Contagious Adverse Selection[*]

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May 2009

Abstract

We illustrate the corrosive effect of even small amounts of adverse selection in an asset market and how it can lead to the total breakdown of trade. The problem is the failure of "market confidence", defined as approximate common knowledge of an upper bound on expected losses. Adverse selection reverberates through the cells of the traders' information partitions in the manner of Rubinstein's email game. Contagious adverse selection happens when Rubinstein's email game meets Akerlof's lemons problem. We discuss the role of contagious adverse selection and the problem of "toxic assets" in the current financial crisis. We draw lessons on the social value of accounting standards and credit ratings as deriving from their role in generating approximate common knowledge.

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[*] We are grateful to Markus Brunnermeier and other participants at the Princeton Department-wide seminar for comments.

1 Introduction

The problem of "toxic assets" first hit the headlines when the subprime crisis heralded the beginning of the global financial crisis of 2007 – 9. The market for certain asset-backed securities, especially those backed by subprime residential mortgages was the first to suffer extreme illiquidity, as trading slowed to a trickle and market-clearing prices became virtually impossible to establish.[1] However, as the financial crisis has worsened over the subsequent months, the illiquidity in the asset-backed securities market has continued to linger, morphing into a more chronic solvency problem for the banking sector as a whole. Resolving the problem of toxic legacy assets has become a priority for policy makers as they have attempted to grapple with the problem by unveiling policy initiatives such as the PPIP (public-private investment program) that attempt to inject additional balance sheet capacity into the financial system.

The opaqueness of the asset-backed securities market and the attendant potential for adverse selection has frequently been blamed for the sudden drying up of liquidity. Yet, there is a puzzle at the heart of the crisis. Uncertainty about the true value of an asset should not invariably lead to the breakdown of trade. The stock market is a live illustration of how financial markets are normally well adapted to aggregating the diverse information of traders and arriving at a market-clearing price. More reasoned arguments seem necessary to explain satisfactorily the breakdown of trade in the subprime asset-backed securities.

The questions can be posed starkly by examining the fluctuations in the margins involved in collateralized borrowing arrangements such through sale and repurchase agreements (repos). In a repurchase agreement, the borrower sells a security at the price below the current market price on the understanding that it will buy it back at a fixed date at a known price. The difference between the current market price and the price at which the security is sold is known as the "haircut", and fluctuates widely with shifts in market conditions. The size of the haircut determines the degree of leverage that the borrower may attain, so that an increase in the haircut is associated with a decrease in the leverage achieved by the borrower. It is by now well recognized that the global financial crisis that began in the summer of 2007 set

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[1] See Gorton (2008) for a detailed description of the subprime securitization process and the initial phase of the crisis. See also Adrian and Shin (2007), Greenlaw et al. (2008) and Brunnermeier (2009).

off a dramatic deleveraging episode on the part of financial intermediaries, leading to a generalized run from the leveraged sector as a whole.[2] The table below is from IMF's Global Financial Stability Report (IMF (2008)), and shows the percentage haircuts prevailing in the securities markets at two dates – in April 2007, before the eruption of the crisis, and in August 2008 a full year into the crisis. Gorton and Metrick (2009) give more detailed time-series charts of haircuts for asset-backed securities over this period.

Security	April 07	August 08
US Treasuries	0.25	3
Investment grade bonds	0 – 3	8 – 12
High yield bonds	10 – 15	25 – 40
Equities	15	20
Prime MBS	2 – 4	10 – 20
ABS	3 – 5	50 – 60

Haircuts on repos (percent) (source: IMF (2008))

The haircuts increase from April 2007 to August 2008, but what is notable is how the extent of the increase varies across asset classes. In particular, notice that the haircut on equities increases only marginally from 15% to 20%, even though equities are arguably the most volatile in terms of price fluctuations and hence subject to the greatest fundamental uncertainty. In contrast, the haircut on asset-backed securities (ABSs) increase from 3 – 5% to a massive 50 – 60%. Even this very high haircut increased further after the bankruptcy of Lehman Brothers in September 2008, effectively shutting off the repo market based on ABSs (see Gorton and Metrick (2009)).

A better handle on the problem comes from the recognition that the natural holders of asset-backed securities are leveraged entitites such as hedge funds and financial intermediaries. Figure 1 taken from Greenlaw et al. (2008) shows that of the approximately \$ 1.4 trillion dollars' worth of subprime exposure, around two thirds were borne by leveraged institutions such as hedge funds, commercial banks and investment banks. As such, the motivation to conserve scarce balance sheet capacity would have figured promi-

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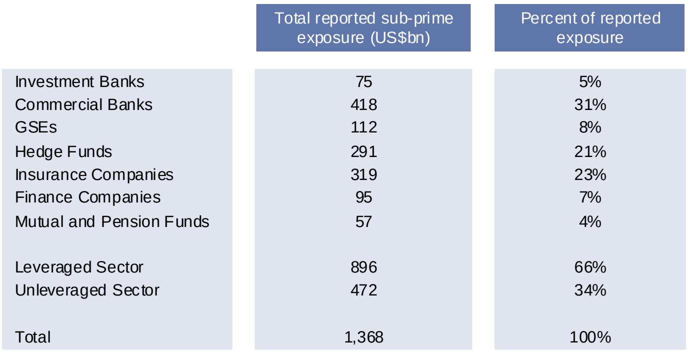
[2] Geanakoplos (1997, 2009) and Brunnermeier and Pedersen (2009) offer alternative theoretical perspectives. See also Adrian and Shin (2007, 2009) and Brunnermeier (2009) for the impact of deleveraging in amplifying the crisis.



	Total reported sub-prime exposure (US$bn)	Percent of reported exposure
Investment Banks	75	5%
Commercial Banks	418	31%
GSEs	112	8%
Hedge Funds	291	21%
Insurance Companies	319	23%
Finance Companies	95	7%
Mutual and Pension Funds	57	4%
Leveraged Sector	896	66%
Unleveraged Sector	472	34%
Total	1,368	100%

Figure 1: Total Subprime Mortgage Exposure ($ Billion) (Source: Greenlaw, Hatzius, Kashyap and Shin (2008))

nently in the willingness to trade toxic securities, as well as to lend against them as collateral.

If a bank were to accept an illiquid security as collateral in a repo, the bank is vulnerable to a shock that necessitates the selling of the security to raise cash. In the absence of a buyer, the bank may have to sell it at firesale prices. Acharya, Gale and Yorulmazer (2009) is a recent paper that formalizes this logic. The large haircuts on some securities could be seen as a response by leveraged entitites to the potential drying up of trading possibilities in the asset-backed securities (ABS) market. The equity market, in contrast, is populated mainly with non-leveraged entities such as mutual funds, pension funds, insurance companies and households, and hence is less vulnerable to the drying up of trading partners.

However, this line of reasoning begs the crucial question of why the market for the ABS security is so illiquid, and why it is so difficult to find terms of trade that would be mutually acceptable to buyer and seller. It is this question that we address in our paper. The answer to this question is the final piece in the jigsaw that completes the picture and answers the key questions on the propagation mechanism behind the current financial crisis.

The starting point of our analysis is adverse selection resulting from information asymmetries on the true value of the asset. For asset-backed securities, the heterogeneity of the underlying loan pools that back the securities gives ample scope for greater expertise and information in ascertaining the fundamental value of the securities. When overall economic fundamentals are strong, such asymmetric information need not matter for the value of the particular asset-backed security, since such securities are debt claims that are insensitive to the value of the underlying claims, as noted by Gorton and Pennacchi (1990). However, when a shock impacts the economy (such as reversal of the housing market that ultimately underpins the value of the security), then the true value of the debt security becomes more sensitive to private information and the asymmetric information begins to exert an influence in the trading decisions.

Moreover, the new breed of asset-backed securities such as collateralized debt obligations (CDOs) written on subprime mortgages have skewed payoffs in which they retain their value close to face value in most states of nature, but suffer catastrophic loss in extremely bad states (see Coval, Jurek and Stafford (2009)). As we will see below, it is this extreme skewness of the payoffs that lead to the most drastic failure of trade.

Concretely, we consider the following bilateral trade problem. We suppose it is common knowledge among two traders that an asset is worth $2c$ more to the potential buyer than to the potential seller at every state of the world. Thus it is common knowledge that the ex post gains from trade are $2c$ and so (if they split the difference) each can be guaranteed an ex post gain of c. The ex ante welfare function can be written simply as:

$$\text{Ex ante welfare} = \ 2c \times \ \text{Probability of trade}$$

Thus, maximizing the ex ante probability of trade is the efficient outcome. However, the question is whether there is a price that the asset can be traded that makes both seller and buyer willing to trade at the interim stage when there is asymmetric information.

We suppose that there is a small probability δ in each uninformed agent's mind, that his partner knows something that creates a large benefit M to the partner at his expense. The "loss ratio" is the ratio of the expected losses of an uninformed agent (δM) and his known gains from a split the difference trade (c). We first consider the benchmark case where the there is complete information about the expected loss ratio, and show that trade will take place if and only if the loss ratio $\left(\frac{\delta M}{c}\right)$ is less than one.

However, the more intriguing case is when there is incomplete information about the loss ratio. In other words, each agent is unsure exactly what his partner's perception of expected losses are. In such circumstances, the adverse selection can be shown to have a much more corrosive effect where the fear of asymmetric information reverberates throughout the information structure and gets amplified in the process. It is possible that even when the ex ante probability of adverse selection is small, there can be a catastrophic breakdown in trade. Essentially, the incomplete information leads to an unraveling result in a coordination game among differentially informed traders. Each uninformed trader would like to trade if the trading partner is also an uninformed trader. Otherwise, the trading partner is likely to be an informed party who will take advantage of the uninformed trader. The strength of the coordination motive depends on the underlying fundamentals. When the risky security ceases to be informationally insensitive in the sense of Gorton and Pennacchi (1990) but instead becomes sensitive to the underlying state, then the coordination motive will interact with the asymmetric information, leading to a breakdown of trade.

Insights from the literature on common knowledge and higher order beliefs going back to Aumann (1976), Milgrom and Stokey (1982) and Monderer and Samet (1989) establish that trade will take place if there is approximate common knowledge of interim gains from trade. We explore this theme further and point to the importance of approximate common knowledge of an upper bound on expected losses. We could dub this approximate common knowledge "market confidence", since the presence of market confidence leads to a collective perception that trade is mutually beneficial. The collective perception is crucial, since without it, the mere fact that trade is mutually beneficial will not induce the right actions. Conversely, if the conditions for market confidence fail, then an ex ante arbitrarily unlikely possibility of high losses can lead to a what we call "contagious adverse selection", where traders whose expected losses are well below their ex post gains from trade withdraw from trade because they fear their uninformed partner may refrain from trade. This phenomenon gives an adverse selection interpretation of the unravelling in the "electronic mail game" of Rubinstein (1989). Indeed, the breakdown of trade in our model could be characterized as the outcome of the meeting between Rubinstein's (1989) email game with Akerlof's (1970) lemons problem. Most importantly, our model demonstrates how even a negligible ex ante probability of loss can shut down the market completely.[3]

While the key insights of our analysis can be obtained from a simple trading game, we also examine how general are the results by examining the

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[3] In what follows, we take the information structure as given. See Dang (2009) for a framework where the information is endogenously determined as a choice of the traders.

more abstract mechanism design problem that does not rely on a particular institutional arrangement associated with fixed trading rules. We show that analogous results on the breakdown of trade hold even in the general mechanism design framework, although we must replace common knowledge with weak common knowledge (Geanakoplos (1994)) for the main impossibility result.

The notion of market confidence as approximate common knowledge ties in with a broader set of arguments on the importance of institutions that ensure common understanding, and common knowledge of the important fundamentals. We argued elsewhere (Morris and Shin (2007a)) that there are important tradeoffs between providing accuracy (individually correct beliefs) and commonality (approximate common knowledge of beliefs) for many problems in economics. Holmstrom (2009) has argued that this tradeoff is particularly important in thinking about the regulatory reforms on transparency, and the coarse nature of credit ratings. The coarse nature of the credit ratings may have a rationale in terms of promoting common understanding, at the expense of a finer grid for the fundamentals. In Morris and Shin (2007a), we argue there coarse accounting standards can be seen as an institution that could potentially provide the commonality.

Our objective in this paper is to highlight the importance of commonality of information, and how the lack of such commonality can lead to sub-optimal outcomes. In order to emphasize our key theme, the model is deliberately stark, but we believe that our results shed much light on the broader problem of common knowledge and trade, as well as providing a spur for a more systematic investigation of the role of adverse selection in exacerbating the current financial crisis.

The outline of our paper is as follows. We begin by stating the fundamentals of our trading environment. We then introduce adverse selection and incomplete information on the severity of the adverse selection. We compare the outcome for two cases. The first is a simple trading game, where trade takes place when both the buyer and seller say “yes” to a proposed exchange price. The second is a more abstract mechanism design context, and highlights the fundamental constraints that face any trading institution. We show that severe limits to trade persist, no matter how elaborate the trading institution can be.

2 Endowments and Preferences

There are two traders, called agent 1 and agent 2. Agent 1 owns an asset with private value of $v - c$, while agent 2's value of the asset is $v + c$. It would be efficient for 1 to sell the object to 2, say at a price of v which splits the gains from trade. However, there is adverse selection from information held by one or other trader. Agent 1 may have some information that the object is less valuable to both agents by amount M, so the values of agents 1 and 2 are $v - M - c$ and $v - M + c$ respectively. Symmetrically, agent 2 may have some information that makes the object more valuable to both agents by the same amount M, so that agents 1 and 2 have values $v + M + c$ and $v + M - c$ respectively. We assume that M is much bigger than c.

We have in mind the archetypal example where the asset in question is an asset-backed security backed by subprime mortgages, but where the quality of the mortgage pool depends sensitively on the region and date of their origination. The two traders are equally well-informed most of the time, but we allow the possibility that one or other of the agents is better informed than his trading partner, and that the information could be positive or negative. The highly skewed payoffs associated with subprime CDOs motivates payoffs in the trading game, where for most of the time there are (small) gains from trade, but for a few states of the world, there are large payoff consequences of trade. See Coval, Jurek and Stafford (2009) for an introduction to the economics of structured finance.

In our simplified setting, the agents' total values can be depicted in terms of the following table. We distinguish the "normal" state as one in which the value to the seller is $v - c$ and the value to the buyer is $v + c$. This is the state that will hold with high probability ex ante. However, in the informed state for the seller the asset is a lemon. In the informed state for the buyer, the asset is a peach.

	value to agent 1	value to agent 2
"normal" state	$v - c$	$v + c$
1's informed state	$v - M - c$	$v - M + c$
2's informed state	$v + M - c$	$v + M + c$

If agents trade at price v, total gains from trade are

	gains of agent 1	gains of agent 2
“normal” state	c	c
1’s informed state	$c+M$	$c-M$
2’s informed state	$c-M$	$c+M$

Ex ante, assume that each agent assigns probability $1-\delta$ to the normal state, and probability δ to the partner’s informed state, so the ex ante probabilities of states are as given in the following table:

	gains of 1	gains of 2	prior prob.
“normal” state	c	c	$\frac{1-\delta}{1+\delta}$
1’s informed state	$c+M$	$c-M$	$\frac{\delta}{1+\delta}$
2’s informed state	$c-M$	$c+M$	$\frac{\delta}{1+\delta}$

Define the *loss ratio* for a trader to be the ratio:

$$\psi = \frac{\text{expected losses}}{\text{gains}} = \frac{\delta M}{c}$$

Throughout the paper we will fix the gains from trade c as a constant. A convenient feature of our basic set up is that ex ante welfare (the sum of the agents’ ex ante expected utility from trade) is simply $2c$ times the probability of trade.

$$\text{Ex ante welfare } = 2c \times \text{ Probability of trade}$$

Thus, we have an easy welfare criterion - namely to maximize the probability of trade.

We first examine a simple trading game where each trader says “yes” or “no” to trade at some proposed price. Trade takes place if and only if both say “yes”. We establish the key role played by approximate common knowledge of the lower bound on the loss from trade. We say that there is “market confidence” when such approximate common knowledge holds. When it fails to hold, we show that there is contagious adverse selection in a sense to be made precise below.

Next, we depart from the simple trading game, and instead consider the allocations that can result from a general mechanism. Our motivation here is to address the potential restrictiveness in the simple trading game as a method of trasferring the asset. In principle, other more sophisticated trading mechanisms may be used. By addressing the allocations that result from the general mechanism, we can be sure that any negative result on the possibility of trade (and hence on the inefficiency of the outcome) does not rely on artificially restricting the trading mechanism.

Both the simple trading game and the general mechanism shed light on the problem. The simple trading game illustrates starkly how the absence of common knowledge leads to inefficiently low trade. The allocations under the general mechanism establish benchmarks that are robust to the institutions, but which by necessity are less easy to associate with commonly encountered market institutions.

3 Simple Trading Game

We first examine the simple trading game where each trader says "yes" or "no" to trade at some proposed price. Trade takes place if and only if both say "yes". This trading mechanism is arguably a fairly realistic portrayal of how trade takes place in an over-the-counter (OTC) market where most asset-backed securities are traded. Recall that we used ψ to denote the loss ratio faced by a trader. We will first examine the benchmark case where ψ is common knowledge between the two traders, and determine the probability of trade. We then present the analysis of the case where ψ is not common knowledge, and establish the importance of approximate common knowledge.

3.1 Complete Information on ψ

We will use a convenient normalization. In what follows, we will let

$$\delta = \frac{c\psi}{M}$$

For now, assume that ψ is common knowledge. Informed types have a dominant strategy to say "yes" to the proposed trade. Thus, assuming the informed types play their dominant strategies, we can identify the payoffs of the 2×2 game at the interim stage of the trading game (once the informed types know the true payoffs) played by the uninformed players.

If a trader expects his uninformed partner to trade, his expected payoff to trade is

$$\begin{aligned} & \left(1-\frac{c\psi}{M}\right)c+\frac{c\psi}{M}\left(c-M\right) \\ = & \; c-\frac{c\psi}{M}M=c\left(1-\psi\right) \end{aligned}$$

If he expectes his uninformed partner not to trade, his expected payoff to trade is

$$\begin{aligned} & \frac{c\psi}{M}\left(c-M\right) \\ = & \; -c\psi\left(1-\frac{c}{M}\right)<0 \end{aligned}$$

Thus, the payoffs in the game between the uninformed traders thus reduce to the payoff matrix:

	Yes	No
Yes	$c\left(1-\psi\right), c\left(1-\psi\right)$	$-c\psi\left(1-\frac{c}{M}\right), 0$
No	$0, -c\psi\left(1-\frac{c}{M}\right)$	0

Observe that if the loss ratio $\psi \leq 1$, (Yes, Yes) is an equilibrium with probability of trade 1. But if the loss ratio $\psi > 1$, (No, No) is the unique equilibrium resulting in probability of trade 0. We summarize this benchmark result as follows.

Proposition 1 *If $\psi \leq 1$, there is an equilibrium where both types of both agents say "yes" and probability of trade is 1. If $\psi > 1$, every equilibrium has no trade with probability 1 and the gains from trade are 0.*

Notice that in the simple trading game, the characterization of equilibrium is unaffected as $M \to \infty$. In this case, the payoff matrix can be written as

	Yes	No
Yes	$c\left(1-\psi\right), c\left(1-\psi\right)$	$-c\psi, 0$
No	$0, -c\psi$	0

Note that if loss ratio $\psi \leq 1$, (Yes, Yes) is an equilibrium with probability of trade 1, while if loss ratio $\psi > 1$, (No, No) is the unique equilibrium with probability of trade 0. We will see shortly that the presence of incomplete information can result in a dramatically changed impact of the parameter M. We construct an example where a large M rules out trade even when ψ is below 1 for most states of the world.

3.2 Incomplete Information Example

We examine the case where ψ is no longer common knowledge. We first deal with a case that has close parallels with Rubinstein's (1989) email game. Introduce the set of states Ω as

$$\Omega = \{1, 2, ..., 2K + 1\}$$

There is a uniform prior over Ω. The loss ratio ψ depends on the realized state, where

$$\psi_1 \geq ..... \geq \psi_{2K+1}$$

The two traders' information partitions are given as follows. Trader 1's partition is

$$\{\{1\}, \{2, 3\}, ..., \{2K - 2, 2K - 1\}, \{2K, 2K + 1\}\}$$

Trader 2's partition is

$$\{\{1, 2\}, \{3, 4\}, ..., \{2K - 1, 2K\}, \{2K + 1\}\}$$

In this way, both players have very good information on the fundamental value of the loss ratio ψ, but as we will see shortly, common knowledge fails in a strong sense.

Note that for each $\omega \in \Omega$ there are three sub-cases to consider – the normal state, 1's informed state and 2's informed state. We will set up the problem so that losses are very high in state 1, but low in other states. In particular, we assume that $\psi_\omega = \psi_L \in \left(\frac{1}{2}, 1\right)$ for $\omega \geq 2$, but that $\psi_1 = \psi_H > 1$, where ψ_H is large enough so that trader 2 who has information $\{1, 2\}$ finds it dominant not to trade, and so always answers "no".

By construction, the uninformed type $\{1\}$ of trader 1 and the uninformed type $\{1, 2\}$ of trader 2 both have the dominant action of saying "no" to trade. However, suppose we attempt to construct an equilibrium where all types of trader 1 trade when $\omega \geq 2$, and all types of trader 2 trade when $\omega \geq 3$.

The expected payoff of uninformed type $\{2, 3\}$ of trader 1 in the proposed equilibrium is given by:

$$
\begin{aligned}
& \frac{\frac{1}{2}\left(\frac{c\psi_L}{M}\right)}{\frac{1}{2}\left(1+\frac{c\psi_L}{M}\right)}(c-M)+\frac{\frac{1}{2}\left(1-\frac{c\psi_L}{M}\right)}{\frac{1}{2}\left(1+\frac{c\psi_L}{M}\right)}c+\frac{\frac{1}{2}\left(\frac{c\psi_L}{M}\right)}{\frac{1}{2}\left(1+\frac{c\psi_L}{M}\right)}(c-M) \quad (1) \\
= \; & c-\frac{\frac{c\psi_L}{M}}{\frac{1}{2}\left(1+\frac{c\psi_L}{M}\right)}M=c-\frac{2c\psi_L M}{M+c\psi_L} \\
\rightarrow \; & c\left(1-2\psi_L\right) \text{ as } M\rightarrow\infty \\
< \; & 0
\end{aligned}
$$

Thus, the uninformed type $\{2,3\}$ of trader 1 refuses to trade. But then, the uninformed type $\{3,4\}$ of trader 2 faces exactly the same payoff to trade as faced by type $\{2,3\}$ of trader 1 given by (1), and so refuses to trade. By induction, all types of both traders refuse to trade. In this way, the only outcome that survives the iterated deletion of strictly interim dominated stategies is the outcome where both traders say "no" at all states of the world. Therefore, the unique equilibrium has no trade.

This is a result that echoes the result in Rubinstein's (1989) email game. Morris, Rob and Shin (1995) discuss the underlying game-theoretic structure of Rubinstein's email game, and how the possibility of coordination depends on the interaction of the payoff function and degree of common knowledge derived from the individual information structures.

Note the important role played by the parameter M in this example. When M is larger, trade is ruled out. This is so even though the equilibrium characterization in the complete information case did not depend on this parameter.

3.3 Incomplete Information: General Case

We now consider a more general incomplete information framework. Let there be some finite state space Ω with common prior π over Ω. Denote by $\psi(\omega)$ the loss ratio at state $\omega \in \Omega$. The information partitions of trader 1 and trader 2 are denoted respectively by $\mathcal{P}_1$ and $\mathcal{P}_2$. We write $P_i(\omega)$ for set of states i thinks possible – i.e. the cell of player i's partition that contans ω.

Write $\widetilde{\psi}_i(\omega)$ for agent i's conditional expected loss ratio at state ω:

$$\widetilde{\psi}_i(\omega) = \frac{\displaystyle\sum_{\omega' \in P_i(\omega)} \pi(\omega')\,\psi(\omega')}{\displaystyle\sum_{\omega' \in P_i(\omega)} \pi(\omega')}$$

For any event $E \subseteq \Omega$, denote by $B_i^{\psi}(E)$ for event where i believes that event E occurs with probability at least $\widetilde{\psi}_i(\omega)$. That is,

$$\begin{aligned} B_i^{\psi}(E) &= \left\{ \omega \,\middle|\, \pi(E \,|P_i(\omega)) \geq \widetilde{\psi}_i(\omega) \right\} \\ \text{where } \pi(E \,|P_i(\omega)) &= \frac{\displaystyle\sum_{\omega' \in E \cap P_i(\omega)} \pi(\omega')}{\displaystyle\sum_{\omega' \in P_i(\omega)} \pi(\omega')} \end{aligned}$$

Write $B_*^{\psi}(E)$ for states ω where both agents believe that event E occurs with probability at least $\widetilde{\psi}_i(\omega)$:

$$B_*^{\psi}(E) = B_1^{\psi}(E) \cap B_2^{\psi}(E)$$

We now come to our key definition. We say that there is *market confidence* at ω if all of the following are true.

1. each trader's expected loss ratio is less than 1
2. each trader i believes (1) with probability at least $\widetilde{\psi}_i(\omega)$
3. each trader i believes (2) with probability at least $\widetilde{\psi}_i(\omega)$
4. and so on...

Write C^{ψ} for the set of states where there is market confidence. That is,

$$\begin{aligned} C^{\psi} &= B_*^{\psi}(\Omega) \cap \left[B_*^{\psi}\right]^2(\Omega) \cap \ldots.. \\ &= \bigcap_{k \geq 1} \left[B_*^{\psi}\right]^k(\Omega) \end{aligned}$$

This iterative definition of market confidence can also be given a fixed point definition in the way that was discussed by Aumann (1976) and Monderer-Samet (1989). The definition of market confidence is analogous to the definition of common p-belief in Monderer and Samet (1989) but with the probability "p" allowed to vary across states, as in Morris and Shin (2007b). Say that event E is *ψ-evident* if $E \subseteq B_*^{\psi}(E)$. Then, C^{ψ} is the largest ψ-evident event.

We can state our main result for this section as follows.

Proposition 2 *There is always a no trade equilibrium. There is a "largest" trade equilibrium in the sense that for any state and any equilibrium with trade, there is trade in the largest equilibrium. In this largest equilibrium, informed agents always trade. Uninformed agent i trades only if there is market confidence.*

We prove this proposition by tacking each part in turn. The fact that there is always a no trade equilibrium is immediate, since a best reply to the other trader saying "no" always is also to say "no" always.

The notion of the largest equilibrium relies on the ordering over the set of strategies that comes from the strategic complementarity of the payoff function. A strategy in the trading game is a function that maps each cell of a trader's inforamtion partition to an action. Formally, a strategy for trader i is a function:

$$\mathcal{P}_i \mapsto \{0,1\}$$

where 0 denotes the answer "no", and 1 denotes the answer "yes". Since the state space Ω is finite, trader i's strategy can be written as a vector consisting of either 0 or 1. Define a partial ordering over the set of all strategies through the usual component-wise ordering over the vectors that correspond to each strategy. Due to the strategic complementarity of the payoffs and the fact that the strategies can be ordered in this way, we can appeal to Theorem 5 of Milgrom and Roberts (1990, p. 1265) to conclude that there is a largest equilibrium of the trading game obtained as the outcome of the iterated deletion of strictly dominated strategies. This largest equilibrium is the one that is associated with the highest attainable probability of trade.

In this largest equilibrium, if any type of any trader finds that saying "yes" is eliminated at the nth round of deletion of strictly dominated strategies at state ω, then we have

$$\omega \notin \left[B_*^{\psi}\right]^n(\Omega)$$

Hence, $\omega \notin C^{\psi}$. Therefore, if market confidence fails, agent i does not trade. This concludes the proof of Proposition 2.

In the light of our proposition, it is illuminating to go back to the example above that mimics the Rubinstein email game. In that example, the higher-order belief events are:

$$\begin{aligned}
\Omega &= \{1, 2, 3, ..., 2K+1\} \\
B_*^{\psi}(\Omega) &= \{2, 3, ..., 2K+1\} \\
\left[B_*^{\psi}\right]^2(\Omega) &= \{3, 4, ..., 2K+1\} \\
\left[B_*^{\psi}\right]^n(\Omega) &= \{n+1, ..., 2K+1\} \\
\left[B_*^{\psi}\right]^{2K+1}(\Omega) &= \varnothing \\
C^{\psi} &= \varnothing
\end{aligned}$$

Hence, there is never market confidence.

4 Mechanism Design

So far, we have examined the possibility of trade when we restrict ourselves to the trading mechanism where both traders have to agree to trade. This trading mechanism is arguably a realistic portrayal of how trade takes place in an over-the-counter (OTC) market where most asset-backed securities are traded. However, we will now broaden our investigation to consider the possible outcomes using more general trading mechanisms by taking a mechanism design approach to the trading problem.

4.1 Complete Information Mechanism

To set ideas, consider first the complete information case where ψ is common knowledge. We have already shown that when $\psi \leq 1$, even a simple trading game is capable of eliciting the efficient outcome as an equilibrium. Instead, we consider the limits of trade in the best mechanism for the case where $\psi > 1$.

In this mechanism, let us suppose that trade occurs with probability q in the normal state and probability 1 in the extreme states. The individual rationality constraint of the uninformed type binds and the incentive constraint of the informed type binds. Thus the expected utility of an uninformed agent is 0 and the informed agents extract all rent. Thus there is no payment in the normal state and the uninformed agent receives a payment of p in the extreme states. The binding incentive constraint of the informed type is

$$c + M - p = q\,(c + M)$$

and thus

$$p = (1 - q)\,(c + M)\,.$$

The binding individual rationality of the uninformed agent becomes:

$$\left(1 - \frac{c\psi}{M}\right) qc + \frac{c\psi}{M}\,(c - M) + p\frac{c\psi}{M} = 0$$

and thus

$$\frac{Mq}{\psi} + qc + c - M + c + M - qc - qM = 0$$

and so

$$\begin{array}{rcl} q\left(2c + M\left(1 - \dfrac{1}{\psi}\right)\right) & = & 2c \\ q & = & \dfrac{2c}{2c + \left(1 - \frac{1}{\psi}\right) M} \end{array}$$

Total probability of trade is thus

$$\frac{2c\psi}{M} + \left(1 - \frac{2c\psi}{M}\right)\left(\frac{2c}{2c + \left(1 - \frac{1}{\psi}\right) M}\right)$$

Proposition 3 *Suppose $\psi > 1$. When ψ is common knowldge, the probability of trade in the optimal mechanism is*

$$\min\left(1, \frac{2c\psi}{M} + \left(1 - \frac{2c\psi}{M}\right)\left(\frac{2c}{2c + \left(1 - \frac{1}{\psi}\right) M}\right)\right);$$

Notice that as $M \to \infty$, the probability of trade goes to 0, even in the optimal mechanism. This result mirrors the analogous result for the simple trading game that, when $\psi > 1$, the unique equilibrium is where both agents refuse to trade.

4.2 Incomplete Information Mechanism

We now consider the mechanism design problem for the incomplete information case where ψ is no longer common knowledge, and where we allow ψ to be below 1. We will explore the extent to which the optimal mechanism can exploit the gains from trade, and explore how corrosive small amounts of adverse selection can be in shutting down trade completely.

For the mechanism design problem, it is useful to use the terminology of types. Let t_i be a type of trader i, and let T_i be the type space for trader i. Assume that there is a common prior π over the joint type space $T_1 \times T_2$. The loss ratio ψ for a trader depends on the types of both traders. Denote by $\psi(t_1, t_2)$ the loss ratio given types (t_1, t_2).

We now introduce the notion of weak market confidence. Let W_1^{ψ} and W_2^{ψ} be the largest pair of events $(T_1^*, T_2^*) \in 2^{T_1} \times 2^{T_2}$ with

$$\sum_{i=1}^{2} \pi(T_i^*) \left[\pi\left(T_j^* \middle| T_i^* \right) - E_i(\psi | T_i^*) \right] \geq 0. \tag{2}$$

Say that there is *weak market confidence* if $(t_1, t_2) \in W_1^{\psi} \times W_2^{\psi}$. To interpret this condition, notice that if $T_1^* = T_2^*$, then $\pi\left(T_j^* \middle| T_i^* \right) = 1$, so that condition (2) has the best chance of holding. When $T_1^* = T_2^*$, there is common knowledge between the two agents that T_1^* holds. Weak market confidence holds when the degree of common knowledge between the two traders is high relative to the conditional expected value of the loss ratio.

Geanakoplos (1994) introduced a notion of weak common p-belief. This is a variant where the "p" is allowed to vary with types. Geanakoplos (1994) and Morris (1999) report results showing that weak common p-belief was necessary and sufficient for versions of no trade results.

We add a technical condition at this stage. We assume that there is a transaction tax to payments; each agent must pay $\alpha |p(t_1, t_2)|$ to the government. This assumption is introduced as a tie-breaking device so that we can state our results without inessential qualifications. Under this assumption, we have the following proposition.

Proposition 4 *If there is not weak market confidence, then for each $\varepsilon > 0$, there exists $M > 0$ such that the probability of trade is less than ε.*

This proposition can be seen as the general analogue of Proposition 2 in highlighting the importance of approximate common knowledge. When the condition for weak market confidence fails, then a small amount of adverse selection can inflict large damage on mutually beneficial trade. As M becomes large (so that the potential cost of adverse selection is large) trade can be eliminated, even when the most general trading mechanism is used. Thus, we see that the importance of approximate common knowledge, as embodied in our notion of market confidence is pivotal for trade in the general mechanism design problem, also. In this sense, the simple trading game turns out to be a good reflection of the underlying mechanisms involved in trade.

The intuition for the argument leading to our result can be explained as follows. We construct the bound on the probability of trade by using the individual rationality constraints of uninformed types and the incentive constraints of informed types who attempt to pool with the uninformed types. We have multidimentional correlated types. Even though there is correlation, it is not possible to do "full surplus extraction" as in Cremer and McLean (1988). Neeman (2004) emphasized that full extraction results rely on the (sometimes implicit) assumption that "beliefs determine preferences" - i.e., that there is common knowledge of a mapping from an agent's beliefs about others' beliefs to his preferences. Parreiras (2005) noted that having one agent being unsure how informed another is one way of breaking down the "beliefs deterimines preferences" and we rely on that mechanism in this argument.

Proof. First observe that if there is not weak market confidence, then there exists $\eta > 0$ such that for each T_1 and T_2,

$$\sum_{i=1}^{2} \pi(T_i)\left[\pi(T_j|\,T_i) - E_i(\psi|T_i)\right] < -\eta\left[\pi(T_1) + \pi(T_2)\right] \tag{3}$$

Let $q(t_1,t_2)$ be the probability of trade in the normal state, let $p_i(t_1,t_2)$ be the payment of agent i in the normal state, let $\overline{p}_i(t_1,t_2)$ be agent i's payment in his own state and let $\underline{p}_i(t_1,t_2)$ be agent i's payment in j's state. We will bound the probability of trade using only the interim individual rationality (IR) constraints and the interim incentive compatibility (IC) constraints. First, the interim IR constraint is given by:

$$\sum_{t_j} \pi(t_j|t_i)\left[\begin{array}{c} \frac{c}{M}\psi(t_i,t_j)\left(c - M - \underline{p}_i(t_i,t_j) - \alpha\left|\underline{p}_i(t_i,t_j)\right|\right) + \\ \left(1 - \frac{c}{M}\psi(t_i,t_j)\right)\left(c.q(t_i,t_j) - p_i(t_i,t_j) - \alpha\left|p_i(t_i,t_j)\right|\right) \end{array}\right] \geq 0 \tag{4}$$

for all i and t_i. The interim IC constraint of informed types is:

$$c + M - \overline{p}_i\left(t_i, t_j\right) \geq \left(c + M\right) q\left(t_i', t_j\right) - p_i\left(t_i', t_j\right) \tag{5}$$

for all i, $\left(t_i, t_j\right)$ and t_i'. Summing the individual rationality constraints across agents and types, we have that total transaction costs cannot exceed ex ante surplus:

$$\sum_{t_1, t_2} \pi\left(t_1, t_2\right) \left[\begin{array}{c} \left(\frac{c}{M}\psi\left(t_i, t_j\right)\right) 2\alpha \left|\underline{p}_1\left(t_i, t_j\right)\right| \\ + \left(1 - \frac{c}{M}\psi\left(t_i, t_j\right)\right) 2\alpha \left(\left|p_1\left(t_1, t_2\right)\right|\right) \end{array} \right] \leq 2c.$$

Letting

$$\pi^* = \min_{\{t:\pi(t)>0\}} \pi\left(t\right),$$

we have a (loose) bound on the absolute size of transfers in the normal state:

$$\begin{aligned} \left|p_1\left(t_1, t_2\right)\right| &\leq \frac{c}{\alpha\pi\left(t_1, t_2\right)\left(1 - \frac{c}{M}\psi\left(t_1, t_2\right)\right)} \\ &\leq \frac{cM}{\alpha\pi^*\left(M - c\overline{\psi}\right)} \end{aligned} \tag{6}$$

Now we manipulate the incentive constraints:

$$\begin{aligned} c + M - \overline{p}_i\left(t_i, t_j\right) &\geq \max_{t_i'} \left[\left(c + M\right) q\left(t_i', t_j\right) - p_i\left(t_i', t_j\right)\right], \text{ by (5)} \\ &\geq \left(c + M\right) \max_{t_i'} q\left(t_i', t_j\right) - \frac{cM}{\alpha\pi^*\left(M - c\overline{\psi}\right)}, \text{ by (6)} \end{aligned}$$

Thus

$$\overline{p}_i\left(t_i, t_j\right) \leq \left(c + M\right)\left(1 - \max_{t_i'} q\left(t_i', t_j\right)\right) + \frac{cM}{\alpha\pi^*\left(M - c\overline{\psi}\right)}.$$

or (switching labels)

$$\begin{aligned} \overline{p}_j\left(t_j, t_i\right) &\leq \left(c + M\right)\left(1 - \max_{t_j'} q\left(t_i, t_j'\right)\right) + \frac{cM}{\alpha\pi^*\left(M - c\overline{\psi}\right)} \\ &= \left(c + M\right)\left(1 - \max_{t_j'} q\left(t_i, t_j'\right)\right) - \frac{cM}{\alpha\pi^*\left(M - c\overline{\psi}\right)} \end{aligned}$$

and

$$\begin{aligned} -\underline{p}_i\left(t_i,t_j\right) &= \overline{p}_j\left(t_i,t_j\right) \\ &\le (c+M)\left(1-\max_{t'_j} q\left(t_i,t'_j\right)\right)-\frac{cM}{\alpha\pi^*\left(M-c\overline{\psi}\right)} \end{aligned}$$

We substitute this expression into the interim individual rationality constraint (4) and delete the transaction costs to give:

$$\sum_{t_j}\pi\left(t_j|t_i\right)\left[\begin{array}{c} \frac{c}{M}\psi\left(t_i,t_j\right)\left[\begin{array}{c} (c+M)\left[1-\max\limits_{t'_j} q\left(t_i,t'_j\right)\right] \\ c-M+\frac{cM}{\alpha\pi^*\left(M-c\overline{\psi}\right)} \end{array}\right] \\ +\left(1-\frac{c}{M}\psi\left(t_i,t_j\right)\right)\left(c.q\left(t_i,t_j\right)-p_i\left(t_i,t_j\right)\right) \end{array}\right]\ge 0$$

and so

$$\sum_{t_j}\pi\left(t_j|t_i\right)\left[\begin{array}{c} \frac{c}{M}\psi\left(t_i,t_j\right)\left(\begin{array}{c} 2c-(c+M)\max\limits_{t'_j} q\left(t_i,t'_j\right) \\ +\frac{cM}{\alpha\pi^*\left(M-c\overline{\psi}\right)} \end{array}\right) \\ +\left(1-\frac{c}{M}\psi\left(t_i,t_j\right)\right)\left(c.q\left(t_i,t_j\right)-p_i\left(t_i,t_j\right)\right) \end{array}\right]\ge 0.$$

Summing across agent 1's types, we have

$$\sum_{t_1,t_2}\pi\left(t_1,t_2\right)\left[\begin{array}{c} \frac{c}{M}\psi\left(t_1,t_2\right)\left(\begin{array}{c} 2c-(c+M)\max\limits_{t'_2} q\left(t_i,t'_j\right) \\ +\frac{cM}{\alpha\pi^*\left(M-c\overline{\psi}\right)} \end{array}\right) \\ +\left(1-\frac{c}{M}\psi\left(t_1,t_2\right)\right)\left(c.q\left(t_1,t_2\right)-p_1\left(t_1,t_2\right)\right) \end{array}\right]\ge 0.$$

or

$$\begin{aligned} & c\sum_{t_1,t_2}\pi\left(t_1,t_2\right)\left[q\left(t_1,t_2\right)-\psi\left(t_1,t_2\right)\max_{t'_2} q\left(t_1,t'_2\right)\right] \\ \ge\ & \left[\begin{array}{l} \sum\limits_{t_1,t_2}\pi\left(t_1,t_2\right)\left(1-\frac{c}{M}\psi\left(t_1,t_2\right)\right)p_1\left(t_1,t_2\right) \\ -\sum\limits_{t_1,t_2}\pi\left(t_1,t_2\right)\psi\left(t_1,t_2\right)\frac{2c^2}{M} \\ -\sum\limits_{t_1,t_2}\pi\left(t_1,t_2\right)\psi\left(t_1,t_2\right)\frac{c}{M}\frac{cM}{\alpha\pi^*\left(M-c\overline{\psi}\right)} \end{array}\right] \\ \ge\ & \left[\sum_{t_1,t_2}\pi\left(t_1,t_2\right)\left(1-\frac{c}{M}\psi\left(t_1,t_2\right)\right)p_1\left(t_1,t_2\right)-\frac{\overline{\psi}c}{M}\left(2c+\frac{cM}{\alpha\pi^*\left(M-c\overline{\psi}\right)}\right)\right] \end{aligned}$$

Adding the analogous constraint for agent 2, we have

$$\begin{aligned} & c\sum_{t_1,t_2}\pi\left(t_1,t_2\right)\left[2q\left(t_1,t_2\right)-\psi\left(t_1,t_2\right)\max_{t_2'} q\left(t_1,t_2'\right)+\max_{t_1'} q\left(t_1',t_2\right)\right] \\ \geq\ & -\frac{2\overline{\psi}c}{M}\left(2c+\frac{cM}{\alpha\pi^*\left(M-c\overline{\psi}\right)}\right). \end{aligned}$$

Now our relaxed problem is to choose $q : T_1 \times T_2 \rightarrow [0,1]$ to maximize

$$\sum_{t_1,t_2}\pi\left(t_1,t_2\right)q\left(t_1,t_2\right)$$

subject to

$$\begin{aligned} & c\sum_{t_1,t_2}\pi\left(t_1,t_2\right)\left[2q\left(t_1,t_2\right)-\psi\left(t_1,t_2\right)\max_{t_2'} q\left(t_1,t_2'\right)+\max_{t_1'} q\left(t_1',t_2\right)\right] \\ \geq\ & -\frac{2\overline{\psi}c}{M}\left(2c+\frac{cM}{\alpha\pi^*\left(M-c\overline{\psi}\right)}\right). \end{aligned}$$

Write

$$q_1^*\left(t_1\right)=\max_{t_2'} q\left(t_1,t_2'\right) \text{ and } q_2^*\left(t_2\right)=\max_{t_1'} q\left(t_1',t_2\right)$$

Now we can re-write the problem as choosing q, q_1^* and q_2^* to maximize

$$\sum_{t_1,t_2}\pi\left(t_1,t_2\right)q\left(t_1,t_2\right)$$

subject to

$$\begin{aligned} & c\sum_{t_1,t_2}\pi\left(t_1,t_2\right)\left[2q\left(t_1,t_2\right)-\psi\left(t_1,t_2\right)\left(q_1^*\left(t_1\right)+q_2^*\left(t_2\right)\right)\right] \\ \geq\ & -\frac{2\overline{\psi}c}{M}\left(2c+\frac{cM}{\alpha\pi^*\left(M-c\overline{\psi}\right)}\right) \\ q\left(t_1,t_2\right) \leq\ & q_1^*\left(t_1\right) \text{ for all } t_2 \\ q\left(t_1,t_2\right) \leq\ & q_2^*\left(t_2\right) \text{ for all } t_1 \end{aligned}$$

Clearly without loss of generality, we can set $q\left(t_1,t_2\right)=\min\left(q_1^*\left(t_1\right),q_2^*\left(t_2\right)\right)$. Thus our problem is choose q_1^* and q_2^* to maximize

$$\sum_{t_1,t_2}\pi\left(t_1,t_2\right)\min\left(q_1^*\left(t_1\right),q_2^*\left(t_2\right)\right)$$

subject to

$$\begin{aligned} & c\sum_{t_1,t_2}\pi\left(t_1,t_2\right)\left[2\min\left(q_1^*\left(t_1\right),q_2^*\left(t_2\right)\right)-\psi\left(t_1,t_2\right)\left(q_1^*\left(t_1\right)+q_2^*\left(t_2\right)\right)\right] \\ \geq\ & -\frac{2\overline{\psi}c}{M}\left(2c+\frac{cM}{\alpha\pi^*\left(M-c\overline{\psi}\right)}\right)\end{aligned}$$

Now fix $Q=\left\{q^1,...,q^K\right\}$, with $q^1<q^2<....<q^K$, be the union of the ranges of the optimal q_1^* and q_2^* Let $\kappa_i\left(t_i\right)$ solve $q_i^*\left(t_i\right)=q^{\kappa_i\left(t_i\right)}$ and $T_i^k=\left\{t_i\left|q_i^*\left(t_i\right)=q^k\right.\right\}=\left\{t_i\left|\kappa_i\left(t_i\right)=k\right.\right\}$. Let

$$\begin{aligned}\xi^k &= \pi\left[\left\{\left(t_1,t_2\right)|\kappa\left(t_1\right)=\kappa\left(t_2\right)=k\right\}\right] \\ \zeta_i^k &= \pi\left[\left\{\left(t_1,t_2\right)|\kappa\left(t_i\right)=k\right\}\right]=\pi\left[T_i^k\right] \\ E\left[\psi|T_i^k\right] &= \frac{1}{\zeta_i^k}\sum_{t\in T_i^k\times T_j}\pi\left(t_1,t_2\right)\psi\left(t_1,t_2\right) \\ \phi^k &= \left[2\xi^k-\zeta^1E\left[\psi|T_1^k\right]-\zeta^2E\left[\psi|T_2^k\right]\right]\end{aligned}$$

Now the maximum can be written as

$$\sum_{k=1}^{K}q^k\xi^k$$

and the constraint can be written as

$$\sum_{k=1}^{K}q^k\phi^k\geq-\frac{2\overline{\psi}c}{M}\left(2c+\frac{cM}{\alpha\pi^*\left(M-c\overline{\psi}\right)}\right).$$

First suppose that $\phi^K\geq 1$. In this case,

$$2\pi\left[T_1^K\cap T_2^K\right]-\pi\left[T_1^K\right]E\left[\psi|T_1^K\right]-\pi\left[T_2^K\right]E\left[\psi|T_2^K\right]>0$$

contradicting (3). Thus we must have $\phi^K<0$. Now we can establish that $K=2$ (fill in step!), $q^1=0$ and $q^2>0$. Now

$$q^2\left(2\pi\left[T_1^2\cap T_2^2\right]-\pi\left[T_1^2\right]E\left[\psi|T_1^2\right]-\pi\left[T_2^2\right]E\left[\psi|T_2^2\right]\right)\geq-\frac{2\overline{\psi}c}{M}\left(2c+\frac{cM}{\alpha\pi^*\left(M-c\overline{\psi}\right)}\right)$$

$$\begin{aligned} q^2 &\leq \frac{\frac{2\overline{\psi}c}{M}\left(2c+\frac{cM}{\alpha\pi^*\left(M-c\overline{\psi}\right)}\right)}{\left|2\pi\left[T_1^2\cap T_2^2\right]-\pi\left[T_1^2\right]E\left[\psi|T_1^2\right]-\pi\left[T_2^2\right]E\left[\psi|T_2^2\right]\right|} \\ &\leq \frac{2\overline{\psi}c}{\eta\left(\pi\left(T_1\right)+\pi\left(T_2\right)\right)M}\left(2c+\frac{cM}{\alpha\pi^*\left(M-c\overline{\psi}\right)}\right) \end{aligned}$$

Thus the total probability of trade is at most

$$\frac{2\overline{\psi}c}{M}+\left(1-\frac{2\overline{\psi}c}{M}\right)\frac{2\overline{\psi}c}{\eta M}\left(2c+\frac{cM}{\alpha\pi^*\left(M-c\overline{\psi}\right)}\right)$$

This can be made arbitrarily small by choice of M.

5 Concluding Remarks

Our result on the importance of approximate common knowledge in enabling mutually beneficial trade reiterates the importance of shared understanding as in many other areas of economic life. Arguably, credit ratings and accounting numbers also derive part of their importance from common understanding. Holmstrom (2009) argues that the coarse nature of credit ratings serve this importance purpose, and that misguided attempts to enhance "transparency" by making finer distinctions may undermine this useful purpose. Elsewhere (Morris and Shin (2007a)), we have argued that accounting numbers also serve the important role of generating shared understanding. There are inevitable tradeoffs. The imperative for common understanding can sometimes detract from the precision of accounting numbers. Common understanding is predicated on the lowest common denominator — the coarsest shared framework among a set of disparate individuals. So, the coarser is the information, the greater is the chance that the information can be understood by all. However, coarse information is also imprecise information. The flipside of "common understanding" is "unsophisticated". When communication is based on the coarsest individual information, there will be many individuals who are capable of handling more finely nuanced and complex usage. Hence there may be welfare losses when the opportunity to utilize the greater sophistication is forgone in favor of simplicity. However, there is great virtue in simplicity's ability to generate common understanding.

When common understanding is important, it is possible that greater precision of information can be detrimental to welfare if the greater precision comes at the expense of greater fragmentation, or if the greater precision of information leads to an exacerbation of externalities in the use of information that detracts from overall welfare. Accountants make the important distinction between *disclosure* of information (e.g., reporting of numbers in a footnote) and *recognition* (e.g., inclusion in profit and loss statement) and observe that the latter has a larger empirical impact than the former (Barth, et al. 2003; Espahbodi, et al. 2002). The greater impact of recognized numbers presumably reflects greater common understanding of that information.

In this paper, we have seen the interaction between asymmetric information and the coordination motive generated by that asymmetric information. We have seen the potentially corrosive effect of even small amounts of adverse selection in an asset market and how it can lead to the total breakdown of trade. In our model, there is common knowledge among two traders that an asset is worth strictly more to the buyer than the seller at every state of the world, and yet there can be a total breakdown of trade. The problem is the failure of common understanding, and in particular what we have termed "market confidence", defined as approximate common knowledge of an upper bound on expected losses. Adverse selection reverberates through the cells of the traders' information partitions in the manner of Rubinstein's email game. Contagious adverse selection is the result of Rubinstein's email game meeting Akerlof's lemons problem.

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