A Simple Model of The Costs and Benefits of Accounting Standards

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1 Introduction

If there is a feature distinguishing accounting from all other fields of business, it is the emphasize on standards: standards pervade accounting, whereas standards play a minor role in the fields of economics, finance, organizational behavior, etc. Given the importance of standards in accounting, one would expect there to be a substantial body of accounting research describing when standards serve a positive allocational function, as well as what form the standards will take. Yet there is surprisingly little theoretical work on accounting standards in the contemporary accounting research literature. In fact, some of the most prominent contemporary academic accountants seem openly skeptical about the notion that accounting standards and, more generally, accounting regulation, serve any socially desirable allocational role. For example, Beaver [1998] states that


The purpose of this paper is to provide a simple formal model in which some of the more salient costs and benefits of accounting standards can be examined. While the model cannot document that the accounting standards actually implemented do serve a socially valuable role, it does provide an indication of what circumstances may be most, or least, propitious for the emergence of accounting standards.

We begin by observing that accounting standards, by imposing uniformity in reporting, inevitably suppress some substantive differences among transactions, and this suppression compromises the information contained in the financial reports based on accounting standards. A clear example of this is SFAS 2, the reporting of research and development expenditures: the expenditures outlined
in SFAS 2 are expensed regardless of a firm’s past history of transforming R&D into commercially viable products, and regardless of the apparent success of its current R&D projects. Another clear example is the decision by the FASB to disallow any firm affected by the World Trade Center terrorist attacks from reporting the losses associated with those attacks as extraordinary items. That decision was apparently a result of the FASB’s inability to identify a criterion that clearly delineated between those firms whose losses were directly related to the terrorists’ activities, and those firms whose losses were at most peripherally related to the attacks. Though it is clear that the losses of some firms (e.g., airlines) were more closely connected to the WTC attacks than others (e.g., other firms in the tourism industry), the FASB’s decision had the effect of imposing uniformity in firms’ reporting that suppressed these differences. These are only two of myriad examples where accounting standards have suppressed variations in the reporting of transactions.

This uniformity is a cost of accounting standards. Were there no standards, however, the information contained in financial reports is also compromised. The problem is not that, in the absence of standards, firms would tend to inflate their stated financial condition – after all, if investors knew that all firms overstated earnings by, say, 10%, this would cause no interpretative problems with financial reports at all. Rather, the problem is that, without standards, different firms will tend to state their financial reports in different ways - perhaps using uncommon definitions for conventional terms, perhaps overstating, or understating, their performance by varying amounts, depending on circumstances, time periods, the ethics of their financial officers, etc. It is the variation in reporting that compromises investors’ ability to interpret financial reports prepared without the guidance of accounting standards.

It is not a priori obvious whether the information loss from the imposed homogenization of financial reports induced by accounting standards is greater or

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1 See the news release by the FASB’s Emerging Issues Task Force on 10/1/01.
less than the information loss related to the idiosyncratic non-substantive variations in financial reports introduced by the absence of accounting standards. The purpose of the present paper is to construct a simple model that identifies when accounting standards are, on net, beneficial or undesirable based on these two offsetting effects (imposed homogenization vs. non-substantive variation).

We start the formal analysis by describing an investment setting in which a firm’s financial reporting method influences its investment levels. We contrast the expected profits of a company under several standards regimes. We subsequently compare the performance of standards to a regime which can be interpreted as one in which there are either no accounting standards or else the accounting standards are sufficiently liberal so as to permit a variety of accounting reporting procedures. In the latter regime, reporting choice is constrained by costs associated with departing significantly from reports that reflect the economics underlying the transactions firms engage in. This comparison between the "standards" and "no standards" regimes may thus be considered one way of addressing, theoretically, the "principles vs. rules" debate.2

The comparison between "standards" and "no standards" regimes is conducted in two distinct settings, one a "competitive" capital market setting in which no investors need be induced, or compensated, to study a firm’s financial statements, and a second, imperfectly competitive setting in which investors are compensated for their activities involving information collection and analysis. In the imperfectly competitive setting, we evaluate the attitudes of informed investors and firms toward "standards" vs. "no standards" in two distinct settings: one in which the number of informed investors is fixed and constant across regimes (we call this the "short run") and one in which the number of informed investors is endogenously determined based on the costs and benefits of becoming an informed investor (we call this the "long run"). For the long run analysis,

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we also obtain comparative statistics regarding the number of informed investors in both the "standards" and "no standards" regimes.

We obtain necessary and sufficient conditions for "standards" to perform better economy-wide (as measured by aggregate economic profits) than "no standards" when capital markets are competitive and also, in the short-run, when capital markets are imperfectly competitive. In both these cases, we show that "standards" tend to perform better (resp., worse) than "no standards" when there is relatively little (resp., relatively a lot of) cross-sectional variation in transactions that are treated homogenously under the standards, and also when there is substantial (resp., little) variation in firms' financial reports under "no standards" due to value-irrelevant variations in a firm's financial reporting environment. We show that, in the long run in imperfectly competitive securities markets, the factors that contribute to the superior performance of "standards" over "no standards" can be quite different than in the short-run, because the more informative a firm's financial reports are, the less likely is entry by informed investors into the capital market, and entry to the capital market by informed investors is an informational substitute for informative accounting reports. We additionally establish when there is tension between the preference orderings between "standards" and "no standards" by value-maximizing firms and profit-maximizing informed traders when the capital market is imperfectly competitive.

The model that follows is simple, but we believe it captures some of the fundamental elements influencing the desirability of accounting standards. It is, to the best of our knowledge, the only model in all of the theoretical literature on accounting that evaluates the costs and benefits of accounting standards.
2 Base Model

2.1 The Description of Accounting Reports and Accounting Standards

We start with an abridged description of the model (several aspects of this description will be clarified below). There are a collection of firms indexed by $i$. Each firm privately learns the realization of some context-specific information $\tilde{\theta}_i$ that will affect the future economic value of its transactions. It then selects an accounting reporting procedure $T_i(\bullet)$ according to which firm $i$’s future accounting reports will be constructed. The reporting procedure selected is assumed to be public information. At the same time it chooses a reporting procedure, firm $i$ invests $I_i$ in a production process that affects the expected volume of (e.g., sales) transactions it subsequently engages in. Both the volume and economic value of these transactions then realize their values. These economic values are not publicly observable. The firm subsequently releases its financial report, which provides information about the transactions that the firm has engaged in, after which the firms are sold for life cycle reasons to a collection of risk-neutral investors. The value of each firm at the time of sale is the value the risk-neutral investors assign to the value of the transactions it has engaged in, conditional on whatever information the investors glean about the transactions from observing the firm’s financial report. The goal of the initial owners of each firm is to maximize the firm’s expected selling price net of the cost of their initial investment.

We note that, in all of what follows, it makes no difference whether the transactions a firm engages in (that are being priced by investors) involve both the production and sale of some product or merely the production (but not the sale) of a product, as long as the property rights over the value of the transactions (whatever they may be) are transferred to the investors who buy the firm.
We now provide more details about this setup. The expected volume (not the expected value) of the firm’s transactions conditional on the private investment $I_i$ is given by $E[\tilde{q}_i|I_i] = 2\sqrt{T_i}$. Suppose the firm actually engages in $q_i$ transactions, with $i_1, i_2, \ldots, i_{q_i}$ indexing the individual transactions. For transaction $i_j$, there is a random variable (or random vector, depending on dimensionality) $\tilde{\omega}_{ij}$ that summarizes what is recorded in firm $i$’s general ledger about the $i_j$th transaction, for each $j = 1, 2, \ldots, q_i$. (In general, $\tilde{\omega}_{ij}$ may be multi-dimensional, but we often confine $\tilde{\omega}_{ij}$ to be one-dimensional in much of the discussion and analysis that follows.) All $\tilde{\omega}_{ij}$ are iid with (common) mean $m$. The general ledger summarizing the book values of all $q_i$ transactions is given by the vector $\tilde{\omega}_i = (\tilde{\omega}_{i1}, \tilde{\omega}_{i2}, \ldots, \tilde{\omega}_{iq_i})$.

The book value of transaction $i_j$ is not the same as the transaction’s economic or market value. Rather, the economic value of the transaction is determined by adjusting the transaction’s book value to reflect some context-specific variation across the transactions. Specifically, for each transaction $i_j$, there is assumed to be some random variable (or, more generally, random vector) $\tilde{\theta}_{ij}$ such that the economic value of transaction $i_j$ is given by $\tilde{\theta}_{ij}\tilde{\omega}_{ij}$ (in case $\tilde{\omega}_{ij}$ is a vector, $\tilde{\theta}_{ij}\tilde{\omega}_{ij}$ is a dot product). The aggregate economic value of all $q_i$ transactions that occur at firm $i$ is given by $S_i = \sum_{j=1}^{q_i} \tilde{\theta}_{ij}\tilde{\omega}_{ij}$. The original, beginning of period, context-specific information $\theta_i$ and the "adjusting values" $\tilde{\theta}_{ij}$ associated with firm $i$’s actual transactions are linked through the expectation: $E[\tilde{\theta}_{ij}|\theta_i] = \theta_i$ for each $j = 1, \ldots, q_i$. The financial reporting procedure $T_\lambda(\bullet)$ converts what is recorded about each transaction $\tilde{\omega}_{ij}$ in the company’s general ledger into a component of the firm’s published financial report: $T_\lambda(\tilde{\omega}_{ij})$. As is true in practice, the investors who purchase the firm from its initial owners do not get to observe either the firm’s general ledger $\tilde{\omega}_i$ nor its vector of constituent component accounting reports $(T_\lambda(\tilde{\omega}_{i1}), T_\lambda(\tilde{\omega}_{i2}), \ldots, T_\lambda(\tilde{\omega}_{iq_i}))$. Rather, the investors observe just the aggregated report $R_i = \sum_{j=1}^{q_i} T_\lambda(\tilde{\omega}_{ij})$. The firm’s selling price conditional on the accounting report $R_i$ is given by $E[S_i|R_i]$. 

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We now provide some additional commentary about this setup. One may ask: why doesn’t the bookkeeping entry \( \omega_{ij} \) for transaction \( ij \) contain all the information required to determine the economic value of the transaction? In practice, there are a variety of reasons: the bookkeeper might not have the expertise to record this information, the firm’s accounting system may not be capable of capturing the qualitative information that helps determine the expected economic value of a transaction, the information \( \theta_{ij} \) may be soft (in the sense of Ijiri [1975]) and the accounting library (as in Demski [1994]) may record only "hard" (in the sense of Ijiri [1975]) information, etc. Since the bookkeeping entry corresponding to a transaction typically will not equal the transaction’s economic value, the economic value of a transaction can be obtained from the bookkeeping entry of the transaction only by adjusting the value of the bookkeeping entry, as we have done through the product \( \hat{\theta}_{ij} \hat{\omega}_{ij} \).

This idea of having to make an adjustment to the book value of a transaction to arrive at the transaction’s market value is common to most transactions, as the following four examples illustrate. Consider, as possible bookkeeping entries \( \hat{\omega}_{ij} \) : (1) the acquisition cost of the inventory, (2) the dollar value of a credit sale, (3) the selling price of an airline ticket to an individual who participated in the airline’s frequent flier program, (4) the wage paid to a laborer, etc. The adjustment of the bookkeeping entry so as to reflect the economic value of the transaction in each of these four examples is performed: (1) in the case of the inventory acquisition, by correcting for the difference between the market value and the historical cost of a unit of inventory; (2) in the case involving credit sales, by adjusting for the effects of bad debt expense; (3) in the case involving the sale of an airline ticket, by adjust the bookkeeping entry of the airfare for the expected cost of redeeming the frequent flier miles associated with the fare; and (4) in the case involving a worker’s wage payment, by adjusting the worker’s wages to reflect the cost of fringe benefits. In all four examples, the bookkeeping value of a transaction must be adjusted to reflect the transaction’s market value,
consistent with the formal setup described above.

What is the financial reporting procedure $T_\lambda(\bullet)$? In general, we think that a financial reporting procedure is an algorithm, or operator, that converts what is recorded about transactions into components of a financial report. The input for the algorithm is whatever information the firm collects about the transactions. The algorithm can be either purely inward-focused and mechanical (e.g., the process by which FIFO assigns inventory values, or more generally, any purely historical cost–based accounting procedure), or the algorithm can take into account external information in converting the transactions into components of a financial statement (e.g., the "lower of cost or market" method, or more generally any accounting procedure that takes into account the fair or market values of transactions). Many financial reporting procedures in practice utilize a combination of inward-looking and externally-focused information. For example, SFAS 87 describes specific procedures to be followed in calculating a firm’s pension liability and periodic pension expense, which incorporates the (inward) details of the pension plan and the aging of a firm’s labor force as well as (external) information about the applicable interest rates by which to either discount the pension liability or to record the growth in pension assets.

Though the algorithms used to construct financial reports are often complex, for tractability, we confine analysis to algorithms that are simple scalar linear functions of the (generally assumed one-dimensional) book values of transactions. Specifically, we suppose they take the form $T_\lambda(\hat{\omega}_i) = \lambda \hat{\omega}_i$, and that

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3In the paper, a financial reporting procedure is assumed to be described sufficiently completely so that there is no ambiguity in how to apply the procedure to individual transactions. Given this assumption, it is appropriate to refer to the procedure by which transactions reported according to an accounting standard as an "algorithm." We recognize that, in practice, there may be some vagueness in the statement of an accounting standard, so that two different accountants could arrive at different financial reports for transactions prepared ostensibly in conformity with the same standard. This possibility is inconsistent with the notion of an algorithm (in which the identity of the machine, person, etc., executing the algorithm has no influence on the output of the algorithm). In the model below, we also consider financial reporting procedures that give preparers some latitude in how financial reports are presented.

The notion of financial reporting procedures as operators has antecedents in the accounting literature. See, e.g., Arya et al [forthcoming].
financial reports are given by the aggregate \( R_i = \sum_{j=1}^{q_i} T_{\lambda}(\tilde{\omega}_{ij}) \). \(^4\)

To interpret the variable \( \tilde{\theta}_i \), note that the product \( m\tilde{\theta}_i = E[\tilde{\theta}_i \tilde{\omega}_{ij}] \) represents an unbiased estimate of the expected economic value of a single transaction, given \( \theta_i \). Thus, while the firm, at the time it makes its investment decision, has some private prior knowledge about the value of the transactions it will subsequently engage in, the realized market value of a transaction can depart from the transaction’s prior expected value for two reasons: the realized information about the transaction recorded in the general ledger \( \tilde{\omega}_{ij} \) can deviate from its expected level \( (m) \), and the other "adjusting information" \( (\tilde{\theta}_i) \) relevant for pricing a transaction but not recorded in the firm’s general ledger can deviate from its expected value \( \tilde{\theta}_i \).

An accounting standard, or financial reporting procedure, is represented by a particular \( T_{\lambda}(\cdot) \), with different procedures represented by different choices of \( T_{\lambda}(\cdot) \). Notice that if the index \( \lambda \) for the financial reporting procedure \( T_{\lambda}(\cdot) \) happens to be the same as (resp., is close to) the contextual information \( \theta_{ij} \) of a transaction, then the accounting report of the transaction perfectly (resp., approximately) captures the economic value of the transaction.

We suppose that there are some commonalities in the economic context \( \theta_i \) of transactions across firms. Specifically, we suppose that \( \theta_i = \eta + \tilde{\epsilon}_i \), for some variable \( \eta \), where \( \eta \) captures the central tendency in the economic context of a (particular class of) transaction(s) and the error term \( \tilde{\epsilon}_i \) denotes the idiosyncratic components of the economic context of transactions specific to firm \( i \).\(^5\) This is natural: for example, while the cost of honoring frequent flier miles may be different across different programs, there will be some similarities in

\(^4\)While it might seem that the choice of \( \lambda \) is irrelevant here (as long as \( \lambda \neq 0 \)), we will see in the following that the choice among financial reporting procedures does in fact have allocational effects.

\(^5\)Notice that there are two types of variation being addressed in the paper. First, for a given firm, there is variation in the economic values of its transactions - represented by variations in the realization of \( \tilde{\theta}_{ij} \) for a given \( \tilde{\theta}_i \). This variation was introduced previously. Second, there is also variation across \( \tilde{\theta}_i \), i.e., across firms.
the costs of operating these programs. Likewise, though the return to research and development expenditures for pharmaceutical firms will be different across firms, there will be some commonalities in the returns to R&D efforts across programs. We take the error terms $\tilde{\varepsilon}_i$ to have mean zero and to be independent of the central tendency term $\eta$. In the following, we let $\eta$ be either constant or stochastic; if $\tilde{\eta}$ is stochastic, we let its mean and variance be denoted by $\tilde{\eta}$ and $\sigma_\eta^2$. Throughout the following, we take the distribution of $\tilde{\varepsilon}_i$ to be non-degenerate, with a positive variance $\sigma_\varepsilon^2$, and we assume that $\tilde{\omega}_{ij}$ is independent of $\tilde{\eta}$ and $\tilde{\varepsilon}_i$.

What we mean by the "standards regime" is simply this: the same operator $T_\lambda(\bullet)$ is used by all firms to report a designated set of transactions.

In brief, what the paper does is to compare (1) the performance of the economy when all firms are forced to adhere to the same financial reporting procedure to (2) the performance of the economy when every firm gets to choose its own, unique financial reporting procedure.

We end this section by discussing the two principal types of accounting standards we study. One standard is a "fixed" accounting standard $T_\lambda(\bullet)$, where $\lambda \neq 0$ is fixed, and the second is the "normal" standard $T_\eta(\bullet)$, where (recall) $\theta_i = \eta + \varepsilon_i$. A fixed standard represents historical cost accounting well, if the bookkeeping entry $\tilde{\omega}_{ij}$ of a transaction consists of the transaction’s historical cost and $\lambda = 1$. A normal standard provides a representation of fair value accounting (for a class of transactions) if each transaction in the class is recorded at the average value of all transactions across firms who engage in that transaction.

In the "no-standards" regime, a firm can prepare its financial report using whatever financial reporting procedure $T_\lambda(\bullet)$ it wants to, but it incurs greater costs in selecting some reporting procedures than others. We suppose that, if the firm’s context-specific information is $\theta_i$, and it chooses financial reporting procedure $T_{\tilde{\eta}}(\bullet)$, then ex post it incurs the cost $5c(\tilde{\theta}_i - \theta_i - \delta_i)^2\omega_{ij}$ for a trans-
action with book value $\omega_{i,j}$. There are two interpretations of the (assumed) normal, mean zero random variable $\delta_i$. In the first interpretation, the management of the firm only gets to see $\theta_i$ with error at the time it selects its financial reporting procedure $T_\theta(.)$. Specifically, it only gets to see $\theta_e = \hat{\theta}_i + \delta_i$. Under this interpretation, the firm incurs a cost $0.5c(\hat{\theta}_i - \theta_e)^2$ in reporting any amount $\hat{\theta}_i$ different from what it sees. In the second interpretation, the management of the firm sees $\hat{\theta}_i$ perfectly, but the cost it incurs in reporting $\hat{\theta}_i \neq \theta_i$ varies with not just the realization of $\hat{\theta}_i$, but also with the realization of the exogenous random variable $\delta_i$. Under this second interpretation, the random variable $\delta_i$ is intended to capture the many aspects of a firm’s reporting environment that cannot be understood by outsiders to a firm but that, nevertheless, can influence the firm’s reporting decision. In the following, we assume $\delta_i$ is uncorrelated with $\hat{\theta}_i$, $\bar{\theta}_{ij}$, and $\tilde{\omega}_{ij}$ for all $i$ and $ij$. We scale the misreporting costs by the size of the book value of the transactions to capture the idea that if these misreporting costs typically include litigation-related expenses, and so the misreporting of transactions with large book values is more costly than for transactions with small book values.\footnote{Results would be quite different if the misreporting costs were incurred only once rather than on a “per transaction” basis. One can make arguments in favor of either one-time fixed costs (e.g., constructing a contract that gets applied to multiple transactions) or variable costs (e.g., giving customers special terms of sale to secure early recognition of revenue).}

2.2 First-Best Production

As a reference point for what follows, we begin with a description of the first-best investment policy.

**Definition 0** A first-best investment policy consists of a function $I^B_i(\theta_i)$

\footnote{We have also studied variations in this technology in which the cost of misreporting varies with the realized value $\theta_{ij}$. That is, rather than have the misreporting cost function be of the form $0.5c(\hat{\theta}_i - \theta_i - \delta_i)^2\omega_{ij}$, we take the misreporting cost function to be given by $0.5c(\hat{\theta}_i - \theta_i - \delta_i)^2\omega_{ij}$. The results that follow for this alternative cost specification are quite similar to the results we report in the text below.}
where, for each $\theta_i$, $I^*_i(\theta_i)$ maximizes $\mathbb{E}[\sum_{j=1}^{\hat{\theta}_i} \hat{\theta}_i \hat{\omega}_i | I_i, \theta_i] - I_i = 2m \theta_i \sqrt{T_i - I_i}$.

It is clear that $I^*_i(\theta_i) = (\theta_i m)^2$ for $\theta_i > 0$ and $I^*_i(\theta_i) = 0$ for $\theta_i < 0$. Given first-best investment, the expected profits of firm $i$ with $\hat{\theta}_i = \theta_i > 0$ are given by $\mathbb{E}[\sum_{j=1}^{\hat{\theta}_i} \hat{\theta}_i \hat{\omega}_i | I^*_i(\theta_i), \theta_i] - I^*_i(\theta_i) = 2\theta_i m \sqrt{T_i^B(\theta_i)} - I^*_i(\theta_i) = (\theta_i m)^2$.

In the following, we suppose that the distribution of $\hat{\theta}_i$ across firms is normally distributed with mean $\bar{\theta}$ and variance $\sigma^2$. We let the density associated with this distribution be denoted by $f(\theta | \bar{\theta}, \sigma^2)$. It follows that the economy-wide (not firm-specific) performance of the economy when each firm adopts a first-best investment policy is $m \int_{\theta > 0} \theta^2 f(\theta | \bar{\theta}, \sigma^2) d\theta$. In the following, we employ the approximation

$$\int_{\theta > 0} \theta^2 f(\theta | \bar{\theta}, \sigma^2) d\theta \approx \int \theta^2 f(\theta | \bar{\theta}, \sigma^2) d\theta$$

(1)

in representing the performance of the economy. It is clear that this approximation becomes increasingly accurate as $\bar{\theta}$ increases. Using this approximation, we can record the first-best performance of the economy as follows.

**Lemma 1** Using (1), the first-best expected performance of the economy is approximated by

$$m^2 \mathbb{E}[\hat{\theta}_i^2] = m^2 \times (E[\bar{\theta}^2] + \sigma^2).$$

(2)

These approximate first-best profits are typically not achievable, for two reasons: first, the individuals making investment decisions (the firm’s initial owner(s)) are not the individuals reaping the benefits of those investments (the investors who buy the firm); in addition, there are information asymmetries between the initial owners making the investment decisions and the future investors who capture the fruits of the initial owners’ investment decisions.
2.3 The performance of various standards regimes when capital markets are competitive

As discussed previously, a fixed standard regime is defined by the accounting reporting procedure $T_\lambda(\bullet)$, where $\lambda$ is some known fixed constant. The definition of an equilibrium corresponding to a fixed standard is as follows:

**Definition 1** An equilibrium relative to a fixed standard $\lambda \neq 0$ consists of a pricing equation $P_i(R_i) = P_i(\sum_{j=1}^{\hat{q}_i} T_\lambda(\tilde{\omega}_{ij}))$ and an investment policy $I_i^*$ for every firm $i$ such that

(i) taking the pricing function $P_i(R_i)$ as given, firm $i$’s investment $I_i^*$ attains

$$\max_{I_i} E[P_i(\sum_{j=1}^{\hat{q}_i} T_\lambda(\tilde{\omega}_{ij}))|R_i] - I_i.$$  

(ii) for all $R_i = \sum_{j=1}^{\hat{q}_i} T_\lambda(\tilde{\omega}_{ij})$, the pricing equation satisfies

$$P_i(R_i) = E[\sum_{j=1}^{\hat{q}_i} \tilde{\omega}_{ij}|R_i].$$

The analysis of an equilibrium relative to a fixed standard is straightforward. Given firm $i$’s financial report $R_i$, the value investors attach to the firm is given by $E[\sum_{j=1}^{\hat{q}_i} \hat{\theta}_{ij} \tilde{\omega}_{ij}|R_i]$. Since $\hat{\theta}_{ij}$ and $\tilde{\omega}_{ij}$ are taken to be independent of each other, there is no information in the realization of any $\tilde{\omega}_{ij}$ that reveals anything about the realization of any $\hat{\theta}_{ij}$ for any $j$ and $j'$. Thus, for all $ij$, $E[\hat{\theta}_{ij}|\tilde{\omega}_{i1}, \tilde{\omega}_{i2}, \ldots, \tilde{\omega}_{iq}] = \tilde{\eta}$. This implies $E[\hat{\theta}_{ij} \sum_{j=1}^{\hat{q}_i} T_\lambda(\tilde{\omega}_{ij})] = E[\hat{\theta}_{ij}|R_i] = \tilde{\eta}$ too. This gives rise to the central fact that:

$$E[\sum_{j=1}^{\hat{q}_i} \hat{\theta}_{ij} \tilde{\omega}_{ij}|R_i] = \tilde{\eta}E[\sum_{j=1}^{\hat{q}_i} \tilde{\omega}_{ij}|R_i] = \tilde{\eta}R_i/\lambda. \quad (3)$$

That is, the pricing equation $P_i(R_i)$ is given by $P_i(R_i) = \tilde{\eta}R_i/\lambda$. Since $E[\tilde{R}_i R_i] = \lambda m \times 2\sqrt{T_i}$, it follows that $E[P_i(\tilde{R}_i)|R_i] = 2\tilde{\eta}m\sqrt{T_i}$. It follows that the initial owners of firm $i$ seek to maximize $2\tilde{\eta}m\sqrt{T_i} - I_i$. If $\tilde{\eta} > 0$ and $m > 0$ (as we shall assume), the optimal investment $I_i^*$ for firm $i$ is given by $I_i^* = (m\tilde{\eta})^2$. From this,
it is easy to check that the equilibrium expected profits of firm \( i \) under the fixed standard \( \lambda \neq 0 \) are \((m\bar{\epsilon})^2\) too. Since this is true for every firm \( i \), no matter what the realization of \( \hat{\theta}_i \), we have the following result.

**Lemma 2** The expected performance of the economy under a fixed standard \( T_\lambda(\bullet) \) for \( \lambda \neq 0 \) is given by \((m\bar{\epsilon})^2\).

Perhaps the most important observation about a fixed standard regime is that the firm’s equilibrium investment policy does not utilize information available to the firm’s initial owners. This occurs since the future owners of the firm are unable to observe - and hence are unable to price - any of the context-specific information that the initial owners possess. This failure of the initial owners to exploit their context-specific information results in an expected performance level that is (perhaps substantially) below first-best expected performance. The general observation here is that when the initial owners of a firm seek to maximize future investors’ perceptions of the firm’s value, they are likely to make investment decisions that appear to be optimal from the standpoint of the information set that they know future investors will have available to them at the time the firm is priced/sold, and they will tend to disregard the superior information that the initial investors themselves have about the returns to investment. This point is related to a similar observation by Brandenburger and Pollack [1996].

The next standard we examine is a "normal" standard, \( T_\eta(\bullet) \). Here, \( \eta \) refers to the central tendency in the contextual element of a standard (recall \( \theta = \eta + \varepsilon_1 \)).

Given the general ledger \( \tilde{\omega}_i = (\tilde{\omega}_{i1}, \tilde{\omega}_{i2}, ..., \tilde{\omega}_{iq_i}) \) of realized transactions for firm \( i \),

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\(^8\)Though we have not been able to construct it, there may be another equilibrium in which investors can draw some inferences about the realized value of \( \hat{\theta}_i \) from observation of the firm’s accounting report by conjecturing that there is a relationship between the number \( q_i \) of transactions the firm engages in and the value of \( \hat{\theta}_i \). In practice, we do not believe that such an alternative equilibrium, if it exists, is of practical importance, since any such equilibrium’s construction would depend upon investors having a detailed knowledge of a firm’s production function. In contrast, the equilibrium discussed in the text holds even when investors are completely ignorant of the production function that generated a firm’s transactions.
the financial report under a normal standard is $\sum_{j=1}^{\tilde{q}_i} T_{ij}(\omega_{ij})$. Clearly, a normal standard suppresses some differences among transactions, but it does capture some extra information about the transactions relative to a fixed standard.

The formal definition of an equilibrium corresponding to a normal standard parallels that of a fixed standard given above, with $\eta$ replacing $\lambda$. It is not repeated here. The central fact involving normal standards is the counterpart to the expectation (3). It is given by:

$$E[\sum_{j=1}^{\tilde{q}_i} \tilde{\theta}_{ij} \tilde{\omega}_{ij}] = E[\sum_{j=1}^{\tilde{q}_i} \tilde{\theta}_{ij} \rho_{ij}^* | R_i] = \eta E[\sum_{j=1}^{\tilde{q}_i} \tilde{\omega}_{ij} | R_i] = R_i. \quad (4)$$

Given this central fact, it follows almost immediately that the equilibrium investment policy under a normal standard is $I^*_n(\eta) = (\eta m)^2$ for $\eta > 0$ and is 0 otherwise, and so the expected performance of a normal standard is as reported in the next lemma.

**Lemma 3** Using (1), the expected performance of a normal standards regime is approximated by $m^2 \times E[\eta^2]$.

Since $E[\eta^2] > \tilde{\eta}^2$ as long as $\bar{\eta}$ is not degenerate, it is clear that the expected performance of a normal standard dominates that of a fixed standard. The superior performance results from the fact that at least some of the context-specific information gets relayed to future investors through the accounting report under a normal standard, and hence the initial investors have an incentive to predicate their investment decision on some of that information. However, since

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9 This is the only replacement necessary as long as we assume that, in addition to observing $\theta_i$, the initial owners also observe the central tendency $\eta$ in transactions at the time they select their investment levels. If the initial owners did not know the central tendency $\eta$, then the definition of equilibrium would be slightly different, since the initial owners would have to make estimates of $\eta$ based on observing $\theta_i$.

10 This follows from almost the same deductions used in the fixed standards case: the presumed independence of $\tilde{\theta}_{ij}$ and $\tilde{\omega}_{ij}$ implies that for all $i, T[\tilde{\theta}_{ij} | \omega_{ij}, \tilde{\omega}_{ij}, \tilde{\theta}_{ij}, T_{ij}(\bullet)] = \eta$. So, $E[\tilde{\theta}_{ij} | \sum_{j=1}^{\tilde{q}_i} T_{ij}(\omega_{ij}), T_{ij}(\bullet)] = E[\tilde{\theta}_{ij} | R_i, T_{ij}(\bullet)] = \eta R_i/\eta = R_i$, and thus $E[\sum_{j=1}^{\tilde{q}_i} \tilde{\theta}_{ij} \tilde{\omega}_{ij} | R_i] = \eta E[\sum_{j=1}^{\tilde{q}_i} \tilde{\omega}_{ij} | R_i] = \eta R_i/\eta = R_i$.

11 To see this, note that it follows from (4) that the pricing equation $P_t(R_i)$ is given by $P_t(R_i) = R_i$. Since $E[R_i | I, \eta] = \eta m \times 2\sqrt{T}$, it follows that $E[P_t(R_i) | I, \eta] = 2\eta m / T$. It follows that the initial owners of firm $i$ seek to maximize $2\eta m / T - I_i$. If $\eta > 0$ and $m > 0$, the optimal investment is $I_i^* = (m\eta)^2$. 

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the equilibrium investment decision fails to make use of all the context-specific information available to the initial owners of the firm, the performance of a normal standard still falls short of the performance of first-best investments, as a comparison of Lemmas 1 and 3 makes clear.

One could define other standards - e.g., by selecting the economic context $\theta_i$ of the transactions of a particular firm $i$, and use the value $\theta_i$ as the basis for the financial reporting procedure $T_{\hat{\theta}_i}(\bullet)$ to be used by all firms. Since it is clear that this approach is in general inferior to normal standards, we do not pursue the calculations of the performance of such "representative firm" standards here.

2.4 The "No Standards" Regime

We next introduce the definition of an equilibrium for an economy with "no standards". Recall that, in the "no standards" regime, a firm can choose whatever financial reporting procedure it wants to, but it pays a cost for having a financial reporting procedure that results in reports that differ from its underlying economics.

**Definition 2** An equilibrium relative to an economy with "no standards" consists of a pricing equation $P_i(R_i, T_{\hat{\theta}_i}(\cdot))$, a reporting policy $\hat{\theta}_i = \hat{\theta}_i(\theta_i, \delta_i)$ and an investment policy $I^*_i(\theta_i, \delta_i)$ for every firm $i$ such that

(i) taking the pricing equation $P_i(R_i, T_{\hat{\theta}_i}(\cdot))$ as fixed, for each $\theta_i$ and $\delta_i$, the investment policy $I^*_i(\theta_i, \delta_i)$ and the reporting policy $\hat{\theta}_i(\theta_i, \delta_i)$ attain

$$\max_{I_i, \hat{\theta}_i} \mathbb{E}[P_i(\sum_{j=1}^{q_i} T_{\hat{\theta}_j} (\tilde{\omega}_{ij}), T_{\hat{\theta}_i}(\bullet)) - \sum_{j=1}^{q_i} .5c(\hat{\theta}_i - \theta_i - \hat{\delta}_i)^2 \tilde{\omega}_{ij} | I_i] - I_i.$$ 

(ii) taking as given the investment policy $I^*_i(\theta_i, \delta_i)$ and reporting policy $\hat{\theta}_i(\theta_i, \delta_i)$, for each report $R_i = \sum_{j=1}^{q_i} T_{\hat{\theta}_j} (\omega_{ij})$, the pricing function $P_i(R_i, T_{\hat{\theta}_i}(\bullet))$ satisfies

$$P_i(R_i, T_{\hat{\theta}_i}(\bullet)) = \mathbb{E}[\sum_{j=1}^{q_i} \hat{\theta}_{ij} \tilde{\omega}_{ij} | R_i].$$
This definition is straightforward. In (i), the firm takes how the capital market prices financial reports as given, when choosing what kind of report manipulation, and how much investment, to engage in. In (ii), we see that the capital market correctly prices, on average, the market value of transactions, based on observing the aggregated report $R_i$.

In the "no standards" regime, we will restrict attention to equilibria that satisfy the following two properties:

**Definition 3** An equilibrium in the "no standards" regime is linear provided the pricing equation $P_i(\mathbf{R}_i; \mathbf{T}^\ast_i(\cdot))$ is linear in $\mathbf{R}_i$, that is, there are functions $g(\hat{\theta}_i)$ and $h(\hat{\theta}_i)$ such that $P_i(\mathbf{R}_i; \mathbf{T}^\ast_i(\cdot)) = g(\hat{\theta}_i) + h(\hat{\theta}_i)R_i$.

**Definition 4** The pricing equation $P_i(\mathbf{R}_i, \mathbf{T}^\ast_i(\cdot))$ associated with the equilibrium reporting policy $\hat{\theta}_i = \hat{\theta}_i(\theta, \delta)$ and investment policy $I_i^\ast(\theta, \delta)$ is said to be separable provided when $R_i = \hat{\theta}_i \sum_{j=1}^{\hat{q}_i} \hat{\omega}_{ij}$, the pricing equation takes the form $P_i(\mathbf{R}_i, \mathbf{T}^\ast_i(\theta, \delta)(\cdot)) \equiv G(\sum_{j=1}^{\hat{q}_i} \hat{\omega}_{ij}, E[\hat{\theta}_i(\theta, \delta)])$ for some bivariate function $G(\cdot)$.

Restricting attention to equilibria in which prices are linear in a firm’s financial reports is commonplace, but the assumption of separability is less common and deserves comment. It amounts to the requirement that investors estimate the realized value of the context-specific information $\mathbf{R}_i$ by observing the firm’s choice of financial reporting procedure $(T_{\hat{\theta}_i} = T_{\hat{\theta}_i}(\theta, \delta))$, but they do not use the value of the sum of the bookkeeping entries $\sum_{j=1}^{\hat{q}_i} \hat{\omega}_{ij}$ (which is inferable from observing the financial report $R_i$ and the financial reporting choice $T_{\hat{\theta}_i}$) in forming this estimate. If the number of bookkeeping entries is a constant, say $q^0_i$, then there would be no information in principle derivable from the sum of bookkeeping entries that would reveal information about the realized value $\hat{\theta}_i$, in which case the assumption of separability automatically holds. But when
the number of bookkeeping entries is variable, investors who know that firm i's production function is $E[\hat{q}_i|I] = 2\sqrt{T}$ might be able to infer something about the realized value of $\hat{q}_i$ by engaging in the following three-step process. First, make inferences about the realized number $\tilde{q}_i$ of transactions by observing the sum $\sum_{j=1}^{\tilde{q}_i} \tilde{\omega}_{ij}$. Second, make inferences about the equilibrium investment $I^*$ based on the inferences formed about $\tilde{q}_i$. Third, make inferences about $\tilde{q}_i$ based on conjecturing how the firm’s equilibrium investment choice $I^*$ varies with $\theta_i$. Executing such a complicated sequence of inferences is difficult for investors to do. It is impossible if investors do not know the firm’s production function for transactions. By confining attention to separable equilibria, which we do throughout the following in analyzing the “no standards” case, we are implicitly assuming that investors do not know the firm’s production function.\footnote{This discussion relates to the previous discussion in footnote 7 above about the possibility of alternative equilibria for either fixed or normal standards.}

We start analyzing the case of "no standards" by conjecturing that there is a linear separable equilibrium with $g(\hat{\theta}_i) \equiv 0$ and $h(\hat{\theta}_i) = \frac{a}{\hat{\theta}_i} + b$ for some constants $a$ and $b$, and then we constructively establish what values $a$ and $b$ must assume in order for this conjecture to be correct. If there were such a linear equilibrium, then the firm’s investment policy and reporting policy would be chosen to maximize

$$
E\left[ \frac{aR_i}{\theta_i} + bR_i - 5c \sum_{j=1}^{\tilde{q}_i} (\hat{\theta}_i - \tilde{\theta}_i - \tilde{\delta}_i)^2 \tilde{\omega}_{ij} | I_i \right] - I_i
$$

$$
= E\left[ \frac{\sum_{j=1}^{\tilde{q}_i} T_{\theta_i} (\tilde{\omega}_{ij})}{\theta_i} + b \sum_{j=1}^{\tilde{q}_i} T_{\theta_i} (\tilde{\omega}_{ij}) - .5c \sum_{j=1}^{\tilde{q}_i} (\hat{\theta}_i - \tilde{\theta}_i - \tilde{\delta}_i)^2 \tilde{\omega}_{ij} | I_i \right] - I_i
$$

$$
= E\left[ \sum_{j=1}^{\tilde{q}_i} (a + b\hat{\theta}_i - .5c(\hat{\theta}_i - \tilde{\theta}_i - \tilde{\delta}_i)^2) \tilde{\omega}_{ij} | I_i \right] - I_i
$$

$$
= 2m \sqrt{T_i} (a + b\hat{\theta}_i - .5c(\hat{\theta}_i - \tilde{\theta}_i - \tilde{\delta}_i)^2) - I_i.
$$

This leads to the first-order condition:

$$
\hat{\theta}_i(\theta_i, \delta_i) = \theta_i + \delta_i + \frac{b}{c}.
$$

\footnote{This discussion relates to the previous discussion in footnote 7 above about the possibility of alternative equilibria for either fixed or normal standards.}
Hence, the market’s inference about $\hat{\theta}_i$, given the report $\hat{\theta}_i$, is:

$$E[\hat{\theta}_i|\hat{\theta}_i] = E[\hat{\theta}_i] + \frac{\text{cov}(\hat{\theta}_i, \hat{\theta}_i)}{\text{var}(\hat{\theta}_i)} \times (\hat{\theta}_i - E[\hat{\theta}_i])$$

$$= \bar{\eta}(1 - \alpha) + \alpha(\theta_i + \delta_i), \quad (7)$$

where

$$\alpha = \frac{\sigma_\theta^2}{\sigma_\bar{\eta}^2 + \sigma_\delta^2}. \quad (8)$$

Equilibrium requires that $a + b\hat{\theta}_i(\theta_i, \delta_i) \equiv E[\hat{\theta}_i|\hat{\theta}_i, \theta_i, \delta_i]$. From (7) and (8), it follows that $b = \alpha$ and $a + b\hat{\theta}_i(\theta_i, \delta_i) = \bar{\eta}(1 - \alpha) + \alpha(\theta_i + \delta_i)$. Hence,

$$a + b\hat{\theta}_i(\theta_i, \delta_i) - .5c(\hat{\theta}_i(\theta_i, \delta_i) - \theta_i - \delta_i)^2 = k + \alpha(\theta_i + \delta_i), \quad (9)$$

where $k \equiv \bar{\eta}(1 - \alpha) - .5\frac{\sigma_\theta^2}{\sigma_\bar{\eta}}$. Substituting (9) into (5), we see that the equilibrium investment policy entails maximizing

$$2m\sqrt{I_i\{k + \alpha(\theta_i + \delta_i)\} - I_i}.$$

Hence, $I_i^*(\theta_i, \delta_i) = (k + \alpha(\theta_i + \delta_i))^2m^2$, for $k + \alpha(\theta_i + \delta_i) > 0$ and is 0 otherwise.

Given this investment, then the expected profits of firm $i$ are given by:

$$E\left[\sum_{j=1}^{\hat{\theta}_i} \left(\hat{\theta}_{ij} - .5c(\hat{\theta}_i - \theta_i - \delta_i)^2\right)\bar{\omega}_{ij}|\theta_i, \delta_i, I_i^*(\theta_i, \delta_i) - I_i^*(\theta_i, \delta_i)\right]$$

$$= 2(\theta_i - .5c(\hat{\theta}_i - \theta_i - \delta_i)^2)m\sqrt{I_i^*(\theta_i, \delta_i) - I_i^*(\theta_i, \delta_i)}$$

$$= (2\theta_i - \frac{\alpha^2}{c})m\sqrt{I_i^*(\theta_i, \delta_i) - I_i^*(\theta_i, \delta_i)}$$

$$= (2\theta_i - \frac{\alpha^2}{c})(k + \alpha(\theta_i + \delta_i))m^2 - (k + \alpha(\theta_i + \delta_i))^2m^2$$

Taking expectations across $\hat{\theta}_i$ and $\hat{\delta}_i$, using the approximation (1), substituting for $k$, and simplifying, we conclude that the economy-wide expected performance of the "no standard" regime (when performance is calculated net of the cost of misreporting) is approximately:

$$\left\{\sigma_\theta^2(1 - (1 - \alpha)^2) + (\bar{\eta} - \frac{\alpha^2}{2c})^2 - \alpha^2\sigma_\delta^2\right\} \times m^2$$

19
Writing \( E[\hat{\eta}^2] = \sigma_\theta^2 + \bar{\eta}^2 - \sigma_\varepsilon^2 \), and recalling \( \alpha = \frac{\sigma_\theta^2}{\sigma_\varepsilon^2 + \sigma_\theta^2} \), we obtain the following comparison of the performance of the "standards" and "no standards" regimes.

**Theorem 1** Comparing "standards" and "no standards" regimes when capital markets are competitive

Using (1),

(a) A necessary and sufficient condition for the "normal standards" regime to be superior to the "no standards" regime net of the cost of misreporting is:

\[
\alpha^2 \sigma_\theta^2 + (1 - \alpha)^2 \sigma_\theta^2 > \sigma_\varepsilon^2 - \frac{\alpha^2}{c} (\bar{\eta} - \frac{\alpha^2}{4c}).
\]  

(b) A necessary and sufficient condition for a fixed standards regime \( \lambda \neq 0 \) to be superior to the "no standards" regime net of misreporting costs is that

\[
\alpha^2 \sigma_\theta^2 + (1 - \alpha)^2 \sigma_\theta^2 > \sigma_\varepsilon^2 - \frac{\alpha^2}{c} (\bar{\eta} - \frac{\alpha^2}{4c}).
\]  

The expressions (10) and (11) are intuitive: the relative desirability of standards as compared to "no standards" depends on the amount of variation that results from idiosyncratic reporting under "no standards" (recall from (6) that \( \text{var}(\hat{\theta} | \theta) = \sigma_\varepsilon^2 \)), the variation in the realization of the idiosyncratic component of transactions \( \sigma_\varepsilon^2 \), and the cost of misreporting.

To expand on this intuition, we consider three kinds of changes in parameters: changes in the cost \( c \) of misreporting, changes in the variance \( \sigma_\theta^2 \) of the idiosyncratic factor in the misreporting regime, and variance in the underlying heterogeneity \( \sigma_\varepsilon^2 \) of transactions. We will confine the presentation to a comparison of normal standards to "no standards"; similar comparisons are obtainable involving fixed standards and "no standards".

Consider first increases in the cost \( c \) of misreporting. It is easy to show that this results in an improvement in the expected profits associated with the
"no standards" regime.\textsuperscript{13} Hence, as $c$ increases, RHS(10) increases, making it less likely that standards beat "no standards". This is intuitive: increases in the cost $c$ of misreporting is in effect a way for firms to commit to not engage in misreporting in the "no standards" regime, which enhances the value of "no standards." It follows that the circumstances under which "standards" beat "no standards" declines as $c$ increases.

Next, suppose there is substantial variation in how the firm can report its performance, i.e., in $\tilde{\delta}_i$, i.e., that $\sigma_\delta$ gets very large. Then, $\alpha$ approaches zero, and (it can be shown that) $\alpha^2 \sigma_\delta^2$ approaches zero, and so the inequality (10) approaches

$$\sigma_\theta^2 > \alpha^2.$$

This inequality holds as long as the distribution of $\tilde{\eta}$ is not degenerate. That is, in this case, when there is substantial variation in how the firm can make its report, standards are preferred to "no standards". This is also intuitive: the fundamental cost of "no standards" is that investors cannot distinguish whether variations in value of financial reports is due to substantive variations in the economic value of the transactions or value-irrelevant variations in a firm’s financial reporting environment. As the variance in $\tilde{\delta}_i$ increases, one would expect the "no standards" regime to perform worse than the "standards" regime.

Suppose, alternatively, there is virtually no variation in how a firm can report its performance, i.e., in $\tilde{\delta}$, so $\sigma_\delta$ approaches zero. Then, if the cost of misreporting is relatively large - so it is expensive to misreport - we would expect "no standards" to beat standards, since a nonstandard report will contain a lot of information about the realized $\theta_i$. This is what we find: as $\sigma_\delta$ approaches

\textsuperscript{13}The proof runs as follows. Some simple algebra shows that the derivative of $\frac{\sigma_\theta^2}{c} (\tilde{\eta} - \frac{\sigma_\theta^2}{2c})$ with respect to $c$ has the same sign as $-(\tilde{\eta} - \frac{\sigma_\theta^2}{2c})$, which is negative.
zero, $\alpha$ approaches one, and (10) reads
\[
0 > \sigma^{2} - \frac{1}{c}(\bar{\eta} - \frac{1}{4c}),
\]
which will clearly not hold for sufficiently large $c$. Again, this is intuitive.

Suppose there is substantial variation in transactions, i.e., in $\bar{\varepsilon}$, i.e., that $\sigma_{\varepsilon}$
gets very large. Then $\sigma_{\delta}^{2}$ gets large too, and so $\alpha$ approaches 1. It can be shown
that $(1 - \alpha)^{2}\sigma_{\delta}^{2}$ approaches zero, and (10) reduces to
\[
\sigma_{\delta}^{2} > \sigma^{2} - \frac{1}{c}(\bar{\eta} - \frac{1}{4c}),
\]
which will certainly be violated for large enough $\sigma_{\varepsilon}$. This is also to be expected:
big variation in $\bar{\varepsilon}$ will mean that standards - which suppress reporting variations
- will result in inferior allocations to "no standards".

Finally, suppose that there is little variation in transactions, i.e., that $\sigma_{\varepsilon}^{2}$
approaches zero. If $\sigma_{\varepsilon}^{2}$ approaches zero, then since LHS(10) is surely positive,
and since RHS(10) is surely negative as $\sigma_{\varepsilon}^{2}$ gets small, "standards" beat "no
standards". This too is to be expected: standards should perform well in relatively homogenous environments.

3 Standards in Imperfectly Competitive Capital Markets

The previous section described circumstances under which accounting standards
serve a positive allocational role, in a setting where capital markets are perfectly
competitive. By "perfectly competitive" here, we mean both that (1) no investor
believes that his actions influence the price of any firm’s securities and (b) firms’ prices are set at the expected values of their transactions, based on the
information available to investors. In a perfectly competitive environment, no

\[14\text{Using (1), we conclude that } \bar{\eta} - \frac{1}{4c} > 0, \text{ since } E[\sqrt{\bar{F}}] = mE[(k + \alpha(\theta + \delta))] = m(\bar{\eta} - \frac{\alpha^{2}}{4c}) > 0 \text{ and hence } \bar{\eta} - \frac{\alpha^{2}}{4c} > 0. \text{ This is true for any } \alpha, \text{ and is in particular true for } \alpha \text{ approaching 1.} \]
An investor has to be induced to collect and evaluate the information that generates capital market prices equalling the expected values of transactions. In practice, of course, the activities of information collecting and processing are not free. In this section of the paper, we examine the extent to which the previous results must be modified to compensate traders for incurring these informational costs through their expected trading profits. We give investors the opportunity to recoup these costs by making capital markets imperfectly competitive.

The way we represent and analyze imperfectly competitive securities’ markets is by means of (a modification of) Kyle’s [1985] model. In the Kyle [1985] model, prices at which market orders for firms’ shares are executed are determined by market makers who take into account both what they know about the firms’ values and what they can infer about those values from observing the aggregate order flow of market orders. Some orders are placed by traders who know more about the firms’ values than the market makers do. Since large long positions on average are associated with informed investors who have a favorable perception of a firm’s value (relative to the publicly available information), the market maker "price protects" himself by increasing the price at which market orders are executed as the aggregate order flow increases. Since investors are aware of this price-protecting behavior of the market maker, they are also aware of how their trades, on average, move the price at which market orders are executed. This awareness of how their trades affects market prices implies that traders are not price-takers, and so the market for firms’ shares is imperfectly competitive (in the usual sense of that term). Thus, in the Kyle representation, informed investors have the opportunity to earn positive expected profits from their trading activities, and hence they get the opportunity to recover their information collection and processing costs.

Nor is trading, but we ignore trading commissions in what follows.
3.1 Information processing and evaluation costs

An investor who only goes to the trouble of learning how to interpret the firm’s accounting reports will have no informational advantage over a market maker in the firm’s securities - because the market maker is himself certain to evaluate the accounting reports of the firm(s) he specializes in. Accordingly, such an "informed" investor will generate zero expected trading profits. So, if an investor expects to generate positive trading profits, he must acquire non-accounting information in addition to the accounting information. Though we do not model it formally, we believe that, often, investors can generate trading profits by acquiring non-accounting information only after having first studied a firm’s financial reports, because the ability to intelligently interpret non-accounting information sources frequently requires knowledge of the firm’s accounting reports. We use this discussion to motivate the assumption that informed traders who expect to generate trading profits in a firm’s securities will study the firm’s accounting reports and, in addition, will learn non-accounting information about the firm.

In the following, we posit the simplest possible representation of the non-accounting information that informed investors who incur the cost of processing the accounting reports learn: we posit that they learn the exact value of $\theta_i$. Other less complete forms of non-accounting information could also be studied in future work.

3.2 Summary of results from the generic Kyle model

Consider a generic multi-investor Kyle model in which firm $i$ issues public accounting report $R_i$. Further suppose that, based on this report, the market maker in firm $i$’s securities believes that the distribution of the firm’s expected value is given by $\tilde{\mu}_i$, where

$$
\tilde{\mu}_i \sim N(v(R_i), \sigma^2(R_i)).
$$

(13)
Also suppose that there are \( n \) informed traders who learn the realization of \( \hat{\mu}_i \), that is, they know that the firm’s actual expected value is \( \mu_i \). If the prior distribution of liquidity traders’ trading volume in the asset is \( \hat{e} \sim N(0, \sigma_e^2) \), and the realized value of their trading volume is \( e \), then the Appendix shows that:

**Lemma 4** In a generic Kyle model, as described above,

1. the equilibrium market price of the firm is
   \[
   P_i(R_i) = \frac{v(R_i)}{n+1} + \frac{n\mu_i}{n+1} + de,
   \]
   where \( d = \frac{\sigma(R_i)\sqrt{n}}{\sigma_e(n+1)} \).

2. the expected profits of each informed trader, calculated before \( \hat{\mu}_i \) and \( \hat{e} \) are known but after the report \( R_i \) has been released is:
   \[
   \frac{\sigma(R_i)\sigma_e}{(n+1)\sqrt{n}}.
   \]

3.3 The short-run performance of normal standards when securities markets are imperfectly competitive

We now apply the preceding lemma to the normal standards regime. By definition of a normal standard, the financial reporting procedure is \( T_\eta(\bullet) \). Suppose the accounting report is \( R_i = \sum_{j=1}^{q_i} T_\eta(\omega_{ij}) \). From this report and an informed investor’s observation of the realized value \( \hat{\theta}_i \) of \( \hat{\theta}_i \), an informed investor’s assessment of the firm’s value is \( R_i\theta_i/\eta \). In the notation of the previous subsection, it follows that \( \mu_i = R_i\theta_i/\eta \). In contrast, the market maker, having only observed the accounting report \( R_i \), estimates the firm’s value is \( R_i \) (see (4) above). That is, in terms of the notation \( v(R_i) \) in (13) above, \( v(R_i) = R_i \). Thus, according to (14), if the volume of liquidity traders turns out to be \( e \) and there are \( n \)

\[\text{25}\]
informed traders, then the market price of firm $i$ is

$$P_i(R_i, T_\theta(\bullet)) = \frac{R_i}{n + 1} + \frac{nR_i\theta_i/\eta}{n + 1} + de.$$  

The initial owners of firm $i$ anticipate that this price will prevail when the securities market is imperfectly competitive, the realized value of the accounting report is $R_i$, and $\tilde{e} = e$. At the time they make their investment decision $I_i$, they know the realized values $\theta_i$ and $\eta$ so they expect $E[R_i|\theta_i, \eta, I_i] = 2m\eta\sqrt{T_i}$. Hence, they perceive the expected selling price of the firm to be:

$$E[P_i(R_i, T_\theta(\bullet)|I_i, \theta_i)] = \frac{2\sqrt{T_i}m}{n + 1} \{\eta + n\theta_i\}.$$  

Hence, the initial owners will choose $I_i$ to maximize

$$\frac{2\sqrt{T_i}m}{n + 1} \{\eta + n\theta_i\} - I_i,$$

resulting in investment choice, for $\eta + n\theta_i > 0$, of:

$$I^*_i(\eta, \theta_i) = \left(\frac{m}{n + 1}\right)^2 \eta \{\eta + n\theta_i\}^2 \text{ for } \eta + n\theta_i > 0 \text{ and } I^*_i(\eta, \theta_i) = 0 \text{ otherwise.} \quad (16)$$

So, the economy-wide expected performance of the normal standard, using (1), is given by:

$$E[\hat{q}_i, \hat{\omega}_i|I^*_i(\eta, \theta_i)] - I^*_i(\eta, \theta_i)$$

$$= E \left[ \left(\frac{2m}{n + 1}\right) \eta \{\eta + n\theta_i\}^2 \left(\frac{m}{n + 1}\right)^2 \eta \{\eta + n\theta_i\}^2 \right]$$

$$= \left(\frac{2m^2}{n + 1}\right) \{\eta^2 + nE\theta_i^2\} - \left(\frac{m}{n + 1}\right)^2 \{\eta^2 + n^2(E\eta^2 + \sigma^2_\epsilon) + 2nE\eta^2\}$$

$$= m^2 \{E\eta^2 + n(n + 2)(n + 1)^2 \sigma^2_\epsilon\}. \quad (18)$$

Note that the performance of the normal standard regime as depicted in this last expression is better than the performance of the normal standard regime in the case where capital markets were assumed competitive (compare (18) to
Lemma 3). This is not surprising, because the informed investors of this section are endowed with better information than is available to any of the investors in the perfectly competitive case. Additional evaluation of the performance of the normal standards is discussed below.

3.4 The short run performance of "no standards" when securities markets are imperfectly competitive

We now turn to imperfectly competitive capital markets with "no standards." Suppose the initial owners of the firm chose accounting reporting procedure \( T_{\hat{\theta}} (\bullet) \). Informed investors who know both the accounting report \( R_i = \sum_{j=1}^{q_i} T_{\hat{\theta}} (\omega_{ij}) \) and the realized value of \( \hat{\theta}_i \) will evaluate the firm to be worth

\[
E[\sum_{j=1}^{q_i} \hat{\theta}_i \omega_{ij} | \sum_{j=1}^{q_i} T_{\hat{\theta}} (\omega_{ij})] = \theta_i \sum_{j=1}^{q_i} \omega_{ij} = \frac{\theta_i R_i}{\theta_i}.
\]

In the notation of (14), \( \mu_i = \frac{\theta_i R_i}{\theta_i} \).

Next, suppose the market maker conjectures the expected value of firm \( i \) based on accounting report \( R_i \) produced according to accounting reporting procedure \( T_{\hat{\theta}} (\bullet) \) is \( (a + b\hat{\theta}_i) \frac{R_i}{\theta_i} \), for some constants \( a \) and \( b \). That is, in the notation of (14), \( v(R_i) = (a + b\hat{\theta}_i) \frac{R_i}{\theta_i} \). Then, according to (14), when the liquidity traders’ trading volume is \( e \), the market price of the firm is:

\[
P_i(R_i, T_{\hat{\theta}} (\bullet)) = \frac{(a + b\hat{\theta}_i) \frac{R_i}{\theta_i}}{n + 1} + \frac{n \frac{\theta_i R_i}{\theta_i}}{n + 1} + de.
\]

The firm’s initial owners take into account both this equation and their costs of misreporting costs when choosing both \( \hat{\theta}_i \) and \( I_i \). The expected misreporting costs are \( E[.5c \sum_{j=1}^{q_i} \omega_{ij} (\hat{\theta}_i - \theta_i - \delta_i)^2] = c\sqrt{T_i}m(\hat{\theta}_i - \theta_i - \delta_i)^2 \). Since \( E[\frac{R_i}{\theta_i} | I_i] = 2\sqrt{T_i}m \), it follows the initial owners maximize

\[
\frac{2\sqrt{T_i}m(a + b\hat{\theta}_i - .5(n + 1)c(\hat{\theta}_i - \theta_i - \delta_i)^2)}{n + 1} + \frac{n2\sqrt{T_i}m\theta_i}{n + 1} - I_i.
\]

This leads the initial owners to choose

\[
\hat{\theta}_i(\theta_i, \delta_i) = \theta_i + \delta_i + \frac{b}{c(n + 1)}.
\]
The values $a$ and $b$ must satisfy the equilibrium requirement:

$$(a + b\hat{\theta}_i(\theta_i, \delta_i)) \frac{R_i}{\hat{\theta}_i(\theta_i, \delta_i)} \equiv E[\sum_{j=1}^{q_i} \hat{\theta}_{ij} \tilde{\omega}_{ij} | R_i, \hat{\theta}_i(\theta_i, \delta_i)],$$

that is,

$$(a + b\hat{\theta}_i(\theta_i, \delta_i)) \sum_{j=1}^{q_i} \omega_{ij} \equiv \sum_{j=1}^{q_i} \omega_{ij} E[\hat{\theta}_i|R_i, \hat{\theta}_i(\theta_i, \delta_i)],$$

that is,

$$a + b\hat{\theta}_i(\theta_i, \delta_i) = E[\hat{\theta}_i|R_i, \hat{\theta}_i(\theta_i, \delta_i)].$$

(21)

At this point, we invoke (as we did in the analysis of the competitive markets case) the assumption that the pricing equation is separable - i.e., that $E[\hat{\theta}_i|R_i, \hat{\theta}_i(\theta_i, \delta_i)]$ does not depend on $R_i$. To be explicit, this implies that we replace (21) by:

$$a + b\hat{\theta}_i(\theta_i, \delta_i) = E[\hat{\theta}_i(\theta_i, \delta_i)].$$

From this, (20), and the regression result

$$E[\theta_i(\hat{\theta}_i(\theta_i, \delta_i))] = \bar{\eta}(1 - \alpha) + \alpha(\hat{\theta}_i - \frac{b}{c(n+1)}),$$

we conclude $b = \alpha$.

Given the realization of $\tilde{\delta}_i$, we can rewrite (22) as $E[\theta_i(\hat{\theta}_i(\theta_i, \delta_i))] = \bar{\eta}(1 - \alpha) + \alpha(\hat{\theta}_i + \delta_i)$ and so the initial owners’ investment choice is given by solving, with $h = .5\alpha^2/(c(n+1))$,

$$\max_{I_i} \frac{2\sqrt{I_i m}}{n+1} \{\bar{\eta}(1 - \alpha) + (\alpha + n)\theta_i + \alpha\delta_i - h\} - I_i.$$ 

The optimal value for investment is given by is:

$$I_i^* = \left(\frac{m}{n+1}\right)^2 \{\bar{\eta}(1 - \alpha) + (\alpha + n)\theta_i + \alpha\delta_i - h\}^2, \text{ for } \bar{\eta}(1 - \alpha) + (\alpha + n)\theta_i + \alpha\delta_i - h > 0, \text{ and is zero otherwise.}$$

(23)
Using (1), this leads to expected performance gross of the cost of misreporting:

\[ E \left[ \sum_{j=1}^{\tilde{q}_i} \tilde{\theta}_{i,j} \tilde{\omega}_{i,j} - I^*_i \right] = \left( \frac{m}{n+1} \right)^2 (\tilde{\eta}^2(1-\alpha)^2 + (\alpha+n)(n+2-\alpha)E\tilde{\theta}_i^2 - \alpha^2 \sigma_3^2 - h^2). \]

Substituting for \( h \) and subtracting out the expected cost of misreporting, we obtain the following expression for the expected performance of the "no standard" regime net of expected misreporting costs:

\[ \left( \frac{m}{n+1} \right)^2 \left[ (\tilde{\eta}^2(1-\alpha)^2 + (\alpha+n)(n+2-\alpha)E\tilde{\theta}_i^2 - \alpha^2 \sigma_3^2) - \frac{\alpha^2}{c} (\tilde{\eta} - \frac{\alpha^2}{4c(n+1)^2}) \right] \]

The expression (25) is used in the next section to compare the performance of the "standards" and "no standards" in imperfectly competitive capital markets.

### 3.5 Comparison of the short-run performance of the "standards" and "no standards" regimes in imperfectly competitive capital markets

We compare the performance of "standards" and "no standards" in two settings, first (in the short run) when the number of informed investors is fixed and common to both regimes, and second (in the long run) when the number of informed investors is variable and variable across regimes.

---

18 The details follow:

\[
E \left[ \sum_{j=1}^{\tilde{q}_i} \tilde{\theta}_{i,j} \tilde{\omega}_{i,j} - I^*_i \right] = E \left[ \sum_{j=1}^{\tilde{q}_i} \tilde{\theta}_{i,j} \tilde{\omega}_{i,j} | I^*_i, \tilde{\theta}_i, \tilde{\delta}_i \right] - I^*_i
\]

\[
= E \left[ \left( \frac{m}{n+1} \right) \left[ (\tilde{\eta}(1-\alpha) + (\alpha+n)\tilde{\theta}_i + \alpha\tilde{\delta}_i - h) \tilde{\theta}_i - \left( \frac{m}{n+1} \right)^2 (\tilde{\eta}(1-\alpha) + (\alpha+n)\tilde{\theta}_i + \alpha\tilde{\delta}_i - h)^2 \right] \right]
\]

\[
= 2 \left( \frac{m^2}{n+1} \right) \left[ \tilde{\eta}^2(1-\alpha)^2 + (\alpha+n)E\tilde{\theta}_i^2 - \tilde{\eta}^2 \right] - 2 \left( \frac{m}{n+1} \right)^2 \left[ \tilde{\eta}^2(1-\alpha)^2 + (\alpha+n)^2E\tilde{\theta}_i^2 + \alpha^2 \sigma_3^2 + h^2 + 2\tilde{\eta}^2(1-\alpha)(\alpha+n) - 2\tilde{\eta}(1-\alpha)h - 2(\alpha+n)\tilde{\eta}h \right]
\]

\[
= \left( \frac{m}{n+1} \right)^2 \left[ \tilde{\eta}^2(1-\alpha)^2 + (\alpha+n)(n+2-\alpha)E\tilde{\theta}_i^2 - \alpha^2 \sigma_3^2 - h^2 \right].
\]
Theorem 2  Comparing "standards" and "no standards" regimes in the short-run when capital markets are imperfectly competitive

Using (1) and holding the number of investors in both regimes fixed at \( n \), normal standards have superior expected performance to "no standards" when securities markets are imperfectly competitive net of the cost of misreporting if and only if

\[
\alpha^2 \sigma_\delta^2 + (1 - \alpha)^2 \sigma_\tilde{\theta}_i^2 > \sigma_\zeta^2 - \frac{\alpha^2}{c} (\bar{\eta} - \frac{\alpha^2}{4c(n+1)^2}). \tag{26}
\]

To be noticed is the strong parallels in the conditions leading to the ranking of the performance of standards and "no standards" in the competitive and imperfectly competitive securities markets. Apart from the replacement of \( \frac{\alpha^2}{4c} \) with \( \frac{\alpha^2}{4c(n+1)^2} \) in the RHS(10), the inequalities (10) and (26) are the same. Notice that the "no standards" regime always compares more favorably to the "standards" regime in the imperfectly competitive case than in the perfectly competitive case previously analyzed and that, as the number of informed investors increases, the performance of the "no standards" regime improves relative to the "standards" regime. This occurs because informed investors are not affected by a firm’s accounting machinations in the "no standards" regime, and so, as the number of informed investors increases, a firm in the "no standards" regime finds diminishing returns to report manipulation. This effect enhances the relative performance of the "no standards" regime.

3.6  Informed traders’ short-run views toward accounting standards

Theorem 1 gave necessary and sufficient conditions for firms to prefer standards to "no standards" in a competitive securities market, and Theorem 3 provided the same comparison, holding fixed the number of informed traders at \( n \). We now wish to study the views of investors toward accounting standards. In the
case where securities’ markets are competitive, and no trader has an informational advantage over other traders, all investors earn zero expected trading profits. Accordingly, investors are indifferent between standard and no standard regimes. However, when securities’ markets are imperfectly competitive, investors may not be indifferent between the "standards" and "no standards" regimes.

To keep the analysis tractable, in this section, we simplify the information environment in two respects. First, we assume that the bookkeeping entry for all transactions conducted in the period are the same. That is, if firm $i$ engages in $q_i$ transactions during the period, we assume that the bookkeeping entry $\omega_{ij} = \omega_{ij'} = \omega_i$ for all transactions $i_j$ and $i_{j'}$. We call this the "homogenous transactions" assumption. Second, we assume that the volume of transactions $q_i$ is reported to investors. We call this "volume reporting." Under a normal standard (resp., "no standard") regime, the assumptions of homogenous transactions and volume reporting imply that upon learning a firm’s financial report and chosen financial reporting procedure, investors know (i) the realization of $\eta$ (resp., $\hat{\eta}$), (2) the (common) bookkeeping entry $\tilde{\omega}_i$ and (3) the volume of transactions $q_i$ the firm conducted. For this section, we let $R_i$ denote the two dimensional report report $(q_i, T_{\lambda}(\omega_i))$ (where $\lambda = \eta$ or $\lambda = \hat{\eta}$, depending on whether we are discussing the normal or "no standard" regimes).

**Theorem 3** The preferences of informed traders for "standards" vs. "no standards" in the short run

Assuming homogenous transactions, volume reporting, and (1),

(a) Holding the number $n$ of informed investors constant across regimes, and ignoring investors’ cost of information processing, informed investors prefer normal "standards" to "no standards" if and only if

$$\sigma_{\tilde{\eta}} > \left\{ \tilde{\eta} - \frac{\alpha^2}{2c(n+1)^2} \right\}_{\sigma_{\delta}\sqrt{\alpha}};$$

(b) If the costs of information acquisition and processing are the same across
regimes, there will be more informed investors under normal standards if and only if (27) holds.

(c) If the information acquisition costs are lower in the normal standards regime, then there will be more informed investors under normal standards regime than under the "no standards" regime if (27) holds.

In interpreting inequality (27), the following corollary may be helpful.

**Corollary 1** A sufficient condition for inequality (27) is \( \sigma_z \geq \sigma_\delta \).

According to the corollary, informed investors in the short run prefer standards to "no standards" when there is more variation in the types of transactions \( \tilde{c} \) than there is variation in the idiosyncratic factor \( \tilde{\delta} \) that influence firms’ reporting decision in the "no standards" case.

The result in Theorem 4 about informed investors’ preferences toward standards depends, considerably, on the information processing capabilities of the market maker. If the market maker were incapable of evaluating the firm’s accounting report (and hence, relied on only his initial priors regarding the firm’s value in conjunction with the realized value of the aggregate order flow to make inferences about the firm’s value), then informed investors are always better off by having very informative accounting reports, since that increases their informational advantage over the market maker and liquidity traders. In this situation (which is not the case we analyze), the preferences of the informed traders and the initial investors are roughly aligned, because both parties are better off with more informative accounting reports. If, however, the market maker does correctly process accounting information (as we have assumed in our analysis of imperfectly competitive capital markets), then informed investors will prefer those accounting reports which maximize their informational advantage over the market maker. This entails having accounting reports that are least informative. As a consequence, in the short term (where the number
of informed investors are fixed), the interests of informed investors and a firm’s initial owners are roughly opposed: the value-maximizing owners want informative accounting reports, whereas - as just noted - informed investors prefer relatively uninformative reports.

The informativeness of a firm’s accounting reports is influenced by two distinct factors. The first factor relates to how much information about \( \hat{\theta}_i \) is revealed by the firms’ accounting reports. Ceteris paribus, informed investors prefer whichever reporting regime reveals less revealed about this context-specific information, as was argued in the previous paragraph. Normal standards reveal the central tendency \( \eta \), but they reveal nothing about the idiosyncratic information \( \varepsilon \). Given the assumptions of homogenous transactions and volume reporting, the posterior variance in the value of firm \( i \)'s transactions is given by

\[
q_i^2 \omega_i^2 \sigma^2, \quad \text{so - using the notation in Lemma 4, } \sigma(R_i) = q_i \omega_i \sigma. 
\]

The residual uncertainty about \( \theta_i \) in the case of "no standards" after the release of the firm’s accounting report is given by

\[
\text{var}(q_i \omega \hat{\theta}_i | q_i, \omega, \hat{\theta}_i) = q_i^2 \omega_i^2 \frac{\sigma^2}{\sigma^2 + \sigma^2},
\]

using the standard Bayesian updating formulas. This informational difference in part accounts for informed investors' relative preferences for standards vs. "no standards".

The second part of investors' attitudes toward standards is that the expected quantity of output is different across the two regimes. Differences in the expected quantity of output matter, because variations in the quantity of production magnify or shrink variations in the perceived differences in the value of the assets being sold to the investors. The expected level of output chosen by firms is not the same across the two regimes, because the equilibrium expected level of investment is not the same across the two regimes. Using (1), in the normal standards regime, expected output is

\[
E[\tilde{q}_i | I_i^{\text{normal}}] = 2m \bar{\eta};
\]

in the "no standards" regime, expected output is

\[
E[\tilde{q}_i | I_i^{\text{nostandards}}] = 2m (\bar{\eta} - \frac{\sigma^2}{2c(n+1)^2}).
\]

Clearly, the expected level of output under the standards regime is greater than under "no standards"; this, by itself, tends to increase the variance in the value
of the output under that regime, and therefore, ceteris paribus, predisposes informed investors to favor that regime. This volume effect also accounts for informed investors being more likely to prefer the "no standards" regime as the number of informed investors increases: as the proof of Theorem 4 shows, as the number of informed investors increases, the expected volume of the firm’s output increases under the "no standard" regime and so, as discussed previously, the information asymmetry between informed traders and the market maker increases.

3.7 The long-run number of informed investors and a comparison of the performance of standards and "no standards" in the long-run

The preceding section demonstrated that the profits an informed investor gets from trading in a firm’s securities is sensitive to whether the accounting regime involves "standards" or "no standards." To the extent that there is free entry in the market for being an informed investor, these differential profits can affect the number of informed investors that trade in a firm’s securities. In the long run, accounting for the entry and exit decisions of informed investors who trade in a firm’s securities can overturn intuition about the relative performance of the "standards" and "no standards" regimes derived from a short run analysis. In this section, we concentrate on number of informed investors who follow a firm. In the next section, we examine the implications of these entry decisions on economy-wide performance.

Let the per firm cost of acquiring and evaluating accounting and non-accounting information about a firm in the standards (resp., "no standards") regime be denoted by $c_{std}$ (resp., $c_{no\;std}$). It seems reasonable to assume that $c_{std} \leq c_{no\;std}$, since the information about standards is "scalable," that is, once an investor has learned how to evaluate one firm who reports according to a standard, then that investor can evaluate other firms that adopt the same standard. However,
the analysis that follows is not predicated on relative size of the costs $c_{\text{std}}$ and $c_{\text{no std}}$.

Since $n^{\frac{3}{2}} \leq (n + 1)\sqrt{n} \leq (n + 1)^{\frac{3}{2}}$, then the derivations in the proof of Theorem 4 place bounds on the equilibrium number of investors in both the standards and "no standards" regimes, as reported in the following lemma:

**Lemma 5** \(^{19}\) Assuming homogenous transactions, volume reporting, and (1), the equilibrium number of investors following a firm in the "standards" (resp., "no standards") regime is bounded as follows:

(a) In the normal standards regime,

$$\left[ \frac{2m^2\sigma_e\bar{\eta}\sigma_e}{c_{\text{std}}} \right]^{\frac{3}{2}} - 1 \leq n_{\text{std}} \leq \left[ \frac{2m^2\sigma_e\bar{\eta}\sigma_e}{c_{\text{std}}} \right]^{\frac{3}{2}};$$

(b) in the "no standards" regime,

$$\left[ \frac{2m^2\left( \bar{\eta} - \frac{a^2}{2c} \right)\sigma_e\sigma_\delta \sqrt{\alpha}}{c_{\text{no std}}} \right]^{\frac{3}{2}} - 1 \leq n_{\text{no std}} \leq \left[ \frac{2m^2\sigma_e\sigma_\delta \sqrt{\alpha}}{c_{\text{no std}}} \right]^{\frac{3}{2}}.$$

Several comparative statics results regarding the equilibrium number of informed investors in the normal standards case follow. \(^{20}\)

Most of these results are intuitive. For example, it is not a surprise that the number of informed investors increases as the volume of liquidity traders increases, since a high volume of liquidity traders allows the informed traders to "hide" their trades among the trades of the liquidity traders. It is also not a surprise that the number of informed traders increases as the costs of becoming informed decrease. The fact that the number of informed traders increases under the normal standards regime as the heterogeneity in the transactions increases is to be expected too, since the informativeness of accounting reports produced under normal standards declines as this heterogeneity increases, which increases

\(^{19}\)Proof of Lemma 5 follows immediately from using the bounds $n^{\frac{3}{2}} \leq (n + 1)\sqrt{n} \leq (n + 1)^{\frac{3}{2}}$ and the expressions for an informed trader’s expected trading profits as presented in the proof of Theorem 4.

\(^{20}\)These comparative statics do not depend on the bounds described in the preceding lemma.
the potential trading profits of informed traders. Increases in the average value of the central tendency $\bar{\eta}$ of transactions increases the entry of traders, since this increases the expected volume of firms’ production, and increases in production volume, ceteris paribus, increase uncertainty about the value of assets being sold (recall that the variance of in the value of the asset, conditional on the accounting report, is $q_i^2 \omega_i^2 \times var(\theta_i | R_i)$).

The comparative statics for the "standards" regime are relatively easy to obtain because increasing the number of informed investors reduces any given informed investor’s expected profits, and we can compute how a change in a parameter (such as those presented in the statement of Corollary 2) affects the expected profits of an informed investor, holding the number of informed investors fixed. We have not obtained comparative statics regarding the effect of a change in a parameter on the equilibrium number of informed investors in the "no standards" case, because it is typically difficult to determine any unambiguous effects in that case. The problem is that the effect of an increase in the number of informed investors on any given informed investor’s expected profits in the "no standards" case is not clear because, on the one hand, it increases competition in the securities market which, by itself decreases an investor’s profits, but on the other hand, it can also increase the overall profits of all investors (since the size of the average investment in the "no standards" case increases as the number of informed investors increases). This latter effect enhances an informed investor’s profits by the previously discussed effect that increasing the volume of output, ceteris paribus, increases the asymmetry of information between informed investors and the market maker. The net effect is consequently ambiguous.

The following pair of tables presents a comparison of the long run performance of standards vs. "no standards" in imperfectly competitive securities’
markets:

Limiting case The Long Run Performance of Standards

\[ \sigma_\varepsilon \to 0 \quad m^2 E \eta^2 \]

comment number of informed investors goes to zero, and performance reflects only the information \( \eta \) in the accounting report

\[ \sigma_\varepsilon \to \infty \quad m^2 (E \eta^2 + \sigma_\varepsilon^2) \]

comment the number of informed investors goes to infinity with \( \sigma_\varepsilon \), and expected performance is increasing with \( \sigma_\varepsilon^2 \), and approaches first-best levels

\[ \sigma_\delta \to 0 \quad m^2 \{ E \eta^2 + n_{std}(n_{std} + 2) \sigma_\varepsilon^2 \} \]

comment \( n_{std} \) is within the bounds specified in Lemma 5 and is unaffected by \( \sigma_\delta \)

\[ \sigma_\delta \to \infty \quad m^2 \{ E \eta^2 + n_{std}(n_{std} + 2) \sigma_\varepsilon^2 \} \]

comment \( n_{std} \) is within the bounds specific in Lemma 5 and is unaffected by \( \sigma_\delta \)

Limiting case The Long Run Performance of No Standards

\[ \sigma_\varepsilon \to 0 \quad \left( \frac{m}{n_{no\ std} + 1} \right)^2 \left[ \frac{\bar{\eta}^2}{\sigma_\varepsilon^2} \left( 1 - \alpha \right)^2 + \frac{1}{\varepsilon} \left( \alpha + n_{no\ std} \right) \left( n_{no\ std} + 2 - \alpha \right) \theta_i^2 \right] \]

comment \( \alpha \) approaches \( \frac{\sigma_\varepsilon^2}{\sigma_\eta^2 \sigma_\varepsilon^2} \), and with this \( \alpha \), \( n_{no\ std} \) is bounded as reported in Lemma 5

\[ \sigma_\varepsilon \to \infty \quad \left( \frac{m}{n_{no\ std} + 1} \right)^2 \left[ \left( n_{no\ std} + 1 \right)^2 \theta_i^2 - \sigma_\varepsilon^2 - \frac{1}{\varepsilon} (\bar{\eta} - \frac{1}{\varepsilon} \left( \frac{1}{n_{no\ std} + 1} \right) \theta_i^2 \right] \]

comment \( \alpha \) approaches 1, and \( n_{no\ std} \) is bounded, as reported in Lemma 5

\[ \sigma_\delta \to 0 \quad m^2 (\theta_i^2 - \frac{1}{\varepsilon \sigma_\delta}) \]

comment \( \alpha \) approaches 1, and \( n_{no\ std} \) approaches zero

\[ \sigma_\delta \to \infty \quad m^2 \left( \frac{\bar{\theta}_i^2}{(n_{no\ std} + 1)^2} + \frac{n_{no\ std}(n_{no\ std} + 2) \theta_i^2}{(n_{no\ std} + 1)^2} \right) \]

comment \( \alpha \) approaches 0, and \( n_{no\ std} \) approaches \( \left[ \frac{2 m^2 \bar{\eta} \sigma_\varepsilon \theta_i}{\varepsilon n_{no\ std}} \right]^2 \)

Making use of the table, several comparisons between the long run performance of standards and "no standards" can be made, some of which are presented in the following theorem
Theorem 4 \(^{21}\) The Long Run Performance of Standards vs. No Standards

Assuming homogenous transactions, volume reporting, and (1):

(a) For large \(\sigma_\varepsilon\), standards have higher performance than "no standards";

(b) If \(\sigma_\delta\) is small, \(\sigma_\varepsilon\) is small, and \(c\) is sufficiently large, then "no standards" beat standards;

(c) For large \(\sigma_\delta\), if the equilibrium number of investors is sufficiently large in both regimes (because, any of: \(m_i\) is big, \(\sigma_\varepsilon\) is big, \(\eta\) is big), then the performance of standards and "no standards" are nearly the same.

Perhaps the most unexpected result reported in Theorem 5 is part (a), that as \(\sigma_\varepsilon\) gets large, in the long run, standards have higher performance than "no standards". This is surprising, because standards suppress reporting information about variations in the idiosyncratic, context specific information \(\varepsilon\). The reason for the result is that, as \(\sigma_\varepsilon\) gets large, standard reports generate substantial entry by informed investors, and this entry compensates for the lack of information about \(\varepsilon\) embedded in a standard report. A more precise statement of (b) is this: if \(\sigma_\delta\) is small and \[
\left(\frac{c_{\text{std}}}{2m^2\sigma_{\delta}\sigma_{\varepsilon}}\right)^{\frac{1}{4}} \leq \frac{1}{4c^2}, \text{ then standards beat } "\text{no standards}".\]

These results are contrary to what one might predict from the short-run analysis. With a fixed number of informed investors, one would

\(^{21}\) The proof of Theorem 4 follows from substituting the long run number of informed investors into the expressions for the expected performance of each regime.

\(^{22}\) The argument is this: as \(\sigma_\delta\) approaches 0, then the performance of standards converges, according to the table, \[
m^2(\mathbb{E}\theta^2 - \frac{1}{4c^2}) = m^2(\mathbb{E}\eta^2 + \sigma_\varepsilon^2 - \frac{1}{4c^2}).\]

So, a necessary and sufficient condition for standards to beat no standards is \[
\frac{n_{\text{std}}}{(n_{\text{std}}+1)^2} \geq \frac{\sigma_\varepsilon^2 - \frac{1}{4c^2}}{c^2}, \text{ then standards beat no standards}.\]

This condition is equivalent to: \[
\frac{c_{\text{std}}}{2m^2\sigma_{\delta}\sigma_{\varepsilon}} \leq \frac{1}{4c^2}, \text{ so } \left(\frac{c_{\text{std}}}{2m^2\sigma_{\delta}\sigma_{\varepsilon}}\right)^{\frac{1}{4}} \leq \frac{1}{4c^2}.\]

So, if \(c_{\text{std}} \leq \frac{1}{4c^2}\), standards perform better than no standards. The previous lemma also demonstrated that \(n_{\text{std}} + 1 \leq \left(\frac{2m^2\sigma_{\delta}\sigma_{\varepsilon}}{c_{\text{std}}}\right)^{\frac{1}{2}} + 1\), so \[
\frac{1}{(n_{\text{std}}+1)^2} \leq \left(\frac{1}{m^2\sigma_{\delta}\sigma_{\varepsilon}}\right)^{\frac{1}{2}}.\]

So, if \[
\left(\frac{1}{m^2\sigma_{\delta}\sigma_{\varepsilon}}\right)^{\frac{1}{2}} \geq \frac{1}{4c^2}, \text{ no standards beat standards}.
\]
expect that, generally, when $\sigma_\delta$ is sufficiently small, "no standards" would be preferred to standards (since there is not much idiosyncratic noise), and that the extent to which "no standards" would beat standards would increase as $\sigma_\varepsilon$ increased - because standards fail to reveal anything about the idiosyncratic term $\varepsilon$, whereas the accounting reports under "no standards" do reflect this variation in $\varepsilon$. What overturns the intuition of the short-run results is the long-run entry or exit of informed investors from the capital market. Regarding result (c), one would expect that, as $\sigma_\delta$ gets sufficiently large, that standards would beat "no standards". But, what the tables report is that, for large $\sigma_\delta$, the performance of "no standards" is $m_1^2\frac{\tilde{\eta}^2}{(n_{no\ std}+1)^2} + \frac{n_{no\ std}(n_{no\ std}+2)}{(n_{no\ std}+1)^2}E\theta_i^2$, which when $n_{no\ std}$ is large, is nearly first-best: $m_1^2E\theta_i^2$; the performance of the standards regime for large $\sigma_\delta$, $m_1^2\{E\eta^2 + \frac{n_{std}(n_{std}+2)}{(n_{std}+1)^2}\sigma^2\}$, also approaches first best when $n_{std}$ is large. When $\sigma_\delta$ is sufficiently large, the performance disadvantage of the "no standards" regime due to costly misreporting goes away, because - for sufficiently large $\sigma_\delta$, there is little benefit to misreporting. Substantial entry by informed investors in both regimes then serves to equalize the expected performance of the two regimes. This, too, is contrary to what one would predict from the short-run analysis, since in the short run, the standards regime would seem to strictly dominate the "no standards" regime when there is substantial variation in the realized idiosyncratic factor $\tilde{\delta}$.

### 3.8 Summary

Among the central findings of the analysis are the following: in either competitive securities markets, or in imperfectly competitive securities markets over the short-run, “standards” tend to be preferred to "no standards" when transactions tend to be homogenous or when there is substantial variation in how transactions are reported for reasons unrelated to the economic value of the transactions. Also, in the short-run, informed traders view of "standards" vs. "no standards" tend to be quite different from those of value-maximizing firms,
since informed traders benefit from relatively uninformative accounting reports, whereas, roughly, value-maximizing firms benefit from informative accounting reports. In the long run, where informed traders can enter or exit the capital markets, informed investors are necessarily indifferent between the “standards” and "no standards" regimes, as in the long run, the gross returns to being an informed investor must equal the cost of becoming informed. General statements about firms’ preference between "standards" and "no standards" in the long run are often difficult to make, as there are two offsetting effects. On the one hand, the regime that results in the least informative accounting reports will, holding the number of investors fixed, tend to be the regime with the lowest expected value and smallest level of investment. On the other hand, the regime with the least informative accounting reports will tend to attract the greatest number of informed investors, and firm value tends to increase with the number of informed investors trading in the firm’s shares. But, the normal standards regime often performs better than the "no standards" regime if the number of informed investors following a firm is moderately large, for two reasons: since the per firm cost of becoming informed is lower for firms in the "standards" regime, there will tend, ceteris paribus, to be more informed investors following firms adhering to standards and, second, in a standards regime, performance will be better because firms make less expenditures on report manipulation.

3.9 Appendix: A generic multi-investor version of Kyle [1985]

This appendix presents generic results related to the multi-investor version of Kyle [1985]; several of these results are similar to those found in the multi-investor version of Kyle [1985] found in Fishman and Hagerty [1992].

There is a publicly traded asset whose expected value is $\tilde{\mu}$, and the common priors regarding $\tilde{\mu}$ are that $\tilde{\mu} \sim N(\nu, \sigma^2)$. The market maker and all uninformed investors know these priors, but they have no direct knowledge about the real-
ized value of \( \mu \). There are \( n \) informed risk-neutral traders, all of whom know the realized value \( \mu \). Each informed trader places a market order for \( D(\mu) = g + h\mu \) units of the asset. All informed traders use the same function \( D(\mu) \). There are, in addition, a collection of noise traders who have aggregate demand for the asset summarized by \( \tilde{\epsilon} \sim N(0, \sigma_\epsilon^2) \). The market maker observes the "aggregate order flow" \( a = nD(\mu) + \epsilon \). The market maker then establishes the price \( P(a) \), at which these market orders are executed. The pricing function \( P(a) \) is represented in two ways. On the one hand, it is posited to be given by some linear function \( P(a) = b + da \). Informed investors anticipate that this function \( P(a) \) will be used by the market maker in setting the execution price of the \( a \) market orders. On the other hand, the price \( P(a) \) is assumed equal to the expected value \( \tilde{\mu} \) of the asset, based on what the market maker knows and what he can infer about \( \tilde{\mu} \) from observing the aggregate order flow \( a \). In equilibrium, these two representations of \( P(a) \) coincide. The trading strategy \( D(\mu) \) posited to be adopted by each informed investor is assumed to maximize that investor’s expected trading profits, taking the pricing function \( P(a) \), the behavior of the other informed traders, and the behavior of the liquidity traders, as given.

We refer to the preceding set up as "linear" since both the pricing function \( P(a) \) and the market order function \( D(\mu) \) are linear functions, and we refer to it as "symmetric," since we assume that all informed investors adopt the same trading strategy. Formally, an equilibrium is defined as follows.

**Definition** A symmetric linear Nash equilibrium consists of a linear pricing function \( P(a) = b + da \) and linear market orders \( D(\mu) = g + h\mu \) such that

(i) given \( D(\bullet) \) and \( P(\bullet) \), for each \( \mu \),

\[
D(\mu) \in \arg \max_q q \times (\mu - E[P((n - 1)D(\mu) + q + \tilde{\epsilon})]);
\]

(ii) given \( D(\bullet) \), \( P(a) = E[\tilde{\mu}nD(\tilde{\mu}) + \tilde{\epsilon} = a] \).

Several features of this equilibrium are characterized in the following lemma.

**Lemma 5** There is a unique symmetric linear equilibrium characterized as
follows:

(i) given $P(a) = b + da$, then $D(\mu) = \frac{\mu - b}{d(n+1)}$,

(ii) $b = \nu$ and $d = \frac{\sigma_\nu \sqrt{n}}{\sigma_e (n+1)}$

(iii) a sophisticated trader’s expected trading profits are given by $\frac{\sigma_\nu \sigma_e}{(n+1) \sqrt{n}}$.

By combining (i) and (ii) and using $a = nD(\mu) + e$, we can also write the pricing equation as

$$P = \nu + \frac{n}{n+1} (\mu - \nu) + de.$$ (28)

Lemma 5 can be applied to the situation in which there is a public accounting report $R$ by replacing the priors $\tilde{\mu} \sim \mathcal{N}(\nu, \sigma^2_\mu)$ by posteriors formed from observing the public report. Explicitly, if after observing $R$, the market-maker updates his beliefs about the firm’s value $\tilde{\mu}$ to $\mathcal{N}(\nu(R), \sigma^2(R))$, then

(1) the price of the firm based on the report $R$ when $\tilde{\mu} = \mu$ and liquidity traders’ demands total $e$ are given by:

$$P = \frac{\nu(R)}{n+1} + \frac{n\mu}{n+1} + de,$$ (29)

and (2) an informed trader’s expected trading profits are given by

$$\frac{\sigma(R) \sigma_e}{(n+1) \sqrt{n}}.$$

Proof of Lemma 5

Begin by taking the pricing function $P(\mu) = b + d\mu$ as given. Consider the trading behavior of a single sophisticated trader who also takes the demand functions $D(\mu) = g + h\mu$ of the other $n - 1$ sophisticated traders as given. In picking his market order $q$ when $\tilde{\mu} = \mu$, this investor’s perception of the expected price at which his market order will be executed is given by:

$$E[P((n-1)D(\mu) + q) + \tilde{e}] = b + d ((n-1)D(\mu) + q).$$

So, the size of this investor’s expected profit-maximizing market order is determined by that $q$ that solves:

$$\max_q q [\mu - b - d ((n-1)D(\mu) + q)].$$ (30)
This maximization problem has first-order condition:

\[
q = \frac{[\mu - b - d ((n - 1) D (\mu))]}{2d}.
\]  \hspace{1cm} (31)

In a symmetric equilibrium, this value \( q \) must equal \( D(\mu) \). So, the equation

\[
g + h\mu = \frac{[\mu - b - d ((n - 1) (g + h\mu))]}{2d}
\]  \hspace{1cm} (32)

is an identity in \( \mu \). Solving, we find that \( h = \frac{1}{d(n+1)} \). The constant terms on both sides of (32), (i.e., the terms not involving \( \mu \)), must also equal each other, i.e., \( g = -\frac{c-d(n-1)a}{2d} \), that is, \( g = -\frac{c}{d(n+1)} \), so \( D(\mu) = \frac{\mu-b}{d(n+1)} \), as claimed in (i).

The market maker takes the function \( D(\bullet) \) as just derived, as given and calculates \( E[\tilde{\mu}nD(\tilde{\mu}) + \tilde{c} = a] \). Since all random variables are normal, this conditional expectation is given by

\[
E[\tilde{\mu}] + \frac{\text{cov}(\tilde{\mu}, \tilde{a})}{\text{var}(\tilde{a})}(a - E[\tilde{a}]) = \nu + \frac{\sigma^2}{\sigma^2 + \sigma^2(n+1)}(a - \frac{(\nu - b)n}{d(n+1)})
\]

But, since this conditional expectation must also equal \( P(a) = b + da \) for all \( a \), it follows that

\[
d = \frac{\frac{\sigma^2}{\sigma^2 + \sigma^2(n+1)}\frac{n}{\sigma^2(n+1)}}{\frac{n^2}{\sigma^2(n+1)^2} + \sigma^2}\n
\]

and

\[
b = \nu - \frac{d(\nu - b)n}{d(n + 1)}
\]

The second equation implies

\[
b = \nu
\]

and the first equation implies

\[
d = \frac{\sigma^2}{\sigma^2(n+1)}
\]
Given $\mu$, the expected trading profits of a sophisticated investor are

$$D(\mu)(\mu - P(nD(\mu)))$$

$$= \frac{\mu - \nu}{d(n+1)}(\mu - \nu - dn(\frac{\mu - \nu}{d(n+1)}))$$

$$= \frac{(\mu - \nu)^2}{d(n+1)^2}$$

$$= \frac{\sigma_\epsilon(\mu - \nu)^2}{\sigma_\mu \sqrt{n}(n+1)}.$$  

Taking expectations over $\hat{\mu}$, we conclude that these expected trading profits are

$$\frac{\sigma_\epsilon \sigma_\mu}{\sqrt{n}(n+1)}.$$ These observations prove Lemma 5,

**Proof of Theorem 2**

The following sequence of inequalities proves the claim.

$$m^2\{E\eta^2 + \frac{n(n+2)}{(n+1)^2} \sigma_\epsilon^2\} > \left(\frac{m}{n+1}\right)^2 (\hat{\eta}^2(1-\alpha)^2 + (n+2-\alpha)E\theta^2 - \alpha^2 \sigma_\theta^2 - \frac{m^2 \alpha^2}{c(n+1)^2} (\bar{\eta} - \frac{\alpha^2}{4c(n+1)^2})$$

$$(n+1)^2 E\eta^2 + n(n+2) \sigma_\epsilon^2 > \bar{\eta}^2(1-\alpha)^2 + (n^2 - \alpha^2 + 2(n+\alpha)) (E\eta^2 + \sigma_\epsilon^2) - \alpha^2 \sigma_\theta^2 - \frac{\alpha^2}{c} (\bar{\eta} - \frac{\alpha^2}{4c(n+1)^2})$$

$$(1-\alpha)^2 \eta^2 + ((1-\alpha)^2 - 1) \sigma_\epsilon^2 > \bar{\eta}^2(1-\alpha)^2 - \frac{\alpha^2}{c} (\bar{\eta} - \frac{\alpha^2}{4c(n+1)^2})$$

$$(1-\alpha)^2 \sigma_\theta^2 + ((1-\alpha)^2 - 1) \sigma_\epsilon^2 > -\alpha^2 \sigma_\theta^2 - \frac{\alpha^2}{c} (\bar{\eta} - \frac{\alpha^2}{4c(n+1)^2})$$

$$(1-\alpha)^2 \sigma_\theta^2 + \alpha^2 \sigma_\epsilon^2 > \sigma_\epsilon^2 - \frac{\alpha^2}{c} (\bar{\eta} - \frac{\alpha^2}{4c(n+1)^2}).$$

**Proof of Theorem 3** Recall that, according to (15), in the generic Kyle model, the expected trading profits of an informed investor, calculated after the firm has issued its accounting report $R_i$, are given by $\frac{\sigma(R_i) \sigma_\epsilon}{(n+1)\sqrt{c}}$. Here, $\sigma(R_i)$ is the standard deviation in the value of the asset being traded, as perceived by the market maker, after the accounting report $R_i$ has been issued. At the time an investor chooses what accounting firms and/or standards to study, he does not know $R_i$. But, he can calculate the expected value of his trading profits based on what possible reports will subsequently appear.
In the normal standard regime, if $\tilde{\eta} = \eta$, and the published report turns out to be $R_i$, then $\sigma(R_i) = q \omega_i \sigma_\varepsilon$, since the uncertainty to the market maker after this report emerges involves only the idiosyncratic information $\tilde{\varepsilon}$. It follows from (16) that, at the time the firm announces its accounting standard, $E[\hat{q}_i | I^*, \eta] = \frac{2m}{n + 1} \{ \eta + n \theta_i \}$, and so $E[\hat{q}_i \omega_i \sigma_\varepsilon | I^*, \eta] = \frac{2m^2 \sigma_\varepsilon^2}{n + 1} \{ \eta + n \theta_i \}$, and so, using (1), $E[\hat{q}_i \omega_i \sigma_\varepsilon] = E[E[\hat{q}_i \omega_i \sigma_\varepsilon | I^*, \eta]] = 2m^2 \sigma_\varepsilon \tilde{\eta}$, and hence an informed investor’s expected trading profits (calculated before any accounting report is released) from studying a firm on normal standards when there are $n$ informed investors is $\frac{2m^2 \sigma_\varepsilon \tilde{\eta} \sigma_\varepsilon}{(n + 1) \sqrt{n}}$.

Now consider the "no standards" regime. Given the report $R_i = (q_i, T_{\hat{\theta}_i}(\omega_i))$ in the "no standards" regime, since $\text{var}(\theta_i | \hat{\theta}_i) = \frac{\sigma_\varepsilon^2}{\sigma_{\hat{\theta}_i}^2 + \sigma_\varepsilon^2}$ (since $\hat{\theta}_i$ is a (biased) sample estimate of $\theta_i$ with precision $\frac{1}{\sigma_{\hat{\theta}_i}^2}$, and according to DeGroot [1970], the posterior precision of an estimate is the sum of the prior precision (in this case, $\frac{1}{\sigma_{\hat{\theta}_i}^2}$) and the precision of the sample (in this case, $\frac{1}{\sigma_\varepsilon^2}$), it follows that $\sigma(R_i) = q \omega_i \sqrt{\frac{\sigma_\varepsilon^2}{\sigma_{\hat{\theta}_i}^2 + \sigma_\varepsilon^2}}$. Now, according to (23), $E[\hat{q} | I^*, \theta_i, \delta] = \frac{m_n}{n + 1} \{ \tilde{\eta}(1 - \alpha) + (\alpha + n) \theta_i + \alpha \delta - \frac{\alpha^2}{2(n + 1)} \} + \alpha \delta$, and so $E[E[\hat{q} | I^*, \theta_i, \delta]] = 2m \{ \tilde{\eta} - \frac{\alpha^2}{2n(n + 1)} \}$. Therefore, $E[E[\hat{q} \omega_i \sigma_\varepsilon | I^*, \theta_i, \delta]] = 2m^2 \{ \tilde{\eta} - \frac{\alpha^2}{2n(n + 1)} \} \sqrt{\frac{\sigma_\varepsilon^2}{\sigma_{\hat{\theta}_i}^2 + \sigma_\varepsilon^2}}$, so the expected trading profits of an investor are $\frac{2m^2 \{ \tilde{\eta} - \frac{\alpha^2}{2n(n + 1)} \} \sigma_\varepsilon \sqrt{\sigma_{\hat{\theta}_i}^2 + \sigma_\varepsilon^2}}{n + 1} = \frac{2m^2 \{ \tilde{\eta} - \frac{\alpha^2}{2n(n + 1)} \} \sigma_\varepsilon \sigma_{\hat{\theta}_i} \sqrt{\alpha}}{(n + 1) \sqrt{n}}$.

**Proof of Corollary 1** Clearly, $\tilde{\eta} > \{ \tilde{\eta} - \frac{\alpha^2}{2n} \}$. So, the inequality holds if $\sigma_\varepsilon \geq \sigma_{\hat{\theta}_i} \sqrt{\alpha}$. But, the latter inequality is equivalent to $\sigma_{\hat{\theta}_i}^2 (\sigma_\varepsilon^2 - \sigma_{\hat{\theta}_i}^2) + \sigma_\varepsilon^4 \geq 0$.

**Proof of Lemma 5** follows immediately from using the bounds $n^2 \leq (n + 1) \sqrt{n} \leq (n + 1)^2$ and the expressions for an informed trader’s expected trading profits as presented in the proof of Theorem 4.

**Proof of Corollary 2**

Let $\pi$ be an informed trader’s expected profits in the normal standard regime. In equilibrium, the number of informed investors adjusts so as to preserve the identity: $\frac{\pi}{c_{ext}} = (n + 1) \sqrt{n}$. Set $k = \frac{\pi}{c_{\delta}}$ and consider the identity in $k : (n(k) +
1) $\sqrt{n(k)} = k$. The solution to this identity, $n(k)$, is clearly increasing in $k$. The various results then follow by seeing how $k$, which proxies for $\frac{2m^2 \sigma_x \bar{u} \sigma}{\epsilon_{std}}$ in the normal standard regime changes with the indicated parameters.$\blacksquare$

4 References


