PRICE DISCRIMINATION
IN A COMPETITIVE
MARKET WITH INFORMED
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ABSTRACT

In virtually all previous work concerning informed trading on stock markets or futures markets those with inside information could trade only once on the basis of their information. This paper gives a more appropriate model of informed trade by permitting agents to make transactions with different market makers. A competitive equilibrium always exists in this model, but perfect price discrimination is not possible since a trader does not signal perfectly (i.e., completely reveal his information) until he has finished trading. Because of this, those who make large aggregate transactions will get capital gains. Another feature of this sequential revelation model is that there will generally be a price correction after a trader exits. This follows because traders are facing a sequence of "pooling prices".
1. INTRODUCTION

This paper deals with equilibrium in a competitive market with informed traders. There is a large number of market makers who transact with better-informed hedgers. These hedgers are free to trade more than once.

When a hedger can trade only once, a market maker can set a non-linear offer schedule that sorts the hedgers and returns an expected profit of zero. When an equilibrium exists, then, the size of the hedger's market order reveals his information (or, equivalently, his type). This assumption of one trade is critical to the results of much of the literature which deals with adverse selection. (See Leland and Pyle [1977] or Rothschild and Stiglitz [1976], for example.) It is clearly not appropriate in the context of trade on financial or commodity markets since traders do not generally commit to trading only once.

In the present paper the hedger can trade with many different market makers at different prices. Even though market makers can monitor the transactions made by their competitors, the hedger does not reveal all of his information while he is trading because the aggregate quantity bought or sold is not revealed until he has completed trading.

The type of setting envisaged is the following (although the approach is applicable to other problems). A grain exporter has just negotiated a favorable deal with a foreign country. The exporter has a desired net position, and this deal represents an endowment shock (albeit self-induced) to his holdings. Because there is still demand side uncertainty, a risk averse grain exporter has an incentive to trade quickly on his inside information.
The analysis is done in a general framework. In the present model, a unique equilibrium with trade always exists. In this equilibrium, better-informed traders collect rent from their information. Trade is not just a question of risk transfer. While ex ante expected profits are zero for all market makers, hedgers who make large trades get expected capital gains while those who make small trades take expected losses. Thus, large hedgers gain from the externality that they impose on small hedgers. Again, this runs counter to results from previous work dealing with adverse selection. In Rothschild and Stiglitz (op cit), for example, the externality is totally dissipative - the high risk types are no better off than in the full information case.

The competitive equilibrium is unique in terms of the aggregate offer schedule. This schedule has appealing properties. The first is that a positive bid-ask spread necessarily exists. A buy order indicates that the hedger's estimate of expected value is higher than the common prior. The opening ask price is therefore greater than the ex ante expected value, and some traders may be "priced out" of the market.

In addition to the possibility that some traders may find it unprofitable to enter, it is also possible that different types of hedgers might exit the market at the same price-quantity pair. Then, the closing price cannot reveal perfectly the information of the trader who enters either. This contrasts with the full revelation property of the one-shot rational expectations equilibrium.

It also happens that the sequence of the hedgers' opening and closing prices will exhibit negative serial correlation. Buyers will push the closing price above expected value and sellers will push it below because the hedging motive causes traders to take an expected capital loss on (at least) their last transaction. When a buyer pushes price above expected value there must be a sub-
sequent (expected) decline in price since the act of leaving the market does not generate a transaction price. This means that the sequence of opening and closing prices will exhibit negative serial correlation even though all agents have rational expectations.

In the next section the basic model is described. In Section 3 the results are given for the case of a single hedger whose type follows a discrete distribution. Existence and uniqueness of equilibrium are shown. Section 4 gives the equilibrium for the case of a continuum of types. In Section 5 there is a discussion of the results and possible extensions. A conclusion follows.
2. MODEL

In the basic model there is one risk averse hedger who can be one of several types. The hedger has exponential utility:

\[ U(W) = -\delta W. \]

\( W \) is wealth and \( \delta \) is the coefficient of absolute risk aversion. Before trade takes place, the hedger receives an endowment shock \( \tilde{z} \) which has a mean of zero. The size of the shock is correlated with the value of the risky asset. The hedger has no other endowment.

There is one risky asset. It has liquidation value

\[ \tilde{v} = -b\tilde{z} + \tilde{\theta}. \]

The parameter \( b \) is a known constant, while the noise term has distribution:

\[ \tilde{\theta} \sim N(0, \sigma^2_\theta). \]

The liquidation value is not affected by the actions of the hedger or dealers. The expectation of the liquidation value, before any information arrives, is \( V_0 = 0 \). We will concentrate on the case of a negative shock, so the hedger will be a buyer. The other case is handled symmetrically.

A type \( t \) hedger receives a shock \( s_t \) or \( -s_t \) with equal probability. Thus when we refer to a "type \( t \) trader" we mean that the trader has received this shock from the distribution of all possible shocks. Without loss of generality we assume that the \( s_t \) form an increasing sequence. When there is just one hedger in the world we define \( V(t) = bs_t \) as the expectation of the liquidation value given that the hedger is of type \( t \). The probability that the hedger is of type \( t \) is given by \( f(t) \).
A hedger with exponential utility who receives an endowment shock \(-s_t\), and faces the outlay schedule \(R(x)\), would solve the problem:

\[
\max_x E[-e^{-\delta[(x-s_t)\tilde{V}-R(x)]}|V(t)|].
\]

This gives the first order condition:

\[
0 = E[e^{-\delta(x-s_t)}(\tilde{V}-R'(x))|V(t)|].
\]

This is solved by:

\[
x = s_t + [V(t)-R'(x)]/\delta \sigma^2_	heta.
\]

The slope of the outlay schedule does not matter because the price of the inframarginal units is not affected by, and does not affect, the total quantity purchased. In particular, this means that a hedger facing the constant price \(p\) has demand

\[
x = s_t = (V(t)-p)/\delta \sigma^2_	heta.
\]

The reservation price of a type \(t\) hedger is the price at which he is indifferent about purchasing. That is,

\[
r(t,0) = V(t) + \delta \sigma^2_	heta s_t = (b + \delta \sigma^2_	heta) s_t.
\]

Similarly, the reservation price for the type \(t\) hedger after he has purchased an amount \(x\) is

\[
r(t,x) = r(t,0) - \delta \sigma^2_	heta x.
\]
This reflects what the hedger is willing to pay for the marginal unit precisely because demand depends on the net holdings of the risky asset, but not on the level of non-stochastic wealth. In particular, the actual purchase prices paid previously do not affect the decision of when to stop buying and leave the market.

The buyer pooling price is defined as:

\[
 p(t) = \frac{\sum_{i > t} V(i)f(i)/\sum f(i)}{\sum_{i > t} f(i)/\sum f(i)} = \frac{b\sum_{i > t} f(i)/\sum f(i)}{\sum_{i > t} f(i)/\sum f(i)}.
\]

This price is the expected value of the asset, given that the buyer's type is in the interval \([t, \infty)\). It will turn out that these are the ask prices which will be charged in equilibrium by the competitive market makers.

There is a large pool of risk neutral market makers who have no inventory costs or constraints. They can see the publicly announced offer schedules of each of their competitors which are posted at the beginning of trade. Market makers can also see trades being completed by their competitors.

Setting the entire schedule at the beginning, rather than making new offerings after each transaction, is not restrictive. If hedgers can be recognized, and if market makers are rational, it would never be profitable to sell first and then to commence buying. This issue arises in Kyle (1985).

The market makers individually announce offer schedules \(Q_j(p)\) giving the maximum quantities they are willing to trade. These are cumulative schedules, so \(Q_j(p)\) gives the total quantity offered by dealer \(j\) at prices less than or equal to \(p\). The aggregate offer schedule is \(Q(p) = \sum_j Q_j(p)\). Some dealers may find it optimal to offer no trades, given the schedules of their competitors.

Given the aggregate offer schedule, define \(R(x)\) as the total outlay required to purchase an aggregate quantity \(x\). Letting \(P(q)\) be the inverse of the aggregate offer schedule, the outlay schedule is given by the (Lebesgue) integral
(2.11) \( R(x) = \int_0^x P(q) dq \).

\( R(x) \) is continuous (assuming the asset is perfectly divisible) and increasing, but need not be differentiable everywhere. Where the outlay schedule is not differentiable, \( R'(x) \) is taken to be the left hand derivative. As the hedger moves along the outlay schedule the left hand derivative represents the price paid for the marginal unit. \( R'(x) \) is increasing since hedgers always buy from cheaper sources first.

There are no search or transactions costs for the hedger. The hedger completes his purchase by going from market maker to market maker, starting with the lowest posted ask price and making individual purchases until he decides to exit. Thus the hedger is a perfectly discriminating monopsonist. If a hedger desires less than the total quantity offered at a given price, he will select randomly from the group of market makers setting that ask price. Thus there is no ordering of market makers.

When the hedger exits the market, the value of the asset is determined from knowledge of the total quantity purchased. It is only upon his exit that the information possessed by the hedger can be known with certainty. We can now define an equilibrium.

Definition 1. An equilibrium consists of a trading strategy \( X(z) \) from the hedger and a set of offer schedules \( Q_j(p) \), one from each market maker, such that the following conditions hold:

(2.12) All active dealers receive a non-negative expected profit, and no entrant can add to the aggregate offer schedule \( Q(p) \) and earn a positive profit, given rational behavior by the hedger; and

(2.13) \( X(z) = \arg\max \{ E[U((x+\bar{z})V-R(x))| \bar{z}=z] \} \) is the optimal total market order.
In a market equilibrium, each market maker earns an expected profit of zero because of the threat of entry by identical market makers. Risk neutrality means that the provision of market making services exhibits constant returns to scale. Hence there will be an indeterminacy of the number of market makers who actually trade. However, the aggregate quantity offered at any price will be determinate.
3. ENDOWMENT SHOCKS WITH A DISCRETE DISTRIBUTION

In this section we first demonstrate the general form of the equilibrium for the case of a two point distribution, and then for a more general discrete distribution. The proof that the equilibrium is of the form given will follow.

Suppose that the hedger can be one of two types. It is straightforward to calculate the ask prices that will be seen in this competitive equilibrium. First note the possible clienteles that might be served by an individual market maker. When a trader enters the market his initial market order, if it is a purchase, only says that the updated expectation of \( \tilde{V} \) is higher than the common prior. If this alone is known then the ask price must be the first pooling price \( p(1) \) since it is not known whether the hedger trading received a shock \(-s_1\) or \(-s_2\).

We first consider the case in which the reservation price for the type 1 hedger is

\[
(3.1) \quad r(1,0) = (b + \delta \sigma^2) s_1 > p(1).
\]

In this case a type 1 hedger is willing to buy at the pooling price. As is shown in Figure 1, he will purchase an amount \( x_1 \). (In the only other qualitatively different case, \( r(1,0) \leq p(1) \) and only a type 2 hedger would trade.)

At this point we reach the quantity constraint necessitated by the adverse selection problem. If a quantity greater than \( x_1 \) is offered in aggregate at this price, then the expected profit to a dealer selling at this price is negative. To see this, assume that an amount \( x_1 + \varepsilon \) is available at price \( p(1) \). A type 1 hedger would still purchase only \( x_1 \), but a type 2 would take \( x_1 + \varepsilon \). This leaves an aggregate expected profit:

\[
(3.2) \quad -x_1 (f(1)V(1) + f(2)V(2) - p(1)) + \varepsilon f(2)(p(1) - V(2)) < 0.
\]
Each individual market maker setting an ask price of $p(1)$ would get an ex ante expected loss. In this case, market makers would get all of the bad trades (those with a type 2 hedger) but are rationed with respect to the good trades. Thus only a quantity $x_1$ will be offered at this price.

For quantities beyond $x_1$, only a type 2 hedger would make purchases. The price at which he will be served is $p(2) = V(2)$, and he will purchase $s_2 - x_1$ at that price.

There are no problems with separation of the types. A type 2 trader will always get full insurance. After purchasing at $p(1)$, a type 2 hedger has the option of further reducing his position in the risky asset by purchasing at a price equal to his estimate of expected value. This trade is unambiguously beneficial to a risk averse trader. Hence the two types will purchase different aggregate quantities, and it will be clear which type of hedger entered.

Here the type 1 hedger pays a price above expected value. A type 2 hedger receives the expected capital gain of $bf(1)(s_2 - s_1)$ on the inframarginal units since he cannot be identified initially. Thus the externality imposed by the type 2 is not dissipative.

When there are three possible types, the only ask prices which can occur in equilibrium are $p(1)$, $p(2)$ and $p(3) = V(3)$. If $r(1,0) < p(1)$ a type 1 hedger will not enter. Now the problem reduces to the case of two possible types. Thus either the type 2 and type 3 hedgers will enter, or just a type 3 will.

Consider now the case $r(1,0) > p(1)$. A type 1 hedger will purchase an amount $x_1$ at $p(1)$, as will a type 2 or type 3 hedger, given the strict ranking of demands. The problem has again been reduced to the case of two types, but with a twist. If $r(2,x_1) < p(2)$, a type 2 hedger would also exit after purchasing
x₁ at p(1). The condition necessary for this bunching is derived later when the case of K types is solved. With bunching, the two types cannot be distinguished by their market behavior. Thus the price at which trading ends will not be fully revealing if the hedger who enters the market is a type 1 or type 2.

For the case of K types, the equilibrium industry offer schedule is determined iteratively. It turns out that there will be between 1 and K different ask prices offered.

The first step is to find the marginal type that enters the market. First we check whether the reservation price of the type 1 hedger is larger than the pooling price which he faces. If so, he would enter. If not, we check whether the reservation price for the type 2 hedger is larger than the pooling price that he faces, and so on. In terms of the present notation, if r(1,0)>p(1) a type 1 hedger enters. If not, check whether r(2,0)>p(2). Since r(K,0)>p(K)=V(K), there exists at least one type which satisfies the condition. Designate the first such type encountered t₁. This hedger will buy an amount x₁ at price p(t₁).

The procedure continues by checking whether r(t₁+1,x₁)>p(t₁+1) or r(t₂+2,x₁)>p(t₂+2) and so on. The first type which satisfies this is denoted t₂. We start again at t₂+1, and continue until reaching t=K.

There will always be trade offered at the ask price p(K). A type t₁ hedger buys x₁ at a price p(t₁)>V(t₁) and hence x₁<s₁. Similarly, for all but the highest type, the final trade takes place at a price above expected value, and therefore x_j<s_j. All of this means that when a type K trader finishes buying from the market makers with prices below V(K), he will have purchased an aggregate amount less than s_K. Thus a type K hedger will want to purchase when price equals p(K)=V(K). This shows that the market never breaks down: there will
always be an equilibrium with trade. We now state the general uniqueness result.

Theorem 1. When the hedger who comes to market can be one of K types, there will be a unique equilibrium industry offer schedule. Depending on the actual distribution of the endowment shocks, the equilibrium schedule will have between 1 and K different ask prices. These ask prices and the quantities offered are as given in the above algorithm.

Proof. Assume that the first m trades given by the aggregate offer schedule are of the desired form. If the next price is above the appropriate pooling price, an entrant can undercut the incumbents and make a profit. (In particular, this means that there can be no cross-subsidization of trades.) If this next price is below the pooling price, the incumbents are getting less than expected value, and hence are taking an expected loss.

Now say that the price does equal the appropriate pooling price. If the quantity offered is below the specified level, there is an opportunity for profitable entry at a slightly higher price. If the quantity is high, then there is an adverse selection problem. Dealers are rationed with respect to the good trades and would have a negative expected profit. Thus the equilibrium schedule must be of the form described above. Q.E.D.

In equilibrium, all but the highest type get less than complete hedging. The smallest types take an expected capital loss while the largest types receive an expected capital gain. Note also that this discrete bid-ask offer schedule was not assumed. Rather, it came about as the unique competitive equilibrium.

The possibility of bunching has also been mentioned. Say that after purchasing $x_1$ at price $p(t_1)$, types $t_1+1$, $t_1+2$, ..., $t_1+e$ all would exit. For $w$ in this
interval, it must be the case that \( r(w,x_t) < p(w) \). This leads to the following theorem.

**Theorem 2.** The necessary and sufficient condition for bunching is:

\[
(3.3) \quad p(t+1) - p(t) > (b + \delta \sigma^2_\theta)(s_{t+1} - s_t).
\]

Proof. By definition of the reservation prices,

\[
(3.4) \quad r(t+k,x_t) - r(t,x_t) = (b + \delta \sigma^2_\theta)(s_{t+k} - s_t) > 0 \quad \text{for} \quad k > 0.
\]

Thus a type \( t+1 \) or higher hedger would never drop out before a type \( t \). Attention can be restricted to the lowest type that would exit early.

For early exit, the reservation price for a type \( t+1 \) hedger after purchasing \( x_t \) must be below the next pooling price. That is, \( r(t+1,x_t) < p(t+1) \). But we know that

\[
(3.5) \quad r(t+1,x_t) = (b + \delta \sigma^2_\theta)s_{t+1} - \delta \sigma^2_\theta x_t.
\]

We also know from (2.7) that:

\[
(3.6) \quad x_t = s_t + (b s_t - p(t)) / \delta \sigma^2_\theta.
\]

Thus the necessary and sufficient condition for bunching can be written as:

\[
(3.7) \quad (b + \delta \sigma^2_\theta)(s_{t+1} - s_t) < p(t+1) - p(t). \quad \text{Q.E.D.}
\]

An example illustrates the analysis. We look at a uniform distribution for the endowment shock:

\[
(3.8) \quad f(t) = 1/K \quad \text{for} \quad t = 1, 2, ..., K; \quad \text{with} \quad s_t = t.
\]

Thus a type \( t \) hedger gets a shock \( t \) or \(-t\). The first type which would enter has \( r(t,0) > p(t) \). By the same token, \( r(t-1,0) < p(t-1) \). This determines the marginal
trader \( \hat{t} \):

(3.9) \[ \frac{1}{2}b(K-\hat{t}-1)/(\hat{t}-1) > \delta \sigma^2 > \frac{1}{2}b(K-\hat{t})/\hat{t}. \]

The change in the pooling price is,

(3.10) \[ (bt + b(k+t)/2) - (bt + b(k+t-1)/2) = b/2. \]

This is always smaller than

(3.11) \[ (b+\delta \sigma^2)(s_t - s_{t-1}) = b+\delta \sigma^2. \]

Thus there will never be a case of two types which would leave at one price.

The total purchase by a type \( t \) hedger is

(3.12) \[ x = t + (V(t) - p(t))/\delta \sigma^2 = t + (1/2)b(t-K)/\delta \sigma^2. \]

This gives a regular stepwise aggregate offer schedule.
4. CONTINUOUSLY DISTRIBUTED ENDOWMENT SHOCKS

We now move to the case where shocks have a continuous distribution. Put differently, we look at a world with a continuum of possible types. A trader of type $t$ has an endowment shock of $t$ or $-t$. Thus expected value conditional on his information is $V(t) = bt$. A competitive market maker who knows that he is facing a buyer whose type is in the interval $[t, \infty)$ would set price equal to

$$p(t) = \frac{\int_{t}^{\infty} V(i) f(i) di}{\int_{t}^{\infty} f(i) di}$$

in order to break even on the trade.

In analyzing the continuous case, we will derive the industry offer schedule. By the previous arguments, it will be seen to be the unique equilibrium. At each price, there will be dealers offering infinitesimal transactions. (There could also be mass points, giving the aggregate offer schedule flat spots.)

A trader of type $t$ will never purchase at a price greater than $p(t)$ in equilibrium. Competition ensures that he will not have to pay a price above $p(t)$. The threat of entry by competitive market makers enables him to purchase at prices up to $p(t)$. As before, however, the type $t$ hedger may drop out at a lower price. In this case there will be bunching, and the offer schedule will be discontinuous over an interval of prices containing $p(t)$.

In analyzing the case of a continuous distribution for endowment shocks, we will first consider the case where a continuous offer schedule exists (i.e. no bunching). Say the industry offer schedule is continuous for $x > 0$. Then the outlay schedule is differentiable and, as before, the hedger of type $t$ maximizes expected utility by setting
(4.2) \[ x = t + \frac{[V(t) - R'(x)]}{\sigma^2}. \]

For a continuous offer schedule, a type \( t \) hedger exits the market at a price equal to \( p(t) \). Substituting for \( V(t) \) and \( R'(x) \) gives:

(4.3) \[ x = t + \left( \frac{b}{\sigma^2} \right) \int_t^\infty \frac{f(i)di}{f(i)di}. \]

This gives \( x \) as a function of \( t \) alone.

A hedger in this case will trade until his reservation price is reached. With bunching, \( p(t) = r(t, x_t) \) but, for some small \( \epsilon > 0 \), \( p(t+\epsilon) > r(t+\epsilon, x_t) \). That is, the change in the pool of possible types left drives the pooling price above the reservation price of the type \( t+\epsilon \) hedger. This leads to discontinuities in the offer schedule. The necessary condition is now derived.

Theorem 3. The necessary and sufficient condition for bunching when the range of possible types forms a continuum is:

(4.4) \[ p'(t) > \frac{\partial r(t, x_t)}{\partial t} = b + \sigma^2. \]

Proof. Assume \( p(t) = r(t, x_t) \). We know that \( r(t, x) \) is strictly increasing in \( t \). Thus it cannot be the case that a type \( \nu \) would drop out but a type \( \eta \) would stay in when \( t < \eta < \nu \). If there is bunching, the types involved will form an interval of the form \([t, y]\).

It must be the case that \( p(w) > r(w, x_t) \) for all \( w \) in the interval \([t, y]\). A necessary and sufficient condition for there to exist such an interval with \( p(w) > r(w, x_t) \), is that \( p'(t) > \frac{\partial r(t, x_t)}{\partial t} = b + \sigma^2. \) Q.E.D.

As with a discrete distribution, examples can be constructed which have entire intervals of types which would leave the market at a given price and
quantity. When there is not simultaneous dropping out, the offer schedule is given by \( r(t, x_t) = p(t) \) for all types which enter.

One final point is that there will necessarily be a positive bid-ask spread. That is, the initial purchase will take place at a price bounded away from \( V_0 \). This is shown in the following theorem.

Theorem 5. There will be a positive bid-ask spread for all non-degenerate distributions of endowment shocks.

Proof. For the cases of both continuous and discrete shocks, the pooling prices are the only ask prices which will be seen in equilibrium. So long as there is dispersion in the distribution, these are all strictly greater than \( V_0 = 0 \). In particular, \( p(0) > 0 \). Q.E.D.
5. DISCUSSION

The preceding analysis can be extended in several ways. When there are several informed hedgers, the value of the asset is

\[ V = -b \sum_{i=1}^{N} z_i + \theta. \]  

(5.1)

For simplicity, we take the \( z_i \) to be independently and identically distributed, with means of zero. Hedgers enter the market sequentially. The first hedger enters, trades and then exits. Quantity is announced, prices are reset, and the next hedger enters.

The above setting captures the idea that traders arrive at random intervals and complete their trades quickly, before the next trader arrives. This is what typically happens on commodity markets. Again using the example of a grain deal, there is an incentive to trade quickly on the basis of this information.

The sequence of opening and closing prices will exhibit negative serial correlation even though the price will be semi-strong form efficient by virtue of its reflecting all public information. This contrasts with the martingale properties traditionally found in theoretical work involving informed trading. (See Roll [1984].) Look at the case \( N=2 \) hedgers, and let the first trade be a purchase. The opening price is \( p(1) \), and the closing price is greater than or equal to expected value conditional on the hedger's information. The expectation this period of the second period's opening and closing prices is \( V(t) \), by independence. Hence a price rise is followed by an expected drop. Likewise, a drop is followed by an expected rise. This happens, of course, because the hedger's exit does not generate a transaction price.
In much previous work use has been made of noise traders or liquidity traders who possess no information and hence appear to trade randomly. Certainly not all traders who come to the market possess valuable information. Here, we model the case in which there is one type of liquidity trader and one type of hedger.

By analogy with the case of two informed types, we let \( s_1 \) be the maximum purchase which a liquidity trader would make. \( V_1 = 0 \) because he has no information. The two pooling prices are \( p(1) = f(2) V_2 \) and \( p(2) = V_2 \). If the first pooling price is smaller than the reservation price for the liquidity trader he enters and purchases an amount \( x_1 < s_1 \). If the pooling price is higher, then the liquidity trader will not enter, but the informed trader will enter regardless and purchase \( x_2 = s_2 \).

When there are \( K \) types or a continuum of types the results generalize. This happens even if the liquidity traders have a larger position to hedge than do some of the informed traders. As well, even when liquidity traders are present, small informed traders may take an expected capital loss.

Finally, this type of analysis is relevant for other situations where an agent reveals his type by market behavior. For example, it is relevant to the pricing of new issues of bonds and equity. Depending on the fixed costs of floating new issues, it may pay some firms to go to the market more than once rather than signalling their riskiness all at once. Conversely, good new firms may have to seek venture capital because they are "priced out" of traditional markets.
6. CONCLUSION

This paper has developed a model of an asset market where informed hedgers can trade several times. There is always a unique equilibrium with trade. It is also a general property that there is negative serial correlation in the sequence of opening and closing prices. Those who buy drive price up above expected value conditional on their information. Because of this, the closing price was biased upward in the case of a purchase, and downward in the case of a sale. This serial correlation of prices occurred even though all traders have rational expectations, and no frictions are present.

Small traders suffer for being unable to identify themselves as not being well-informed. The spread precludes some from trading, while those who do trade cannot get complete hedging, and make purchases at prices above expected value. By contrast, the largest type can get both complete hedging and a capital gain. This result occurs because large traders cannot be identified with certainty until after they have finished trading.

Another feature common to the cases of discrete and continuous endowment shocks alike is that the signal of those who trade may not be revealed fully. This happens when an interval of types of hedgers would leave the market at the same price. This bunching meant that the market sorted the hedgers imperfectly.
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