

Welfare Cost of Informed Trade

By

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Abstract

In order to address the issue of the welfare costs of informed trade, a new Glosten-Milgrom type model is constructed with elastic uninformed trade. Since uninformed trade is elastic, there are some uninformed who choose not to trade because their idiosyncratic valuation lies within the spread. This lack of trade is a welfare loss and the model can be used to estimate the magnitude of the loss. Calculations show that the welfare loss tends to be single-peaked in the amount of informed trade, reaching a maximum at an internal point. That is, after some point, the welfare loss is decreasing in the amount of informed trade because with more informed trade information gets into prices faster and spreads decline. For short term information (information likely to be revealed in a short amount of time) the maximum loss occurs at a very high probability of informed trade meaning that the welfare loss is mostly increasing in informed trade. For longer term information, the maximum occurs at a relatively small probability of informed trade suggesting that over some range welfare loss is actually declining in informed trade.

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There is a significant amount of capital market regulation, in the US and around the world that is concerned with maintaining a level playing field. In the US, Regulation FD (“Fair Disclosure”) states that if a company provides material information to anyone, it must release it to everyone and if material information is leaked, the information must be made public. The intent is clear—the firm cannot convey to anyone an informational advantage.

Rule 242.601 of Regulation NMS (“National Market System”) that covers the “dissemination of transaction reports and last sale data with respect to transactions in NMS stocks” states, among many other things, “...no national securities exchange or national securities association may...prohibit, condition or otherwise limit...the ability of any vendor to retransmit or display in moving tickers, transaction reports or last sale data...” The regulation does not control what an exchange may charge the vendor for the data, except to say that the charges must be “...reasonable [and] uniform...” My reading suggests that, at least in part, the regulation is aimed at leveling the trade history informational playing field. Some have argued that the SEC should go further and access to quotes and trades should be free, requiring a sort of “net neutrality” in the market.

Rule 10b-5 of the 1934 act has been and is construed as protecting against individuals doing something based on private information. In fact insider trading cases are typically prosecuted under this theory of 10b-5 and the SEC enacted Rule 10b5-1, in 2000, which clarifies the use of 10b5 in these prosecutions. These examples suggest that the SEC and others consider a “level informational playing field” important. That is the cost of an unlevel playing field is worth the cost of regulation. I venture, however, that we really do not have much of an idea of the welfare cost of informed trade. The

question is what, in fact, are the welfare consequences of informed trade. What are the consequences of reducing but not eliminating informed trade?

To be clearer, for this analysis, I am not interested in the value (or cost) of the information that informed trade might convey, but rather the mechanism by which the information comes to be reflected in prices. One might imagine that informed trade provides signals to managers and thus makes for better real decisions (Fishman and Hagerty (1992), Goldstein and Jiang (2005)). On the other hand, information that comes out before hedgers have an opportunity to hedge provides a welfare cost of information (Foucault and Cespa (2008) and Glosten (1989)). I will provide no analysis of these questions here. Rather, the welfare loss associated with informed trade will be defined to be the total welfare of all participants without informed trade, but with the same information that would be generated by informed trade, less the total welfare of all participants with informed trade. Thus, the cost of informed trade is calculated for the same information arrival process.

That the answer to this question should not be obvious is suggested by the following loose analysis. Consider the standard example of a Glosten Milgrom model in which the future price will either be high or low, informed know this future value and arrive at some rate α . Uninformed randomly buy or sell and arrive at rate $1-\alpha$. The higher is α , the higher is the *initial spread*, but the faster information is revealed through trade, and the lower is the spread after some time is elapsed. Thus, if we consider the spread to be a measure of welfare loss (not in general legitimately as the foregoing will show), we see that with higher α , the total welfare loss might be quite low since most of the time trading will be at a very small spread. On the other hand, with low α , the initial

spread is low, but this spread will persist for a longer time since information revelation is much slower.

Market microstructure models are suggestive of a welfare cost of informed trade since they deliver a trading friction—a spread between bid and offer. Yet, the models have not generally been useful for this since they typically involve noise traders—traders whose trades are independent of the terms of trade. Both Kyle and Glosten Milgrom models typically use noise traders. This implies that the spread represents merely a transfer from the uninformed to the informed with the dealers as zero profit conduits. A few market microstructure papers have fully endogenized trade in order to make welfare statements—Glosten (1989), Bhattacharya and Spiegel (1991), Ausubel (1990), Medrano and Vives (2004)). These models, however, consider only a point in time and do not address the dynamic issues considered above.

The welfare costs and benefits of insider trading have been extensively debated in the law and economics literature as well as in the finance literature. In the finance literature, the discussion is typically framed within a noisy rational expectations equilibrium paradigm. Furthermore, most of these papers are of the normal-CARA type (except Ausubel (1990) and Bhattacharya and Nicodano (2001)), and investigate the effect on real investment of insider trading. Ausubel (1990), Bhattacharya and Nicodano (2001) and Medrano and Vives (2004) are notable in that they do not rely on noise trade (random supply) and hence can calculate expected utilities. Indeed Medrano and Vives (2004) provides numerical results that suggest it is not legitimate to do a welfare analysis in the presence of noise trade.

The normal-CARA model, is typified by the one in Medrano and Vives (2004). There are three types of traders—those with information, those who wish to hedge a random position correlated with the future security value and speculators. The future value of the security is an exogenous normal random variable. Three types of results come out of this model. The fact that the price conveys information, makes uninformed traders demands less responsive to price than if there were no private information. That is, the market is thinner due to adverse selection. This reduces the amount of risk sharing and hence reduces total welfare.

The second effect is that the price revealing information implies that there is less information unrevealed and the risk premium goes down. This effect is also examined in Easley and O'Hara (2004). This is perhaps a less interesting result since this follows from the exogenous future payoff. An institutional change (insider trading) that makes the current price more informative will likely make the future price more informative as well leaving the uncertainty of the price change mostly unchanged.

The third effect is often referred to as the Hirschleifer effect—revealing more information before agents get a chance to hedge is welfare reducing. Informed trade then has a negative welfare effect, and the more informed there are, the more information gets into prices (unless the market closes down) and the worse is the welfare effect. This effect is probably stronger in the models than in reality and the model result is again due to the exogenous uncertainty. A change in an institution that increases the amount of information in prices today will also increase the amount of information in prices tomorrow, leaving the unresolved uncertainty roughly the same.

Any model that includes private information must have some feature that negates the no trade theorem (Milgrom and Stokey (1982) and the normal CARA models do this with random endowments correlated with the security payoff. Certainly this is mathematically convenient and economically easy to interpret. I am not sure, however, that the assumption can realistically generate the number of shares traded in a typical day, nor the frequency with which some agents trade. They may be called “hedge funds” but a fraction of their trades involve hedging in the sense of these models.

This paper presents a new Glosten-Milgrom type model with informed and uninformed traders. In a binomial world, the value of the security will be either high or low and the informed receive signals about its future value. Unlike typical incarnations of this model, uninformed trade is modeled rather than specified exogenously. The specifics are given below, but the idea is that uninformed traders have private values for the security and they buy if the private value is sufficiently high and sell if the value is sufficiently low. However, if a private valuation lies within the spread, the uninformed does not trade. Thus, the decisions of the uninformed to buy, sell or not trade are based on their valuations and the quotes. It is this potential lack of trade that leads to the welfare calculations. Yet, the zero profit quotes are easily derived and the transaction prices (updated probabilities that the future value is high) have nice dynamic properties. One possibility is that potential informed trade is so heavy, and their information is so good that the market will not open at all.

The specification of uninformed preferences allows a calculation of the expected total welfare earned from trading. This welfare can be compared to the expected welfare that would be earned in an environment with the same information process as that

generated by the informed trade but with no spread. The latter minus the former is the welfare loss of informed trade, keeping the information the same. This per period expected welfare loss is related to the spread, but is not identical to it. The total expected welfare loss is the sum from trade 1 to trade T of the expected welfare losses. Time T is the random time that the information is publically announced.

From the observations above, it is apparent that if there is very little informed trade, then the initial spread and welfare loss is low. However, information gets into prices very slowly as well and so this spread and welfare loss will persist. If there is a lot of informed trade, but not enough to shut down the market, the initial spread and expected welfare loss will be high, but information will get into prices quickly with consequent low spreads and low welfare loss. The question to be answered is how the total expected welfare changes as a function of the arrival rate of informed traders.

Examining the total expected welfare loss as a function of the arrival rate of informed traders, it is obvious that the loss is zero at zero. The welfare loss if the probability of informed trade is greater than .5 and their information is perfect is quite large since the market closes down. However, the limit of the total welfare loss, as the probability of informed trade goes to .5 is positive, and the derivative is negative in the limit. There evidently is a probability of informed trade that maximizes the total welfare loss.

Computations reveal the following. When the time to public revelation of the information is probabilistically small, the relation between welfare loss and the probability of informed trade is essentially monotonically increasing, with the total loss dropping very near .5. On the other hand, when the time to public revelation of the

information is probabilistically large, the relation is more clearly hill shaped. One calculation shows that the total welfare loss is maximized when the probability of informed trade is near roughly .25.

Calculations reveal that, reasonably, the per capita profit to the informed traders declines with the number of traders. Thus one can imagine the equilibrium number of informed traders (and hence the probability of informed trade) being determined by a break even condition based on the cost of becoming informed. The analysis above suggests that if obtaining private information is costly relative to the return to information, then an increase in the cost of obtaining information, which reduces the probability of informed trade will reduce the welfare cost and increase total welfare. On the other hand, if the cost is low and the probability of informed trade is high, an increase in the cost will increase the welfare cost for long dated private information but generally decrease the welfare cost for short dated information.

The Model

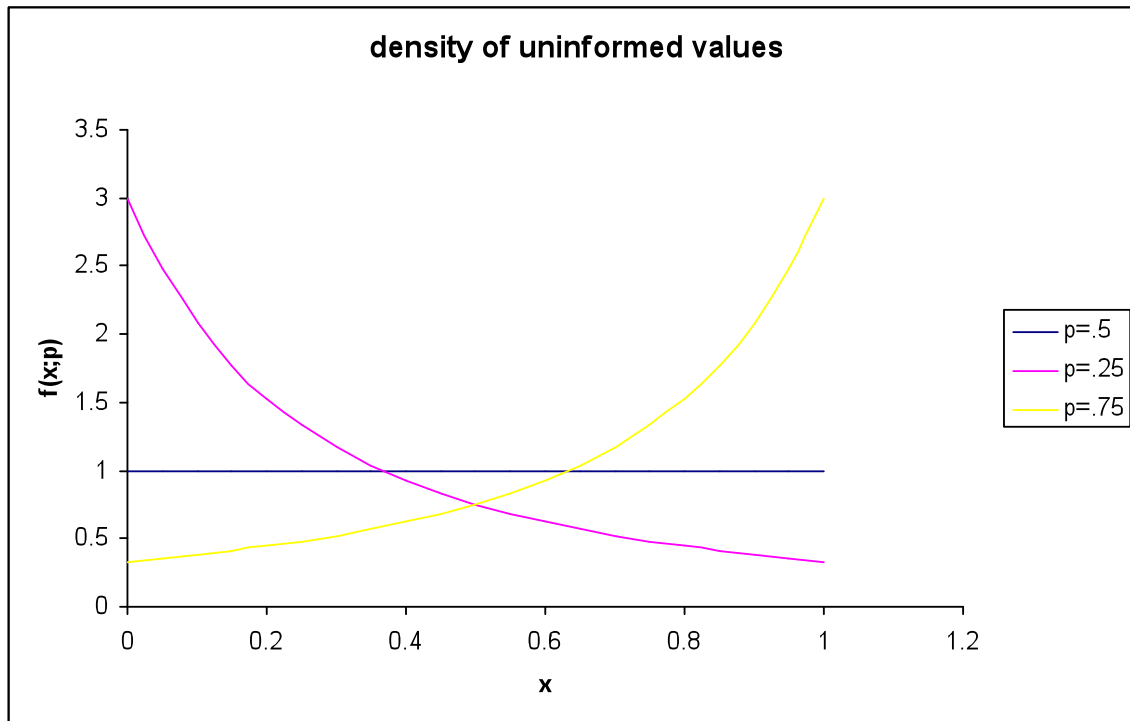
I adopt a GM framework in which the (not distant) future value of the security in question will be V . The future value will be either one or zero. Informed serially receive a signal regarding the future value and upon receiving the information go to the market planning to trade once. The rate at which informed learn and trade on this information is captured by α , the probability that an arrival is informed. The signal the informed receive is either H (high) or L (low) and the quality of the signal is measured by $q = P\{\text{Signal} = H|V = 1, \text{history}\} = P\{\text{Signal} = L|V = 0, \text{history}\} > .5$. An informed trader who sees the signal H when the current expected value of V is p will have revised value $v_H = pq/[pq +$

$(1-p)(1-q)]$ while an informed trader who sees signal L will have revised value $v_L = p(1-q)/[p(1-q) + (1-p)q]$. The informed trader who sees the high signal will buy at the ask if v_H exceeds the ask and the informed who sees the low signal will sell at the bid as long as v_L is below the bid. In equilibrium this will be the case.

An uninformed trader, who arrives at time t with probability $1-\alpha$, has a private valuation $v(t)$. Given the expectation at time t , p , $v(t)$ has the following distribution:

$$P\{v(t) < v | p, \text{ history}\} = v(1-p)/[v(1-p) + (1-v)p] = F(v). \tag{1}$$

The uninformed buys if $v(t)$ is larger than the offer, sells if $v(t)$ is less than the bid and otherwise does not trade. By definition of being uninformed, this value is, given p , independent of V . The figure below illustrates the density associated with this distribution for various p 's.



When $p = .5$, the distribution is uniform. When $p < (>) .5$ the density is has more mass near zero (one).

This distribution has an interesting interpretation. Imagine that the uninformed receive signals that they believe are informative about V , but in fact are not. Furthermore, in the cross section different uninformed individuals have different confidence in their signals. Specifically, an uninformed agent drawn at random sees a high or low signal, and this agent believes that $P\{\text{high}|V=1\} = P\{\text{low}|V=1\} = z > 1/2$. Across agents, this perceived quality z is uniformly distributed on $[\frac{1}{2}, 1]$. In fact, of course, since these individuals are uninformed, the true probability of receiving the high signal is $.5$, independent of V . This setup, which is stated as result 1, leads to the distribution proposed in (1).

Result 1

Let $v_H(z;p)$ and $v_L(z;p)$ be the valuations of an uninformed agents who have seen a high signal and low signal respectively, and who believe that the quality of their signal is z . The current expectation of V is p . Define $v = I_H v_H(z) + I_L v_L(z)$, where I_i is an indicator function for receiving signal i . Suppose z is uniformly distributed on $[\frac{1}{2}, 1]$ and suppose the probability of receiving the high signal is $.5$. Then, $P\{v < t\} = t(1-p)/[t(1-p) + (1-t)p]$.

With this interpretation of the uninformed behavior it is clear that, very confident people, those who think that their signal quality is high will trade, buying on the high signal and selling on the low. Those with less confidence, who think that their signal quality is near $.5$ will decide not to trade since their value, conditional on their signal, will lie within the spread. It is this lack of trade that will be the basis for the welfare cost measure.

As is standard, I assume that bids and offers are determined so that a liquidity supplier expects zero profits. Recall that α is the probability of an informed arrival, and F

is the distribution of uninformed private values. Then, the following expressions are immediate:

$$P\{\text{buy}|V=1, \text{history}\} = \alpha q + (1-\alpha)(1-F(\text{Ask}));$$

$$P\{\text{Sell}|V=1, \text{history}\} = \alpha(1-q) + (1-\alpha)F(\text{Bid});$$

$$P\{\text{Buy}|\text{history}\} = \alpha(pq + (1-p)(1-q)) + (1-\alpha)(1-F(\text{Ask}));$$

$$P\{\text{Sell}|\text{history}\} = \alpha(p(1-q) + (1-p)q) + (1-\alpha)F(\text{Bid}).$$

This leads to a characterization of equilibrium ask, A, and bid, B.

Result 2

The zero profit offer and bid when the public information expectation of V is p and q, the quality of informed information, is less than 1 are given by:

$$A/(1-A) = \delta p/(1-p)$$

$$(1-B)/B = \delta(1-p)/p.$$

$$\delta = \frac{2\alpha q - 1 + \sqrt{1 - 4\alpha(1-\alpha)(2q-1)}}{2\alpha(1-q)} \quad (2)$$

Furthermore, as long as $\alpha < 1$, A is less than the informed valuation given a high signal and B exceeds the informed valuation given a low signal so the market is always open.

If $q = 1$, then for $\alpha < 1/2$, the above holds with $\delta = 1/(1-2\alpha)$. The market closes down if it is anticipated that α would be $1/2$ or greater.

For $q < 1$, it is clear why the market is open no matter what $\alpha < 1$ is. Since the informed valuation given a high signal is less than one, a possible offer quote is that valuation itself. Since the probability of an uninformed valuation in the neighborhood of 1 is positive, there is a positive probability of an uninformed trade at this quote and this quote will yield positive expected profits to the quoter. Thus, an offer less than the

valuation given a high signal but in the neighborhood of it will yield positive profits. A lower offer will yield zero profits.

When $q = 1$, the above argument clearly fails. Consider what happens when $\alpha = \frac{1}{2}$. In this case, as the offer is increased, the losses to informed traders decrease. While the profits per uninformed trader increase, the probability of the uninformed trade decreases at a greater rate than the losses to the informed decrease. As a result there are no quotes that will allow trade and nonnegative expected profits to liquidity providers.

Recalling that bids and offers are, respectively, updated expectations in response to a sell and buy, the equilibrium bids and offers in (2) show that the dynamics of expectations are of a particularly convenient form. Let Q denote the last action in the market (buy=1, sell=-1, no trade = 0). Then updated expectations in response to trade of Q are given by: $p^+(1-p^+) = \delta^Q p/(1-p)$. Thus, if p_t is the updated expectation of V after t trades, we have that

$$\begin{aligned} \ln(p_t/(1-p_t)) &= \ln(p_0/(1-p_0)) + \ln(\delta)(Q_1 + \dots + Q_t) = \\ &= \ln(p_0/(1-p_0)) + \ln(\delta)(\# \text{ buys minus } \# \text{ sells in } t \text{ units of time}). \end{aligned}$$

Further more, given V , the probability distribution of Q_t depends only on the parameters and not on the endogenous expectations of V . These observations are collected in the following:

Result 3

Let p_{t+1} indicate the expectation of V after t units of time, and let Q_t indicate the market action at time t ; i.e. $Q_t = 1$ indicates a buy, $Q_t = -1$ indicates a sale and $Q_t = 0$ indicates no trade. Further, let $N_b(t)$ and $N_s(t)$ indicate respectively the number of buys and number of sells in t units of time. Then the dynamics are given by:

$$p_{t+1}/(1-p_{t+1}) = \delta^Q_t p_t/(1-p_t)$$

$$\ln(p_t/(1-p_t)) = \ln(p_0/(1-p_0)) + \ln(\delta)(N_b(t) - N_s(t)).$$

$$P\{Q_t = 1|V=1\} = P\{Q_t = -1|V=0\} = \alpha q + (1-\alpha)/(\delta + 1)$$

$P\{Q_t = 0|V\} = (1-\alpha)(\delta-1)/(\delta+1)$. Given V , $\{N_b(t), N_s(t), (t-N_b(t)-N_s(t))\}$ follows a trinomial distribution with fixed (given V) probabilities.

Welfare calculations

I take a completely libertarian point of view regarding welfare—if uninformed choose to trade they do so because they want to. A reduction in uninformed trade represents a reduction in overall welfare. Therefore, I calculate realized welfare as follows assuming that the market is open (I is an indicator of an informed arrival, U of an uninformed arrival).

Informed realized welfare is:

$$I[(v_H - A)I_{\{S=H\}} + (B - v_L)I_{\{S=L\}}]$$

where v_i is the revised expected value given all past history and that the signal S is i .

Uninformed realized welfare given a private valuation v is:

$$U[(v-A)I_{\{v>A\}} + (B-v)I_{\{v<B\}}]$$

Liquidity suppliers realized welfare is:

$$I[(A - v_H)I_{\{S=H\}} + (v_L - B)I_{\{S=L\}}] + U[(A-p)I_{\{v>A\}} + (p-B)I_{\{v<B\}}].$$

Total realized welfare, the sum of the above components is:

$$U[(v-p)I_{\{v>A\}} + (p-v)I_{\{v<B\}}]. \quad (3)$$

From the above, it is obvious that welfare depends upon the amount of informed trade because informed trade determines the bids and offers. The higher the bid and the lower the offer, the more uninformed choose not to trade, which reduces welfare.

The benchmark welfare is that which could be earned with a zero spread.

Replacing A and B with p in (3) results in the maximum welfare that could be earned:

$U[(v-p)I_{\{v>p\}} + (p-v)I_{\{v<p\}}]$. Subtracting (3) from this amount leads to my realized welfare cost of informed trade:

$$U[((v-p)I_{\{A>v>p\}} + (p-v)I_{\{B<v<p\}})]. \quad (4)$$

Using the distribution function in (1) and the bids and asks reported in (2), it is straightforward to calculate the expected welfare loss conditional on the markets expectation of V, p.

Result 4

Conditional on p, and $q < 1$, the expected one period welfare loss EWLP, is given by:

$$(1 - \alpha) \frac{p(1 - p)}{(1 - 2p)^2} \ln\left(\frac{(\delta + 1)^2}{4(p + (1 - p)\delta)(1 - p + p\delta)}\right), p \neq .5$$

$$.25(1 - \alpha) \frac{(\delta - 1)^2}{(\delta + 1)^2}, p = .5 \quad (5)$$

For $q=1$, the corresponding expressions are:

$$(1 - \alpha) \frac{p(1-p)}{(1-2p)^2} \ln\left(\frac{(1-\alpha)^2}{1-2\alpha+4p(1-p)\alpha^2}\right), p \neq .5, \quad (6)$$

$$.25 \frac{\alpha^2}{(1-\alpha)}, p = .5$$

The above welfare costs are expected welfare costs at a point in time. It should be clear that these welfare costs are maximized at $p=.5$ and the costs are symmetrical about $p=.5$. Furthermore, it is straightforward to verify that (5) is increasing in δ . While not so obvious, it is possible to show that keeping q fixed, (5) is increasing in α . Similarly, (6) is increasing in α .

It is interesting to relate the welfare cost to the spread. This comparison is easiest at $p = 1/2$, and $q=1$. The spread is given by $\alpha/(1-\alpha)$, while the welfare cost is $.25\alpha^2/(1-\alpha)$. One is proportional to the other, but this proportionality changes as the probability of informed trade changes. The spread is proportional to the welfare cost per informed trader.

The whole point of this exercise is to calculate the sum of total expected welfare loss over time. To do so, I assume that trading will occur until the information that V is either one or zero is publically announced. This occurs at a random time T , which is geometrically distributed, with parameter ρ . That is, the expected value of T is $1/(1-\rho)$ and hence ρ can be a measure of how long the informed have an informational advantage.

The calculations in (5) and (6) show that the per-period expected welfare loss at time t is a function of the parameters and p_t . The dynamics described in (3) and (4) show that p_t is a function of $N_b(t)$ and $N_s(t)$, the number of buys and sells respectively through

trading date t , and as noted, these random variables follow a trinomial distribution, conditional on V . The expected total welfare cost is thus:

$$p_0 \sum_{t=1}^{\infty} \rho^t \sum_{b+s \leq t} \frac{t!}{b!s!(t-b-s)!} P\{buy | V = 1\}^b P\{Sell | V = 1\}^s P\{NT | V = 1\}^{t-b-s} EWLP(b,s) +$$

$$(1 - p_0) \sum_{t=1}^{\infty} \rho^t \sum_{b+s \leq t} \frac{t!}{b!s!(t-b-s)!} P\{buy | V = 0\}^b P\{Sell | V = 0\}^s P\{NT | V = 0\}^{t-b-s} EWLP(b,s)$$

I focus first on the case $q=1$ and $\alpha < 1/2$. I also, for numerical reasons simplify the per period welfare cost to $\alpha^2 p(1-p)/(1-\alpha)$. This approximation to (6) is very accurate (exact at $p = .5$). For this case, the following can be shown.

Result 5

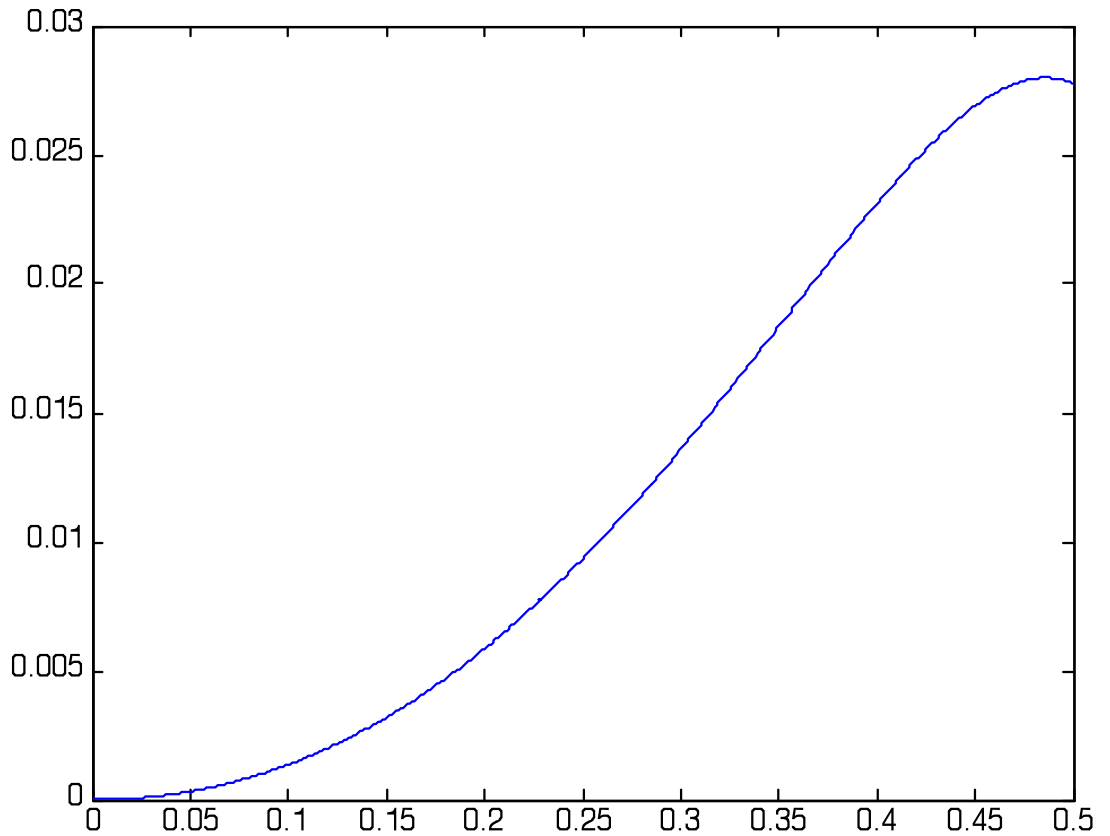
The limit as α goes to .5 of the expected total welfare cost is positive and in the limit, the derivative with respect to α is negative

This result suggests that there is, indeed a trade-off. As the probability of informed trade increases, the initial period welfare effect is negative, but greater informed trade implies that information gets into prices more rapidly. So, for α near to .5, an increase in α actually reduces the total expected welfare costs.

To get a better sense of how the welfare costs are related to α , numerical analysis is required. The next set of figures shows the relation between welfare cost and α for various specifications of ρ .

The next picture show the expected welfare costs for small ρ , i.e. short lived private information. While indeed the derivative is negative near $\alpha=.5$, the cost is

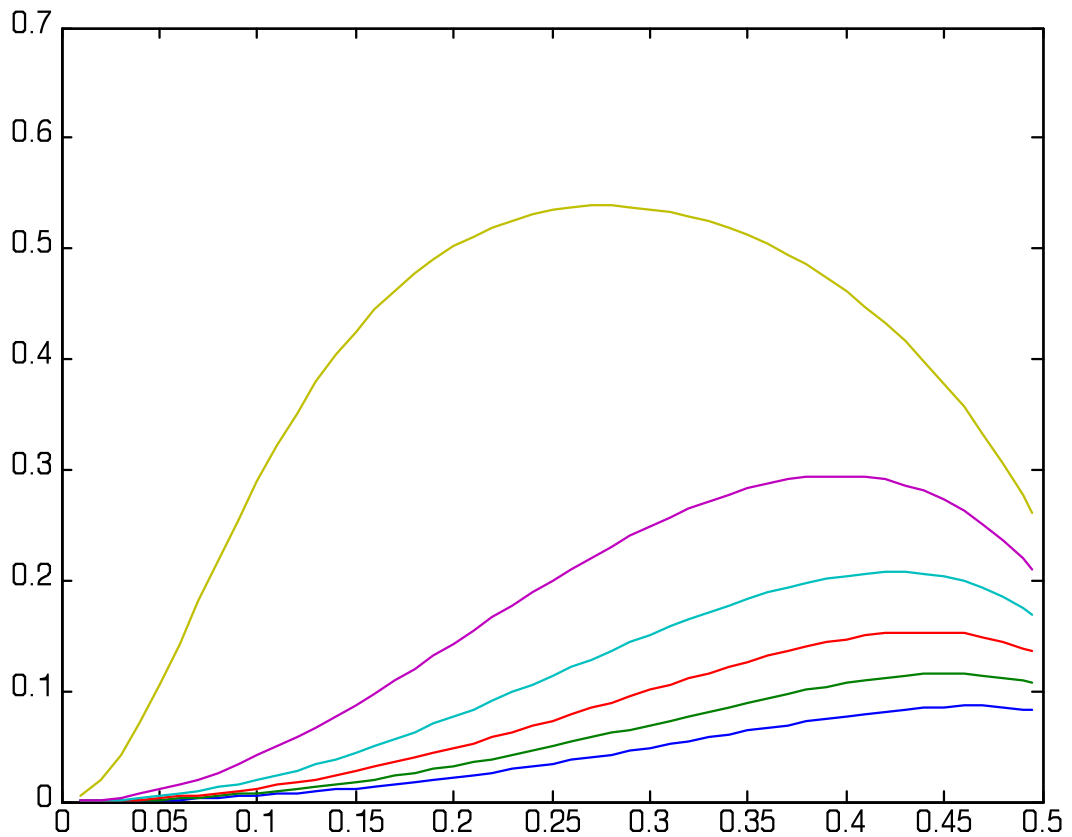
essentially increasing for most of the range of α . For this picture, the expected number of trading periods until the information is revealed is 20.



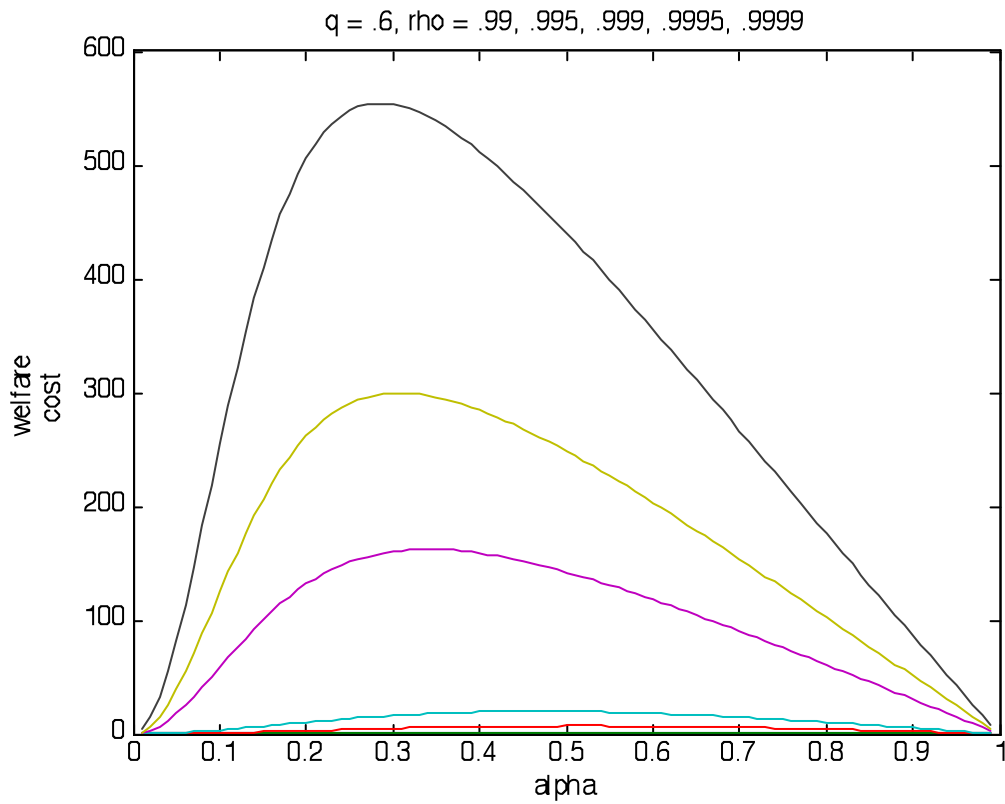
An interesting feature of the model is revealed as longer lived (higher ρ) private information is considered.

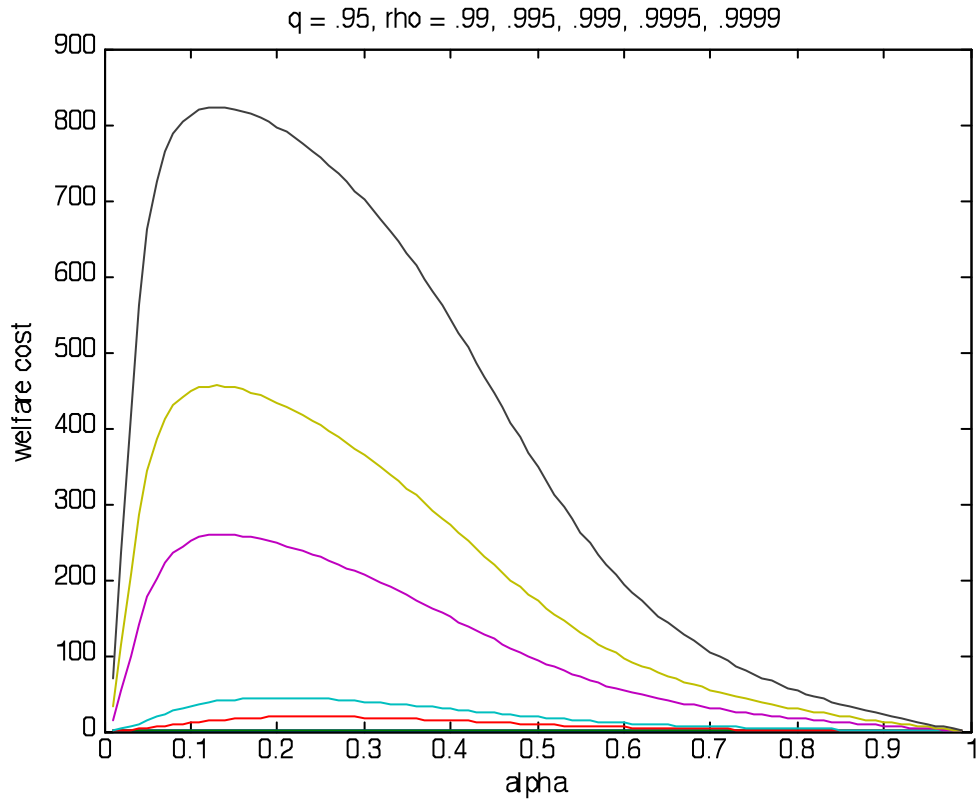
The next figure illustrates that as information becomes longer lived the trade-off between initial per-period welfare cost and the speed of informational arrival. Each of the curves represents the relation between the probability of informed trade, α , and total expected welfare costs. It is not surprising that as ρ increases, the total welfare cost increases.

Once the information is made public, there is no further welfare cost and so if that is done quickly, there will be a lower cost. What is more interesting is that the shapes change rather dramatically. For short lived information, the cost is essentially increasing in α , while it becomes single peaked for longer lived information. The highest curve represents an expected time to public announcement of 200 trading periods. The explanation for this is that with short lived information, the aforementioned tradeoff has little time to materialize. It is only for the longer term information that the tradeoff can be realized.



For the case in which q is less than one the pictures are similar, though, as q increases the welfare minimizing point moves to the left. The following two pictures illustrate the welfare losses for $q = .6$ and $q = .95$. The expected number of trades until the information is revealed for the top curve is now 10,000. Hence, the welfare losses are much higher.





Discussion

The analysis suggests that rules which increase the costs of informed trading are not necessarily welfare improving even if there is no value to the information itself. If, for a particular application, it is thought that the economy lies on the downward face of the welfare cost hill, then increasing the cost of informed trade will reduce α and actually increase welfare costs. On the other hand, there does not appear to be such a conflict for short lived information. For short lived information it might be argued that there is indeed no value to information getting into prices via informed trade. At the same time, reducing the probability of informed trade is likely to be welfare enhancing..

Critical discussion of the model

An important assumption for the specific calculations is that α is taken to be exogenous and unchanging. The first part is quite intentional. My view is that information arrives to traders serially. When an individual becomes informed he or she trades on that information. Specific applications may make specific assumptions about the rate with which new information arrives. Alternatively, and as suggested above, a model might specify a cost of becoming informed which will relate to the number of potential informed and hence the rate at which they arrive to trade.

The constancy of the α is somewhat more problematic, as it is inconsistent with analysis of Back and Baruch (2004). That paper shows that a Glosten Milgrom type model converges to a Kyle type model as uninformed trade becomes small and frequent. But that implies that the intensity of informed trade increases as time passes. That model does consider a monopolist informed trader, while I have in mind a number of distinct individuals becoming informed. But even with that interpretation, as the number of informed increase, and if each informed trader makes more than one trade, then presumably α will increase, perhaps at an increasing rate as the amount of competition increases. In the model in which informed have less than perfect signals, however, it may be that the early informed do not have information that is very valuable. This needs to be examined.

Another aspect of the Back and Baruch result is that the monopolist informed will often engage in bluffing. The motivation for this bluffing is reduced by the presence of other traders with private information. After all, a bluff by one informed trader provides a potential profit opportunity for another informed trader.

Finally, the two point Bernoulli distribution of the final value is certainly unrealistic. I am not sure that it is more unrealistic than the normal model, particularly because the model is designed to exam welfare costs over rather short periods of time.

Application (very preliminary)

Irvine, Lipson and Puckett find evidence of “tipping” in which Wall Street Analysts tell good clients when there will be an equity recommendation change (hold to buy or strong buy). This is not illegal, unless the Wall Street Firm has a policy of not doing it. Should it be illegal? This could be longer term information as the authors suggest the tip could be received up to 4 days before the announcement. On the other hand, institutions doing unusual buying prior to an upgrade account for only 2.5% of volume suggesting that “ α ” is small. There might be evidence that it is welfare reducing. This might call for a “Reg FD” type response.

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