The Power of Accounting Recognition beyond Disclosure:

an Incomplete Contracts Approach*

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Abstract

I use the incomplete contracts approach to distinguish accounting recognition from disclosure. Accounting recognition settles contracts while disclosure facilitates arms-length transactions. The endogenous power of recognition in settling contracts unilaterally makes it vulnerable to influence activities more than disclosure. In particular, recognition is susceptible to transparent influence activities from which disclosure is immune. The extra vulnerability of recognition to influence activities calls for special safeguards that are otherwise viewed as excessive from the disclosure perspectives. Examples of such safeguards include the restriction of the use of expectations (transaction-based recognition) and the asymmetric use of expectations (conservatism).

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1 Introduction

Accounting provides information. Information is communicated through either disclosure of any form or recognition in financial statements. While information is important, does the form of information provision, *i.e.*, disclosure versus recognition, matter? If so, how? What are the incremental economic consequences of accounting recognition above and beyond disclosure?

An example illustrates the question. $1.27 trillion is the total undiscounted minimum future payment the US firms commit to pay under non-cancelable leases as of year 2009. Although this number is disclosed in financial reports, only $84 billion is recognized on balance sheet under current accounting standards. (The remaining $1.19 trillion is often termed as off balance sheet debt.) What would be the economic consequences if accounting standards were modified to put more leases back on balance sheet?

The economic distinction between recognition and disclosure is real and substantial. Underlying many accounting literatures is the concept of pure "accounting recognition incentive," which refers to firms’ incentive to influence the recognition of business activities without directly affecting the disclosure. The operating lease above is only one example of the long-list of off-balance sheet activities, including securitization, equity investment with other entities, pensions, derivatives, and other contractual obligations. In each of these issues firms strive to move trillions of dollars of contingent contractual obligations off financial statements, even though most of them are disclosed in financial reports anyway (see [SEC (2005)] report on the disclosure and recognition details of these transactions.). Another example is the ongoing controversy about mark-to-market accounting. The controversy is more about whether the market value changes should be recognized or only disclosed, than about whether the information should be provided at all. Accounting recognition seems to be accorded the status of reality it is supposed to measure, which is at odds with the principle of disclosure. For information provision, it is the inference made from disclosure, not the disclosure per se, that matters. What is the incremental value of recognition?

The incremental value of recognition is also the key to explain traditional accounting principles that are not easily reconciled with the information provision perspective, such as
transaction-based recognition and conservatism. The former restricts the use of expectations and the latter uses expectations asymmetrically. Defining disclosure broadly as information provision, accounting recognition could be viewed as a special form of disclosure whose production is constrained by accounting principles. Traditionally, these long-survived accounting principles are justified on the ground that their alternatives lack reliability and invite abuse. Recently, this rationale has been challenged by the fair value accounting movement with the powerful weapon from the disclosure literature. If the process of fair value measurement is made transparent through disclosure, cannot the abuse of reliability be curtailed and the benefit of informativeness be reaped? The same idea of using disclosure to control the abuse of flexibility has also been employed to argue against conservatism and for principle-based accounting.

In this paper I distinguish recognition from disclosure by its distinct function: accounting recognition settles contracts while disclosure facilitates market transactions. Unlike the vast literature on the role of accounting information in contracting, I use the incomplete contracts approach. The primitive friction is that the state space is not directly contractible. Accounting recognition is used to settle contracts because it measures the ex post state under systematic ex ante rules. However, this endogenous power of recognition makes it vulnerable to influence activities more than disclosure. In particular, it is susceptible to transparent influence activities from which disclosure is immune. The extra vulnerability to influence activities calls for special safeguards, such as transaction-based recognition and conservatism, that are otherwise viewed as excessive from the disclosure perspective.

In a setting of financing a long-term project, I rely on the framework of Aghion and Bolton (1992) to create a situation in which the lender’s discipline is socially optimal in and only in the bad state. Short-term debt leads to excessive intervention in the good state and long-term debt without contingent covenant results in insufficient intervention in the bad state. Therefore, a state-contingent covenant to allocate the control right could improve the efficiency.

The implementation of a state-contingent covenant requires a contractible measurement of the ex post state. I argue that one major source of such measurements is accounting
recognition. Empirically, accounting variables are widely used in contracts and regulations, which for our purpose could be viewed as contracts as well. Conceptually, any attempt to use information to settle a contract essentially requires an administrative apparatus that resembles the accounting system, that is, a system that measures the ex post state under ex ante rules. It is immediate that the role of accounting recognition in settling contracts is fulfilled ultimately by its informativeness about the underlying state. Therefore, information content is important for accounting recognition as much as it is for disclosure.

I then open the black box of accounting recognition and look at how the informativeness of accounting recognition is determined. This is where recognition differs from disclosure. Disclosure affects actions through the inference recipients make from the disclosure. In contrast, the contractual use of accounting recognition requires that the recognition rules be pre-specified in the contract before the actual state to be measured occurs. After signing the contract, it is the accounting recognition of the state, whose production is constrained only by the pre-specified rules in the contract, that settles the contract. The actual state is not directly relevant for the purpose of contract settlement, nor is the disclosure that informs contracting parties of the actual state. Accounting recognition creates reality.

However, this power of accounting recognition in settling contracts unilaterally makes accounting recognition vulnerable to influence activities more than disclosure. While disclosure is vulnerable to unobservable influence activities, recognition is susceptible to any non-contractible influence activities. Therefore, transparent accounting manipulation exists in equilibrium. Accordingly, it is justified to exclude from recognition some items that are easily subject to influence activities, even if the influence activities could be costlessly disclosed.

Accounting principles, such as transaction-based recognition and conservatism, could be evaluated as responses to the influence activities. Influence activities affect the efficiency through three channels. First, they consume resources. Second, they increase the chance that the control right is wrongly allocated to the firm in the bad state. Finally, they reduces the chance that the control right is wrongly allocated to the lender in the good state. Therefore, an universally efficient recognition rule has to affect the influence activities differently across
two states, and its implementation cannot rely directly on the ex post knowledge of the realized state. Based on these two criteria, I identify a reasonable condition with which transaction-based recognition and conservatism improve the efficiency.

Finally, this contractual perspective of accounting recognition is also consistent with the capital market consequences of the difference between disclosure and recognition. As the residual claimant, the value of equity is affected by all contracts and thus sensitive to accounting recognition beyond disclosure.

In next section, I discuss the intended contribution of the paper by placing it in the related literatures. In Section 3, I describe the model in which accounting-based covenant arises as a response to primitive frictions. In Section 4, I endogenize the recognition process to differentiate it from disclosure. Transparent influence activities on recognition occur in equilibrium. Section 5 studies the ex ante efficiency of the accounting-based covenant. In this setting, transaction-based recognition and conservatism are evaluated. Section 6 examines the capital market consequences of accounting recognition. Section 7 concludes.

2 Related Literature

The positive accounting literature is predicated on the basic idea that accounting recognition is useful for contracting (e.g., Watts and Zimmerman (1978), Watts (1979), Ball (1989), Watts and Zimmerman (1990)). The literature is too vast to be summarized here and readers are referred to the existing surveys, including, among others, Holthausen and Leftwich (1983), Watts and Zimmerman (1990), Holthausen (2001), Lambert (2001), Beyer, Cohen, Lys, and Walther (2010), and Kothari, Ramanna, and Skinner (2010). As a whole, the literature has established the empirical regularity that recognition has economic consequences beyond disclosure. However, the literature is mainly empirical and the consequence is that a number of issues are not articulated, including the endogenous nature of contracts, the substitution of other institutions for contracts, and the ability of agents to respond to accounting recognition (e.g., Leuz (2001), Lambert (2010)).

This paper is an attempt to formalize and develop the argument that recognition settles
contracts. Using the incomplete contracts approach, I study a setting in which accounting-based covenant arises endogenously. I then show that the function of recognition in settling contracts explains the existence of transparent manipulation of recognition and justifies such accounting principles as conservatism and transaction-based recognition.

Most analytical models on the contractual value of accounting information rely on the principal-agent framework. By treating accounting as an information source, the information content perspective has been used to study features of accounting recognition, such as earnings management, managerial flexibility in recognition, comparison of alternative accounting methods, and the relation between accounting and non-accounting information (see surveys, e.g., Lambert (2001), Liang (2001)). As a result of emphasizing accounting as an information source, the literature pays little attention to the distinction between recognition and disclosure. I argue later that the incomplete contracts approach has some advantage in studying the distinction between recognition and disclosure. Few papers in accounting use the incomplete contracts approach. Sridhar and Magee (1996) studies debt contracting with incomplete contracts. They find ex post opportunism in equilibrium and examine the effects of non-contractibility of some variables on the use of other contractible variables. Leuz (1998) argues that accrual accounting creates value by providing contractible state-contingencies and that this role is enhanced by the reliance on past transactions.

Some recent papers focus on the role of conservatism in debt contracting. Some relies on the idea that suppression of information through conservatism could be efficient. In Gox and Wagenhofer (2009) the ex ante commitment to suppress information provides the firm an insurance across states. In Li (2009a) suppression of information reduces the cost associated with renegotiation. In contrast, conservatism in Gigler, Kanodia, Sapra, and Venugopalan (2009) reduces efficiency because the ex ante cost of inefficient liquidation dominates that of inefficient continuation.

In two excellent surveys, Bernard and Schipper (1994) and Schipper (2007) provide lucid discussions of the distinction between recognition and disclosure. In addition to these

\[1\] The ignorance of this difference between recognition and disclosure is explained partly by the implicit assumption in the early stage of the contracting theory that anything observable is contractable. It is revealing that Holmstrom (1979) is titled as "Moral Hazard and Observability" even though "Moral Hazard and Contractibility" would probably be more accurate.
discussed above, other explanations of the distinction between recognition and disclosure could be roughly divided to three categories. One is the "processing cost argument." It contends that the cost of processing a piece of information is lower if it is recognized than if disclosed, an assumption that receives much support from the experimental literature (see Libby, Bloomfield, and Nelson (2002) for a survey). Versions differ about the sources of this competitive advantage of recognition. For example, Barth, Clinch, and Shibano (2003) assumes that investors understand recognition at no cost but have to pay a cost to gain expertise to understand disclosure. Hirshleifer and Teoh (2003) uses the similar assumption except that it is justified from limited attention and the salience of recognition. The second category is the signaling argument. Recognition is more informative because it is used by either managers or standard setters to signal their private information. The third category involves some element of a self fulfilling argument. Because recognition is more important, more resources (e.g., auditor efforts and managerial attention) are devoted to make recognition more informative and reliable. As a result of the endogenous quality of recognition, it becomes more important.

Finally, this paper also contributes to the incomplete contracts literature by examining the direct creation of contractible information in practice. The incomplete contracts literature has focused almost exclusively on mechanism design under the exogenous constraint of the lack of contractible information. However, little attention has been paid to the issue that how information is made contractible in practice. Accounting recognition is one of the most important institutions in creating contractible information. It is the detailed work by accountants, guided by accounting principles and standards, that lays a foundation for contractible financial information. On one hand, the incomplete contracts theory provides guidance for explaining accounting practice; on the other hand, understanding accounting in turn may deepen our knowledge about the roots of incomplete contracts (see Tirole (1999) and Hart and Moore (1999) for the debate about the philosophical foundation of the incomplete contracts theory).
3 A Model of Endogenous Accounting-based Covenant

The model adapts Aghion and Bolton (1992) to create a setting in which accounting-based debt covenant, \textit{i.e.}, the allocation of control right based on accounting measurement of the state, arise endogenously. In the next section I endogenize the measurement process to study accounting recognition.

An entrepreneur (the firm) with no wealth has a project that requires an initial fixed investment $K$ at date 0. If the project is continued to date 2, the entrepreneur enjoys a control benefit $B > 0$ and the cashflow of the project at date 2 depends on the state realized at date 1, $\omega$. There are three possible states, $\omega \in \{\text{bad, good, bliss}\}$, and each occurs with probability $\{q, q, 1-2q\}$. The project’s cashflow is 0 in the bad state and $\underline{Y}$ in the good state. Moreover the project pays out a large amount $\underline{Y} > K$ immediately if the bliss state occurs at date 1.

At date 1 the project could also be put into an alternative course of action with a different pattern of cashflow at date 2. For simplicity, I assume that the alternative action yields a state-independent cashflow $L$ and label the action as liquidation, $L < K$. Further, the entrepreneur does not receive any control benefit if the project is liquidated.

The realized state at date 1, $\omega$, is observable to the contracting parties but not contractible. Ex ante refers to the time before the state is realized and ex post refers to after. The introduction of the bliss state ensures that the project is not credit constrained and always financed at date 0. Later the lending market is assumed to be competitive at date 0. Therefore, efficiency is defined as the ex ante expected total surplus to the firm, including both the cashflow and the control benefit.

I assume that from the social perspective the project has a negative NPV \textit{in and only in} the bad state, \textit{i.e.}, $B < L < \underline{Y} + B$. Therefore, the optimal action at date 1, the action that maximizes the total surplus, is state-contingent: liquidate the project in the bad state but continue in the good state. The first-best efficiency, the efficiency when the optimal action is implemented, is $V^{FB} \equiv (1 - 2q)(\underline{Y} + B) + q(\underline{Y} + B) + qL - K$.

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\textsuperscript{2}The interpretations of liquidation and non-assignable control benefits are standard in the literature (see e.g., Aghion and Bolton (1992), Diamond (1991)).
Initial investment $K$ could be raised either through short-term or long-term debt. Both could be described as a contract $(K, F)$ with a covenant to allocate the control right at date $1$, $Y \geq F \geq K$. The lender provides $K$ at date 0 and in return receives a prioritized payment up to $F$ after the project pays out. A short-term debt is replicated by the contract $(K, F)$ with a covenant that assigns the control right to the lender non-contingently. If $Y > L$, the first best is achieved by using such a short term debt contract. Thus, I assume $Y < L$.

**Lemma 1** Debt contract $(K, F)$ with non-contingent allocation of control right does not implement the (socially) optimal action in all states. In particular, the optimal action is incentive-compatible only with the firm in the good state and only with the lender in the bad state.

Lemma 1 illustrates the classic difficulty of selective intervention (Williamson (1985)). Relying purely on market for financing (short-term debt) generates the incentive to take the optimal action in the bad state, but does not provide the right incentive in the good state. The ex post loss (relative to the first best) is $C_{\text{Lender}}^L = Y + B - L > 0$. Continuation would yield $Y + B$ but the lender prefers liquidation that produces $L$. On other hand, long-term debt without covenant (i.e., the firm retains the control right non-contingently) generates the right incentive in the good state but the wrong incentive in the bad state. The ex post loss (relative to the first best) is $C_{\text{Firm}}^L = L - B > 0$. Liquidation would yield $L$ but the firm prefers continuation in order to pursue $B$. Apparently there is no conflict of interest in the bliss state.

In absence of contractible information, if $C_{\text{Lender}} < C_{\text{Firm}}$ the firm uses short-term debt and achieves the efficiency of $V_{\text{Lender}} = V^{FB} - qC_{\text{Lender}}$. If $C_{\text{Lender}} > C_{\text{Firm}}$, the firm retains the control right uncontingently (through long-term debt) with the efficiency $V_{\text{Firm}} = V^{FB} - qC_{\text{Firm}}$. Randomization of the control right could be shown to be dominated by uncontingent allocation.

An exogenous measurement of the state at date 1 could improve the efficiency. I argue that accounting recognition is an important supply of such contractible measurements. Empirically, accounting variables are extensively used in compensation contracts, debt con-
tracts, and regulations, which for our purpose could be viewed as contracts. Holthausen and Leftwich (1983), Watts and Zimmerman (1990), Fields, Lys, and Vincent (2001), and Kothari, Ramanna, and Skinner (2010) provide surveys of evidence supporting this claim.

In a conceptual level, any process to use the measurement of states in a contract requires some variants of these elements: the definition of the measurement, the mapping from future transactions to the measurement, and the enforcement of the definition and mapping rules. This entire process clearly requires an administrative apparatus that resembles an accounting system. GAAP defines the elements of the financial statements and prescribes the mapping from transactions and events to accounting numbers. The web of management, auditors, regulators, and courts constitutes the infrastructure to implement GAAP. Accounting recognition creates contractible information by measuring the ex post state under the constraint of ex ante rules.

Denote $m$ as the accounting recognition of $\omega$ and $m \in \{g, b\}$ with $g > b$. Accounting recognition could be modeled as the pair $(\alpha, \beta)$:

$$\Pr(m = g | \omega = \text{good}) = \alpha, \Pr(m = b | \omega = \text{bad}) = 1 - \beta.$$ 

The precision of recognition increases in $\alpha$ and decreases in $\beta$. For convenience I call $\beta$ the type one error and $1 - \alpha$ the type two error. Recognition is treated as a hypothesis testing with the null that the state is bad. Without loss of generality, if $m$ is used in a covenant, it takes the following form: the lender takes over if $m = b$ and the firm retains the control right otherwise.

**Lemma 2** When $\alpha$ and $\beta$ are exogenous, the contracting efficiency increases in $\alpha$ and decreases in $\beta$. The first best is restored when $\alpha \rightarrow 1$ and $\beta \rightarrow 0$.

The benefit of recognition derives from its informativeness about the underlying state. A more informative recognition improves the accuracy of the covenant to assign the control right.

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3The measurement of the bliss state is not an issue because the project pays out immediately in the bliss state. This is for simplicity because the optimal action is incentive compatible with both parties in the bliss state.
to the party with the right incentive. Therefore, informativeness is important for recognition as much as it is for other use of information.

The rest of the paper endogenizes \((\alpha, \beta)\) by opening the black box of the accounting recognition process. In particular, I focus on contracting parties’ influence activities (e.g., Milgrom (1988)) on the recognition process.

## 4 Ex post Influence Activities

### 4.1 Modeling Influence Activities

At date 1 the state is realized and observed by contracting parties. Before the recognition process is completed, the firm could exert influence on the process. Denote \( x \in [0, 1] \) as the firm’s influence activity in the good state and \( y \in [0, 1] \) as that in the bad state. The effects of influence activities on the informativeness of recognition are summarized by \( \alpha(x) \) and \( \beta(y) \), the probabilities that the firm receives recognition \( g \) in the good and bad states, respectively. In particular, I define

\[
\alpha(x) \equiv f(x; \alpha_0), \beta(y) \equiv f(y; \beta_0),
\]

\[
\alpha_0 \equiv \alpha(0), \beta_0 \equiv \beta(0).
\]

\( \alpha_0 \) (\( \beta_0 \)) is the probability of receiving recognition \( g \) in the good (bad) state in absence of influence activities and labeled as the exogenous informativeness. \( \alpha_0 > \beta_0 \). The influence function \( f \) has the following properties. Denote partial derivatives with subscriptions. First, \( f_t > 0, f_{tt} = 0, t \in \{x, y\} \). The firm receives \( g \) with a higher probability if it spends more on influence activities in either state. \( f_{tt} = 0 \) is assumed for simplicity and the convexity of the problem will be ensured by the convexity of the cost function yet to be introduced. Second, \( f_s > 0, s \in \{\alpha_0, \beta_0\} \). Fixing the influencing activities, the firm receives \( g \) with a higher probability if the exogenous informativeness is higher. Finally, \( f_{ts} < 0 \). The more likely the firm receives \( g \) in absence of influence activities, the less useful the influence activities on improving the probability of receiving \( g \). For example, as \( \alpha_0 \) approaches 1, the marginal
effect of $x$ on receiving $g$ approaches 0. In the next section, I will endogenize this influence function $f$ with these properties.

The cost of influence activities is $z(t), t \in \{x, y\}$. It has the standard properties. First, $z(0) = 0$. Second, $z_t > 0$, $z_{tt} > 0$ and $z_{ttt} = 0$. The cost is increasing and convex. $z_{ttt} = 0$ is assumed for simplicity. Finally, $z_t(0) = 0$ and $z_t(1) \geq N$, with $N$ being a sufficiently large number. This assumption makes the firm’s choice of influence activities smooth. For example, $z(t) = \frac{h}{2}t^2$ with $h \geq N$ satisfies all these properties.

$x$ and $y$ are not contractible. Any contractible influence activity could have been controlled by ex ante rules and thus is reflected in $\alpha_0$ and $\beta_0$. The type one error becomes $\beta(y)$ and the type two error becomes $1 - \alpha(x)$. I also term the influence activity $x$ as correction and $y$ as fabrication, because $x$ makes the recognition more accurate but $y$ makes it less.

I provide interpretations for influence activities $x$ and $y$. To do so, I first give a brief description of the institutional features of accounting recognition. It is not optimal to delegate the ex post recognition task to either the firm or the lender because neither party has the right incentive in all states ex post. As a result, measurers external to the contracting relation have to be involved. However, the external measurers suffer either incentive or/and information problems. At one extreme, recognition could be delegated to the measurers without any constraint and at the other extreme recognition could be pre-specified completely by ex ante rules. The former takes the advantage of the availability of information ex post but could suffer when the measurers’ incentives are compromised by the influence activities from contracting parties. The latter has the opposite trade-offs. As a result, both the external measurers’ judgement and the constraints on her judgement (rules) are observed in recognition.

This description corresponds well to the real-world institutional setting in which the outcome of recognition is ultimately a joint product of private parties, regulators, legislatures, and the courts. The measurement is a direct product of the negotiation between the firm and its auditor; the negotiation is governed by GAAP set by FASB and SEC; the rule-making power of FASB and SEC are delegated by the Congress; and finally accounting recognition could be challenged in courts.
Based on this description, there are at least four types of influence activities ($x$ and $y$). First, in the macro level, the firm could participate in the policy making process through its political influence on FASB, SEC, and the Congress. The fierce lobby involved in employee stock option expensing is the best example. Second, given accounting standards, the firm could restructure transactions, devise new contracts, or even adjust its organization structures to satisfy the letters of accounting standards. Lease and securitization are good examples. Third, given the transactions, the firm could negotiate with the auditor and potentially take advantage of its information. For example, the firm could make it harder and more costly for the auditor to find information that is not in the firm’s favor and the firm could do so simply by being less cooperative. Finally, the firm could also exert influence on the auditor. High engagement fee, future engagements, lucrative consulting business, future employment, or outright bribery are just some examples.

4.2 Transparent Influence Activities

Now I show the first result that transparent influence activities occur in equilibrium. At date 1, after the firm observes the state but before the measurement is conducted, the firm treats the debt contract $(F, K)$ as given. In both states, it receives $B$ if the recognition is $g$ and receives 0 if the recognition is $b$. Thus, its decision is to choose $x$ to maximize $\alpha(x)B - z(x)$ in the good state and to choose $y$ to maximize $\beta(y)B - z(y)$ in the bad state. The optimal influence activities in each state, $x^*$ and $y^*$, are determined by the respective first-order conditions:

$$\alpha^*_x B - z^*_x = 0,$$  \hspace{1cm} (1)

$$\beta^*_y B - z^*_y = 0.$$  \hspace{1cm} (2)

A star “*” superscripted to a variable indicates that the variable is evaluated at $x^*$ or $y^*$. For example, $\alpha^*_x = \alpha_x(x^*)$.

**Proposition 1** The firm engages in correction in the good state and fabrication in the bad state, i.e., $x^* > 0$ and $y^* > 0$, regardless of the observability of the influence activities.
After signing the contract with the accounting-based covenant, the firm could keep out the external intervention and gain the private benefit $B$ as long as the state is recognized as good by the pre-specified recognition rules. The actual state realized at date 1 is not directly relevant for settling the contract. Thus, accounting recognition creates reality for the purpose of contracting and this function of recognition is above and beyond disclosure.

This power of accounting recognition makes it vulnerable to influence activities. Any influence activity that is not contractually prohibited is pursued by the firm even if it is perfectly observable to the lender. Therefore, differentiating contractibility from observability is the key to distinguish recognition from disclosure. Both disclosure and recognition provide information. The fundamental intuition about disclosure, i.e., the unraveling result of Grossman and Hart (1980) and Grossman (1981), is that actions are affected by the inference recipients extract from the disclosure, not by the disclosure per se. It is the substance, not the form, of the information that matters. Thus, a necessary condition for influence activities on disclosure to occur in equilibrium is that the influence activities are not observable. Further, even if the influence activities are not observable, the recipients are aware of the incentive of the discloser and discount the disclosure properly in deciding their actions. As a result, the incentive to influence recognition is much stronger than that to influence disclosure.

The simple result in Proposition 1 has broad implications for accounting. Accounting recognition emphasizes on the form of information production, as reflected in its heavy reliance on rules, standards, documentations and procedures to produce information. This hallmark feature of accounting is not easily explained by the disclosure perspective and is most puzzling when the recognition is also accompanied by disclosure. Proposition 1 provides one rationale for the emphasis on the form of information production. The use of accounting recognition in contracting is a response to the problem of the state space being non-contractible. To the extent that the substance of the state can not be described completely and perfectly in the contracting stage, ex ante rules to measure the future state could be useful in creating contractible information, even though ex post these rules will be proven incomplete and imperfect. When the ex post incompleteness and imperfection are exposed, it is incentive-compatible for the firm to exploit them. Pure accounting recognition benefit
and transparent accounting management occur in equilibrium.

Anticipating the vulnerability of recognition to ex post opportunism, how could the accounting system be designed to improve the efficiency? I show that two long-standing accounting principles, transaction-based recognition and conservatism, can be justified as the safeguards to mitigate the problem.

5 Ex ante Design of Accounting Recognition

5.1 The Efficiency Consequences of Influence Activities

The lender has rational expectations about the firm’s ex post opportunism and protects himself through the contract at date 0. When negotiating the debt contract with the firm at date 0, the lender conjectures that the firm will choose \( \hat{x} \) and \( \hat{y} \) at date 1 and demands a face value of \( F(\hat{x}, \hat{y}) \) to break even. A hat “\(^\hat{}\)” topping over a variable indicates that the variable is evaluated at \( \hat{x} \) or \( \hat{y} \). For example, \( \hat{F} = F(\hat{x}, \hat{y}) \) and \( \hat{\alpha} = \alpha(\hat{x}) \). The lender’s binding Individual Rationality (IR) condition is

\[
(1 - 2q)\hat{F} + q(\hat{\alpha} Y + (1 - \hat{\alpha})L) + q(1 - \hat{\beta})L = K. \tag{IR Condition}
\]

The left hand side is the lender’s expected payment across three states. In the bliss state, the lender receives the full face value \( \hat{F} = F(\hat{x}, \hat{y}) \). In other two states, the lender receives all cash flow either from continuation or liquidation because \( \hat{F} > K > L > Y \). If the good state occurs and is recognized as such, which occurs with probability \( q\hat{\alpha} \), the project is continued and the lender receives \( Y \). Otherwise, he receives \( L \). If the bad state occurs but is recognized as bad, which occurs with probability \( q(1 - \hat{\beta}) \), the project is liquidated and the lender receives \( L \). Otherwise, he receives 0. The IR condition is binding because of the assumption that the lending market is competitive at date 0.

Given the lender’s conjecture, the expected payoff to the firm with the ex post choice of \( x \) and \( y \) is \( V(x, y) = (1 - 2q)(Y + B - \hat{F}) + q(\alpha(x)B - z(x)) + q(\beta(y)B - z(y)) \). In the bliss state, the firm receives \( (Y + B - \hat{F}) \). In the good and bad states, the firm’s payoff relies directly on
recognition $m. m = g$ allows the firm to continue the project and obtain the control benefit $B$. Otherwise, the project is liquidated and the firm receives nothing. Spending $z(x)$ and $z(y)$ gives the firm the probability $\alpha(x)$ and $\beta(x)$ to receive the preferred recognition $g$ in the good and bad states, respectively. Recall $V$ is also the total efficiency because the lender receives zero surplus.

Rational expectations require that the lender’s conjecture about the influence activities be consistent with the firm’s actual influence activities. Therefore, the equilibrium consists of the first order conditions (eqn. 1 and 2) and rational expectations requirements, $x^* = \hat{x}$ and $y^* = \hat{y}$. Substituting the IR Condition, $x^* = \hat{x}$, and $y^* = \hat{y}$, the ex ante efficiency at date $0, V^*$, could be written as

$$V^* = (V^{FB} - q(1-\alpha_0)C^{Lender} - q\beta_0C^{Firm}) - q((\alpha_0 - \alpha(x^*))C^{Lender} + (\beta(y^*) - \beta_0)C^{Firm} + z(x^*) + z(y^*)).$$

(3)

$(V^{FB} - q(1-\alpha_0)C^{Lender} - q\beta_0C^{Firm})$ is the efficiency in the absence of influence activities. The shortfall from the first best efficiency $V^{FB}$ comes from the recognition error $(1 - \alpha_0)$ and $\beta_0$.

The influence activities $(x^*, y^*)$ affect the contracting efficiency through three channels. First, the fabrication in the bad state obfuscates the recognition and makes it more likely that the control right is wrongly allocated to the firm, resulting in the cost of $(\beta^* - \beta_0)C^{Firm} > 0$. Second, the correction in the good state makes the recognition more accurate and reduces the chance that the control right is wrongly allocated to the lender, leading to a saving of $(\alpha_0 - \alpha^*)C^{Lender} > 0$. Finally, both types of influence activities consume resources because $z(x^*) > 0$ and $z(y^*) > 0$.

An ex ante recognition rule could be designed to control the incentive of ex post influence activities. If the third channel, the direct cost of influence activities, dominates the other two, then any ex ante rule that reduces the incentive of ex post influence activities in both states improves the efficiency.

The more interesting case is when the first two channels are more important than the third one, that is, when the efficiency resulting from the change of decisions as a result of
the influence activities is more important than the direct cost of the influence activities. I focus on this case. In this case, I identify two criteria (necessary conditions) for an ex ante recognition rule to be universally efficient. A recognition rule is universally efficient if it improves the efficiency for any pair of \((C_{Firm}, C_{Lender})\).

**Criterion 1:** the rule affects the incentive of influence activities differently across states.

**Criterion 2:** the rule is consistent with the assumption of the optimality of the accounting-based covenant. In particular, the implementation of the rule cannot rely directly on the ex post knowledge of the realized state.

For example, a recognition rule that permits correction in the good state and prohibits fabrication in the bad state satisfies the first criterion but not the second. The implementation of this rule requires the identification of the states in the contract. Had such ex ante identification been possible, the first best efficiency could have been achieved without the accounting-based covenant. In contrast, a recognition rule that discourages influence activities in the same way across the states is implementable but is not universally efficient. It is not efficient if \(C_{Lender}\) is sufficiently larger than \(C_{Firm}\).

Using these two criteria, I examine in turn two accounting recognition principles, transaction-based recognition and conservatism. Even though the two principles are different, it turns out the intuition behind their efficiency is similar. Thus, I will discuss mainly the intuition for conservatism.

### 5.2 Transaction-based Recognition

Accounting is a transaction-based system. Accounting recognition is based on the records of business transactions that have taken place. To its extreme, it excludes any expectations about future. However, "to know the past, one must first know the future", the accrual accounting in practice involves many subjective judgements about future. After all, all accruals and deferrals are estimates about future benefits and obligations. For example, revenue recognition is based on the realizable principle, not the realized principle.

Past transactions are distinguished from future events by their hardness. Following Ijiri (1975) I define hardness of an event as the inverse of its vulnerability to influence activities.
It is operationalized in the model as a parameter $h$ in the marginal cost of influence activities, $z_t(t; h)$, $t \in \{x, y\}$. That it is more costly to influence the measurement of a harder transaction corresponds to the condition that $z_{th} > 0$. In parallel with the properties of $z(t)$, I assume that $z_h(0) = 0$ and $z_{th} > 0$. For example, $z(t) = \frac{ht^2}{2}$ satisfies these conditions.

**Proposition 2** As a transaction becomes harder ($h$ increases), both the correction in the good state and the fabrication in the bad state decrease, i.e., $x_h^* < 0$ and $y_h^* < 0$. Further, the correction decreases less than the fabrication, i.e., $|x_h^*| < |y_h^*|$.

The informal argument about the merit of the transaction-based system comes from $x_h^* < 0$ and $y_h^* < 0$. Excluding softer transactions and events from recognition reduces influence activities. However, the problem is that it cuts in both ways. Hardness reduces the type one error in the bad state ($\beta_h^* < 0$) but also increases the type two error in the good state ($-\alpha_h^* > 0$). For example, when revenue recognition relies strictly on cash receipts, both the inefficient and efficient credit managements are not recognized. Therefore, it makes recognition informative in some states but less informative in some other states. The net effect on overall efficiency is not clear.

**Proposition 3** There exists a pair of parameters $(\alpha_0, \beta_0)$ such that transaction-based recognition is universally efficient, i.e., $V_h^*(\alpha_0, \beta_0) > 0$ for any pair of $(C_{Firm}, C_{Lender})$. Moreover, if $(\alpha_0, \beta_0)$ is such a pair and if $\alpha_0 \geq \alpha_0$ and $\beta_0 \leq \beta_0$, then $(\alpha_0, \beta_0)$ is another such pair.

One sufficient condition for the transaction-based recognition to be universally efficient is that $\alpha_0$ is sufficiently larger than $\beta_0$. While I postpone the discussion of the intuition, I illustrate it with an example. In the extreme as $\alpha_0 \to 1$, the firm will spend no resources on correction regardless of $h$. Thus, as $h$ increases, only the influence activities in the bad states are reduced and thus the overall efficiency is improved. The reason that $\alpha_0$ has to be sufficiently larger than $\beta_0$ is to accommodate different combination of $C_{Firm}$ and $C_{Lender}$. 
5.3 Conservatism

Conservatism is another prominent feature of accounting recognition. It is often defined as the differential verifiability required for recognition of good versus bad news (e.g., Watts (2003)). More structure on the influence function is required to model conservatism explicitly in my setting.

I focus on the following institutional setting. Accounting standards set the ex ante rules of interpreting evidence presented by the firm. In absence of influence activities, the firm’s business activities produce one piece of evidence about the state. This first piece of evidence is positive with probability $\alpha_0$ in the good state and $\beta_0$ in the bad state. Otherwise, it is negative. This evidence cannot be manipulated. After observing the state but before observing the first piece of evidence, the firm could engage in influence activity $t$, $t \in \{x, y\}$, to generate an additional piece of evidence with probability $t$. With probability $1 - t$, the influence activities do not generate additional evidence. The additional evidence could be either positive or negative with equal probability.

The opportunism of the firm is that the firm could present the additional evidence from the influence activities selectively. The firm will always present the positive evidence, but could hide the negative evidence with probability $a$. A higher $a$ thus indicates a higher degree of opportunism of the firm in the recognition process.

The evidence rules set by accounting standards are as follows: if all the evidence presented is positive (negative), the firm receives recognition $g$ ($b$) with probability 1. If one piece is positive and the other is negative, then the firm receives $g$ with probability $n(c), n_c < 0, n(0) \to 1$ and $n(\infty) \to 0$. Conservatism is captured by parameter $c$. A higher $c$ means that lower weight is placed on the positive evidence when mixed evidence is presented. In other words, it requires more evidence to recognize good news $g$ than to recognize bad news $b$ as $c$ increases.

With this setting, the probability that the firm receives recognition $g$ with influence
activity $x$ in the good state is

$$
\alpha(x) \equiv f(x; \alpha_0) = (1 - x)\alpha_0 + x\left(\frac{\alpha_0}{2} + \frac{1 - \alpha_0}{2}n(c) + \frac{\alpha_0}{2}(a + (1 - a)n(c))\right) \quad (4)
$$

$$
= \alpha_0 + \frac{x}{2}(n(c)(1 - a\alpha_0) + (a\alpha_0 - \alpha_0)). \quad (5)
$$

When the influence activity $x$ does not produce additional evidence, which occurs with probability $1 - x$, the firm presents only one piece of evidence and receives recognition $g$ with probability $\alpha_0$. This explains the first item. When $x$ produces additional evidence, there are four combinations of evidence. First, with probability $\frac{1}{2}\alpha_0$ the firm receives and presents two pieces of positive evidence and thus recognizes $g$ with probability 1. Second, with probability $\frac{1}{2}(1 - \alpha_0)$, the first evidence is negative and the additional evidence is positive. In this case the firm presents the mixed evidence and recognizes $g$ with probability $n(c)$. Third, with probability $\frac{1}{2}\alpha_0$ the first evidence is positive but the additional evidence is negative. The firm could hide the negative evidence generated from the influence activities with probability $a$ and then recognizes $g$. With probability $1 - a$, it has to present the mixed evidence and receives $g$ with probability $n(c)$. Finally, both pieces of evidence are negative and the firm does not receive $g$ with probability 1. This explains $\alpha(x)$. $\beta(y)$ is similarly defined:

$$
\beta(y) \equiv f(y; \alpha_0) = \beta_0 + \frac{y}{2}(n(1 - a\beta_0) + (a\beta_0 - \beta_0)). \quad (6)
$$

**Lemma 3** Define $c_1$ and $c_2$ as $n(c_1) \equiv \frac{\alpha_0 - a\alpha_0}{1 - a\alpha_0}$ and $n(c_2) \equiv \frac{\beta_0 - a\beta_0}{1 - a\beta_0}$, $c_1 < c_2$. The influence activities in equilibrium are as follows:

1. If $c \in [c_2, \infty]$, $x^* = y^* = 0$;
2. If $c \in [c_1, c_2)$, $y^* > x^* = 0$;
3. If $c \in (0, c_1)$, $y^* > x^* > 0$.

I focus on the interior region $c \in [0, c_1)$ in the text. In this region, it could be verified that the influence function $f$ has all properties assumed before.
Lemma 4  When $c \in [0, c_1)$, $f(t; s), t \in \{x, y\}$ and $s \in \{\alpha_0, \beta_0\}$ has the following properties:

1. $f_t > 0$, $f_s > 0$, $f_{tt} = 0$
2. $f_{ta} > 0$, $f_{ts} < 0$, $f_{tc} < 0$.

The first set of properties are explained earlier. The influence activity is a risky gamble and the determinants of the attractiveness of this gamble to the firm are summarized by the second set of properties. First, the firm’s ability to present evidence opportunistically gives it favorable odds, hence $f_{ta} > 0$. Second, the attractiveness also depends on the state the firm is in. There is a built-in curvature in the influence function in that the effect of the additional evidence is not linear. If the first piece of evidence is positive (negative), the additional evidence reduces (increases) the chance that it recognizes $g$. The gamble is less attractive to the firm if the probability that the first piece of evidence is positive is higher, hence $f_{ts} < 0$. Finally, conservatism reduces the chance of recognition $g$ in the presence of mixed evidence and thus makes the game less attractive, hence $f_{tc} < 0$.

Now we look at how conservatism affects the influence activities and the efficiency.

Proposition 4  As accounting recognition becomes more conservative ($c$ increases), both the correction in the good state and the fabrication in the bad state decrease, i.e., $x^*_c < 0$ and $y^*_c < 0$. Further, the correction decreases less than the fabrication, i.e., $|x^*_c| < |y^*_c|$.

Like hardness, conservatism also reduces the type one error and increases the type two error simultaneously. Since the verification requirement cannot be imposed differently in different states (Criterion 2), asymmetric verification requirement per se does not necessarily improve the efficiency.

The merit of conservatism derives from the second part of Proposition 4, that $|x^*_c| < |y^*_c|$. This result makes conservatism satisfy Criterion 1 for a universally efficient recognition rule. Conservatism has a larger effect on the fabrication in the bad state than the correction in the good state. The intuition is as follows. Because $f_{ts} < 0$, the more likely that the firm receives recognition $g$ in the absence of influence activities, the less useful of the influence activities to help the firm secure recognition $g$. $\alpha_0 > \beta_0$ thus implies that the correction in
the good state is less useful than the fabrication in the bad state, resulting in \( x^* < y^* \). In the extreme, as \( \alpha_0 \to 1 \), the firm has no incentive to engage in correction at all because there is little to be corrected. Because the influence cost is convex, the marginal cost of fabrication is higher than that of correction in equilibrium. Thus, the fabrication in the bad state is more sensitive to conservatism than the correction in the good state, leading to \( |x_{c*}| < |y_{c*}| \).

With \( |x_{c*}| < |y_{c*}| \), it is straightforward to identify the sufficient condition for conservatism to be useful.

**Proposition 5** There exists a pair of parameters \( (\alpha_0, \beta_0) \) such that conservatism is universally efficient, i.e., \( V^*_c(\alpha_0, \beta_0) > 0 \) for any pair of \( (C_{Firm}, C_{Lender}) \). Moreover, if \( (\alpha_0, \beta_0) \) is such a pair and if \( \tilde{\alpha}_0 \geq \alpha_0 \) and \( \tilde{\beta}_0 \leq \beta_0 \), then \( (\tilde{\alpha}_0, \tilde{\beta}_0) \) is another such pair.

Criterion 1 and 2 for an universally efficient recognition rule can be satisfied at the same time only if there is some difference between the good and bad states. Among many possible differences, \( \alpha_0 > \beta_0 \) seems to be one of the most reasonable and intuitive. In absence of influence activities, it is more likely that the firm in the good state receives a better recognition than the firm in the bad state. This difference creates the differential incentives for influence activities and thus the differential sensitivity to conservatism. Conservatism improves efficiency because it reduces influence activities more in the bad state than in the good state, and its implementation does not rely on the contractibility of the state space.

**Corollary 1** If \( C_{Firm} \) is sufficiently larger than \( C_{Lender} \), then conservatism increases the efficiency.

If the type one error, which results in inefficient continuation by the firm in the bad state, is much more costly than the type two error, which leads to inefficient liquidation by the lender in the good state, then conservatism improves efficiency by reducing type error at the cost of increasing type two error.

While this result is often invoked in the literature, it does not provide a universal rationale for the merit of conservatism. For example, Gigler, Kanodia, Sapra, and Venugopalan...
(2009) assume that a more conservative accounting system generates low signals more often, which is endogenized in my model from the firm’s opportunism in presenting evidence. They then observe that if a project has positive NPV, then the cost of type one error (excessive continuation) must be smaller than the cost of type two error (excessive liquidation), i.e., $C^{\text{Firm}} < C^{\text{Lender}}$. Thus, conservatism reduces debt contracting efficiency in their setting.

More broadly, both type one and type two errors are costly and their relative rank is situation specific. While overinvestment is an issue, underinvestment is important as well. More importantly, this sufficient condition may also conflict with the reason that the contingent contract is used in the first place. Recall that one reason for the optimality of an accounting-based covenant is that both types of errors are costly. For example, if $C^{\text{Lender}}$ is trivial relative to $C^{\text{Firm}}$, then the first best is approximated by using short-term debt (uncontingent allocation of control right to the lenders).

In addition, conservatism sometimes is interpreted as the asymmetric requirement of recognizing the state, as oppose to recognizing the measurement of the state. It states that if the underlying state is bad (a loss), it is recognized; if the underlying state is good (a profit), the recognition is postponed. This interpretation of conservatism is not accurate because the implementation of such a principle requires the contractibility of the underlying state, thus violating Criterion 2 for an universally efficient recognition rule.

5.4 The Optimality of Accounting-based Covenant

So far I have taken the optimality of long-term debt contract with a state-contingent covenant as given. However, as the ex post opportunism by the firm increases and the ex ante rules to control it weakens, the firm may choose to change its capital structure as a response.

The efficiency of short-term debt, long-term debt without covenant, and long-term debt with an accounting-based covenant are $V^{\text{Lender}}$, $V^{\text{Firm}}$ and $V^*(\alpha_0, \beta_0, h, c)$, respectively. Note that $V^{\text{Lender}}$ and $V^{\text{Firm}}$ are independent of $(\alpha_0, \beta_0, h, c)$ but $V^*$ depends on these parameters. Thus, accounting recognition technology $(\alpha_0, \beta_0, h, c)$ predicts firms’ capital structure.

To tie down the comparison, I look at the benchmark case where there are no influence activities and $\beta_0 = 1 - \alpha_0 \leq \frac{1}{2}$. The case with influence activities relies on the specific
assumptions about the influence function and cost function.

**Proposition 6** In the absence of influence activities with \( \beta_0 = 1 - \alpha_0 \leq \frac{1}{2} \), the long-term debt with covenant dominates both short-term debt and long term debt without covenant if and only if \( \beta_0 < \tilde{\beta}_0 \), \( \tilde{\beta}_0 = \min\left(\frac{C^{\text{Firm}}}{C^{\text{Lender}}} - \frac{C^{\text{Lender}}}{C^{\text{Firm}}}\right) \) increases in the difference \( |C^{\text{Firm}} - C^{\text{Lender}}| \).

Randomized combination of the three is dominated.

The covenant is either used or not. It is a discrete choice. In the benchmark case the fact that \( \beta_0 < \frac{1}{2} < \alpha_0 \), that is the accounting system is strictly informative, is not sufficient for it to be used in the covenant. This result differs from the informativeness principle in the contracting literature where any informative signal is utilized in contracts (e.g., Holmstrom (1979)). The reason for the difference is that the opportunity cost to use the accounting-based covenant is not the randomized allocation of control right; rather it is the uncontingent allocation to either the firm or the lender. As a result, randomization among the three choices is dominated.

The discreteness in the ex ante choice indicates that the ability for contracting parties to undo influence activities is severely limited. The use of accounting-based covenant restricts the lender’s ability to undo non-contractible influence activities ex post. In the literature of the contracting value of accounting information, it is often assumed that some contracting parties have either no information or no incentive to undo the ex post influence activities. In light of the discussion above, such an assumption is not necessary. Even though ex post the lender could undo the firm’s accounting manipulation at no cost, the contract does not allow the lender to do so. The reason for this contractual restriction is because the lender has incentive to abuse the power of making ex post adjustment in some states. Without the ability to contract on the ex post state, the lender is given either all power or no power to make ex post adjustment that are used to settle the contract.

Could the contracting parties renegotiate after accounting numbers are recognized? In the good state, renegotiation is not feasible because the firm does not have any wealth to pay the lender. If the bad state occurs and is recognized as such, renegotiation is not feasible because the lender will take the socially optimal action and thus nothing is left to be renegotiated.
The only case where renegotiation is possible is when the state is bad but recognized as good. The firm would continue the project that should have been liquidated from the social perspective. Thus, the lender could bribe the firm to take the right decision (liquidation) by paying the firm some surplus from the improvement in the decision. Denote the firm’s bargaining power as \( \mu \in [0,1] \) and consider a Nash bargaining solution. Then the firm’s payoff in the bad state with \( m = g \) is \( B + \mu C_{Firm} \geq B \). Anticipating this payoff, the firm’s influence activity \( y^{**} \) is determined by the following first-order condition.

\[
\beta_y^{**}(B + \mu C_{Firm}) - z_y^{**} = 0. \tag{7}
\]

Comparing this new first-order condition to the one in the baseline model (equation 2), it is straightforward that \( y^{**} \geq y^* \). Therefore renegotiation improves the continuation decision of the project but intensifies the influence activities.

6 Capital Market Consequences

Equity holders are one of the few classes of stakeholders who do not have an explicit long-term contract with the firm. However, as a residual claimant, the value of equity is affected by all long-term contracts. Thus, equity value is sensitive to accounting recognition, not only because recognition provides information about the underlying state, but also because recognition settles contracts. The settlement of contracts affects the creation of value on which valuation depends.

In the model, the proxy for equity value is the surplus to the entrepreneur.

**Proposition 7** When the state at date 1 is disclosed, the stock price reacts. It moves from \( V^* \) to \( \{\bar{Y} + B - F^*, \alpha^* B - z(x^*), \beta^* B - z(y^*)\} \) in the bliss, good and bad state, respectively. After disclosure, when the recognition is announced, price reacts further. In the good state it moves to \( B - z(x^*) \) if \( m = g \) and to 0 if \( m = b \). In the bad state it moves to \( B - z(y^*) \) if \( m = g \) and to 0 if \( m = b \).
7 Discussion and Conclusion

The paper has focused on a particular model with particular frictions to establish the necessity of a long-term contract and studied the role of accounting recognition in improving the performance of the long-term contract. Relying on the huge literature on the theory of the firm, I could argue that long-term contracts are prevalent as a response to frictions in spot markets. After all, if all spot markets were frictionless, no firms would exist in the first place and accounting recognition would be irrelevant, (even though disclosure would still be useful even in the spot market). To the extent that the transaction cost of using markets gives rise to long-term relationship, accounting is part of the institution to improve the efficiency of the long-term relationship. In this aspect, recognition is the primary function of accounting.

The paper raises more issues than it answers. One major issue could be summarized as the trade-off of accounting menu approach. Changing economic environment requires adaptation of accounting standards. Unexpected ex post changes of accounting standards affect not only the division but also the creation of wealth through the allocation of control right (power). Can we anticipate the future changes (in accounting standards as well as economic environment) and react ex ante? If the answer is yes, then taken to the extreme, we should expect the accounting recognition to be a menu that accommodates all possible accounting recognition rules from which users could choose. In reality, typically only one GAAP is permitted within one jurisdiction and within one GAAP only a small number of alternative accounting methods are available. More importantly, the accounting menu approach is not consistent with the presumption that future states are not directly contractible. As a result, the ability to deal with future changes in accounting standards is constrained by the same incompleteness and imperfection in contracting on future states.

One example of the accounting menu approach is the as-if-recognized type of disclosure, as illustrated in the case of operating lease accounting. As-if-recognized type of disclosure is closer to recognition but still not as good as recognition for contracting purpose. First, as-if-recognized disclosure may be sufficient for information provision purpose, but for contracting purposes it requires more details in producing the numbers. Second, as-if-recognized items
are not constrained by the articulate of the double-entry book keeping system across accounts and over time.

An interesting question is that what role regulation of accounting standards (or standardization) plays in this background. Is the role for regulation different from the typical arguments based on externality or public goods types of market failure? To the extent that incompleteness in contracts is one form of market failure, the incomplete contracts approach may help develop a new theory of regulation of accounting recognition. This theory could help to answer questions like what are the trade-offs of deviating from GAAP (e.g., Leftwich (1983), Li (2009b), of using rolling versus frozen GAAP in contracts (e.g., Christensen and Nikolaev (2010)), or of having multiple accounting standards (e.g., Dye and Sunder (2001)).

8 Appendix

Proof of Lemma 1: In the bad state, the firm receives $B$ with continuation and 0 with liquidation ($L < F$). Thus, the firm’s incentive is not consistent with the optimal action in the bad state. In the good state, the lender receives $Y$ with continuation and $L$ with liquidation. Because, $L > Y$, the lender prefers liquidation even though the optimal action in the good state is to continue. Q.E.D.

Proof of Lemma 2: With exogenous $(\alpha, \beta)$, the ex ante efficiency, which is equal to the total surplus to the firm, is

$$V(\alpha, \beta) = (1 - 2q)(Y + B) + q(\alpha(Y + B) + (1 - \alpha)L) + q(\beta B + (1 - \beta)L)$$

$$= V^{FB} - q(1 - \alpha)C^{Lender} - q\beta C^{Firm}.$$

Therefore, $V_\alpha = qC^{Lender} > 0$ and $V_\beta = -qC^{Firm} < 0$. Limit $V(\alpha, \beta) = V^{FB}$. Q.E.D.

Proof of Proposition 1: Because $\alpha^*_x > 0$, $z_x(0) = 0$ and $z^*_{xx} > 0$, the first-order condition $\alpha^*_x B - z^*_x = 0$ implies that $x^* > 0$. Similarly, $y^* > 0$. Q.E.D.

Proof of Proposition 2: First, I show that $x^* < y^*$. From the first-order conditions (eqn. 1 and 2), $z^*_x = f_x(x^*; \alpha_0) / f_y(y^*; \alpha_0)$. Because $f^*_x = 0$, $f^*_s < 0$, and $\alpha_0 > \beta_0$, $0 < f_x(x^*; \alpha_0) = f_y(y^*; \alpha_0) <
Thus, $z^*_x < z^*_y$. Because $z^*_tt > 0$, $x^* < y^*$. Second, differentiating the first-order conditions (eqn. 1 and 2) with respect to $h$, $z^*_tt + z^*_th = 0$. $t^*_h = -\frac{z^*_h}{z^*_tt} < 0$, $t \in \{x, y\}$. Because $z^*_th > 0$ and $x^* < y^*$, $0 < z^*_xh < z^*_yh$. Because $z^*_tt$ is a constant, $\frac{z^*_h}{z^*_yh} = \frac{z^*_y}{z^*_xh} < 1$. Thus, $|x^*_h| < |y^*_h|$. Q.E.D.

**Proof of Proposition 3.** Differentiate $V^*$ (eqn. 3) with respect to $h$,

$$V^*_h = \frac{d\alpha^*}{dh}C_{Lender} - \frac{d\beta^*}{dh}C_{Firm} - d(z(x^*) + z(y^*)) \frac{dh}{dh}.$$ 

First, I show that $\frac{d(z(x^*)+z(y^*))}{dh} < 0$.

$$\frac{dz(t^*)}{dh} = z^*_tt + z^*_h = -\frac{z^*_h}{z^*_tt} + z^*_h = \frac{1}{z^*_tt}(z^*_tt - z^*_t z^*_th).$$

Note that

$$\frac{d(z^*_tt z^*_h - z^*_t z^*_th)}{dt} = z^*_tt z^*_h - z^*_tt z^*_th - z^*_t z^*_th = -z^*_t z^*_tt < 0$$

Thus, $(z^*_tt z^*_h - z^*_t z^*_th)$ is maximized as $t \to 0$. Because $\text{Limit } (z^*_tt z^*_h - z^*_t z^*_th) = (z^*_tt z^*_h(0) - z^*_t(0)z^*_th(0)) = 0$, $\frac{dz(t^*)}{dh} < 0$ when $t^* > 0$. Thus, $\frac{d(z(x^*)+z(y^*))}{dh} < 0$.

Therefore, a sufficient condition for $\frac{d\alpha^*}{dh}C_{Lender} - \frac{d\beta^*}{dh}C_{Firm} > 0$ is also sufficient for $V^*_h > 0$. I now show that $\frac{d\alpha^*}{dh}$ increases in $\alpha_0$ and $\frac{d\beta^*}{dh}$ increases in $\beta_0$.

$$\frac{d\alpha^*}{dh} = f_x(x^*; \alpha_0)x^*_h, \quad \frac{d\beta^*}{dh} = f_y(y^*; \beta_0)y^*_h$$

Differentiating the first-order conditions (eqn. 1 and 2) with respect to $\alpha_0$ and $h$, $\alpha^*_x \alpha_0 B - z^*_xx^*_x = 0$, $-z^*_xh \alpha_0 \alpha^*_x - z^*_xh \alpha^*_x = 0$. Thus,

$$x^*_{\alpha_0} = -\frac{z^*_xh \alpha^*_x}{z^*_x} = -\frac{z^*_xh \alpha^*_x B}{(z^*_x)^2} > 0,$$

$$\frac{d^2\alpha^*}{dh \alpha_0} = f^*_xh x^*_h + f_x(x^*; \alpha_0)x^*_h > 0.$$

Similarly, $\frac{d\beta^*}{dh}$ increases in $\beta_0$. Thus, $\frac{d\alpha^*}{dh}C_{Lender} - \frac{d\beta^*}{dh}C_{Firm}$ increases in $\alpha_0$ and decreases in $\beta_0$. Because $\text{Limit } \frac{d\alpha^*}{dh}C_{Lender} - \frac{d\beta^*}{dh}C_{Firm} = -\frac{d\beta^*}{dh}C_{Firm} > 0$, there exists a pair $(\alpha_0, \beta_0)$ such that $V^*_h(\alpha_0, \beta_0) > 0$. For example, $\alpha_0 = 1 - \varepsilon$ and $\beta_0 < \alpha_0$ are such a pair. If there
exists another pair \((\tilde{\alpha}_0, \tilde{\beta}_0)\) such that \(\tilde{\alpha}_0 \geq \alpha_0\) and \(\tilde{\beta}_0 \leq \beta_0\), then \(V_h(\tilde{\alpha}_0, \tilde{\beta}_0) \geq V_h(\alpha_0, \beta_0) > 0\). Q.E.D.

**Proof of Lemma 3**: When \(c\) is large, the gamble of generating an additional piece of evidence is not attractive to the firm any longer. By examining the influence function \(\alpha(x)\) (eqn. 5) and \(\beta(y)\) (6), when \(c \in [c_2, \infty]\), \(\alpha_x < 0\) and \(\beta_y \leq 0\), resulting in \(x^* = y^* = 0\). When \(c \in [c_1, c_2]\), \(\alpha_x \leq 0\) and \(\beta_y > 0\), leading to \(y^* > x^* = 0\). When \(c \in [0, c_1), 0 < \alpha_x < \beta_y\), leading to \(y^* > x^* > 0\). Q.E.D.

**Proof of Lemma 4**: All the properties are obtained by differentiating the influence function \(\alpha(x)\) (eqn. 5) and \(\beta(y)\) (6) with respect to various parameters.

**Proof of Proposition 4**: I have shown in the proof of Proposition 2 that \(x^* < y^*\).

Second, differentiating the first-order condition eqn. 1 and 2 with respect to \(c\), \(f_{tc}B - z_{tt}t_c^* = 0\), \(t \in \{x, y\}\). Because \(f_{tc} < 0\), \(t_c^* = \frac{f_{tc}B}{z_{tt}} < 0\). Thus, \(x_c^* = \frac{(1-a\alpha)}{2} B \frac{1}{z_{xx}}\) and \(y_c^* = \frac{(1-a\beta)}{2} B \frac{1}{z_{yy}}\). Because \(z_{xx} = z_{yy}\) (constants) and \(\alpha_0 > \beta_0\), \(|x_c^*| < |y_c^*|\). Q.E.D.

**Proof of Proposition 5**: Differentiate \(V^*\) (eqn. 3) with respect to \(c\),

\[
\frac{dV_c^*}{dc} = \frac{d\alpha^*}{dc} C_{Lender} - \frac{d\beta^*}{dc} C_{Firm} - \frac{d(z(x^*) + z(y^*))}{dc}.
\]

First, I show that \(\frac{dz(t^*)}{dc} < 0\), \(t \in \{x, y\}\). Differentiating the first-order conditions (eqn. 1 and 2) with respect to \(c\), \(f_{tc}^* = z_{tt}^* t_c^* = \frac{f_{tc}}{z_{tt}} < 0\). Therefore, \(\frac{dz(t^*)}{dc} = z_{tt}^* t_c^* < 0\).

Thus, the sufficient condition for \(\frac{d\alpha^*}{dc} C_{Lender} - \frac{d\beta^*}{dc} C_{Firm} > 0\) is also sufficient for \(V_c^* > 0\).

I now show that \(\frac{df(t^*; s)}{dc}\) increases in \(s\), \(s \in \{\alpha_0, \beta_0\}\).

\[
\frac{df(t^*; s)}{dc} = f_t^* t_c^* + f_c^* \quad \frac{df(t^*; s)}{dcds} = f_t^* t_c^* + f_t^* t_s^* + f_{tc} t_c^* + f_{cs} t_c^* > 0
\]

The last inequality holds because all four components are positive, which could be proved.
by differentiating the first-order conditions (eqn. [1] and [2]) with respect to various parameters repeatedly.

Therefore \( \frac{d\alpha^*_C}{dc} C_{Lender} - \frac{d\beta^*_C}{dc} C_{Firm} \) increases in \( \alpha_0 \) and decreases in \( \beta_0 \). Because \( \lim_{\alpha_0 \rightarrow 1} \frac{d\alpha^*_C}{dc} C_{Lender} - \frac{d\beta^*_C}{dc} C_{Firm} = -\frac{d\beta^*_C}{dc} C_{Firm} > 0 \), there exists a pair \((\alpha_0, \beta_0)\) such that \( V^*_c(\alpha_0, \beta_0) > 0 \). For example, \( \alpha_0 = 1 - \varepsilon \) and \( \beta_0 < \alpha_0 \) are such a pair. If there exists another pair \((\tilde{\alpha}_0, \tilde{\beta}_0)\) such that \( \tilde{\alpha}_0 \geq \alpha_0 \) and \( \tilde{\beta}_0 \leq \beta_0 \), then \( V^*_c(\tilde{\alpha}_0, \tilde{\beta}_0) \geq V^*_c(\alpha_0, \beta_0) > 0 \). Q.E.D.

Proof of Corollary 1: Fixing \( \alpha_0, \beta_0 \) and \( B \), \( \frac{d\alpha^*_C}{dc} \) and \( \frac{d\beta^*_C}{dc} \) are constants. Define \( \tilde{M} \equiv \frac{d\alpha^*_C}{dc} / \frac{d\beta^*_C}{dc} \). Thus, \( V^*_c > 0 \) if \( \frac{C_{Firm}}{C_{Lender}} > \tilde{M} \). Q.E.D.

Proof of Proposition 6: \( V(\alpha_0, \beta_0, B) = \min \{ V_{Firm}, V_{Lender} \} \)
\[ V_{Firm} = \min \{ C_{Firm}, C_{Lender} \} - \beta_0 C_{Firm} \]
\[ V_{Lender} = \min \{ C_{Firm}, C_{Lender} \} - \beta_0 C_{Lender} \]
It is positive if and only if \( \beta_0 < \tilde{\beta}_0 \equiv \min \{ C_{Firm}, C_{Lender} \} / C_{Firm} \). If \( C_{Firm} > C_{Lender} \), \( \tilde{\beta}_0 \) increases in \( C_{Firm} / C_{Lender} \). If \( C_{Firm} < C_{Lender} \), \( \tilde{\beta}_0 \) increases in \( C_{Lender} / C_{Firm} \). Thus, \( \tilde{\beta}_0 \) increases in the difference \( |C_{Firm} - C_{Lender}| \). Note \( \tilde{\beta}_0 \leq \frac{1}{2} \) and the equality holds only when \( C_{Firm} = C_{Lender} \).

A randomization among the three choices is equivalent to a randomization of the allocation of the control right between the firm and the lender. Denote \( \phi \) as the probability the control right is allocated to the firm, \( 0 \leq \phi \leq 1 \). This yields a surplus
\[ V_{Rand} = (1 - 2\phi)(Y + B) + q(\phi(Y + B) + (1 - \phi)L) + q(\phi B + (1 - \phi)L) - K \]
\[ = V_{FB} - \phi q C_{Firm} - (1 - \phi) q C_{Lender} \]
Thus, \( V_{Rand} \leq \max \{ V_{Firm}, V_{Lender} \} \). Randomization is dominated by uncontingent allocation. Q.E.D.

Proof of Proposition 7: The proof is straightforward by calculating the payoff to the firm at various points of time.
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