permit AM through restricting optimistic estimates of bad debt expense, a firm may reduce sales prices for customers in danger of bankruptcy to delay firm failure, even though it will sacrifice its long-run cash flows. This body of work emphasizes that we cannot evaluate accounting standards without taking into account the effects on overall earnings management activity. Unfortunately, most of these studies do not explicitly examine the optimal level of accounting discretion when AM and RM choices are substitutes.

In contrast, the present paper derives the optimal stringency of accounting regulation by connecting the dual role of accounting numbers (i.e., valuation and stewardship) with the sequential decisions found in RM and AM. From the valuation perspective, current firm owners have an incentive to manage earnings to boost stock prices, whereas from the stewardship perspective, they also have an incentive to alleviate earnings management to improve the efficiency of managerial contracts.[2]

In related work, Chen et al. (2007) show that conservative accounting standards, by weakening the impact of good news on stock prices, decrease the benefit of earnings management and, by making managerial contracts more inefficient, increase the cost of earnings management. In other words, accounting conservatism lowers the weighting of the valuation perspective in favor of the stewardship perspective. Drawing on Chen et al. (2007), the present study formulates the dual role of accounting numbers. However, unlike this paper, Chen et al. (2007) assume that earnings management is determined before managerial effort, and so do not take account for the possibility that earnings management is determined after managerial effort.

Further, Zang (2005) empirically shows that RM and AM are determined

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[1] See Beatty, Chamberlain and Magliolo (1995), Hunt, Moyer and Shevlin (1996), Gaver and Paterson (1999), Barton (2001), Fields, Lyz and Vincent (2001), Pincus and Rajgopal (2001), Demski (2004), Ewert and Wagenhofer (2005), Zang (2005), Wang and D'Souza (2006), and Cohen, Dey and Lys (2007) for discussion of the multiple purposes of AM and RM.

[2] See Watts and Zimmerman (1986), Dye and Verrecchia (1995), Narayanan and Davila (1998), Bushman, Engel and Smith (2006), and Chen, Hemmer and Zhang (2007) for the dual role of accounting numbers.

sequentially.[3] In Zang's (2005) model, managers determine the level of AM after observing an exogenous shock to RM. In contrast, the present paper highlights that the sequential decisions of RM and AM relate to whether they directly affect managerial incentives during the fiscal period. This is because RM manipulates accounting numbers by affecting real operations. Accordingly, RM must be determined early in the fiscal period and therefore tends to harm managerial incentives during the same period. This discourages the firm's owners from increasing RM. For example, assume that early in the fiscal period a firm decides to cut R&D expenditure to improve the accounting numbers. Managers will then infer that the accounting numbers are likely to be good during the period and they reduce effort if managerial compensation links to the accounting numbers.

In contrast, AM is determined later in the fiscal period and therefore is directly less linked with managerial incentives during the same period. This encourages the firm's owners to increase AM. In reality, after AM is determined, managers' additional efforts may be necessary and then their incentive problems could remain. However, it is natural that the RM introduced early in the fiscal period directly harms managerial incentives more than the AM introduced later in the period. To highlight this difference, the present paper assumes that managerial effort is only exerted after the determination of RM and before the determination of AM. In other words, "early in the fiscal period" means "before managerial effort" and "later in the fiscal period" means "after managerial effort." Of course, the owners could determine AM early in the fiscal period. However, as shown in this paper, it is time inconsistent for owners to determine AM early in the fiscal period. Consequently, AM is determined (or redetermined) later in the fiscal period.

Thus, unlike RM, AM does not directly harm managerial incentives. However, this does not mean that AM is a less serious problem than RM. Rather, as shown in the present paper, the opposite is true. The reasoning is as follows: while AM does not directly harm the efforts of managers, their ex ante rational inferences on AM do. In other words, while the level of AM chosen by the owners can be ex post efficient, it is ex ante too high. However, owners cannot commit in advance not to increase AM. This time inconsistency means AM involves more serious problems than RM.

In related work, Graham, Harvey and Rajgopal (2005) find that financial executives tend to employ RM as a substitute for AM in the post-Sarbanes–Oxley world where regulators and auditors strictly apply GAAP to firm accounting policies. The present paper assumes that AM is costless, but perfectly restricted by accounting regulation. That is, AM is costless within accounting standards but prohibitively costly when firms violate accounting standards. For example, firms or their managers that engage in accounting fraud may suffer financial penalties from regulators or risk litigation, such as class-action lawsuits.[4] In contrast, while accounting regulation cannot restrict RM, it is costly because of the inefficient real operations or resource allocations required for manipulating the accounting numbers.[5] As an example of the

[3] Wang and D'Souza (2006) also highlight the sequential decisions found in RM and AM.

[4] In reality, AM could also be costly, e.g., because of legal error, even within accounting standards. However, the present paper highlights that unlike AM, RM is costly in that it directly sacrifices long-term cash flows.

[5] In Graham et al. (2005), an interviewed financial executive states, "…while auditors can second-guess the firm's accounting policies, they cannot readily challenge real economic actions to meet earnings

costs of RM, a decrease in discretionary spending, such as R&D, advertising or maintenance, sacrifices the long-term value-maximizing objective. Thus, as long as AM is not restricted, the firm's owners will not employ costly RM, and so choose the level of AM at which its ex post marginal benefit is zero. However, as discussed, the level of AM chosen is then ex ante too high because it does not reflect the fact that because of the rational inferences of managers on AM, AM harms their incentives.

The present paper shows that if accounting regulation is moderate, it decreases AM but does not induce RM. The reason is as follows: the firm owners' chosen level of RM when AM is perfectly prohibited is less than their chosen level of AM when it is not restricted because, unlike AM, they take into account the effects of RM on their managers' incentives when they adopt RM. Therefore, as long as the decrease in AM is moderate, they will not substitute RM. In other words, there is a threshold level at which tighter accounting regulation can decrease AM without inducing RM (i.e., without sacrificing long-term economic value).

However, when accounting regulation is too strict and consequently exceeds the threshold level, owners employ RM as a substitute for AM to attain their chosen total level of earnings management. This theoretical result is consistent with extant empirical research that emphasizes that reducing accounting flexibility may distort corporate real operations through RM. However, most of these studies do not examine the optimal flexibility of accounting standards. In contrast, the present paper leads to the optimal stringency of accounting regulation. In this paper, the stakeholders are current firm owners, professional managers hired by the firm owners and potential investors. The paper shows that in equilibrium, potential investors rationally infer the owners' chosen level of earnings management and therefore do not suffer any damage. Thus, the paper defines the objective of accounting regulation to be to maximize the owners' expected payoff in equilibrium, which is equivalent to minimizing the sum of the rents earned by professional managers and the costs of RM employed by owners.[6]

The present paper obtains the following theoretical result: optimal accounting regulation is to restrict AM to some ex ante efficient level, which coincides with the level of RM firm owners would choose if RM were costless and AM were perfectly prohibited. It is noteworthy that this regulation does not induce RM as a substitute. In other words, the regulatory authorities should minimize the level of AM conditional on not inducing RM (i.e., not sacrificing long-term economic value).

The remainder of the paper is organized as follows. Section 2 formulates two benchmark models of earnings management: one is the case where only RM is feasible and the other is where only AM is feasible. Section 3 analyzes the multiple uses of AM and RM leading to the optimal stringency of accounting regulation. Section 4 concludes.

2. Benchmark Models

This section considers two benchmark models: Benchmark 1 assumes that only RM is feasible and Benchmark 2 assumes that only AM is feasible.

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targets that are taken in the ordinary course of business."

[6] Dye and Verrecchia (1995) and Chen et al. (2007) also evaluate accounting standards from the viewpoint of the expected welfare of current shareholders.

a. Benchmark 1: the case where only real earnings management is feasible

Consider the case where only RM is feasible to manage earnings. More formally, we base Benchmark 1 on Chen et al. (2007). Chen et al. (2007) assume that a principal (the current firm owner) is risk neutral and an agent (the professional manager) is risk averse. Then from a stewardship perspective, earnings management causes inferior risk sharing between the principal and the agent.

In this paper, it is important whether earnings management is determined before or after managerial effort. However, Chen's et al. (2007) framework may not be tractable for analyzing the effects of the timing of earnings management on equilibrium. To examine this issue, we assume that both the principal and the agent are risk-neutral but the latter has limited liability (i.e., negative compensation is not imposed on the agent). Then from a stewardship perspective, earnings management aggravates managerial rent seeking. In addition, Chen et al. (2007) endogenously derived the costs of earnings management from the dual perspective of accounting numbers. While this is their important contribution, the present paper introduces both the endogenous and exogenous costs of earnings management to highlight the difference in cost structures between AM and RM.

At date 1, a principal (i.e., current firm owner) hires an agent (i.e., a professional manager) to yield an output realized at date 5. The agent's reservation level of utility is zero. At date 2, the agent chooses the level of effort, which is given by $e \in \{e_H, e_L\}$, where $e_H > e_L = 0$. If the agent makes a high effort e_H, the output at date 5 is v_H (>0) with probability π and $v_L (=0)$ with probability $1-\pi$. If the agent makes a low effort e_L, the output is necessarily v_L. The agent's effort is unobservable by either the principal or outside investors.

At date 4, the principal discloses an accounting report and (for liquidity needs) sells the firm to outside investors. At date 1, the principal offers the agent a compensation package linked with the accounting report. Compensation cannot relate to the output realized at date 5 because the agent retires at date 4. The compensation package is unobservable by outside investors.

Without any manipulation, the accounting report is a precise signal on the output: if the output at date 5 is v_H, the signal at date 4 is s_H with probability 1; if the output is v_L, the signal is s_L with probability 1. At date 1, the principal is assumed to have an opportunity to engage in RM, such as a cut in R&D expenditure or a sales price reduction. Note that RM is determined before managerial efforts are exerted at date 2. As formulated in the following subsection, AM is determined at date 3; therefore, at that time, managerial efforts have been completed. The relative timing of earnings management and managerial efforts is the most important factor to yield the following new results.

Figure 1 illustrates the event timeline. In this subsection, AM and accounting regulation are not considered and therefore dates 0 and 3 are not used. In the next subsection, date 3 is introduced to examine AM instead of RM. In the next section, all dates are used to examine both RM and AM and the effects of accounting regulation on both.

Hereafter, subscript R represents that earnings management is RM. RM can replace signal s_L with s_H with probability λ_R when the output is v_L.[7] Employing RM is costly: it lowers the success output v_H by $\beta\lambda_R v_H$, where β is constant and $0<\beta<1$.[8] Conditional on the agent's high effort, a large β increases the expected marginal costs of RM, given by $\pi\beta v_H$. The costs of RM correspond to the magnitude of cash flows sacrificed to manipulate accounting numbers upwards.

At date 4, uncertain factors make the effects of RM stochastic. For example, assume that only when the output at date 5 is v_L, bad debts can occur at dates 4 or 5. If bad debts occur at date 4, outsiders rationally infer the output to be v_L and therefore the principal fails to manage earnings. Then, by employing RM through reducing sales prices for some customers in danger of bankruptcy, the principal can lower the probability of their failure or delay its occurrence until date 5, which increases probability λ_R. This setting is also used in the case of AM formulated later.

Here, RM through real operations does not offer any information about λ_R to outside investors because they cannot distinguish RM from ordinary real operations to maximize the firm's value. In contrast, the agent correctly recognizes the level of λ_R from RM activities because he/she is closely related to the firm's real operations and therefore can distinguish RM from the firm's ordinary operations. Consequently, as shown below, by maximizing his/her expected payoff, the principal simultaneously determines the level of λ_R and the compensation package. Then, by solving the same maximization problem, the agent also can obtain the solutions.

When the agent chooses e_H and outside investors infer that RM is $\hat{\lambda}_R$, $\hat{P}_{HH}$ and $\hat{P}_{HL}$ denote the market price of the firm at date 4 when the signal is s_H and s_L, respectively. A caret shows that outside investors calculate conditional probabilities, denoted by $\hat{\Pr}(\cdot|\cdot)$, using their inference on the level of earnings management, $\hat{\lambda}_R$. Then

$$\begin{aligned}
\hat{P}_{HH} &= \hat{\Pr}(v_H|e_H,s_H)(1-\beta\hat{\lambda}_R)v_H + \hat{\Pr}(v_L|e_H,s_H)\cdot 0 \\
&= \frac{\Pr(v_H|e_H)\Pr(s_H|v_H)(1-\beta\hat{\lambda}_R)v_H}{\Pr(v_H|e_H)\Pr(s_H|v_H)+\Pr(v_L|e_H)\hat{\Pr}(s_H|v_L)} = \frac{\pi(1-\beta\hat{\lambda}_R)v_H}{\pi+(1-\pi)\hat{\lambda}_R}, \\
\hat{P}_{HL} &= \hat{\Pr}(v_H|e_H,s_L)(1-\beta\hat{\lambda}_R)v_H + \hat{\Pr}(v_L|e_H,s_L)\cdot 0 \\
&= \frac{\Pr(v_H|e_H)\Pr(s_L|v_H)(1-\beta\hat{\lambda}_R)v_H}{\Pr(v_H|e_H)\Pr(s_L|v_H)+\Pr(v_L|e_H)\hat{\Pr}(s_L|v_L)} = 0.
\end{aligned} \tag{1}$$

The principal conditions managerial compensation on the following signal: w_H

[7] Gigler and Hemmer (2001) and Chen et al. (2007) include a similar binary signal setting to represent earnings management. For other earnings management formulations, see, e.g., Dye (2002), Dye and Sridhar (2004), Stocken and Verrecchia (2004), Ewert and Wagenhofer (2005), Goldman and Slezak (2006), Kedia and Philippon (2009), and Povel, Singh and Winton (2009).

[8] For tractability, the cost function of RM is simplified. However, as long as RM is assumed to lower the success output, the following analysis is fundamentally invariant for other familiar types of function.

and w_L are paid to the agent if the signal is s_H and s_L, respectively. Then, the participation constraint is

$$\Pr(s_H|e_H)w_H + \Pr(s_L|e_H)w_L - e_H$$
$$= \{\pi + (1-\pi)\lambda_R\}w_H + (1-\pi)(1-\lambda_R)w_L - e_H \geq 0\,. \quad (2)$$

The incentive compatibility constraint is

$$\Pr(s_H|e_H)w_H + \Pr(s_L|e_H)w_L - e_H$$
$$\geq \Pr(s_H|e_L)w_H + \Pr(s_L|e_L)w_L$$

$$\Leftrightarrow \{\pi + (1-\pi)\lambda_R\}w_H + (1-\pi)(1-\lambda_R)w_L - e_H \geq \lambda_R w_H + (1-\lambda_R)w_L\,. \quad (3)$$

In addition, the agent has limited liability

$$w_H\,,\ \ w_L \geq 0\,. \quad (4)$$

At date 1, subject to (2)~(4), the principal chooses w_H, w_L and λ_R to maximize his/her expected payoff as

$$\Pr(s_H|e_H)(\hat{P}_{HH} - w_H) + \Pr(s_L|e_H)(\hat{P}_{HL} - w_L)$$
$$= \{\pi + (1-\pi)\lambda_R\}\left\{\frac{\pi(1-\beta\hat{\lambda}_R)v_H}{\pi + (1-\pi)\hat{\lambda}_R}\right\}$$
$$-[\{\pi + (1-\pi)\lambda_R\}w_H + (1-\pi)(1-\lambda_R)w_L], \quad (5)$$

where the second line in (5) is given by substituting (1) into the first line. This yields

$$w_H = \frac{e_H}{\pi(1-\lambda_R)},\ \ w_L = 0\,. \quad (6)$$

Then, while (3) is binding, (2) is not binding and managerial rent $\frac{\lambda_R}{\pi(1-\lambda_R)}e_H$ arises. The rent means that reducing RM improves contract efficiency; this is the stewardship perspective of accounting numbers.

In equilibrium, as outside investors rationally infer the level of RM, $\hat{\lambda}_R = \lambda_R$ holds and therefore the principal's expected payoff is

$$\pi(1-\beta\lambda_R)v_H - \frac{\pi + (1-\pi)\lambda_R}{\pi(1-\lambda_R)}e_H\,,$$

which is given by substituting (6) and $\hat{\lambda}_R = \lambda_R$ into (5). For the remainder of this paper, it is assumed that

$$\pi(1-\beta\lambda_R)v_H - \frac{\pi+(1-\pi)\lambda_R}{\pi(1-\lambda_R)}e_H > 0$$

holds in equilibrium. This means that even if RM is feasible and rent seeking is inevitable, managerial effort is not only socially valuable but also benefits the principal.

Thus, the maximization problem is simplified such that λ_R maximizes

$$\{\pi+(1-\pi)\lambda_R\}\left\{\frac{\pi(1-\beta\hat{\lambda}_R)v_H}{\pi+(1-\pi)\hat{\lambda}_R}\right\} - \frac{\pi+(1-\pi)\lambda_R}{\pi(1-\lambda_R)}e_H, \tag{7}$$

which is given by substituting (6) into (5). Then, the following proposition is obtained.

Proposition 1: Real earnings management in equilibrium[9]
When outside investors rationally infer RM in equilibrium and inequality $\pi(1-\pi)v_H - e_H > 0$ holds, the equilibrium level of λ_R, denoted by λ_R^*, satisfies $MB_R(\lambda_R^*) = 0$ and assures $0 < \lambda_R^* < 1$, where

$$MB_R(\lambda) = \frac{\pi(1-\pi)(1-\beta\lambda)v_H}{\pi+(1-\pi)\lambda} - \frac{e_H}{\pi(1-\lambda)^2}.$$

At the equilibrium level of λ, $MB_R(\lambda)$ is the marginal benefit of RM to the principal at date 1, that is the stock price enhancing effects of RM (i.e., the valuation perspective of accounting numbers), which is given by $\frac{\pi(1-\pi)(1-\beta\lambda)v_H}{\pi+(1-\pi)\lambda}$, net of the contract inefficiency of RM (i.e., the stewardship perspective of accounting numbers), which is given by $\frac{e_H}{\pi(1-\lambda)^2}$.

Thus, while RM can boost stock prices, it directly aggravates managerial incentives and thereby increases managerial rent. Such contract inefficiency discourages the principal from increasing RM.

Note that the agent also maximizes the principal's expected payoff as (7) and thereby obtains the solution of λ_R chosen by the principal. Then, the principal never changes RM after the compensation package (w_H, w_L) is determined. The reason is that the agent immediately recognizes any change in RM from the firm's real operations and therefore an increase in λ_R induces the agent to shirk. While a decrease in λ_R satisfies the incentive compatibility condition, it lowers the principal's expected payoff.

b. Benchmark 2: the case where only accrual earnings management is feasible

[9] The Appendix includes the proofs of all propositions, except Cases (i) and (ii) in Proposition 3.

Consider the case where only AM is feasible to manage earnings. While RM needs to be determined at date 1 (i.e., before managerial efforts are exerted), the determination of AM can be put off until date 3 (at which time managerial efforts have been completed). This is equivalent to assuming that AM is necessarily determined at date 3 because, as shown later, while it is ex ante efficient that the principal determines the level of AM at date 1, this is time inconsistent and he/she has an incentive to increase the level at date 3. Therefore, this subsection assumes that AM is determined at date 3. Further, AM is costless within the discretion allowed by accounting regulation, such as accounting standards. In this subsection, regulation is not imposed and the principal can choose the level of AM to maximize his/her expected payoff. Hereafter, subscript A indicates that earnings management is AM.

AM can replace signal s_L with s_H with probability λ_A when the output is v_L. Though the accounting numbers are released at date 4, AM needs to be determined at date 3, which reflects the fact that the firm has to prepare for regulator or auditor scrutiny. Like RM, at date 4 uncertain factors make the effects of AM stochastic. Consider the following example previously used in the case of RM: only when output at date 5 is v_L can bad debts occur at dates 4 or 5. Then, by engaging in AM through its chosen (optimistic) estimates of bad debt can the firm lower the probability of their occurrence being revealed at date 4. This increases probability λ_A.

Unlike RM, the agent cannot recognize λ_A from the firm's real operations because AM is not directly connected with such operations. Nevertheless, as shown below, the agent can solve the principal's maximization problem and thereby lead to the solution of λ_A chosen by the principal. The reason is that at date 3 when the principal determines AM, the agent's effort has been completed and therefore they have the same information in solving the principal's expected payoff.

When determining AM at date 3, the principal is assumed to have no additional information about uncertain factors at date 4 compared with determining RM at date 1. This assumption may not be realistic. For example, Zang (2005) demonstrates that firms have more information when determining AM than RM. However, the present paper focuses on the relative timing of earnings management and managerial efforts.

Given that AM is determined at date 3, the principal and the agent use inference on λ_A in entering into managerial contracts at date 1. The outside investors' inferences on λ_A are denoted by $\hat{\lambda}_A$ and the insiders' inferences (i.e., those of the principal and the agent) are denoted by $\tilde{\lambda}_A$, where caret and tilde respectively indicate the inferences of outsiders and insiders. Although both outsiders and insiders rationally infer λ_A in equilibrium (i.e., $\hat{\lambda}_A = \tilde{\lambda}_A = \lambda_A^*$), the two inferences should be distinct because when the principal chooses AM at date 3, $\tilde{\lambda}_A$ is changed into his/her chosen level of λ_A but $\hat{\lambda}_A$ remains constant.

Then, the participation constraint is

$$\begin{aligned}&\widetilde{\Pr}(s_H|e_H)w_H + \widetilde{\Pr}(s_L|e_H)w_L - e_H \\ &= \{\pi + (1-\pi)\tilde{\lambda}_A\}w_H + (1-\pi)(1-\tilde{\lambda}_A)w_L - e_H \geq 0,\end{aligned} \tag{8}$$

where $\widetilde{\Pr}$ means that the principal and the agent calculate conditional probabilities using not λ_A but $\widetilde{\lambda}_A$. The incentive compatibility constraint is

$$\widetilde{\Pr}(s_H|e_H)w_H + \widetilde{\Pr}(s_L|e_H)w_L - e_H$$
$$\geq \widetilde{\Pr}(s_H|e_L)w_H + \widetilde{\Pr}(s_L|e_L)w_L$$

$$\Leftrightarrow \{\pi + (1-\pi)\widetilde{\lambda}_A\}w_H + (1-\pi)(1-\widetilde{\lambda}_A)w_L - e_H \geq \widetilde{\lambda}_A w_H + (1-\widetilde{\lambda}_A)w_L . \quad (9)$$

Limited liability on the agent is denoted by

$$w_H,\ w_L \geq 0 . \quad (10)$$

At date 1, subject to (8)~(10), the principal chooses w_H and w_L to maximize his/her expected payoff as

$$\widetilde{\Pr}(s_H|e_H)(\hat{P}_{HH} - w_H) + \widetilde{\Pr}(s_L|e_H)(\hat{P}_{HL} - w_L)$$
$$= \{\pi + (1-\pi)\widetilde{\lambda}_A\}\left\{\frac{\pi v_H}{\pi + (1-\pi)\hat{\lambda}_A}\right\}$$
$$- \left[\{\pi + (1-\pi)\widetilde{\lambda}_A\}w_H + (1-\pi)(1-\widetilde{\lambda}_A)w_L\right], \quad (11)$$

which yields,

$$w_H = \frac{e_H}{\pi(1-\widetilde{\lambda}_A)},\quad w_L = 0 . \quad (12)$$

Then, managerial rent $\frac{\widetilde{\lambda}_A}{\pi(1-\widetilde{\lambda}_A)}e_H$ occurs. Unlike RM, the rent depends not on the principal's chosen level of AM, but his/her (and the agent's) inference on it, and this aggravates contract efficiency, as shown later.

In equilibrium, $\hat{\lambda}_A = \widetilde{\lambda}_A = \lambda_A$ and therefore the principal's expected payoff is

$$\pi v_H - \frac{\pi + (1-\pi)\lambda_A}{\pi(1-\lambda_A)}e_H ,$$

which is given by substituting (12) and $\hat{\lambda}_A = \widetilde{\lambda}_A = \lambda_A$ into (11). For the remainder of this paper, it is assumed that

$$\pi v_H - \frac{\pi + (1-\pi)\lambda_A}{\pi(1-\lambda_A)}e_H > 0 ,$$

in equilibrium. This means that even if AM is feasible and rent seeking is inevitable, managerial effort is not only socially valuable but benefits the principal.

At date 3, the principal chooses λ_A to maximize

$$\{\pi + (1-\pi)\lambda_A\}\left\{\frac{\pi v_H}{\pi + (1-\pi)\hat{\lambda}_A}\right\} - \{\pi + (1-\pi)\lambda_A\}\left\{\frac{e_H}{\pi(1-\tilde{\lambda}_A)}\right\}, \tag{13}$$

which is given by substituting $\tilde{\lambda}_A = \lambda_A$ and (12) into (11). Note that the principal choosing λ_A at date 3 cannot affect $\tilde{\lambda}_A$ in the denominator of (12) because a compensation package of (w_H, w_L) has been determined at date 1 and the agent's effort has been completed at date 2. This is the reason why the agent who does not observe decision processes of AM can solve the principal's maximization problem as (13) and thereby obtain the level of λ_A chosen by the principal. As the agent's effort has been completed at date 2, the principal and the agent have the same information in leading to the solution of λ_A. At the same time, as shown below, the fact that AM is determined after the agent's effort is the reason why AM can be more serious than RM.

The following proposition is obtained.

Proposition 2: Accrual earnings management in equilibrium
When outside investors rationally infer AM in equilibrium, the equilibrium level of λ_A, denoted by λ_A^*, satisfies $MB_A(\lambda_A^*) = 0$ and ensures $0 < \lambda_A^* < 1$, where

$$MB_A(\lambda) = \frac{\pi(1-\pi)v_H}{\pi + (1-\pi)\lambda} - \frac{(1-\pi)e_H}{\pi(1-\lambda)}.$$

At the equilibrium level of λ, $MB_A(\lambda)$ is the marginal benefit of AM to the principal at date 3, that is the stock price enhancing effects of AM, which is given by $\frac{\pi(1-\pi)v_H}{\pi + (1-\pi)\lambda}$, net of the contract inefficiency of AM, which is given by $\frac{(1-\pi)e_H}{\pi(1-\lambda)}$.

Thus, while AM can boost stock prices it also aggravates managerial incentives and increases managerial rent. However, taking the level of λ as given, the rent caused by AM, which is denoted by $\frac{(1-\pi)e_H}{\pi(1-\lambda)}$, is less than that caused by RM, which is denoted by $\frac{e_H}{\pi(1-\lambda)^2}$, because when the principal determines the level of AM at date 3, managerial efforts have already been completed and he/she need not take into account the negative effects of AM on contract efficiency.

However, this does not mean that AM is a less serious problem than RM. Rather, the opposite is true because AM causes a time inconsistency as follows. As the principal's chosen level of AM does not affect contract efficiency, he/she aggravates AM at date 3. At date 1, the principal and the agent rationally infer this aggravation of AM and therefore managerial contracts are tied to the aggravated level, which makes managerial rents larger than those in the case of RM.

If the principal determined AM at date 1, the level chosen would adequately incorporate such contract inefficiency. As shown in the next section, the ex ante efficient level of AM is $\lambda_A^+ (< \lambda_A^*)$. However, this is not credible because at date 3 it is ex post inefficient and therefore the principal increases AM, which induces the agent at date 2 to shirk. This means that as long as the principal can delay determining the level of AM until date 3, he/she will necessarily do so.

Consequently, Propositions 1 and 2 lead to the following corollary.

Corollary 1: The comparison of the levels of λ_R^* and λ_A^*
For any $\beta \geq 0$, $\lambda_R^* < \lambda_A^*$.

Note that even if RM is costless (i.e., $\beta = 0$), the inequality is invariant because unlike AM, the principal at date 1 adequately incorporates contract inefficiency caused by RM when choosing the level of RM. This is essential to derive the optimal stringency of accounting regulation, as shown later.

3. Multiple uses of accrual and real earnings management and the optimal stringency of accounting regulation

This section examines the case where the principal can use both AM and RM and derives the optimal stringency of accounting regulation.

a. Accrual and real earnings management choices

At date 1, the principal chooses λ_R to maximize his/her expected payoff as

$$\left\{\pi + (1-\pi)\left(\tilde{\lambda}_A(\lambda_R) + \lambda_R\right)\right\}\left\{\frac{\pi\left(1-\beta\hat{\lambda}_R\right)v_H}{\pi + (1-\pi)\left(\hat{\lambda}_A + \hat{\lambda}_R\right)}\right\} - \frac{\pi + (1-\pi)\left(\tilde{\lambda}_A(\lambda_R) + \lambda_R\right)}{\pi\left(1-\tilde{\lambda}_A(\lambda_R) - \lambda_R\right)} e_H, \tag{14}$$

where $\tilde{\lambda}_A(\lambda_R)$ denotes $\tilde{\lambda}_A$ as a function of λ_R. Here, at date 1, the principal infers that his/her chosen λ_A at date 3 is affected by the level of λ_R. Let λ_A^{**} and λ_R^{**} denote the principal's chosen level of AM and RM in equilibrium, respectively, when he/she uses AM and RM as substitutes in managing earnings. Hereafter, consider date 0 as when regulators impose an upper bound on λ_A, denoted by $\bar{\lambda}_A$, such that less (more) stringent accounting regulation raises (lowers) $\bar{\lambda}_A$. The objective of accounting regulation is to maximize the principal's expected payoff at date 0.

Then, the following proposition is obtained.

Proposition 3: The levels of accrual and real earnings management in equilibrium
Let λ_A^+ denote λ satisfying $MB_R(\lambda) = 0$ when $\beta = 0$. Then, the following three

cases exist.

(i) When $\overline{\lambda}_A \geq \lambda_A^*$, $\lambda_A^{**} = \lambda_A^*$ and $\lambda_R^{**} = 0$;

(ii) When $\lambda_A^+ \leq \overline{\lambda}_A < \lambda_A^*$, $\lambda_A^{**} = \overline{\lambda}_A$ and $\lambda_R^{**} = 0$;

(iii) When $\overline{\lambda}_A < \lambda_A^+$, $\lambda_A^{**} = \overline{\lambda}_A$ and

$$\frac{\partial \lambda_R^{**}}{\partial \overline{\lambda}_A} = -\frac{1}{1 + \frac{\pi^2(1-\pi)\beta v_H \left(1 - \overline{\lambda}_A - \lambda_R^{**}\right)^2}{2\left(1 - \beta\lambda_R^{**}\right)\left(1 - \overline{\lambda}_A - \lambda_R^{**}\right) + (1-\pi)e_H}} > -1; \quad (15)$$

In particular, when $\overline{\lambda}_A = 0$, $\lambda_A^{**} = 0$ and $\lambda_R^{**} = \lambda_R^*$.

Proof of Proposition 3:
Case (i) is apparent because even if AM is not restricted, the principal does not choose AM exceeding λ_A^*. Then, from Corollary 1, the principal does not use RM because he/she at date 1 rationally infers that the total level of earnings management will become too high at date 3. See Case (i) in Figure 2.

The level λ_A^+ that appears in Cases (ii) and (iii) is an indispensable indicator to derive the optimal stringency of accounting regulation. The indicator λ_A^+ is defined as the level of RM the principal would choose if RM were costless and AM were perfectly prohibited. This indicator can be also interpreted as follows: if the principal at date 1 could precommit not to change the level of AM, they would choose λ_A^+ and not use costly RM. Note that the marginal benefit of AM in this situation coincides with that of RM when $\beta = 0$. Corollary 1 assures $\lambda_R^* \leq \lambda_A^+ < \lambda_A^*$, depicted in Figure 2. The first and second inequalities reflect that a decrease in β increases the marginal benefit of RM and that time inconsistency aggravates AM, respectively.

In Case (ii) when $\lambda_A^+ \leq \overline{\lambda}_A < \lambda_A^*$, while accounting regulation is binding for the principal at date 3, it is not binding for the principal at date 1 and therefore he/she does not employ costly RM as a substitute. See Case (ii) in Figure 2.

In Case (iii) when $\overline{\lambda}_A < \lambda_A^+$, accounting regulation is binding for the principal at date 1 and therefore lowering $\overline{\lambda}_A$ induces him/her to increase RM as a substitute. Then, Equation (15) means that lowering $\overline{\lambda}_A$ decreases the total level of earnings management, denoted by $\overline{\lambda}_A + \lambda_R^{**}$, because an increase in λ_R^{**} is less than the decrease in $\overline{\lambda}_A$ (See Appendix for the proof of (15)). Such a small reaction of λ_R^{**} is obtained from the fact that the costs of RM restrict the increase in it. In particular, when AM is lowered to $\overline{\lambda}_A = 0$, only RM is feasible and therefore $\lambda_R^{**} = \lambda_R^*$, as shown in Proposition 1. See Case (iii) in Figure 2.

b. The optimal stringency of accounting regulation

In equilibrium, given that $\lambda_A^{**} = \hat{\lambda}_A = \tilde{\lambda}_A$ and $\lambda_R^{**} = \lambda_R = \hat{\lambda}_R$ hold, substituting them into

(14) yields the principal's expected payoff at date 0 as

$$\pi\left(1-\beta\lambda_R^{**}\right)v_H - \frac{\pi+\left(1-\pi\right)\left(\lambda_A^{**}+\lambda_R^{**}\right)}{\pi\left(1-\lambda_A^{**}-\lambda_R^{**}\right)}e_H . \tag{16}$$

At date 0, all the stakeholders know that the firm will fail to increase the stock price because of their rational inference on its earnings management. Nevertheless, the principal engages in RM and AM at dates 1 and 3, respectively, because he/she at date 0 cannot precommit not to manage earnings. Thus, not only AM but RM causes time inconsistency, which occurs between dates 0 and 1. However, unlike AM, as RM cannot be restricted by accounting regulation, the regulatory authorities take the time inconsistency of RM as given. This is an important constraint when reducing AM because RM can be a substitute for AM, as shown below.

The present paper defines the optimal stringency of accounting regulation as the $\overline{\lambda}_A$ maximizing (16). Then, the following proposition is obtained.

Proposition 4: The optimal stringency of accounting regulation
The optimal level of $\overline{\lambda}_A$ is λ_A^+, that maximizes the principal's expected payoff in equilibrium at date 0, given by (16).

As shown in Case (iii) in Proposition 3, accounting regulation can lower the total level of earnings management by allowing RM. However, Proposition 4 asserts that such a decrease in the total level of earnings management is not sufficient to compensate for the costs of RM. The reason is that taking outside investors' inference on RM as given, the principal at date 1 chooses RM. Then, the principal at date 1 does not take into account outside investors rationally infer the equilibrium level of RM, which makes the increase in RM too large. Thus, optimal accounting regulation is to minimize AM conditional on not inducing RM.

The optimum of AM, given by λ_A^+, is the level of RM the principal would choose if RM were costless and AM were perfectly prohibited. Further, from the definition of λ_A^+ in Proposition 3, when the managerial incentive problems (i.e., the stewardship perspective of accounting numbers), which is given by $\frac{e_H}{\pi\left(1-\lambda\right)^2}$, are more serious than the stock price enhancing effects (the valuation perspective of accounting numbers), which is given by $\frac{\pi\left(1-\pi\right)v_H}{\pi+\left(1-\pi\right)\lambda}$, λ_A^+ is lowered and therefore tighter accounting regulation is favored.

4. Conclusion

As shown in past empirical work, tighter accounting regulation decreases accrual earnings management (AM) but increases real earnings management (RM). This means that AM and RM are substitutes in managing earnings. What then is the optimal stringency of accounting regulation?

This paper focuses on the difference in timing when determining AM and RM. RM is determined early in the fiscal period and therefore directly harms managers' incentives during the period. This discourages firm owners from increasing RM. In contrast, AM is determined later in the fiscal period and it is therefore less directly linked with managers' incentives. This encourages owners to increase AM. However, this chosen increment in AM is excessive because the rational inference of managers on its level harms their incentives.

The present paper leads to the following theoretical result: accounting regulation should lower AM to the level of RM the principal would choose if RM were costless and AM were perfectly prohibited. It is noteworthy that the optimal restriction on AM does not induce owners to employ RM as a substitute. The reason is that time inconsistency aggravates the level of AM chosen later in the fiscal period more than RM chosen earlier in the same period, which leads to some threshold level until which accounting regulation can reduce AM without inducing RM. Further, this paper shows that when the managerial incentive problems (i.e., the stewardship perspective of accounting numbers) are more serious than the stock price enhancing effects (the valuation perspective of accounting numbers), tighter accounting regulation is favored.

Appendix

Proof of Proposition 1:
From (7), the first-order condition is

$$\frac{\pi(1-\pi)\left(1-\beta\hat{\lambda}_R\right)v_H}{\pi+(1-\pi)\hat{\lambda}_R}-\frac{e_H}{\pi(1-\lambda_R)^2}=0,$$

where it is straightforward to ascertain that the second-order condition holds.

In equilibrium, as outside investors can infer the firm's chosen level of λ_R, $\hat{\lambda}_R=\lambda_R=\lambda_R^*$ and therefore the first-order condition is

$$MB_R\left(\lambda_R^*\right)=0.$$

Inequality $\pi(1-\pi)v_H-e_H>0$ yields $MB_R(0)=(1-\pi)v_H-\frac{e_H}{\pi}>0$, which assures that there exists $\lambda>0$ satisfying $MB_R(\lambda)>0$.

Proof of Proposition 2:
Differentiating (13) with regard to λ_A yields

$$\frac{\pi(1-\pi)v_H}{\pi+(1-\pi)\hat{\lambda}_A}-\frac{(1-\pi)e_H}{\pi\left(1-\tilde{\lambda}_A\right)},$$

which is denoted by $F\left(\tilde{\lambda}_A,\hat{\lambda}_A\right)$. If $F\left(\tilde{\lambda}_A,\hat{\lambda}_A\right)>0$, the solution is $\lambda_A=1$, which yields $\tilde{\lambda}_A=\hat{\lambda}_A=1$ in equilibrium. However, $F(1,1)=-\infty$ is a contradiction. If $F\left(\tilde{\lambda}_A,\hat{\lambda}_A\right)<0$, the solution is $\lambda_A=0$, which yields $\tilde{\lambda}_A=\hat{\lambda}_A=0$ in equilibrium. However, inequality $(1-\pi)v_H-\frac{1-\pi}{\pi}e_H>0$ yields $F(0,0)>0$, which is a contradiction. Hence, the solution $\lambda_A=\lambda_A^*$ satisfies $F\left(\tilde{\lambda}_A,\hat{\lambda}_A\right)=0$. Given $\tilde{\lambda}_A=\hat{\lambda}_A=\lambda_A=\lambda_A^*$ in equilibrium, $F\left(\lambda_A^*,\lambda_A^*\right)=0$ holds, which yields

$$MB_A\left(\lambda_A^*\right)=0 \text{ and } 0<\lambda_A^*<1.$$

Proof of (15) in Proposition 3:
In Case (iii), (14) is replaced with

$$\left\{\pi+(1-\pi)\left(\bar{\lambda}_A+\lambda_R\right)\right\}\left\{\frac{\pi\left(1-\beta\hat{\lambda}_R\right)v_H}{\pi+(1-\pi)\left(\bar{\lambda}_A+\hat{\lambda}_R\right)}\right\}-\frac{\pi+(1-\pi)\left(\bar{\lambda}_A+\lambda_R\right)}{\pi\left(1-\bar{\lambda}_A-\lambda_R\right)}e_H, \qquad \text{(A1)}$$

where $\overline{\lambda}_A$ is constant and $\overline{\lambda}_A < \lambda_A^+$. The principal at date 1 chooses λ_R to maximize (A1), which yields the first order condition as

$$\frac{\pi(1-\pi)(1-\beta\hat{\lambda}_R)v_H}{\pi+(1-\pi)(\overline{\lambda}_A+\hat{\lambda}_R)} - \frac{e_H}{\pi(1-\overline{\lambda}_A-\lambda_R)^2} = 0,$$

where it is straightforward to ascertain that the second order condition holds.

In equilibrium, as outside investors can infer the firm's chosen level of λ_R, $\hat{\lambda}_R = \lambda_R = \lambda_R^{**}$ and therefore the first order condition is

$$MB_{\overline{A}+R}\left(\overline{\lambda}_A+\lambda_R^{**}\middle|\overline{\lambda}_A\right) = \frac{\pi(1-\pi)(1-\beta\lambda_R^{**})v_H}{\pi+(1-\pi)(\overline{\lambda}_A+\lambda_R^{**})} - \frac{e_H}{\pi(1-\overline{\lambda}_A-\lambda_R^{**})^2} = 0, \tag{A2}$$

where $MB_{\overline{A}+R}\left(\lambda\middle|\overline{\lambda}_A\right)$ denotes the equilibrium marginal benefit to the principal at date 1, of earnings management, which is given by $\lambda = \lambda_A + \lambda_R$, when the upper bound on AM is $\overline{\lambda}_A$. Differentiating (A2) with regard to $\overline{\lambda}_A$ yields (15), where λ_R^{**} is also differentiated as a function of $\overline{\lambda}_A$.

Proof of Proposition 4:

From Proposition 3, accounting regulation can lower the level of $\overline{\lambda}_A$ to λ_A^+ without inducing costly RM. This means that the optimal level of $\overline{\lambda}_A$ is λ_A^+ or some value less than λ_A^+. When $\overline{\lambda}_A < \lambda_A^+$, i.e., when Case (iii) in Proposition 4 holds, substituting $\lambda_A^{**} = \overline{\lambda}_A$ into (16) yields the principal's expected payoff in equilibrium at date 0 as

$$\pi(1-\beta\lambda_R^{**})v_H - \frac{\pi+(1-\pi)(\overline{\lambda}_A+\lambda_R^{**})}{\pi(1-\overline{\lambda}_A-\lambda_R^{**})}e_H, \tag{A3}$$

which is denoted by $V(\overline{\lambda}_A)$. Differentiating (A3) with regard to $\overline{\lambda}_A$ yields

$$V'(\overline{\lambda}_A) = -\left(\pi\beta v_H + \frac{e_H}{\pi(1-\overline{\lambda}_A-\lambda_R^{**})^2}\right)\frac{\partial\lambda_R^{**}}{\partial\overline{\lambda}_A} - \frac{e_H}{\pi(1-\overline{\lambda}_A-\lambda_R^{**})^2},$$

which leads to

$$V'(\overline{\lambda}_A) > 0 \iff \frac{\partial\lambda_R^{**}}{\partial\overline{\lambda}_A} < -\frac{1}{1+\dfrac{\pi^2\beta v_H(1-\overline{\lambda}_A-\lambda_R^{**})^2}{e_H}}.$$

Equation (15) assures the second inequality and therefore inequality $V'(\overline{\lambda}_A) > 0$ is obtained. That is, when $\overline{\lambda}_A < \lambda_A^+$, the principal's expected payoff in equilibrium at date 0 is increasing with $\overline{\lambda}_A$, which means that λ_A^+ is the optimal level of AM.

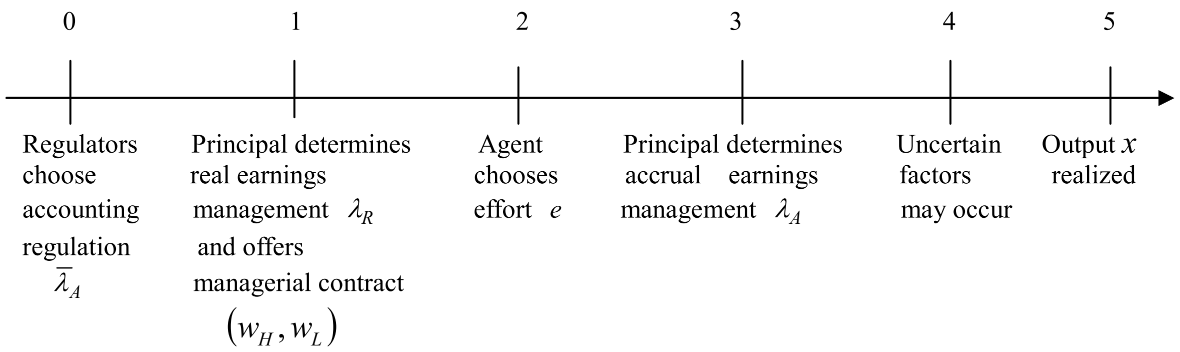
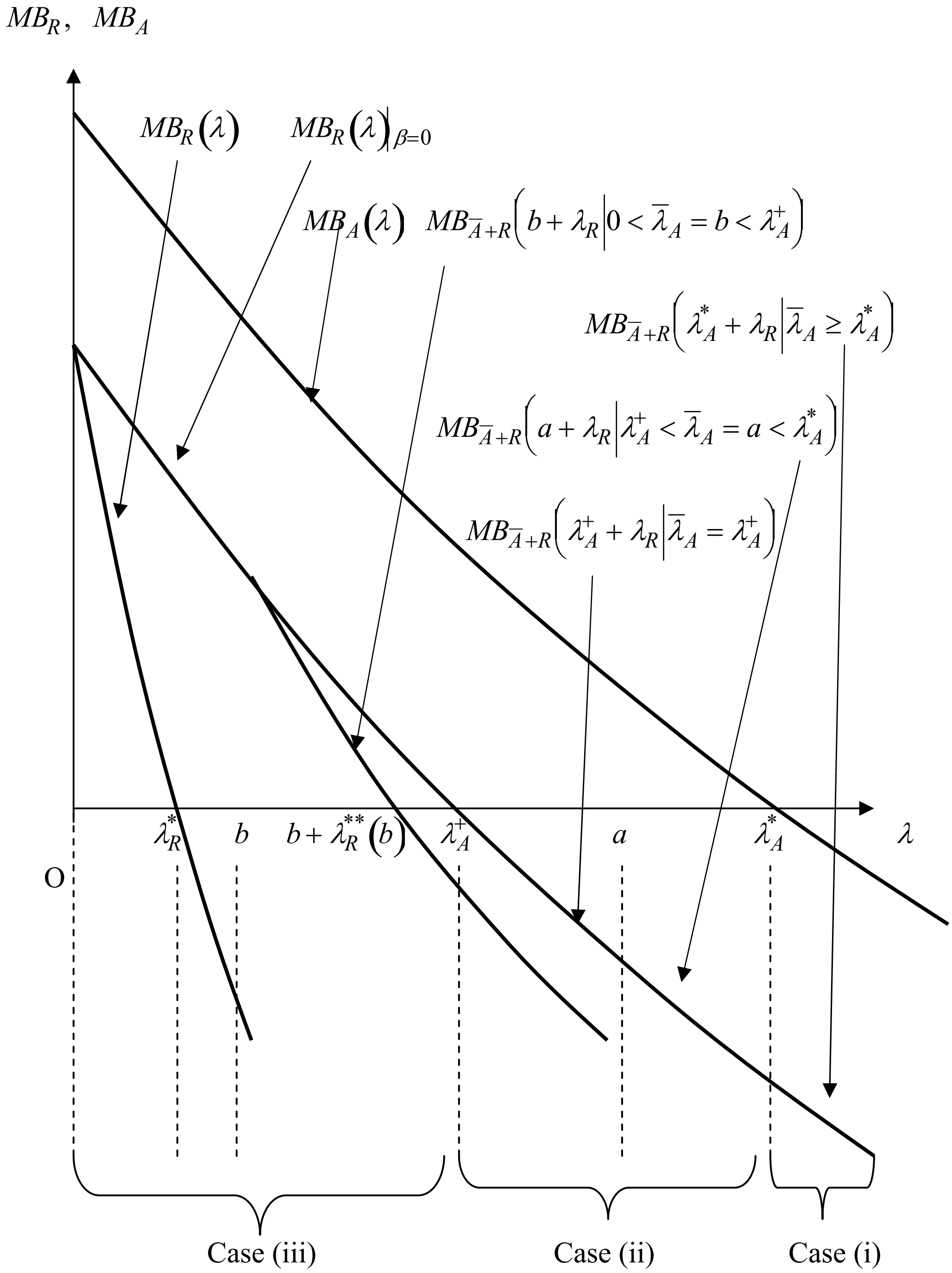

0
1
2
3
4
5
Regulators choose accounting regulation $\bar{\lambda}_A$
Principal determines real earnings management λ_R and offers managerial contract (w_H, w_L)
Agent chooses effort e
Principal determines accrual earnings management λ_A
Uncertain factors may occur
Output x realized

Figure 1



Functions $MB_R(\lambda)$ and $MB_{\overline{A}+R}(\lambda|\overline{\lambda}_A)$ denote the equilibrium marginal benefits to the principal at date 1 of RM when AM is not feasible, and of AM plus RM when the upper bound on AM is $\overline{\lambda}_A$, respectively. Function $MB_A(\lambda)$ denotes the equilibrium marginal benefits to the principal at date 3 of AM when RM is not feasible. They are obtained in Proposition 1, Proof of (15) in Proposition 3 in Appendix, and Proposition 2, respectively.

Figure 2

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