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Optimal accounting policies under financial constraints: aggressive versus conservative

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Abstract

We examine how severity of financial constraints influences firms' choices of accounting policies. This paper shows that firms with mild financial constraints choose an aggressive accounting policy and those with severe financial constraints choose a conservative accounting policy.

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1. Introduction

Conservatism is accepted in many countries as both an accounting practice and a principle. When a firm chooses a conservative accounting policy, its financial reports more precisely reflect bad signals than good ones with regard to its earnings and values of assets. Basu (1997) observed that bad news has a greater influence on financial reports than good news. His observation is supported by empirical evidence indicating that firms choose a conservative accounting policy. Since Basu (1997), a growing literature has examined why conservatism is widely accepted from both theoretical and empirical viewpoints.[1] As aggressive and conservative accounting policies are abstract concepts, many mathematical expressions can capture them. We express them as thresholds to discriminate good from bad messages after observing signals for values of assets.[2] Aggressive (conservative) accounting policies fully capture a high (low) value of assets. This paper uses the debt contract model, which is a slight modification of that of Gök and Wagenhofer (2009), to examine how financial constraints affect which accounting policy a firm chooses. Despite its broad acceptance, conservatism provokes considerable criticism and doubts. The IASB and FASB, which set standards for accounting policies, also raise questions about the adequacy of conservative accounting policies. This suggests that the extent to which conservative accounting policies are rational and robust constitutes an important issue.

This paper uses a standard model of risky investment projects under moral hazard in the simplest setting. In the model, uncertainty is captured by binary states with equal probabilities. Firms have two options for their accounting policies—, aggressive or conservative. We show that a firm's choice of accounting system depends on the severity of the financial constraints it faces. Firms choose an aggressive accounting policy under mild financial constraints and a conservative one under severe financial constraints. This is the first paper to capture both aggressive and conservative accounting policies in a single model. In the simplest setting, we can determine the accounting policy a firm chooses by comparing the benefits of the two policies. We directly explain why firms choose different accounting policies in relation to their financial constraints.

This paper was motivated by Gök and Wagenhofer (2009), who show that financially constrained firms choose a conservative accounting policy. It is interesting that our result differs from theirs, although we introduced a slight change to the setting used in their model. This implies that optimal accounting

[1] Instead of presenting a literature review, we refer to Watts (2003a, 2003b), who summarizes studies on conservatism in accounting.

[2] This definition is similar to that of Kwon (2005), who considers a more general setting and regards signals as uncertain earnings.

policy may be sensitive to model settings, and it points to the interest in examining the robustness of conservative accounting policy.

The organization of this paper is as follows. Section 2 presents the basic model. In Section 3, we derive debt contracts without an accounting system to define financially constrained firms. In Section 4, we examine optimal accounting policy by comparing aggressive with conservative accounting policy. Section 5 offers concluding remarks.

2. The Basic Model

A firm has an amount of assets and a project at $t = 0$. Although the project requires an investment of I, the firm has no funds. Moreover, the firm cannot apply endowment assets to finance the project since it would be costly to liquidate them.[3] Thus, the firm has to borrow I from an investor. At $t = 1$, the firm invests in the project if a debt contract with an amount of collateral C is signed. At $t = 2$, the project is realized, and the firm implements the payment D to the investor according to the contract.

2.1 The investment project and asset value

The project yields a cash flow of R with probability p_e and nothing with probability $1 - p_e$ at $t = 2$ from an investment of I at $t = 1$. The subscript $e \in \{H, L\}$ represents the effort level that the firm manager adopts after implementing the investment. If the manager exerts high effort, then the success probability— the probability that the project yields R— is p_H. If the manager exerts low effort, the success probability is p_L, and he obtains a private benefit of B. We assume that $p_H R > I > p_L R$. According to this assumption, the project is beneficial only if the manager exerts high effort.

The value of the firm's endowment assets is a random variable $\tilde{A}$. The value of assets is A_H with probability 1/2 and A_L with probability 1/2 at $t = 2$, where $A_H > A_L$. Thus, the expected asset value is $\bar{A} \equiv \frac{1}{2}(A_H + A_L)$.

2.2 Information structure

[3]For instance, liquidating the assets to finance a new project may impose not only direct pecuniary costs but also nonpecuniary costs on the firm manager. For simplicity, we use the assets as collateral in debt contracts. Moreover, we do not consider liquidation of the assets at $t = 0$ and $t = 1$ or liquidation costs at $t = 2$.

When the firm installs an accounting system at $t = 0$, the manager privately observes a signal s with respect to $\tilde{A}$ at the beginning of $t = 1$. If the firm does not adopt an accounting system, the manager receives no information. The values of the signal are $A_H + \epsilon$, $A_H - \epsilon$, $A_L + \epsilon$, and $A_L - \epsilon$, where $\epsilon > 0$. The signal is imperfect, but it gives a certain level of information on the terminal value of assets. If the value of assets is A_H at $t = 2$, the signal represents the values of $A_H + \epsilon$ and $A_H - \epsilon$ with equality. If the value of assets is A_L at $t = 2$, the signal represents the values of $A_L + \epsilon$, and $A_L - \epsilon$ with equality. We assume the following environment:

Assumption 1 $\epsilon = \dfrac{A_H - A_L}{2}$.

This assumption is derived from $A_H - \epsilon = A_L + \epsilon$. That is, Assumption 1 implies that the manager cannot distinguish $A_H - \epsilon$ from $A_L + \epsilon$. Now, we define the signals as $s \in \{s_1, s_2, s_3\}$, where $s_1 = A_H + \epsilon$, $s_2 = A_H - \epsilon = A_L + \epsilon$, and $s_3 = A_L - \epsilon$.

If the firm installs an accounting system, the manager will report a message based on observing the signal. If the firm adopts no accounting system, the manager has no additional information and therefore cannot make any announcement. If the firm does not report a message, despite receiving the signal, investors will recognize that the firm's assets are in a poor state, and the firm will fail to finance the investment project. In practice, the firm will incur some costs in installing the accounting system. However, for simplicity, we ignore these costs because they do not affect our results.

2.3 Timeline

At $t = 0$, the firm designs the accounting system. At $t = 1$, the accounting system gives a signal s about the value of $\tilde{A}$, and the firm subsequently reports a message. The firm and an investor then sign a debt contract with an amount of collateral C. The firm invests I in the project if the financing agreement is signed. At $t = 2$, the project is realized, and the payment D to the investor is fulfilled according to the contract. Figure 1 in the Appendix depicts the timeline.

3. The Accounting System

Following Gök and Wagenhofer (2009), we define the accounting system as consisting of receiving a signal (the information system) and reporting a message (the accounting policy). This implies that managers exogenously receive

a signal from the accounting system and managers endogenously determine the accounting policy. If the manager does not install the accounting system, he will report no messages. Thus, he does not need to observe signals.[4] First, we consider the situation without an accounting system so as to characterize the environment in which the firm needs the system to finance the new project. Second, we define the accounting policies that determine how to report a message.

3.1 Optimal debt contract without an accounting system

When the firm discloses no information on the state of assets or adopts no accounting system, the manager faces the following problem:

$$\max_{D,C} \; p_H(R-D) - (1-p_H)C, \tag{1}$$

$$s.t. \;\; p_H D + (1-p_H)C \geq I, \tag{2}$$

$$R - D + C - B/\Delta p \geq 0. \tag{3}$$

Equations (2) and (3) are the participation constraint for the investor (PC_I) and the incentive compatibility constraint for the manager (IC_M), respectively.

Suppose that the manager has no collateral ($C = 0$). Then, PC_I is $D \geq I/p_H$, and IC_M is $I \leq p_H(R - B/\Delta p)$. This implies that the firm can undertake the investment project without endowment assets if the parameters satisfy PC_I and IC_M.

Solving the problem under $I > p_H(R - B/\Delta p)$, we have the following results:

$$C = I - p_H(R - B/\Delta p) \equiv \hat{C}, \tag{4}$$

$$D = R - \frac{B}{\Delta p} + C. \tag{5}$$

$\hat{C}$ is the minimum level of collateral for financing the project. This implies that the firm, which has the expected value of assets $\bar{A} < \hat{C}$, cannot carry out the new project.

Assumption 2 $I > \bar{A} + p_H\left(R - \dfrac{B}{\Delta p}\right)$.

We obtain Assumption 2 by rewriting $\bar{A} < \hat{C}$. In Section 4, we analyze accounting policies such that firms with fewer assets can finance the investment project.

[4] As noted above, in practice, the firm incurs some costs to obtain signals.

3.2 Definition of accounting policies

We now define the accounting policies. When the firm installs an accounting system at $t = 0$, the manager reports an accounting message $m \in \{m_G, m_B\}$ to an investor at $t = 1$. The message depends not only on a signal s that the manager receives but also on a threshold w. That is, a message m is an accounting evaluation of the asset value based on a signal s and a threshold w. The firm announces the good message m_G (the bad message m_B) to the investor if the received signal is a higher (lower) value than the threshold w. Accounting policies are defined by their thresholds w as follows:

Definition 1 *An accounting policy is called aggressive if* $w \in (s_3, s_2)$*, and it is called conservative if* $w \in (s_2, s_1)$*.*

Definition 1 is summarized as follows. In the aggressive policy, the manager reports the signals s_1 $(= A_H + \epsilon)$ and s_2 $(= A_H - \epsilon = A_L + \epsilon)$ as the good message m_G, and the signal s_3 $(= A_L - \epsilon)$ as the bad message m_B. In the conservative policy, the manager reports the signal s_1 as the message m_G, and the signals s_2 and s_3 as the message m_B. The relationship between signals and thresholds is presented in Figure 2 in the Appendix.

When the firm receives the signal s_2 $(= A_H - \epsilon = A_L + \epsilon)$, the manager cannot distinguish between A_H and A_L. In the aggressive (conservative) policy, the firm reports the signal s_2 to the investor as the good (bad) message m_G (m_B). In other words, the message m_G (m_B) fully captures the realization of the value of assets, A_H (A_L), in the aggressive (conservative) accounting policy. This definition captures the aggressive and conservative accounting policies.

Of course, the firm can report the received signal without any changes to the investor, that is, the firm discloses s_i if the manager observes s_i $(i = 1, 2, 3)$. However, the benefit that the firm obtains in the neutral (or unbiased) accounting policy is the same as in the conservative accounting policy. Hence, the firm cannot obtain any additional benefits even if the manager chooses this neutral accounting policy. Thus, we can ignore the neutral accounting policy in the paper. The formal explanation is presented in the Appendix (A.3).

4. Optimal Accounting Policy

In accordance with Göx and Wagenhofer (2009), firms that hold sufficient assets do not need to install the accounting system. We exclude such a situation by Assumption 2. In other words, firms that face financial constraints cannot implement new investments unless they install the accounting system. Financially constrained firms will install the accounting system because the project

yields a positive NPV. In this section, we examine how financial constraints affect the accounting policies of firms. We consider the case of "mild" financial constraints in the first subsection and "severe" financial constraints in the second.

4.1 Optimal accounting policy with mild financial constraints

In this subsection, we consider the case in which the firm faces mild financial constraints. Before defining mild financial constraints, we make the following notations:

$$\bar{A} = \frac{1}{2}\left(A_H + A_L\right), \tag{6}$$

$$\hat{C} = I - p_H\left(R - \frac{B}{\Delta p}\right). \tag{7}$$

$\bar{A}$ signifies the unconditional value of assets, and $\hat{C}$ represents the amount of required collateral for financing the new project. Using these notations, we define mild financial constraints in the following inequality:

$$\frac{A_H + A_L}{2} + p_H\left(R - \frac{B}{\Delta p}\right) < I \leq \frac{2A_H + A_L}{3} + p_H\left(R - \frac{B}{\Delta p}\right). \tag{8}$$

The left inequality is Assumption 2. This is equivalent to the following inequality:

$$\hat{C} - \frac{1}{3}\epsilon \leq \bar{A} < \hat{C}. \tag{9}$$

We depict the severity of financial constraints in Figure 3 in the Appendix. This theorem states which accounting policy (i.e., aggressive or conservative) the firm with mild financial constraints should choose:

Theorem 1 *When the firm faces mild financial constraints, the firm manager chooses an aggressive accounting policy.*

The proof of Theorem 1 is presented in the Appendix (A.1). Here, we provide an explanation as to why the manager chooses an aggressive accounting policy in this case. If the firm faces financial constraints, the manager should adopt an accounting system to overstate the conditional expected value of assets, which must be greater than the amount of required collateral. In the case of mild financial constraints and a good message, the conditional expected value of assets is sufficiently large to exceed the amount of required collateral. In the aggressive accounting policy, the firm can report the message m_B for the signal s_2 $(= A_H - \epsilon = A_L + \epsilon)$ as m_G. As a result, the probability of financing the project is greater if an aggressive accounting policy is adopted.

4.2 Optimal accounting policy with severe financial constraints

In this subsection, we consider the case in which the firm faces severe financial constraints. We define severe financial constraints in the following inequality:

$$I > \frac{2A_H + A_L}{3} + p_H \left(R - \frac{B}{\Delta p} \right). \tag{10}$$

This is equivalent to the following inequality:

$$\bar{A} < \hat{C} - \frac{1}{3}\epsilon. \tag{11}$$

The following theorem claims that the firm with severe financial constraints chooses a conservative accounting policy:

Theorem 2 *When the firm faces severe financial constraints, the firm manager chooses a conservative accounting policy.*

The proof of Theorem 2 is given in the Appendix (A.2). Here, we give the intuitive reasoning behind Theorem 2. When the firm faces severe financial constraints, the manager cannot finance the investment under an aggressive accounting policy because the conditional expected value of assets is too low to exceed the required collateral even though the manager reports a good message. With a conservative accounting policy, the firm can finance the project only by sending a good message. As a result, the firm adopts a conservative accounting policy.

5. Concluding Remarks

We examined how the severity of financial constraints influences a firm's choice of accounting policy. Firms choose accounting policies to maximize the probability of financing a project so that the project will yield a positive NPV. From our analyses, mild financial constraints lead the firm to choose an aggressive accounting policy, and severe financial constraints lead the firm to choose a conservative accounting policy. Many studies justify conservative accounting policy. By contrast, this paper illustrates the rationale behind aggressive accounting policy. This raises a new question in a firm manager's choice over accounting policy. Our analysis is based on the simplest setting. Thus, we should examine whether or not our results apply in more general settings. Our paper can also extend the analysis by introducing the notion of "manipulation." Accounting policies are closely related to the problems of accounting manipulation. This is an important and interesting topic that deserves future consideration.

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Appendix

A.1 Proof of Theorem 1

Proof In our simplest setting, we examine which of the accounting policies has the greater probability of financing the project. First, we consider the case in which the firm chooses a conservative accounting policy. We obtain the following inequality by direct calculation:

$$\frac{1}{3}A_H + \frac{2}{3}A_L < \frac{1}{2}A_H + \frac{1}{2}A_L < \hat{C}. \tag{12}$$

When the manager reports the bad message m_B to the investor, the conditional expected value of assets is equal to $(A_H + 2A_L)/3$. According to (12), its value is lower than the required collateral. Thus, the firm cannot finance the project after receiving the bad message m_B. Contrarily, the firm can finance the project when the manager sends the good message m_G. This is because the high value of assets exceeds the level of the collateral, $\hat{C} < A_H$. To summarize, the firm can finance the project when the manager receives the signal s_1. Therefore, the *ex ante* probability of financing the project is equal to 1/4.

Next, we consider the case in which a firm chooses an aggressive accounting policy. Substituting Assumption 1 into (9), we obtain the following inequality:

$$\hat{C} \leq \frac{2}{3}A_H + \frac{1}{3}A_L. \tag{13}$$

When the manager reports the good message m_G to the investor, the conditional expected value of assets is equal to $(2A_H + A_L)/3$. According to (12), its value is higher than the required collateral. Thus, the firm can finance the project after receiving the good message m_G. Contrarily, the firm cannot finance the project when the manager sends the bad message m_B. This is because the low value of assets does not exceed the level of the collateral, $A_L < \hat{C}$. To summarize, the firm can finance the project when the signal is s_1 or s_2. Therefore, the *ex ante* probability of financing the project is equal to 3/4. We complete the proof. (Q.E.D.)

A.2 Proof of Theorem 2

Proof The idea of this theorem is similar to that of Theorem 1. That is, we examine which of the accounting policies gives the higher probability of financing the project. First, we consider the case in which the firm chooses

an aggressive accounting policy. We obtain the following inequality by direct calculation:

$$\frac{2}{3}A_H + \frac{1}{3}A_L < \hat{C}. \tag{14}$$

This inequality signifies that the required collateral is higher than the expected value of assets that is conditional on the good message m_G. This implies that the firm will never finance the project under an aggressive accounting policy.

We now consider the case in which the firm chooses a conservative accounting policy. When the manager reports the good message m_G to the investor, the value of assets is nothing other than A_H. This means that the value is higher than the required collateral. Therefore, the firm with severe financial constraints will choose a conservative accounting policy. (Q.E.D.)

A.3 The probability of financing the project with a neutral accounting policy

When the firm chooses a neutral accounting policy, the manager directly reports the observed signal. Given the signal s_2, the conditional expected value of assets is equal to the unconditional expected value of assets $\bar{A}$. This implies that the firm receiving the signal s_2 cannot finance the investment project according to Assumption 2. It is clear from $A_H > \hat{C}$ that the firm receiving the signal s_1 can finance the project since the signal s_1 ensures the realization of A_H. By a similar argument, the firm cannot finance the project when the manager observes the signal s_3. As a result, the manager can finance the project only if he observes the signal s_1. Hence, the *ex ante* probability of financing the project is equal to 1/4 with a neutral accounting policy. This probability is identical to that with a conservative accounting policy. Thus, we ignore consideration of a neutral accounting policy.

Figure 1

Firm designs accounting system.	Accounting system gives a signal about the value of assets. Firm reports message to investor.	Firm and investor sign debt contract. Firm invests in project if contract is signed.	Project is realized. Contract is implemented.

Figure 2

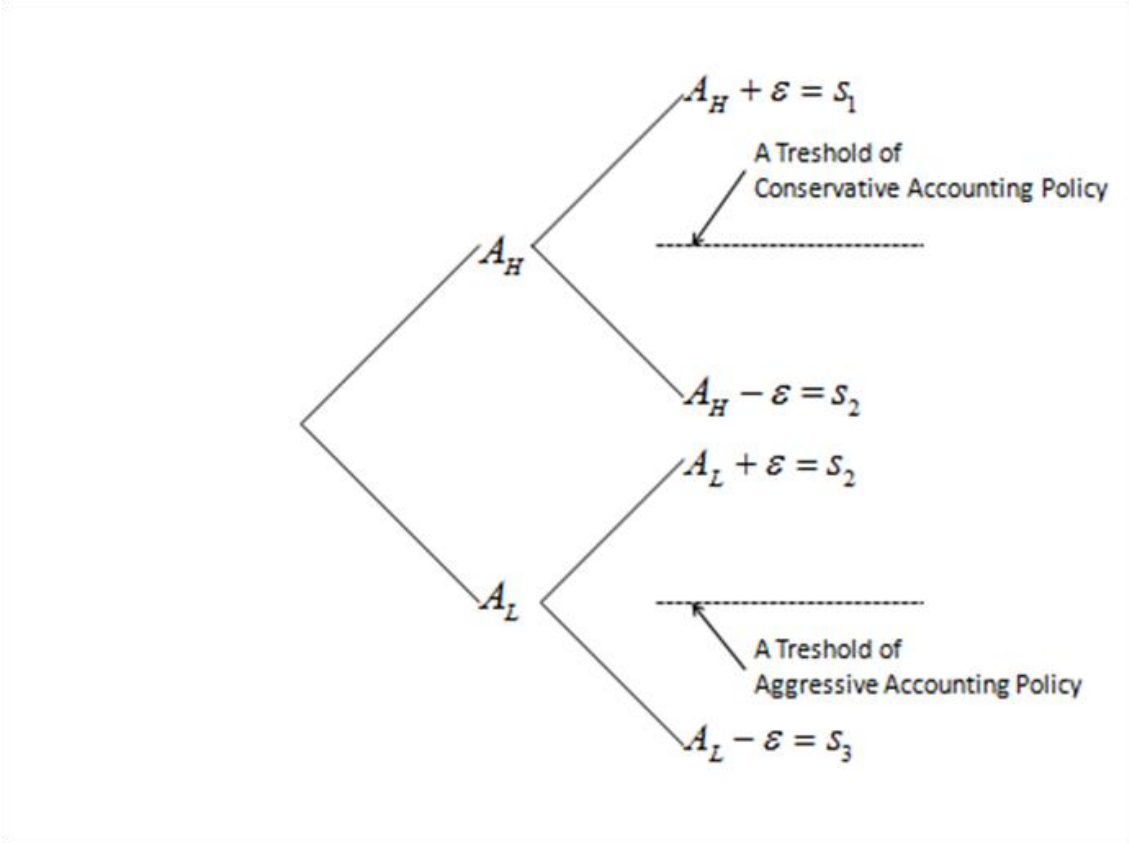
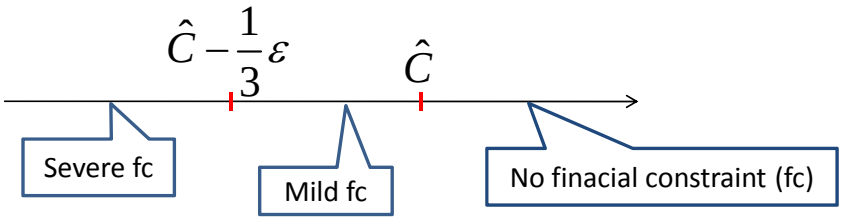


Figure 3


$\hat{C} - \frac{1}{3}\varepsilon$
$\hat{C}$
Severe fc
Mild fc
No finacial constraint (fc)