Information Traps in Over-the-Counter Markets[*]

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Abstract

I study the interaction between information acquisition and market liquidity in over-the-counter markets with adverse selection. When buyers anticipate low future liquidity, they acquire information to avoid purchasing low-quality assets. However, such information acquisition creates a cream-skimming effect, deteriorating the asset pool and further reducing future liquidity. A liquid market may experience a self-fulfilling freeze if buyers begin acquiring information. More critically, prolonged information acquisition can trap the market in a low-liquidity steady state—an information trap. This mechanism helps explain the observed shift in liquidity and investor behavior in the U.S. non-agency mortgage-backed securities market following the financial crisis.

Keyword: Information acquisition; Adverse selection; Market freezes; Over-the-Counter markets

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1 Introduction

During the 2007–2008 financial crisis, many asset markets suffered from periods of illiquidity—sellers found it increasingly difficult to sell assets at acceptable prices. Dry-ups in liquidity were especially pronounced among opaque assets traded in over-the-counter (OTC) markets, such as mortgage-backed securities (Gorton, 2009) and collateralized debt obligations (Brunnermeier, 2009). A large literature has sought to explain these market freezes through the lens of asymmetric information.[1] The standard narrative holds that asset owners are better informed about asset quality than potential buyers. When the perceived average quality of assets declines, this information asymmetry exacerbates adverse selection, potentially causing markets to freeze.

After the financial crisis, the U.S. economy experienced a strong and prolonged recovery, with housing prices continuing to rise.[2] Nevertheless, the market for non-agency mortgage-backed securities (MBS) which was central to the financial turmoil has not returned to its pre-crisis level of activity (Ospina and Uhlig, 2018).[3] At the same time, investors have markedly increased their due diligence when evaluating securitized products. Instead of relying primarily on external ratings, they now develop internal models to assess asset quality.[4] These stark contrasts in market liquidity and investor behavior before and after the crisis—despite broadly similar macroeconomic and housing fundamentals—present a challenge to standard adverse selection models. If the freeze had been driven primarily by deteriorating fundamentals, one would expect a recovery in market activity alongside the rebound in the broader economy and housing sector.

To help account for these contrasting patterns, this paper introduces buyer-side information acquisition into a dynamic adverse selection model with resale considerations. A key insight is that such markets can exhibit multiple steady states, and transitions between them are asymmetric. In particular, a market can experience a *self-fulfilling market freeze*, where

[1]See Tirole (2012), Daley and Green (2012), Camargo and Lester (2014), Guerrieri and Shimer (2014), and Chiu and Koeppl (2016), among others.

[2]See All-Transactions House Price Index for the United States, `https://fred.stlouisfed.org/series/USSTHPI`.

[3]Non-agency MBS are issued by private entities and do not carry explicit or implicit guarantees from the U.S. government, unlike agency MBS issued by Fannie Mae, Freddie Mac, or Ginnie Mae.

[4]See *The Economist*, January 11, 2014: "Before 2008, . . . , investors piled in with no due diligence to speak of. Aware of the reputational risks of messing up again, they now spend more time dissecting three-letter assets than just about anything else in their portfolio."

buyers begin acquiring information and the market transitions from a liquid to an illiquid state. As information acquisition and illiquid trading persist, the market may fall into an *information trap*—a low-liquidity equilibrium from which self-fulfilling recovery is no longer possible. While previous papers have studied sudden liquidity dry-ups in settings with multiple equilibria, this paper highlights an additional, sharp implication: market recovery is not guaranteed once the information trap sets in, even when fundamentals improve.

Before presenting the main results, it is useful to outline the key ingredients of the model. A continuum of investors trade assets that can be either high or low quality. Gains from trade arise because asset holders are subject to idiosyncratic liquidity shocks, which reduce the flow payoff from holding the asset. Upon receiving a liquidity shock, an asset holder enters the market as a seller and meets potential buyers sequentially. The seller is privately informed about the asset's quality, while the buyer can choose to incur a fixed cost to acquire a noisy signal about it. If the asset is traded, the buyer becomes the new holder and may re-enter the market as a seller upon experiencing a future liquidity shock. If no trade occurs, the seller retains the asset and waits for the next buyer to arrive. Although the model is motivated by the dynamics observed in the non-agency MBS market, its framework applies more broadly to over-the-counter markets characterized by asymmetric information.

How does buyers' information acquisition interact with market liquidity? If the current composition of assets for sale is good enough to support pooling trading, buyers' information acquisition reduces current market liquidity. Intuitively, if a buyer acquires information and observes a bad signal, she is unwilling to trade at a pooling price because the posterior belief about the asset's quality becomes worse.

In addition to the static relationship between buyers' information acquisition and market liquidity, there is also a dynamic strategic complementarity between buyers' current and future incentives to acquire information, and hence a complementarity between current and future market liquidity. On one hand, current buyers' incentive to acquire information depends on future buyers' information acquisition through the *resale consideration*. If a buyer anticipates that future buyers will acquire information about asset quality, she has an incentive to acquire information so as to avoid buying a low-quality asset that will be hard to sell at a later date. In this sense, expected future market liquidity improves current market liquidity. On the other hand, current buyers' information acquisition changes future buyers' incentives to acquire information through the *cream-skimming effect*. When current buyers acquire information, high-quality assets are traded faster than low-quality assets. As low-quality assets accumulate on the market over time, future buyers have more incentive to acquire information. Therefore, current market illiquidity harms future market liquidity.

The dynamic strategic complementarity in buyers' information acquisition gives rise to the possibility of a self-fulfilling market freeze. Consider a scenario in which the market is initially in a liquid state: buyers do not acquire information, and the composition of assets available for sale is favorable. At some point, investors begin to anticipate that future buyers will engage in information acquisition, thereby reducing future market liquidity. As a consequence, the expected resale value of low-quality assets declines abruptly, prompting current buyers to begin acquiring information. This shift triggers the cream-skimming effect, whereby high-quality assets are traded more quickly, leaving a growing concentration of low-quality assets in the market. As the asset pool deteriorates over time, future buyers become increasingly inclined to acquire information, reinforcing the expectation of low market liquidity. In this way, the belief in deteriorating market conditions becomes self-fulfilling. A market freeze emerges when investors coordinate on an equilibrium path characterized by persistent information acquisition.

As the self-fulfilling market freeze continues and the composition of assets for sale worsens, the market cannot return to liquid trading without outside intervention. This happens because buyers' incentives to acquire information depend on both their expectations about future market liquidity and the current quality of assets available for sale. When the asset pool becomes poor enough, buyers find it optimal to acquire information even if they expect future trading conditions to improve, in order to avoid buying low-quality assets. This information acquisition prevents the asset pool from improving. As a result, the market becomes stuck in a persistent illiquid state, with continued information acquisition and longer trading delays—an "information trap."

The key mechanism that generates the asymmetric transitions between states with different liquidity is the slow-moving nature of the composition of assets for sale. Buyers' information acquisition worsens this composition through the cream-skimming effect and creates a persistent negative impact on future market liquidity. The composition only improves gradually when buyers stop acquiring information. However, even under the most optimistic belief about future market liquidity, buyers will not stop acquiring information unless the current composition of assets is sufficiently good. Buyers' information acquisition and the poor composition of assets for sale reinforce each other, preventing the market from recovering without outside intervention to clean up the asset pool.

This paper offers important insights into the timing of asset purchase programs designed to restore market liquidity. During the recent financial crisis, the U.S. Treasury implemented the Troubled Asset Relief Program (TARP) to revive trading by purchasing "toxic" assets. I show that the share of low-quality assets in the market is endogenous and shaped by investors' prior information acquisition. Along the path of a self-fulfilling market freeze, the asset composition deteriorates endogenously over time. There exists a critical time threshold such that, if intervention occurs before it, the policymaker can restore liquidity by merely announcing a guarantee program without actually purchasing assets. However, once this threshold is passed, restoring liquidity requires the government to actively purchase low-quality assets.

The remainder of the paper is organized as follows. Section 2 presents the model. Section 3 characterizes equilibrium behavior. Section 4 analyzes the stationary equilibria, while Section 5 examines the set of non-stationary equilibrium paths that converge to different steady states. Section 6 discusses applications and policy implications. Section 7 concludes.

Related Literature

This paper builds on the large literature on adverse selection initiated by the seminal work of Akerlof (1970). Among many other papers, Janssen and Roy (2002); Camargo and Lester (2014); Chari, Shourideh and Zetlin-Jones (2014), and Fuchs and Skrzypacz (2015) analyze dynamic-adverse selection models with centralized or decentralized market structures.[5] These models share the common feature that low-quality assets are sold faster than or at the same speed as high-quality assets. None of these papers feature resale considerations or buyers' acquisition of information about assets' quality.

Taylor (1999), Zhu (2012), Lauermann and Wolinsky (2016), and Kaya and Kim (2018) all considers dynamic adverse-selection models in which each buyer observes a noisy signal about an asset's quality. A new result obtained in this strand of literature is that high-quality assets are traded faster than low-quality assets. This is related to the cream-skimming effect in my model when buyers acquire information. These papers consider a trading environment

[5]See also Hendel and Lizzeri (1999), Blouin (2003), Hörner and Vieille (2009), Moreno and Wooders (2010).

with a single seller and sequentially arriving buyers, and there is no scope for reselling the asset. In contrast, in my paper, buyers anticipate that they will sell their assets in the same market when they experience liquidity shocks.

In papers that study dynamic adverse-selection models with resale considerations—such as Chiu and Koeppl (2016), Fuchs, Green and Papanikolaou (2016), Asriyan, Fuchs and Green (2019) and Maurin (2020)—buyers' valuation of an asset depends on future market liquidity. This endogenous illiquidity discount can give rise to an intertemporal coordination problem which in turn yields multiple steady states with symmetric self-fulfilling transitions. Another closely related study is by Hellwig and Zhang (2012), who analyze a dynamic adverse-selection model with both resale consideration and endogenous information acquisition. While I allow buyers' signals to be noisy, they focus on the situations in which the signals are precise. Therefore, information acquisition has no cream-skimming effect in their model and transitions between steady states are symmetric. In contrast to all of the above papers, mine has the novel feature of generating multiple steady states with unidirectional transitions.

This paper is also related to work by Daley and Green (2012, 2016), who study the role of a publicly observable "news" process in dynamic-adverse selection models. In my paper, buyers make their own decisions on whether to acquire information and the information is not observable to other market participants.

In terms of modeling search frictions, this paper builds on the theoretical papers on OTC markets. Examples are Duffie, Gârleanu and Pedersen (2005, 2007); Vayanos and Weill (2008); and Lagos and Rocheteau (2009). The trading environment is very similar to the investor's life-cycle model in Vayanos and Wang (2007). I contribute to this literature by introducing asymmetric information about asset quality.

There is a large literature that studies information acquisition in financial markets, including Froot, Scharfstein and Stein (1992); Glode, Green and Lowery (2012); Fishman and Parker (2015); as well as Bolton, Santos and Scheinkman (2016).[6] This literature shows that information acquisition can be a strategic complement and excess information acquisition in equilibrium leads to inefficiency. I differ from this line of research by studying information acquisition in a dynamic trading environment. This allows me to characterize transitions

[6] See also Barlevy and Veronesi (2000), Veldkamp (2006), Hellwig and Veldkamp (2009), Goldstein and Yang (2015).

between different states of the market, such as episodes of market freezes or recovery. Also, I consider an opaque trading environment in which trading history is not directly observable to other market participants. This differentiates my paper to the literature that features positive spillover effect of information acquisition.[7]

Lastly, this paper contributes to the literature on the role of transparency and information acquisition in amplifying macroeconomic shocks. Gorton and Ordonez (2014) study how a small shock to the collateral value can be amplified into a large financial crisis when it triggers information acquisition. Fishman, Parker and Straub (2020) study the dynamics of lending standards in loan markets and show that tighter lending standard has negative externality on future lenders and prolongs temporary downturns. In my model, a market freeze can arise as a self-fulfilling outcome without fundamental shocks and eventually lead to an information trap. In terms of policy implications, this paper is related to the recent discussion of optimal disclosure of information by government and regulators, as in Alvarez and Barlevy (2015); Bouvard, Chaigneau and de Motta (2015); Gorton and Ordonez (2020); and Goldstein and Leitner (2018). A closely related study is that of Pagano and Volpin (2012), who also examine the welfare implications of increasing transparency in the securitization process. My work differs in that I argue information disclosure does not directly reveal the value of an asset; instead, investors need to conduct due diligence to interpret the disclosed information. The noise in the interpretation of disclosed information reflects the complexity of the underlying assets, such as securitized products. I show that greater transparency reduces noise, but it can also exacerbate adverse selection in the market through the information trap.

2 The Model

Time is continuous and infinite. There is a continuum of assets with mass 1. The quality of an asset is either high or low, denoted by $j \in \{H, L\}$. The mass of high-quality and low-quality assets is fixed at $\alpha/(1+\alpha)$ and $1/(1+\alpha)$ respectively, so the ratio of high-quality to low-quality assets is α, which is an exogenous parameter that controls the average quality of the assets. Therefore I will refer to α as the *fundamental* of the market.[8]

[7] See Camargo, Kim and Lester (2015) for an example.

[8] I deviate from the conventional notation of using the fraction of high-quality assets to represent the average quality of the assets. The notation adopted here turns out to be convenient for characterizing investors' beliefs and asset distribution.

The trading environment is populated with a continuum of investors. They are risk-neutral and discount time at rate r. Each of them is restricted to holding either 0 units or 1 unit of an asset. Their preference for holding assets can be either *unshocked* or *shocked*, reflecting the fact that some investors experience liquidity shocks and become financially constrained. Whether an investor is shocked is observable or verifiable. When holding an asset of quality $j \in \{H, L\}$, an unshocked investor enjoys a flow payoff designated as rv_j, while a shocked investor enjoys a flow payoff of rc_j. Throughout this paper, I maintain the assumption that $v_H > c_H > v_L \geq c_L > 0$. Thus, the shocked investors enjoy a lower flow payoff from holding both types of assets. Also, $c_H > v_L$, meaning that the common value component dominates the private value component, which is a necessary condition for the existence of the lemons problem.

Following Vayanos and Wang (2007), I consider a life-cycle model of OTC markets. At any time, there is a flow into the economy of unshocked investors without assets, the buyers in the market. They have a one-time opportunity to trade with the shocked asset owners, who are the sellers in the market. After buying an asset, a buyer becomes an unshocked asset owner. Otherwise, if trade is unsuccessful, the buyer exits the market with zero payoff. Since an investor's liquidity shock is observable, there will be no trade between a buyer and an unshocked asset owner.[9] Therefore, unshocked asset owners only passively hold assets until their preferences change. These investors are labeled as holders. Holders face liquidity shocks that arrive at Poisson rate δ. Upon receiving a liquidity shock, a holder becomes a seller and offers her asset for sale on the market. For tractability, I assume that the inflow of buyers at any time equals a constant λ times the mass of sellers in the market. These buyers are matched with sellers randomly. Therefore, from a seller's perspective, buyers arrive at a constant Poisson rate λ. Sellers stay in the market until they sell the assets and exit the economy with zero payoff.

The flow of investors in the economy is summarized in Figure 1. Buyers enter the economy from the pool of outsider investors. When a seller sells an asset, she exits the economy and returns to the pool of outside investors. I use the word *market* to represent the two groups of active traders in the economy, the sellers and the buyers. From a buyer's perspective, the severity of the adverse selection problem is determined by the composition of sellers with high-quality and low-quality assets. Notice that sellers are a subset of asset owners who

[9] This is a direct implication of the No-Trade Theorem in Milgrom and Stokey (1982).

actively participate in the market. Therefore, the composition of assets among sellers can potentially differ from the fundamental of the market, which is the asset composition among all asset owners. In this sense, the level of adverse selection in my model is endogenous and depends on the asset distribution. Later, I use the word *market composition* to represent the composition of high-quality and low-quality assets among sellers.

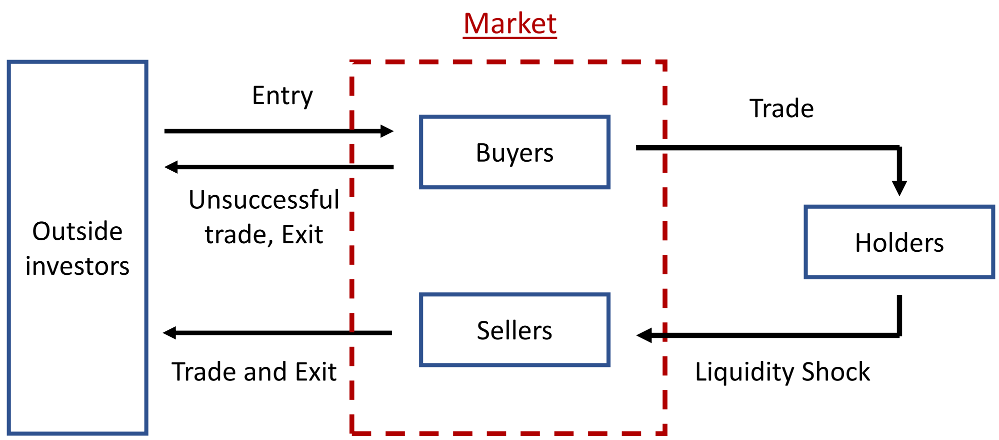


Figure 1: Flow Diagram of the Asset Market

When a buyer meets a seller, the seller is privately informed of the quality of her asset. The buyer does not observe the quality of the seller's asset, nor does she have information regarding time-on-the-market or the trading history of the seller. Her prior belief is determined by the market composition—i.e., the ratio of high-quality assets and low-quality assets among sellers. In addition, the buyer can pay a fixed cost $k \geq 0$ to acquire information and obtain a signal $\psi \in \{G, B\}$ of the asset's quality. G represents a good signal and B represents a bad signal. The probability of observing a signal ψ from an asset of quality j is f_j^ψ. Signals obtained by different buyers are jointly independent conditional on the quality of the asset. The assumption that a buyer can only observe a noisy signal of the asset's quality captures the opaque nature of the assets. Different buyers may have different evaluations of the same asset. Without loss of generality, I assume $f_H^G > f_L^G$, so a high-quality asset is more likely to generate a good signal than a low-quality asset. This implies that a good signal improves the buyer's posterior belief about the asset's quality. The trading protocol is deliberately simple. The buyer makes a take-it-or-leave-it offer to the seller. The entire transaction takes place instantly, with the seller and buyer separating immediately afterward.

Remark 1: In practice, investors' liquidity shocks correspond to changes in hedging needs, investment mandates, or selling pressure induced by redemption flows. In the model, I assume that investors' liquidity shocks are observable, whereas asset quality is not. This assumption is well-motivated in the context of OTC markets. A key feature of these markets is that most trades occur through direct negotiation via phone or messaging, making them non-anonymous (Duffie, 2011). Recent empirical work shows that this non-anonymity enables dealers to engage in price discrimination based on counterparties' identities and inferred trading motives (Di Maggio, Kermani and Song, 2017; Pinter, Wang and Zou, 2024). Moreover, participants in OTC markets tend to engage in repeated interactions over time (Li and Schürhoff, 2019; Hendershott et al., 2020). While investors may be reluctant to explicitly reveal their liquidity needs, such information can often be learned through alternative informational channels—such as market rumors, disclosure patterns, observable shifts in portfolio allocations, or changes in trading intensity—or inferred from their aggregate trading behavior across a portfolio of assets. In contrast, inferring an investor's valuation of a specific asset typically requires detailed knowledge of that asset's trading history, which is harder to obtain. Thus, in this setting, liquidity shocks are arguably more observable than asset-specific valuations.

Chang (2018) develops a model that incorporates two dimensions of private information: one concerning the seller's level of financial distress and the other concerning the asset's common value. In her framework, sellers endogenously decide whether to retain the asset. She shows that the observed low trading volume in non-agency MBS markets—rather than a fire sale at steep discounts—is consistent with sellers' distress levels being at least partially observable to other market participants. While her analysis provides valuable insights, embedding multi-dimensional private information into a dynamic trading environment with endogenous buyer-side information acquisition lies beyond the scope of the present paper.

Remark 2: Secondary OTC markets for financial assets are generally opaque. In particular, it is difficult for a buyer to observe other participants' contacts, quotes, or trades, especially in markets for highly heterogeneous assets such as securitized products (Duffie, 2011; Zhu, 2012). Notably, trades of securitized products were not subject to post-trade reporting under the TRACE system until 2011, further limiting price transparency in these markets. This opaqueness stands in sharp contrast to primary loan markets (e.g., Adelino, Gerardi and Hartman-Glaser (2019)) and to markets such as housing and labor, where an asset's or seller's time on the market is observable or can be reasonably inferred. To reflect these informational frictions, the model assumes that buyers do not observe a seller's time on the market or the trading history of the asset.

Remark 3: When $k = 0$, a buyer receives a noisy private signal about the asset of the matched seller at no cost, which she may incorporate into her trading strategy. In this scenario, the term "information acquisition" as used in subsequent discussions can be more aptly interpreted as "information utilization."

3 Equilibrium Analysis

In this section I analyze investors' optimal trading strategies and define the equilibrium of the model. Since investors are infinitesimal, they take the continuation value of leaving a match as given. This allows me to separate the equilibrium analysis into three parts. First, I study a static trading game between a seller and a buyer, taking the continuation values as given. Second, I determine the continuation values of different agents. Lastly, I characterize the evolution of the asset distribution.

3.1 The Static Trading Game

The static trading game is played by one seller and one buyer. To define a static trading game, it is sufficient to specify the prior belief of the buyer and the terminal payoffs of both players when they separate. I denote the buyer's prior belief by $\theta(t)$, which equals the probability that the seller carries a high-quality asset divided by the probability that the seller carries a low-quality asset. If θ is small, there is a large fraction of low-quality assets on the market, and the adverse selection problem is severe. In equilibrium, θ must be consistent with the asset distribution among sellers when the buyer meets the seller. If the seller sells the asset or the buyer does not buy the asset, they leave the economy with zero continuation value. If the buyer buys an asset of quality $j \in \{H, L\}$, the continuation value is denoted by $V_j(t)$, which is also the continuation value of a passive holder at time t. If the seller keeps an asset of quality j, the continuation value is denoted by $C_j(t)$. From now on, I omit the time argument of all variables when analyzing the static trading game. A static trading game is therefore defined by the combination of the buyer's prior belief and the continuation values

$(\theta; V_H, C_H, V_L, C_L)$. For reasons that will become clear later, we only need to consider the case of $V_H > C_H > V_L, C_L$.

The static game has two stages, the information acquisition stage and the trading stage. We use backward induction to solve the static game. The seller's optimal strategy takes a simple form. A seller with an asset of quality j is going to accept any price higher than the continuation value C_j and reject any offer below C_j. The buyer needs to decide whether to acquire information, and based on her belief about the asset's value after the information acquisition stage, decides upon an optimal offering price. If the buyer acquires information, she will update her belief in a Bayesian way. Her posterior belief about the asset's quality after seeing signal $\psi \in \{G, B\}$ in the form of a high-quality to low-quality ratio is

$$\tilde{\theta}(\theta, \psi) = \frac{f_H^\psi}{f_L^\psi}\theta. \tag{1}$$

If the buyer doesn't acquire information, the posterior belief $\tilde{\theta}$ equals the prior belief θ. For the consistency of notation, let $\tilde{\theta}(\theta, N) = \theta$ represent the posterior belief if the buyer has chosen not to acquire information.

The following lemma characterized the optimal offering strategy of the buyer conditional on the posterior belief $\tilde{\theta}(\theta, \psi)$.

Lemma 1 *The buyer's strategy is characterized by a threshold belief*

$$\hat{\theta} = \frac{C_H - \min\{C_L, V_L\}}{V_H - C_H}.$$

1. *If $\tilde{\theta}(\theta, \psi) > \hat{\theta}$, the buyer makes a pooling offer C_H,*
2. *If $\tilde{\theta}(\theta, \psi) < \hat{\theta}$ and $V_L > C_L$, the buyer makes a separating offer C_L,*
3. *If $\tilde{\theta}(\theta, \psi) < \hat{\theta}$ and $V_L < C_L$, the buyer makes a no-trade offer $p < C_L$.*

If the buyer's posterior belief $\tilde{\theta}(\theta, \psi)$ is above the threshold $\hat{\theta}$, the buyer should offer a pooling price C_H to trade with both the high-quality and the low-quality seller. However, if the buyer's posterior belief is not good enough, the optimal price to offer depends on the relationship between V_L and C_L or, alternatively, whether there are gains from trade of a low-quality asset. If $V_L > C_L$, the buyer values a low-quality asset more than the seller does, and the buyer can offer a separating price C_L that will only be accepted by a low-type seller. On the other hand, if $V_L < C_L$, the buyer values a low-quality asset less than the seller does, and it is optimal for the buyer to offer a no-trade price, which is lower than a low-type seller's continuation value, to avoid buying the asset. In the knife-edge case of $\tilde{\theta}(\theta, \psi) = \hat{\theta}$, or $V_L = C_L$, the optimal offering strategy of the buyer can be a mixed strategy.

In the information acquisition stage, the buyer will compare the value of information, which is the increase in the expected payoff after the buyer observes the signal, to the cost of information acquisition. She will only acquire information about the asset when the net gain is positive. The signal is potentially valuable to the buyer because it gives the buyer the option of making offers conditional on the signal. Depending on prior belief, the buyer will either improve the offered price when seeing a good signal, or lower the offered price when seeing a bad signal.

Lemma 2 *The value of information is*

$$W(\theta) = \begin{cases} \max\left\{-\frac{\theta}{1+\theta} f_H^B (V_H - C_H) + \frac{1}{1+\theta} f_L^B (C_H - \min\{C_L, V_L\}), 0\right\}, & \textit{if } \theta \geq \hat{\theta}, \\ \max\{\frac{\theta}{1+\theta} f_H^G (V_H - C_H) - \frac{1}{1+\theta} f_L^G (C_H - \min\{C_L, V_L\}), 0\}, & \textit{if } \theta < \hat{\theta}. \end{cases}$$

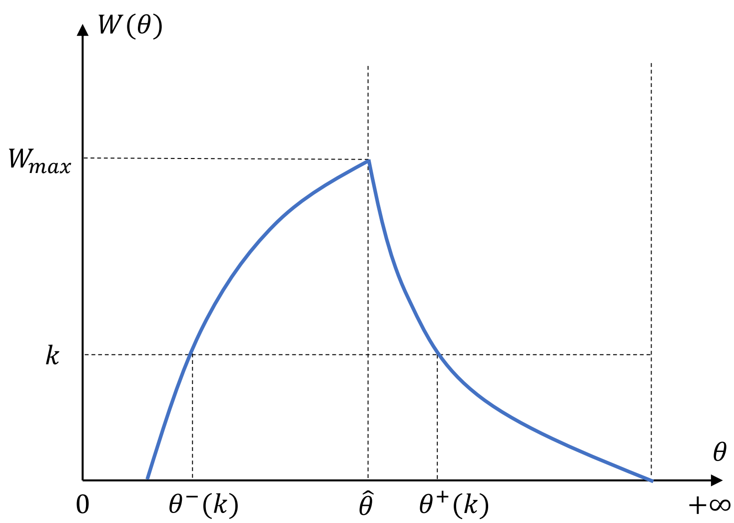


Figure 2: Value of information to the buyer.

Figure 2 depicts the value of information as a function of the prior belief θ. Let W_{max}

be the maximum value of information. If the prior belief θ falls at the left or right end of the $[0, 1]$ interval, the value of information is zero. This is because the prior belief is so high (low) that even after observing a bad (good) signal, the posterior is still higher (lower) than the threshold belief. If the prior belief is around the threshold belief $\hat{\theta}$, the value of information first increases from 0, reaches the maximum at $\hat{\theta}$, and then decreases to 0. The buyer will acquire information if and only if the value of information based on the prior belief is greater than the cost of acquiring information. The following lemma summarizes the buyer's optimal strategy in information acquisition.

Lemma 3 *If $k < W_{max}$, the buyer will acquire information if and only if*

$$\theta^-(k, \min\{C_L, V_L\}) \leq \theta \leq \theta^+(k, \min\{C_L, V_L\}),$$

where the two functions are defined as

$$\theta^-(k, \nu) = \frac{f_L^G(C_H - \nu) + k}{f_H^G(V_H - C_H) - k}, \quad \theta^+(k, \nu) = \frac{f_L^B(C_H - \nu) - k}{f_H^B(V_H - C_H) + k}.$$

Both $\theta^-(k, \nu)$ and $\theta^+(k, \nu)$ are decreasing in ν.

When the value of a low-quality asset ($\min\{C_L, V_L\}$) decreases, the loss of buying a low-quality asset at pooling price C_H is higher. Therefore, the buyer is more inclined to avoid low-quality assets on the right boundary of the information-sensitive region and less willing to rely on the noisy signal on the left boundary. The information-sensitive region $[\theta^-(k), \theta^+(k)]$ moves to the right as both C_L and V_L decrease. As we will show later, C_L and V_L are determined by both the flow payoff from holding the asset and the likelihood that a low-quality asset can be sold at the pooling price in the future. The above comparative statics are important because they are related to the resale consideration that links the current buyers' information acquisition decision to future market liquidity. When the current market composition is relatively good (θ on the right boundary of the information-sensitive region), buyers are more willing to acquire information if their belief about future market liquidity deteriorates.

To conclude the analysis of the static trading game, I summarize the trading probability in the equilibrium of the static trading game (for the non-knife-edge cases) when $k < W_{max}$ in Table 1. When θ falls on the boundary of the information region, the equilibrium is not unique. The buyer will use a mixed strategy of information acquisition. Thus, the set of trading probabilities is the convex combination of the set of trading probabilities of the adjacent regions.

	$\theta < \theta^-(k,\nu)$	$\theta^-(k,\nu) < \theta < \theta^+(k,\nu)$	$\theta > \theta^+(k,\nu)$
$V_L < C_L$	$\rho_H = \rho_L = 0$	$\rho_H = f_H^G, \rho_L = f_L^G$	$\rho_H = \rho_L = 1$
$V_L = C_L$	$\rho_H = 0, \rho_L \in [0,1]$	$\rho_H = f_H^G, \rho_L \in [f_L^G, 1]$	$\rho_H = \rho_L = 1$
$V_L > C_L$	$\rho_H = 0, \rho_L = 1$	$\rho_H = f_H^G, \rho_L = 1$	$\rho_H = \rho_L = 1$

Table 1: Trading probability when $k < W_{max}$

3.2 Continuation Values

First I introduce some notations that describe the investors' strategy in the full dynamic game, allowing for both pure strategy and mixed strategy. I use $\mu(p,j,t) \in [0,1]$ to represent the probability of type j seller accepting offer p at time t. The buyer's strategy is more complicated and can be denoted by a couple of functions $\{i(t), \sigma(p,\psi,t)\}$.[10] $i(t) \in [0,1]$ is the probability that the buyer acquires information at time t. $\sigma(p,\psi,t)$ represents the probability of offering p in a match at time t when seeing signal ψ. If a buyer does not acquire information, $\psi = N$ following the previous notation. Therefore, $\sigma(p,N,t)$ is the buyer's probability of offering p in a match at time t conditional on not acquiring information. In principle, a buyer can draw a price from a mixed distribution. Fortunately, based on the analysis of the static trading game, the buyer will only choose from three relevant offers at any time.[11] Thus it's without loss of generality to assume $\sigma(\cdot,\psi,t)$ is a probability mass function of p.

With the help of the above notations, we can write down $\gamma_j(p,t)$, the probability that a type j seller is offered price p conditional on meeting a buyer at time t.

$$\gamma_j(p,t) = i(t) \sum_{\psi=G,B} f_j^{\psi} \sigma(p,\psi,t) + (1-i(t))\sigma(p,N,t). \tag{2}$$

[10]Note that the strategy functions are independent of the identity of any given buyer or seller. This means that we will focus on equilibria with symmetric strategies without loss of generality because for any equilibrium with asymmetric strategies, we can find an equilibrium in symmetric strategies with the same path of asset distributions, trading volume, and average prices.

[11]We can pick any $p < c_L$ to be the no-trade price.

$\gamma_j(p,t)$ characterizes the market condition faced by a type j seller at time t. If $\gamma_j(p,t)$ has more weights on high prices of p, the market is more liquid for sellers with assets of quality j because it's easier for them to sell the assets at a high price.

The continuation value of sellers with high-quality assets is at least c_H since the sellers can always hold on to their assets. Also, no buyer will offer a price higher than c_H in equilibrium.[12] Therefore

$$C_H(t) = c_H. \tag{3}$$

The previous analysis of the static trading game shows that only three types of prices will be offered by a buyer at time t: the pooling price $C_H(t) = c_H$, the separating price $C_L(t)$ or the no-trade price $p < C_L(t)$. Getting an offer at the separating price or the no-trade price will not change the continuation value of the seller. Therefore, to compute the continuation value of a low-quality seller, we consider the hypothetical case where the seller always holds on to the asset unless offered c_H. In fact, $\gamma_j(c_H, t)$ can be viewed as a proxy of endogenous market liquidity for owners of an asset of quality j. This is especially important for investors with low-quality assets because it measures the likelihood of extracting information rent in future meetings. Since the arrival rate of a pooling offer c_H for a low-type seller at time τ is $\lambda\gamma_L(c_H, \tau)$, for a low-quality seller remaining in the market at time t, the distribution function of the arrival time of an offer with pooling price c_H is $1 - e^{-\lambda \int_t^\tau \gamma_L(c_H,u)du}$. A low-quality seller's continuation value is characterized by[13]

$$C_L(t) = \int_t^\infty \left[(1 - e^{-r(\tau-t)})c_L + e^{-r(\tau-t)}c_H\right] d(1 - e^{-\lambda \int_t^\tau \gamma_L(c_H,u)du}). \tag{4}$$

The seller enjoys the flow payoff rc_L before a pooling offer arrives, and the value jumps to c_H when the seller accepts the offer. If $\gamma_L(c_H, \tau)$ improves for all future $\tau > t$, the low-type sellers' continuation value $C_L(t)$ increases.

Now let's turn to the continuation value of a holder/buyer. A holder enjoys the flow payoff from an asset and mechanically becomes a seller when hit by a liquidity shock that

[12]Otherwise the price of high-quality asset will be unbounded when t goes to infinity

[13]Equivalently, a low-quality seller's continuation value can be characterized by a differential equation $rC_L(t) = rc_L + \lambda\gamma_L(c_H, t)\,(c_H - C_L(t)) + \frac{\mathrm{d}C_L(t)}{\mathrm{d}t}$.

arrives at Poisson rate δ.[14] The continuation value of a type-j holder at time t is

$$V_j(t) = \int_t^\infty \left[(1 - e^{-r(\tau-t)})v_j + e^{-r(\tau-t)}C_j(\tau)\right] d(1 - e^{-\delta(\tau-t)}). \tag{5}$$

To derive the gains from trade at time t, we need to compare the continuation values of sellers and holders. Notice for the high type, $C_H(t) = c_H$,

$$V_H(t) = \frac{rv_H + \delta c_H}{r + \delta}. \tag{6}$$

As long as $\delta > 0$, $V_H(t) > C_H(t)$ holds at any time. There are always gains from trade for high-quality assets. However, the same result doesn't necessarily hold for low-quality assets although $v_L \geq c_L$. Taking the difference between (5) and (4), we have

$$V_L(t) - C_L(t) = \int_t^\infty \Bigg[\underbrace{(1 - e^{-r(\tau-t)})(v_L - c_L)}_{\text{flow payoff}} \cdots \tag{7}$$

$$- \underbrace{\int_t^\tau e^{-r(u-t)}\lambda\gamma_L(c_H, u)(c_H - C_L(u))\mathrm{d}u}_{\text{information rent}}\Bigg] d(1 - e^{-\delta(\tau-t)}). \tag{8}$$

The first component of the integrand represents the holder's extra benefit from the higher flow payoff. However, the positive gain is offset by the information rent of the low-type seller, represented by the second component of the integrand. Notice $C_L(\tau) \leq \frac{rc_L+\lambda c_H}{r+\lambda} < c_H$. When the low-type seller is likely to be offered a pooling price c_H—i.e., $\gamma_L(c_H, u) > 0$—she can take advantage of the liquid market condition and extract information rent from the buyers. This benefit is not enjoyed by the holder. The buyer/holder has an advantage of holding the asset because of the higher flow payoff. However, she has a disadvantage in reselling the asset because her liquidity shock is observable. The fact that an asset holder seeks to immediately sell her asset on the market reveals that she is holding a low-quality asset. Whether the gain from trade is positive or negative depends on the relative size of the two components. As the market condition becomes uniformly more liquid (higher $\gamma_j(c_H, u)$

[14] The continuation value of a type-j holder can be equivalently characterized by a differential equation $rV_j(t) = rv_j + \delta\left(C_j(t) - V_j(t)\right) + \frac{\mathrm{d}V_j(t)}{\mathrm{d}t}$.

for all $u > t$), the gains from trade decrease. Here I state the following assumption regarding the information structure of the signal:

Assumption 1 $f_L^G > \frac{r+\lambda}{\lambda}\frac{v_L - c_L}{c_H - c_L}$.

Given Assumption 1, the gains from trade for low-quality assets could be positive, negative, or zero depending on future market conditions denoted by $\gamma_L(c_H, t)$. A liquid market condition in the future (uniformly higher $\gamma_L(c_H, t)$) increases the low-quality seller's incentive to remain in the market and wait for a pooling offer, therefore lowering the gain from trade. Assumption 1 implies that if future buyers always acquire information, the gains from trade of a low-quality asset are negative. This result is formally stated in Lemma 4.

Lemma 4 *Given Assumption 1, $V_L(t) - C_L(t) < 0$ if $\gamma_L(c_H, \tau) \geq f_L^G$ for any $\tau > t$.*

For Assumption 1 to hold, the value difference between the high-type and low-type assets can not be too small (v_L is relatively close to c_L instead of c_H). Also, buyers' signals must have sufficient "false positives" ($f_L^G > 0$) so that, when acquiring information, there is a non-negligible chance they will offer a pooling price to a low-quality seller.

3.3 The Evolution of Asset Quality

The trading probability of each type of asset at any time can be constructed from the trading strategies. The probability that an asset of quality j is traded in a match at time t is

$$\rho_j(t) = \sum_{\{p:\mu(p,j,t)>0\}} \gamma_j(p,t)\mu(p,j,t). \tag{9}$$

The product $\gamma_a(p,t)\mu(p,a,t)$ represents the probability that a type a asset is sold at price p at time t. The summation of the product over p gives us the trading probability.

Let $m_H^S(t)$ and $m_L^S(t)$ represent the masses of high-quality and low-quality assets held by sellers. Since high-quality and low-quality assets are in fixed supply of $\frac{\alpha}{1+\alpha}$ and $\frac{1}{1+\alpha}$ respectively, mass $\frac{\alpha}{1+\alpha} - m_H^S(t)$ of high-quality assets and mass $\frac{1}{1+\alpha} - m_L^S(t)$ of low-quality assets are held by holders. The evolution of asset distribution is fully characterized by the following differential equations:

$$\dot{m}_H^S(t) = \delta \left(\frac{\alpha}{1+\alpha} - m_H^S(t) \right) - \lambda \rho_H(t) m_H^S(t), \tag{10}$$

$$\dot{m}_L^S(t) = \delta \left(\frac{1}{1+\alpha} - m_L^S(t) \right) - \lambda \rho_L(t) m_L^S(t). \tag{11}$$

In each equation, the right-hand side consists of two terms. The first term represents the inflow of assets brought into the market by holders who just received liquidity shocks. The second term represents the outflow of assets because of trading. Since buyers are assigned to sellers randomly, buyers' prior beliefs about the quality of their counter-parties' assets must be consistent with the market composition of high-quality and low-quality assets. For this reason, we use the same notation $\theta(t)$ to represent both the market composition and the buyers' prior belief

$$\theta(t) = \frac{m_H^S(t)}{m_L^S(t)}. \tag{12}$$

Combining (10) and (11), we can characterize the evolution of the market composition as

$$\frac{\mathrm{d}}{\mathrm{d}t} \ln \theta(t) = \underbrace{\frac{\delta}{m_H^S(t)} \frac{\alpha}{1+\alpha} (1 - \theta(t)/\alpha)}_{\text{fundamental reversion}} - \underbrace{\lambda(\rho_H(t) - \rho_L(t))}_{\text{trading probability differential}} . \tag{13}$$

The evolution of asset distribution can be equivalently characterized by $m_H^S(t)$ and $\theta(t)$. The change in the quality of assets on the market can be decomposed into two effects. The first effect is the *fundamental reversion*. When $\theta(t) < \alpha$, the composition of assets on the market is worse than the fundamental. Therefore, the inflow of assets because of liquidity shocks improves the quality of assets on the market. On the contrary, the inflow of assets worsens the quality of assets on the market when $\theta(t) > \alpha$. Therefore, the market composition tends to revert to the fundamental. This effect is stronger when the high-quality asset on the market is a smaller fraction of total stock of high-quality asset in the economy. The second term is the *trading-probability differential*. Most previous literature has focused on cases where low-quality assets trade weakly faster than high-quality assets in illiquid markets. In those cases, $\rho_H(t) \leq \rho_L(t)$ so the second effect is always weakly positive. In the analysis of the static trading game, we know that when $\theta(t)$ falls in the information sensitive region and there's negative gain from trade for low-quality assets, $\rho_H(t) > \rho_L(t)$. Therefore, high-quality assets leave the market faster than low-quality assets, so the second effect is negative. The negative trading-probability differential effect generates novel implications for the set of steady states and market transitions in the dynamic equilibrium.

3.4 Equilibrium Definition

The equilibrium of the full dynamic game is defined as follows.[15]

Definition 1 *Given an initial asset distribution* $\{\theta(0), m_H^S(0)\}$*, an equilibrium consists of paths of asset distribution* $\{\theta(t), m_H^S(t)\}$*, buyers' strategies* $\{i(t), \sigma(p, \psi, t)\}$ *and continuation value functions* $V_H(t), V_L(t)$*, sellers' strategies* $\mu(p, a, t)$ *and continuation value functions* $C_H(t), C_L(t)$ *such that*

1. *For any time t, given the continuation values* $V_L(t)$*,* $V_H(t)$*,* $C_L(t)$*,* $C_H(t)$ *and the prior belief* $\theta(t)$*, a buyer's strategy* $\{i(t), \sigma(p, \psi, t)\}$ *and a seller's strategy* $\mu(p, a, t)$ *form a sequential equilibrium of the static trading game.*

2. *The sellers' continuation values* $C_H(t)$ *and* $C_L(t)$ *are given by (2), (3) and (4). The buyers' continuation values* $V_H(t)$ *and* $V_L(t)$ *are given by (5).*

3. *The asset distribution* $\{\theta(t), m_H^S(t)\}$ *evolves according to (10) and (13).*

4 Stationary Equilibria

In this section, I characterize the set of stationary equilibria in the dynamic trading game, leaving the analysis of transitional dynamics to the next section. A stationary equilibrium is one in which the asset distribution and investors' trading strategies remain constant along the equilibrium path. These stationary equilibria represent the market's long-run steady states. I primarily focus on pure-strategy stationary equilibria, deferring the analysis of mixed-strategy equilibria to Appendix IA2. The stationary equilibria can be ranked based on the total welfare of the investors.

[15] This definition makes use of some results in the previous analysis. A complete definition of equilibrium is given in Appendix IA1.

4.1 Construction of Stationary Equilibria

The set of stationary equilibria can be characterized using a guess-and-verify approach. We begin by assuming a trading strategy for all investors and computing the continuation values $\bar{V}_H$, $\bar{C}_H$, $\bar{V}_L$, and $\bar{C}_L$. Simultaneously, we determine the stationary asset distribution—particularly the market composition $\bar{\theta}$—and verify whether the assumed trading strategies are consistent with the static trading game $(\bar{\theta}; \bar{V}_H, \bar{C}_H, \bar{V}_L, \bar{C}_L)$.

Let $\bar{\rho}_H$ and $\bar{\rho}_L$ denote the trading probabilities of high-quality and low-quality assets, respectively, in a match. The stationary market composition is given by

$$\bar{\theta} = \frac{\delta + \lambda \bar{\rho}_L}{\delta + \lambda \bar{\rho}_H} \alpha. \tag{14}$$

If high-quality assets are traded with higher probability in the stationary equilibrium (i.e., $\bar{\rho}_H > \bar{\rho}_L$), the stationary market composition is worse than the fundamental α. Conversely, if low-quality assets are traded with higher probability, the stationary market composition is better than the fundamental.

The analysis of the static trading game shows that along any equilibrium path, the continuation values of high-quality assets are constant and given by $\bar{C}_H = c_H$ and $\bar{V}_H = \frac{rv_H + \delta c_H}{r+\delta}$, independent of market conditions. Let $\bar{\gamma}_L(c_H)$ denote the constant probability that a low-quality seller is offered the pooling price c_H in a given match in a stationary equilibrium. The continuation values for low-quality sellers and buyers are then given by

$$\bar{C}_L = \frac{rc_L + \lambda \bar{\gamma}_L(c_H) c_H}{r + \lambda \bar{\gamma}_L(c_H)}, \quad \bar{V}_L = \frac{rv_L + \delta \bar{C}_L}{r + \delta}. \tag{15}$$

If $\bar{\gamma}_L(c_H)$ is low in a stationary equilibrium, the market exhibits lower liquidity, and the value of owning low-quality assets is correspondingly lower.

Depending on buyers' strategies, the pure-strategy stationary equilibria can be classified into three categories. We first describe the trading patterns in each pure-strategy stationary equilibrium and then summarize the conditions under which each equilibrium exists in a proposition.

Information-Insensitive Pooling Stationary Equilibrium (S_1)

In the first case, buyers do not acquire information and always offer the pooling price c_H. Therefore, both high-quality and low-quality assets are traded at the same rate, $\bar{\rho}_{H,1} = \bar{\rho}_{L,1} = 1$, and the stationary market composition $\bar{\theta}_1$ equals the fundamental α. Since low-type sellers receive a pooling offer in every match, $\bar{\gamma}_L(c_H) = 1$, the continuation values of the low-type sellers and buyers are

$$\bar{C}_{L,1} = \frac{rc_L + \lambda c_H}{r + \lambda}, \quad \bar{V}_{L,1} = \frac{rv_L + \delta \bar{C}_{L,1}}{r + \delta}.$$

Assumption 1 implies that $\bar{V}_{L,1} < \bar{C}_{L,1}$, so there are no gains from trade between a buyer and a low-type seller.

S_1 is the stationary equilibrium with the highest market liquidity subject to search frictions. Both high-type and low-type assets are transferred to high-valuation investors (buyers) whenever a match is formed. Moreover, buyers do not spend resources inspecting the assets. They refrain from doing so for two reasons. First, lemons account for only a small fraction of the assets for sale, and the composition of assets is unlikely to deteriorate given the strong fundamentals of the market. Second, the expectation that the market will remain liquid in the future reduces concerns about acquiring a lemon, since investors know they will be able to resell it quickly at a high price.

Information-Sensitive Stationary Equilibrium (S_2)

Now consider a pure-strategy stationary equilibrium with information acquisition (i.e., $\bar{i} = 1$). From the analysis of the static trading game, we know that the pooling price is offered if and only if a good signal is observed. Therefore, the probability that a low-type seller receives a pooling offer is $\bar{\gamma}_L(c_H) = f_L^G$. The continuation values of low-type sellers and buyers in S_2 are

$$\bar{C}_{L,2} = \frac{rc_L + \lambda f_L^G c_H}{r + \lambda f_L^G}, \quad \bar{V}_{L,2} = \frac{rv_L + \delta \bar{C}_{L,2}}{r + \delta}. \tag{16}$$

In S_2, low-type sellers expect to receive the offer c_H with probability f_L^G in each match at any time in the future. Assumption 1 implies that $\bar{C}_{L,2} > \bar{V}_{L,2}$, so there are no gains from trade with low-type sellers. Buyers offer the pooling price c_H after observing a good signal and offer a no-trade price $p < \bar{C}_{L,2}$ after observing a bad signal. The probability that an asset is traded in a match equals the probability that a good signal is generated by the asset, so $\bar{\rho}_{H,2} = f_H^G$ and $\bar{\rho}_{L,2} = f_L^G$. Since high-quality assets are traded more frequently, the stationary market composition is worse than the fundamental:

$$\bar{\theta}_2 = \frac{\delta + \lambda f_L^G}{\delta + \lambda f_H^G} \cdot \alpha < \alpha. \tag{17}$$

Compared to the information-insensitive pooling stationary equilibrium S_1, this market is less liquid. Buyers are cautious about the composition of assets in the market and always acquire information. Since buyers rely on an imperfect signal, high-quality sellers occasionally receive unfavorable offers when their asset is mistaken for a lemon. It takes longer for a high-quality seller to find an acceptable price in the market compared to the more liquid stationary equilibrium S_1. Low-quality sellers, on the other hand, still have a positive probability of receiving a pooling offer, as buyers sometimes mistake lemons for high-quality assets. If the signal is sufficiently noisy, as assumed in Assumption 1, the expected information rent received by a low-quality seller exceeds the difference in discounted flow payoffs between a seller and a buyer. As a result, low-quality sellers demand a high price that buyers are unwilling to offer unless a good signal is observed. Consequently, low-quality sellers remain in the market longer than high-quality sellers.

This rent-seeking behavior by low-quality sellers has two adverse effects on allocative efficiency. The first is direct: low-quality assets are not traded immediately upon a buyer's arrival, even when the buyer has a higher flow payoff from holding the asset. The second is indirect: as low-quality sellers linger in the market, the overall market composition stays below the fundamental, reducing buyers' incentive to offer pooling prices.

Information-Insensitive Separating Stationary Equilibrium (S_3)

When the stationary market composition falls within the information-insensitive region with separating offers, the market is in an information-insensitive separating stationary equilibrium. This is the third and final type of stationary equilibrium with pure strategies.

In S_3, buyers do not acquire information and only offer the separating price. Therefore, low-quality assets are traded with probability 1 in each match, while high-quality assets are never traded: $\bar{\rho}_{H,3} = 0$, $\bar{\rho}_{L,3} = 1$. The stationary market composition is better than the fundamental:

$$\bar{\theta}_3 = \frac{\delta + \lambda}{\delta} \cdot \alpha > \alpha. \tag{18}$$

Since the pooling price is never offered in equilibrium, the continuation values of low-quality asset owners are

$$\bar{C}_{L,3} = c_L, \quad \bar{V}_{L,3} = \frac{r v_L + \delta c_L}{r + \delta}.$$

It is easy to verify that $\bar{V}_{L,3} > \bar{C}_{L,3}$, so there are gains from trade for low-quality assets.

In S_3, the market consists entirely of high-quality assets and a subset of low-quality assets. Yet, the fundamental of the market is so weak that the presence of lemons is sufficient to discourage both pooling offers and information acquisition by buyers. The continuation values of low-quality asset owners are the lowest among all possible equilibria.

Proposition 1 establishes the necessary and sufficient conditions for the existence of each type of pure-strategy stationary equilibrium. These conditions are derived by verifying that the stationary market compositions lie within the respective intervals associated with distinct trading patterns, as characterized in Lemma 3. The proof follows directly from the preceding discussion and is therefore omitted.

To simplify notation, let $\theta_j^-(k)$ and $\theta_j^+(k)$ denote the lower and upper bounds of the information-sensitive region when the continuation values correspond to those in S_j, for $j = 1, 2, 3$:

$$\theta_j^-(k) = \theta^-(k, \bar{V}_{L,j}), \quad \theta_j^+(k) = \theta^+(k, \bar{V}_{L,j}), \quad \text{for } j = 1, 2,$$
$$\theta_3^-(k) = \theta^-(k, \bar{C}_{L,3}), \quad \theta_3^+(k) = \theta^+(k, \bar{C}_{L,3}).$$

Proposition 1 *There exist three types of pure-strategy stationary equilibria:*

a) An information-insensitive pooling stationary equilibrium S_1 exists if and only if

$$\alpha \geq \max\left\{\frac{c_H - \bar{V}_{L,1}}{V_H - c_H},\ \theta_1^+(k)\right\}.$$

b) Under Assumption 1, an information-sensitive stationary equilibrium S_2 exists if and only if

$$\frac{\delta + \lambda f_H^G}{\delta + \lambda f_L^G} \cdot \theta_2^-(k) \leq \alpha \leq \frac{\delta + \lambda f_H^G}{\delta + \lambda f_L^G} \cdot \theta_2^+(k).$$

c) An information-insensitive separating stationary equilibrium S_3 exists if and only if

$$\alpha \leq \frac{\delta}{\delta + \lambda} \cdot \min\left\{\frac{c_H - c_L}{V_H - c_H},\ \theta_3^-(k)\right\}.$$

Broadly speaking, S_1 exists for sufficiently high fundamentals, S_3 exists for sufficiently low fundamentals, while S_2 arises for an intermediate range. Note that the information-insensitive stationary equilibria always exist for some values of α, whereas the novel information-sensitive stationary equilibrium exists only when the cost of information acquisition is sufficiently low. Intuitively, when the cost of acquiring information is prohibitively high, buyers never find it optimal to do so. In that case, the classical dichotomy between pooling and separating equilibria prevails.

Corollary 1 shows that the information-insensitive pooling stationary equilibrium S_1 and the information-sensitive stationary equilibrium S_2 coexist when the fundamental α lies within an intermediate range.[16]

Corollary 1 (Coexistence of S_1 and S_2) *Suppose Assumption 1 holds. Let $A_1(k)$ and $A_2(k)$ be defined as*

$$A_1(k) = \max\left\{\theta_1^+(k),\ \frac{\delta + \lambda f_H^G}{\delta + \lambda f_L^G} \cdot \theta_2^-(k)\right\}, \quad A_2(k) = \frac{\delta + \lambda f_H^G}{\delta + \lambda f_L^G} \cdot \theta_2^+(k).$$

Then S_1 and S_2 coexist if and only if $\alpha \in [A_1(k), A_2(k)]$. When k is small, $A_1(k) < A_2(k)$.

When agents believe that the market will remain liquid in the future, as in S_1, the value of a low-quality asset is high for both sellers and buyers. Buyers are willing to offer

[16] Other combinations of stationary equilibria may also coexist for certain values of α. For example, S_1 and S_3 coexist over an intermediate range of α when both δ and k are sufficiently large. Likewise, S_2 and S_3 coexist when k is sufficiently small and δ is large. Even when pure-strategy stationary equilibria do not coexist, they may coexist with mixed-strategy stationary equilibria. We focus on the coexistence of S_1 and S_2, as it is central to the dynamics in and out of the information trap.

the pooling price without acquiring information over a wide range of market compositions. Moreover, since buyers acquire assets indiscriminately, the market composition remains at its fundamental level. In contrast, when agents expect the market to be partially illiquid, as in S_2, the value of a low-quality asset declines. The information-insensitive pooling region shrinks. Meanwhile, as buyers cream-skim the market, the asset composition remains below the fundamental. Both the trading effect and the valuation effect reinforce the buyers' incentive to acquire information.

4.2 Welfare Analysis

The total welfare along an equilibrium path is given by

$$\begin{aligned}\omega =&\frac{\alpha}{1+\alpha}v_H + \frac{1}{1+\alpha}v_L \\ &-\int_0^\infty e^{-rt}\left[rm_H^S(t)(v_H - c_H) + rm_L^S(t)(v_L - c_L) + \lambda(m_H^S(t) + m_L^S(t))i(t)k\right]\mathrm{d}t. \end{aligned} \tag{19}$$

The first line on the right-hand side, $\frac{\alpha}{1+\alpha}v_H + \frac{1}{1+\alpha}v_L$, represents welfare in a frictionless benchmark. In this benchmark, assets can be transferred instantaneously from shocked to unshocked investors. However, due to search and information frictions, some assets are instead held by shocked investors in equilibrium. The first and second terms in the integrand of (19) represent welfare losses due to market illiquidity. The third term captures the welfare loss from resources devoted to information acquisition.

From (10) and (11) we can solve for the stationary asset distribution characterized by the mass of high-quality and low-quality assets held by sellers,

$$\bar{m}_H^S = \frac{\alpha}{1+\alpha}\cdot\frac{\delta}{\delta+\lambda\bar{\rho}_H},\ \bar{m}_L^S = \frac{1}{1+\alpha}\cdot\frac{\delta}{\delta+\lambda\bar{\rho}_L}. \tag{20}$$

Using the trading probability and (20) for stationary asset distribution, we can write down the welfare loss $\Delta = \frac{\alpha}{1+\alpha} v_H + \frac{1}{1+\alpha} v_L - \omega$ in each stationary equilibrium:

$$\Delta_1 = \frac{\alpha}{1+\alpha} \cdot \frac{\delta}{\delta+\lambda}(v_H - c_H) + \frac{1}{1+\alpha} \cdot \frac{\delta}{\delta+\lambda}(v_L - c_L),$$
$$\Delta_2 = \frac{\alpha}{1+\alpha} \cdot \frac{\delta}{\delta+\lambda f_H^G}\left(v_H - c_H + \frac{\lambda k}{r}\right) + \frac{1}{1+\alpha} \cdot \frac{\delta}{\delta+\lambda f_L^G}\left(v_L - c_L + \frac{\lambda k}{r}\right),$$
$$\Delta_3 = \frac{\alpha}{1+\alpha}(v_H - c_H) + \frac{1}{1+\alpha} \cdot \frac{\delta}{\delta+\lambda}(v_L - c_L)$$

Comparing the welfare losses across pure-strategy equilibria, it is straightforward to show that the welfare loss in S_1 is lower than in S_2 or S_3 when they coexist for the same fundamental α. This is because S_1 features a lower mass of both high-quality and low-quality assets held by shocked investors, and buyers do not incur costs for acquiring information.

The welfare comparison between S_2 and S_3 when they coexist is more nuanced. Either equilibrium may yield higher welfare, depending on the underlying parameters. In S_2, a larger mass of low-quality assets is held by shocked investors, and buyers engage in costly information acquisition. In contrast, S_3 involves a greater mass of high-quality assets held by shocked investors. The overall welfare outcome depends on which of these inefficiencies dominates. The following lemma provides sufficient conditions under which S_2 yields higher welfare than S_3.

Lemma 5 *The following welfare comparisons hold:*

a) S_1 yields higher welfare than S_2 or S_3 whenever it coexists with either of them.

b) When $k = 0$ and there is no gain at the bottom ($v_L = c_L$), S_2 yields higher welfare than S_3 when they coexist.

Under the assumptions in Lemma 5, welfare loss depends solely on the mass of high-quality assets held by shocked investors. Since this mass is larger in S_3 than in S_2, the latter achieves higher allocative efficiency.

4.3 Discussion

At this point, let us revisit the assumption that asset holders' liquidity shocks are observable. As shown in the preceding analysis, this assumption plays a crucial role in two key mechanisms: (a) the reversal of continuation values between shocked and unshocked investors holding low-quality assets, and (b) the cream-skimming effect associated with information acquisition. Conceptually, it serves as a tractable way to introduce a delay in buyers' opportunities to re-trade. While the mechanism developed in this paper relies on the existence of a strictly positive delay in re-trading, it does not fundamentally depend on the observability of investors' preference shocks. Instead, the assumption provides a convenient modeling device to capture the frictions that prevent immediate re-trade.

In practice, it is uncommon for asset buyers to immediately turn around and resell newly acquired assets, as doing so would undermine the rationale for purchase and incur round-trip trading costs. Even in markets where resale decisions may be driven by adverse selection, or where learning-by-holding effects are relevant (Plantin, 2009), it typically takes time for a new holder to acquire additional information beyond what was known at the time of purchase. Moreover, frequently sending sell requests without accepting offers solely to extract pricing information from counterparties is costly in non-anonymous OTC markets, due to both the explicit and implicit costs of soliciting quotes (Zhu, 2012; Yueshen and Zou, 2022; Bak-Hansen and Sloth, 2023).

In Appendix A, I consider a variation of the model in which investors' liquidity shocks are unobservable and holders of low-quality assets may return to the market as informed sellers prior to experiencing a liquidity shock. For tractability, I model this opportunity to re-enter the market as an independent Poisson shock. I show that if the arrival rate of this shock is sufficiently low—implying a relevant delay in re-trade opportunities—this version of the model retains both key mechanisms required for the information trap to arise.

5 Non-Stationary Equilibria

In the previous section, I examined the various steady states of the market in the long run. I now turn to the analysis of how investors' trading behavior and market liquidity evolve over time, starting from a given initial asset distribution. In particular, the following question is of interest: when a liquid steady state and an illiquid steady state coexist, is it possible for the market to transition from one to the other? To address this question, it is essential to study the set of non-stationary equilibria.

To show the existence of a certain equilibrium path from an initial asset distribution to a terminal steady state, I first hypothesize about investors' trading strategies for any $t > 0$.

Given the paths of trading probability $\rho_H(t)$ and $\rho_L(t)$ and the initial asset distribution represented by $m_H^S(0)$ and $m_L^S(0)$, the full path of the asset distribution can be analytically solved from (10) and (11) as follows:

$$m_H^S(t) = e^{-\int_0^t \delta+\lambda\rho_H(s)\mathrm{d}s} m_H^S(0) + \frac{\delta\alpha}{1+\alpha}\int_0^t e^{-(\delta+\lambda\rho_H(u)(t-s))\mathrm{d}u}\mathrm{d}s, \tag{21}$$

$$m_L^S(t) = e^{-\int_0^t \delta+\lambda\rho_L(s)\mathrm{d}s} m_L^S(0) + \frac{\delta}{1+\alpha}\int_0^t e^{-(\delta+\lambda\rho_L(u)(t-s))\mathrm{d}u}\mathrm{d}s. \tag{22}$$

Next I can compute the paths of continuation values to verify whether the assumed trading strategies form an equilibrium of the static trading game at any $t > 0$.

In Appendix B, I provide sufficient conditions for the market composition $\theta(t)$ to change monotonically along a non-stationary equilibrium path.

5.1 Self-fulfilling Market Freeze

Suppose the market starts from the liquid state S_1. Is it possible that all investors suddenly change their beliefs and coordinate to follow an equilibrium path that converges to the illiquid state S_2? To answer this question, we characterize the non-stationary equilibrium paths starting from the initial asset distribution in S_1.

Proposition 2 *If Assumption 1 holds, for small k there exists*

$$A_3(k) = \theta_2^+(k) \in (A_1(k), A_2(k)),$$

such that, for any $\alpha \in [A_1(k), A_3(k)]$, starting from an initial asset distribution in the neighborhood of S_1, there is an equilibrium path that converges to S_2.

When $\alpha \in [A_1(k), A_3(k)]$, the model has multiple equilibria starting from the asset distribution of S_1. Proposition 2 implies that a liquid market can go through a self-fulfilling market freeze. Starting from the asset distribution in S_1, if all investors believe that future buyers will not acquire information and always offer the pooling price, the current buyers have no incentive to acquire information and they continue to offer the pooling price. The market therefore remains in the liquid steady state of S_1. However, if all investors believe the market liquidity will begin to decline and buyers in the future will begin to acquire information as a way of avoiding low-quality assets, the continuation value of holding low quality assets drops immediately. Thus, for current buyers, the loss incurred by buying a low-quality asset at the pooling price becomes larger, and this gives them more incentive to acquire information. When current buyers acquire information but their independent evaluation of the assets are not accurate enough, high-quality assets are traded faster than low-quality assets, resulting in a cream-skimming effect on the market composition. The market composition deteriorates over time and justifies future buyers' information acquisition. Therefore, the market evolves along a path with information acquisition and converges to the information-sensitive steady state S_2.

Notice that Proposition 2 does not imply that the information-insensitive pooling steady state is unstable. In fact, the liquid steady state is locally stable.

Lemma 6 *If α and $\theta(0)$ are both greater than $\theta_1^+(k)$, there exists an equilibrium path with pooling offers and no information acquisition that converges to S_1.*

The results of Proposition 2 and Lemma 6 can be illustrated graphically. In Figures 3a and 3b I plot the phase diagram of the evolution of asset distributions according to (10) and (13). The horizontal axis represents the market composition that determines the current investors' trading strategies. The vertical axis represents the mass of sellers with high-quality assets in the market. Although the mass of high-quality sellers does not affect the current investors' trading strategies directly, it shapes the evolution of the asset distribution through the interaction with market composition. Recall that the evolution of the asset distribution depends on the trading probability of different assets, which in turn depends on investors' belief about future market liquidity through resale considerations. Therefore, before we plot a phase diagram, we need to specify investor's continuation values according to their belief about future market liquidity.

Figure 3a shows the phase diagram when all investors believe future buyers will not acquire information but instead will always make pooling offers. Given this belief, the continuation values of owners of low-quality assets are $\bar{V}_{L,1}$ and $\bar{C}_{L,1}$. The corresponding information-sensitive region is $[\theta_1^-(k), \theta_1^+(k)]$, represented by the red shaded region in the figure; the information-insensitive pooling region is $[\theta_1^+(k), +\infty)$, represented by the blue shaded region in the figure. If the fundamental α is above $\theta_1^+(k)$, there exists an information-insensitive pooling steady state, represented by the stationary asset distribution S_1 in the blue shaded region. If the investors maintain their belief about a liquid market in the future, the market will stay in S_1. Moreover, as Lemma 6 shows, starting from any asset distribution to the right of the shaded region, there is a path converging to S_1. Along the path, the asset composition is always above $\theta_1^+(k)$, consistent with the investors' belief that there is no need for information acquisition.

What happens when investors' beliefs shifts? Suppose the market starts out with the asset distribution in S_1, but investors suddenly start to believe that investors in the future will acquire information and the market will become illiquid. The phase diagram changes from Figure 3a to 3b. The continuation values of owning low-quality assets drop to $\bar{V}_{L,2}$ and $\bar{C}_{L,2}$, the same as in the information-sensitive steady state. Since the continuation values become lower, the information-sensitive region—the red shaded area—moves to the right in Figure 3b. The asset composition is good enough to support pooling trading in S_1 when investors believe in a liquid market in the future. However, after the shift in the investors' beliefs, S_1 is now in the red shaded information-sensitive region, reflecting higher incentives to acquire information when investors anticipate lower liquidity in the future. The market will therefore follow the arrows and move to S_2. The whole path lies within the information sensitive region, meaning that buyers always acquire information along the path, consistent with investors' belief in low liquidity in the future. The transition from S_1 to S_2 is consistent with an event of a self-fulfilling market freeze, in which trading delays suddenly become longer.

In Appendix IA5, I show that the self-fulfilling market freeze described above also arises in a finite-horizon environment. This result follows from the presence of two-way strategic complementarities in the model: a backward-looking complementarity, whereby current information acquisition affects future market liquidity through the cream-skimming effect, and a forward-looking complementarity, whereby expectations of future illiquidity increase the incentive for information acquisition today. This stands in sharp contrast to the existing literature on dynamic adverse selection with multiple equilibria, such as Chiu and Koeppl (2016) and Asriyan, Fuchs and Green (2019), where equilibrium multiplicity typically arises from a one-directional strategic complementarity driven by *infinite* resale considerations.

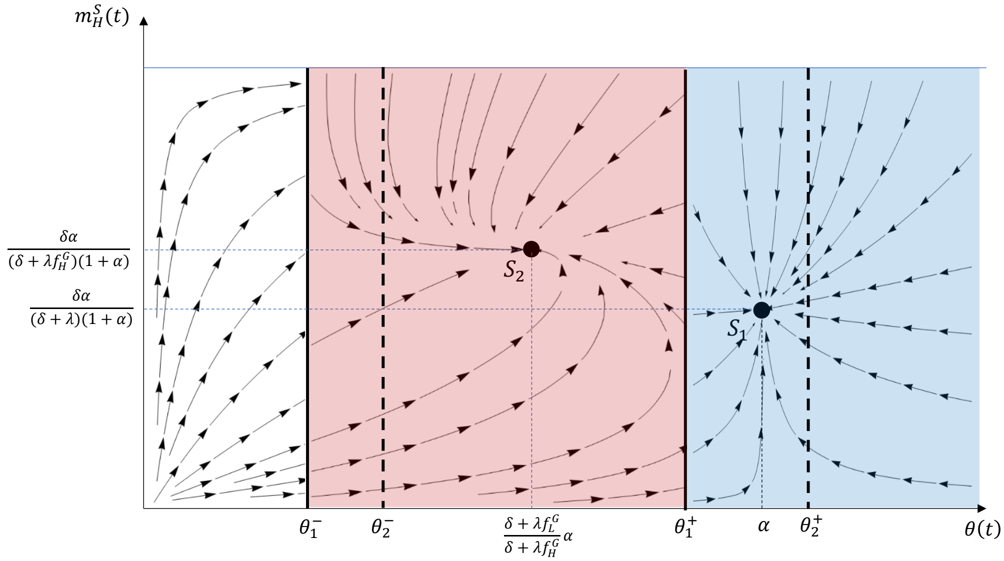
The above results can be extended to show that a market freeze can be an expected probabilistic event in a rational equilibrium. In Appendix IA4, I introduce a public signal process in which a one-time sunspot arrives with a Poisson rate. As long as the arrival rate of the sunspot is below a threshold, the market remains in the liquid state until the arrival of the sunspot triggers information acquisition and a market freeze. Therefore, the self-fulfilling market freeze has similar features as the sentiment-driven market freeze in Asriyan, Fuchs and Green (2019). However, as I will show next, the "sentiment" does not work in reviving the market after a prolonged market freeze pushed the market into an information trap.

5.2 Information Trap

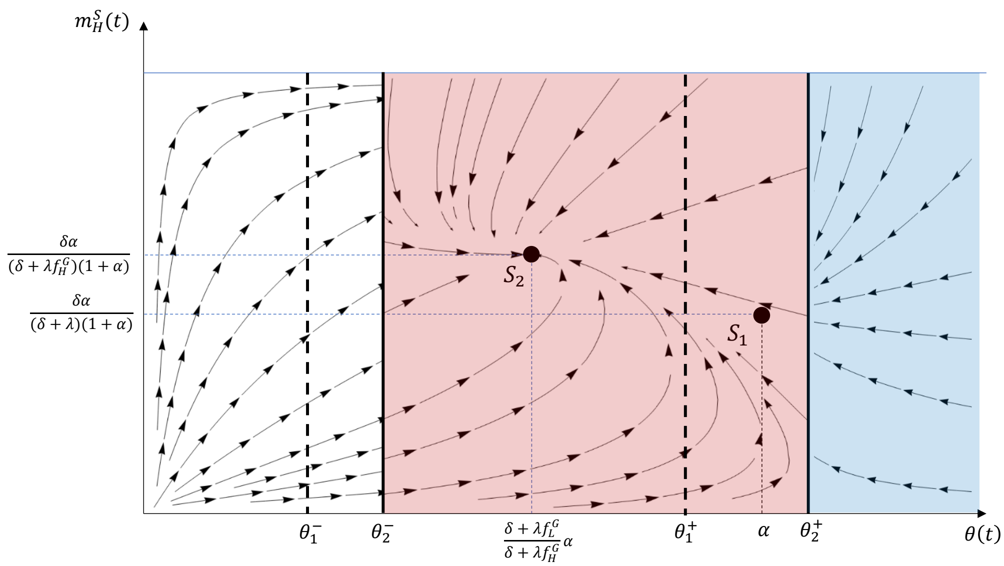
If the market's initial asset distribution is in the illiquid state S_2, is there a non-stationary equilibrium path that converges to liquid trading? The answer depends on the relationship between the market composition in S_2 and the information-sensitive region $[\theta_1^-(k), \theta_1^+(k)]$ in S_1. This can be illustrated in the same set of phase diagrams. In Figure 3a and Figure 3b, the information sensitive regions in S_1 and S_2 overlap and the illiquid state S_2 falls in the overlapping region. Starting from the initial asset distribution in S_2, if all investors hold the belief that future buyers will acquire information, S_2 is in the red shaded information-sensitive region in Figure 3b, consistent with the investors' belief. Now suppose all investors believe that in the future, buyers will not acquire information and will always offer the pooling price. This optimistic belief in future market liquidity improves the continuation values, changing the phase diagram to Figure 3a and shifting the information-sensitive region to $[\theta_1^-(k), \theta_1^+(k)]$. However, since S_2 is also in the red shaded information-sensitive region in Figure 3a, current buyers will still acquire information and cream-skim the market. Their trading behavior keeps the asset distribution at S_2 and prevents the market from recovering to S_1. To summarize, if the steady-state market composition in S_2, denoted by $\bar{\theta}_2$, satisfies $\bar{\theta}_2 < \theta_1^+(k)$, then no equilibrium path exists that converges to the liquid state S_1.

Now let's consider the opposite case if the steady-state market composition in S_2 satisfies $\bar{\theta}_2 \geq \theta_1^+(k)$. Starting from the initial asset distribution in S_2, when investors believe the market will be liquid in the future, the optimal strategy for a buyer is to stop acquiring information and to instead offer the pooling price. As a result, the market composition will gradually improve and converge to $\bar{\theta}_1$, the market composition in S_1. Along this path, buyers do not acquire information. Therefore, if $\bar{\theta}_2 \geq \theta_1^+(k)$, there exists a non-stationary equilibrium path that transitions from S_2 to S_1.

Assumption 2 $\frac{f_H^G}{1-f_H^G} > \frac{c_H - \bar{V}_{L,2}}{c_H - \bar{V}_{L,1}} \cdot \frac{f_L^G}{1-f_L^G}$.



(a) $V_L(t) = \bar{V}_{L,1}$, $C_L(t) = \bar{C}_{L,1}$.



(b) $V_L(t) = \bar{V}_{L,2}$, $C_L(t) = \bar{C}_{L,2}$.

Figure 3: Phase diagrams of asset distributions under different continuation values.

Note: Each diagram illustrates the dynamics of asset distribution under a different belief system: (a) future buyers always make unconditional pooling offers; (b) future buyers always acquire information and offer pooling prices only upon receiving favorable signals. Red-shaded areas indicate the information-sensitive region, while blue-shaded areas correspond to the information-insensitive pooling region. The points labeled S_1 and S_2 represent the liquid and information-sensitive steady states, respectively.

Assumption 2 is equivalent to the condition $\theta_2^-(0) < \theta_1^+(0)$. If this assumption holds, then $\theta_2^-(k) < \theta_1^+(k)$ for small k, implying that the two information-sensitive regions overlap. Note that f_H^G appears only on the left-hand side of the inequality, while f_L^G appears only on the right-hand side. Since $\bar{V}_{L,2} < \bar{V}_{L,1}$, the first fraction on the right-hand side, $\frac{c_H - \bar{V}_{L,2}}{c_H - \bar{V}_{L,1}}$, is strictly greater than one. Assumption 2 therefore requires that the conditional signal distributions for high- and low-quality assets differ sufficiently—i.e., that the signal is sufficiently informative. For instance, $f_H^G = 1$ satisfies Assumption 2 for any $f_L^G < 1$. Under this assumption, information acquisition is optimal for a broad range of market compositions. In contrast, if the signals are very uninformative, buyers rarely find it optimal to acquire information.

I call the overlapping part of the two information-sensitive regions $[\theta_2^-(k), \theta_1^+(k)]$ the *information trap* whenever it exists. The information trap is different from the information sensitive regions we just discussed. At any time t, the information sensitive region depends on the continuation values of owning low-quality assets $V_L(t), C_L(t)$. However, by definition, the information trap is time and strategy invariant so it is independent of investors' beliefs and the continuation values. When the market composition is within the information trap, whether or not investors believe that future buyers will acquire information or not, the optimal strategy is to acquire information today, and the cream-skimming effect will be in play. Intuitively speaking, the market composition will be trapped in the region and dragged into the "sink", which is the information-sensitive state S_2.[17]

Proposition 3 formally conveys the condition in which there is no non-stationary equilibrium path that transitions from S_2 to S_1.

Proposition 3 (Information Trap) *If Assumption 1 and 2 hold, for small k there exists*

$$A_4(k) = \frac{\delta + \lambda f_H^G}{\delta + \lambda f_L^G} \cdot \theta_1^+(k) \in (A_1(k), A_2(k)), \tag{23}$$

such that, for any $\alpha \in [A_1(k), A_4(k)]$, if the initial asset distribution is in the neighborhood of S_2, there is no equilibrium path converging to pooling trading.

The formal characterization of the set of possible non-stationary equilibrium paths and the proof of the proposition are left to Appendices C and D. The proposition is proved

[17] In Appendix C, I consider whether there exists a non-stationary equilibrium path that converges to the liquid state S_1, starting from an arbitrary initial market composition $\theta(0)$ in the information trap. I provide the sufficient and necessary conditions such that the equilibrium path exists.

heuristically by contradiction. Suppose there exists an equilibrium path that converges to pooling trading. Then, the asymptotic market composition as $t \to \infty$ must lie to the right of the right boundary of the information trap, $\theta_1^+(k)$. Since $\theta(t)$ evolves continuously over time and the initial composition lies within the information trap, there must exist a last moment at which $\theta(t)$ crosses $\theta_1^+(k)$ from the left. However, $\theta_1^+(k)$ is a reflective boundary from the left: when $\theta(t)$ is slightly below $\theta_1^+(k)$, buyers optimally acquire information, which reduces $\theta(t)$ and prevents the composition from crossing the boundary. This contradiction implies that no such equilibrium path exists.

Proposition 2 and Proposition 3 jointly imply that, for $\alpha \in [A_1(k), \min\{A_3(k), A_4(k)\}]$, the liquid steady state S_1 and the illiquid steady state S_2 coexist. More importantly, the transitions between the two steady states are asymmetric. Suppose the market is in the liquid state S_1 where buyers are not paying any attention to the idiosyncratic features of the assets. They simply buy assets at the pooling price from any seller they meet in the market. The market composition remains at a high level. A self-fulfilling market freeze starts from a market-wide panic about a decline in future market liquidity. Investors worry that if they hold low-quality assets in the portfolio, in the future, it will be hard for them to sell these assets at good prices. Because of this concern, buyers start to collect information and carefully evaluate the assets they see on the market. They are only willing to offer a good price for an asset if the aspects of the asset satisfy their own criteria. However, because buyers' evaluations of assets are not perfect, sellers who receive a bad quote will stay in the market with the hope that they will receive a high quote from the next buyer. The trading speeds of both types of assets drop immediately, and the value of low-quality assets to the current owners decline. As the market goes further down the illiquid path, the market composition deteriorates gradually as low-quality assets accumulate in the market. At some point, the market composition becomes bad enough that it falls into the information trap. Even if buyers have optimistic beliefs about future market liquidity, since the current market composition is bad, they keep acquiring information to avoid buying low-quality assets at high prices. The low liquidity and the bad market composition reinforce each other through buyers' information acquisition, and the market can not recover to the liquid state.

Proposition 3 rules out the possibility that the market will thaw following an improvement in the market sentiment. In an environment with publicly observable sunspots, once the asset allocation enters the information trap, there doesn't exist an equilibrium path that converges to liquid trading. Therefore, a market freeze because of buyer's information acquisition is different from a sentiment-driven market freeze. This difference give rises to novel policy implications.

6 Applications and Policy Implications

In this section, we use the secondary market for non-agency MBS as a leading example to illustrate features of OTC markets that are particularly prone to information traps. We first discuss the implications of our theoretical results for understanding the dynamics of the non-agency MBS secondary market before and after the Great Financial Crisis. We then examine policy implications for the design of asset purchase programs in response to market freezes, through the lens of the model.

6.1 Dynamics of the Secondary Market for Non-Agency MBS

The secondary market for non-agency MBS provides a compelling example of an OTC market that aligns well with the model, due to its market structure, asset characteristics, and price discovery process.[18]

Non-anonymous Markets As previously discussed, the observability of liquidity shocks plays a critical role in the cream-skimming effect of information acquisition and the emergence of information traps. Like many other fixed-income markets, the non-agency MBS market is dealer-intermediated, with most trades executed through conventional voice or message-based trading.[19] In dealer-intermediated markets, participants are aware of their counterparties' identities. This enables them to combine external signals (e.g., market news, public disclosures, or broader market flows) with observed trading behavior across asset classes to infer the liquidity needs of their counterparties.

[18] For more detailed information on non-agency MBS market, see SIFMA (2006) and Fuster, Lucca and Vickery (2023).

[19] According to a recent report by Greenwich (2025), the share of trades conducted on electronic request-for-quote (RFQ) platforms remains small, except in the TBA segment of the agency MBS market.

Asset Heterogeneity Asset heterogeneity limits investors' ability to accumulate transferable information across securities, thereby increasing asymmetric information. Unlike agency MBS, which are primarily influenced by prepayment risk, non-agency MBS are not backed by government guarantees and are affected by both prepayment and credit risk. The underlying collateral of non-agency MBS is not constrained by agency loan size limits or uniform underwriting standards. This variation in collateral characteristics, cash flow waterfall structures, and interest rate adjustment mechanisms results in greater dispersion in both prepayment and credit risk compared to the agency MBS sector.

Heterogeneous Valuation Models In markets where investors primarily rely on proprietary or internal pricing models—rather than publicly available ratings or transaction data—there is a greater likelihood of divergence in asset valuations. This divergence gives holders of low-quality assets stronger incentives to continue searching for trading opportunities in the hope of eventually receiving a favorable quote. The variation in internal valuation models among investors aligns with the model's assumption that buyers receive independent signals conditional on asset quality. In the non-agency MBS market, the absence of consistent historical transaction prices for comparable assets limits the usefulness of past prices as a basis for valuation. As a result, institutional investors and dealers often depend on their own internal models or those developed by third-party vendors to evaluate asset values.

The non-agency MBS market was a major segment of the fixed-income universe prior to the financial crisis, drawing participation from asset managers, insurance companies, pension funds, hedge funds, and other specialized investment vehicles. Liquidity and trading volume in this market declined sharply with the onset of the crisis. Using micro-level data on insurers' buy and sell transactions, Chernenko, Hanson and Sunderam (2014) show that turnover in non-prime RMBS fell by two-thirds in just one year starting in the fourth quarter of 2007, and has remained at a depressed level ever since. Concurrently, investors in the non-agency MBS market significantly intensified their due diligence. Kaal (2016) find that private funds increased analyst hiring to support investment due diligence, based on textual analysis of ADV II filings. An industry report by Principia Partners LLC (2010) similarly observes that "having a complete understanding of the structure and risk characteristics of any securitized investment has become a prerequisite to investing in it."

The theoretical results from the previous sections help explain the evolution of the non-agency MBS secondary market before and after the Great Financial Crisis. The observed decline in market liquidity resembles a shift from a liquid, information-insensitive steady state (S_1) to an information-sensitive steady state (S_2). Before the crisis, investors largely relied on public signals such as credit ratings, conducting little independent valuation. The prevailing belief in market liquidity reinforced this low level of scrutiny. However, the collapse of Lehman Brothers and other key market participants likely triggered fears about future liquidity. In response, investors raised their due diligence standards and became more selective in their purchases. This cream-skimming behavior—targeting only assets perceived to be of higher quality—deteriorated the pool of actively traded assets and amplified adverse selection, ultimately pushing the market into an information trap.

While the concept of an information trap is useful for explaining the post-crisis decline in liquidity and increased information acquisition in the market for legacy non-agency MBS, it remains puzzling that market conditions have not significantly improved—even for newly issued vintages. Vanasco (2017) and Asriyan, Fuchs and Green (2019) show that assets issued in illiquid markets tend to be of higher quality. Since the vintage of issuance is observable, investors should, in principle, apply different information acquisition strategies to different vintages. Accordingly, one might expect the information trap to be confined to legacy assets only.

Here, I offer a broader discussion of how the information trap mechanism may contribute to persistent illiquidity in the long run, albeit with the caveat that it may not be the sole driving force.[20] In the model, buyers are assumed to purchase and hold a single unit of an asset, and the decision to acquire information is made on an asset-by-asset basis. In practice, institutional investors behave more like collections of atomic buyers, and their investments in price discovery are typically made at the institutional level—generating benefits that extend across future transactions. For instance, a fund might hire additional analysts to enhance its internal valuation models or subscribe to new data sources. These investments in valuation technology create spillovers: they improve the investor's ability to assess not only legacy assets but also newly issued high-quality securities.

[20]Post-crisis regulatory reforms may also have contributed to the prolonged stagnation of the non-agency MBS market. For a summary of the key policy changes, see Fuster, Lucca and Vickery (2023).

6.2 Asset Purchase Programs

When a market freezes due to adverse selection, a natural policy response is to cleanse the market by removing low-quality assets. Several theoretical studies have examined the design of asset purchase programs under severe adverse selection, including Philippon and Skreta (2012), Tirole (2012), Camargo and Lester (2014), and Chiu and Koeppl (2016). A prominent example is the Public-Private Investment Program (PPIP), introduced by the U.S. Treasury during the Great Financial Crisis. The objective of PPIP was to purchase "toxic" assets and restore liquidity in the markets for legacy commercial MBS and non-agency RMBS.

Asset purchase programs can help revive trading through two main channels. First, by buying lemons from the market, the government directly improves the composition of tradable assets. Second, by guaranteeing asset values either at the time of announcement or in the future—typically above prevailing market prices—these programs raise the expected resale value of lemons, encouraging buyers to make pooling offers.

Formally solving for the optimal policy design is analytically challenging in the current model due to the presence of two state variables and the potentially non-monotonic dynamics of market composition. Nevertheless, we are able to derive results concerning the minimum quantity of lemons that a policymaker must purchase in order to restore the full-trading equilibrium along a path of self-fulfilling market freeze.

To formalize this analysis, consider a market with fundamental $\alpha \in [A_1(k), A_3(k)]$ that starts in the steady state S_1 and evolves along the path of a self-fulfilling freeze beginning at time $t = 0$, as characterized in Proposition 2. Let (τ, P, Q) denote an asset purchase program announced at time $t = \tau$, which commits the policymaker to a path of intervention to purchase up to $Q(t) \geq 0$ units of lemons at a price $P(t) > 0$ for any $t > \tau$. This announcement is unanticipated by market participants and thus is not incorporated into their expectations before $t = \tau$. Accordingly, buyers follow their pre-intervention strategy during the freeze: acquiring costly information and making pooling offers only upon receiving good signals.

Note that if $P(t)$ is less than the continuation value of low-quality sellers, $C_L(t)$, then sellers will not sell to the policymaker at time t. If $P(t) > C_L(t)$, the policymaker purchases $\min\left\{Q(t), m_L^S(t)\right\}$ units, where $m_L^S(t)$ denotes the remaining quantity of lemons in the market. If $P(t) = C_L(t)$, sellers may supply any amount between 0 and $\min\left\{Q(t), m_L^S(t)\right\}$. Let $\tilde{Q}$ denote the total quantity of lemons purchased along the equilibrium path induced by the asset purchase program.

Proposition 4 *Suppose $\alpha \in [A_1(k), A_3(k)]$, and the market begins with an asset composition in S_1, following a path of self-fulfilling market freeze from $t = 0$, as characterized in Proposition 2. Then there exists $\hat{\tau} > 0$ such that:*

a) If $\tau \leq \hat{\tau}$, there exists an intervention program that induces full trading from time $t = \tau$ onward, with $\tilde{Q} = 0$.

b) If $\tau > \hat{\tau}$, any asset purchase program capable of restoring full trading at $t \to \infty$ must satisfy $\tilde{Q} > 0$.

Moreover, $\hat{\tau}$ is increasing in the cost of information acquisition k.

With endogenous information acquisition, a self-fulfilling market freeze that transitions from S_1 to S_2 leads to a monotonic deterioration in market composition, as the mass of "toxic" assets accumulates over time. There exists a critical time $\hat{\tau}$ such that $\theta(\hat{\tau}) = \theta_1^+(k)$. If the government intervenes at a time $\tau \leq \hat{\tau}$, the market composition remains above the information trap threshold, and an equilibrium path with pooling trading from τ onwards still exists. In this case, market liquidity can be restored simply by announcing a policy that guarantees a floor price for all assets. The government does not need to actually purchase assets, as the announcement alone prompts buyers to stop acquiring information, allowing the market to return immediately to liquid trading. However, if the intervention occurs after $\hat{\tau}$, the market falls into the information trap and no self-fulfilling equilibrium path can return it to S_1. In this case, the government must actively purchase a positive quantity of assets to revive market liquidity even in the absence of a negative exogenous shock to the asset fundamental.

The literature on dynamic adverse selection—such as Camargo and Lester (2014) and Maurin (2020)—shows that markets suffering from adverse selection can sometimes recover endogenously over time. Similarly, Chiu and Koeppl (2016) demonstrates that it may be optimal for policymakers to delay intervention and exploit the increasing selling pressure in a frozen market. These results suggest that delaying intervention can reduce policy costs by allowing a freezing market to thaw endogenously. In contrast, the model in this paper shows that in a lemons market with costly information acquisition, market composition may not improve during periods of illiquidity. On the contrary, market conditions worsen due to the cream-skimming effect of information acquisition. In such self-fulfilling freezes, early policy intervention is essential to shift market expectations and prevent the accumulation of low-quality assets in the market.

7 Conclusions

In this paper, I develop a model to study the interaction between buyers' information acquisition and market liquidity in over-the-counter markets with adverse selection. Buyers may acquire information to avoid purchasing low-quality assets, and their incentive to do so is particularly strong if they anticipate low market liquidity when reselling in the future. When buyers' signals are imperfect, information acquisition induces a cream-skimming effect that worsens the composition of assets for sale and reduces future market liquidity.

The interaction between resale considerations and the cream-skimming effect gives rise to multiple steady states and asymmetric transitions between them. In particular, the market can transition from a liquid state without information acquisition to an illiquid state with information acquisition, but not in the reverse direction. This one-way transition between steady states is a novel feature of the model that, to the best of my knowledge, is absent from existing models of dynamic adverse selection. The results help explain the stark contrast in market liquidity and investor due diligence in the non-agency MBS market before and after the Great Financial Crisis.

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Appendices

A Liquidity Shock Observability and Delays in Re-trade

I modify the model as follows. Assume that investors' liquidity shocks are unobservable to buyers. In addition, an unshocked asset holder may return to the market as a seller only upon receiving a re-trade shock, which arrives according to a Poisson process with rate μ. The arrival of this re-trade opportunity is assumed to be independent of the liquidity shock. We analyze the gains from trade for low-quality assets and characterize the asset composition in the stationary equilibrium S_2.

First, note that holders of high-quality assets have no incentive to re-enter the market, even if they receive a re-trade shock. In contrast, holders of low-quality assets are incentivized to offer their assets for sale if they anticipate a positive probability of receiving a future pooling offer. Buyers' strategies remain consistent with the analysis in Section 3.1, as offering a price equal to the reservation value of an unshocked low-quality seller remains a dominated strategy.

The value functions for low-quality asset sellers, high-quality asset holders and sellers remain the same as in the baseline model. The value function for a low-quality asset holder prior to receiving a re-trade opportunity shock is given by

$$rV_L(t) = rv_L + \mu\left(J_L(t) - V_L(t)\right) + \delta\left(C_L(t) - V_L(t)\right) + \frac{\mathrm{d}V_L(t)}{\mathrm{d}t}. \tag{A.1}$$

The second term on the right-hand side of the equation represents the expected value change due to the arrival of a re-trade opportunity. Here, $J_L(t)$ denotes the value function of a low-quality asset holder who has received a re-trade shock and is actively offering the asset for sale:

$$rJ_L(t) = rv_L + \delta\left(C_L(t) - J_L(t)\right) + \lambda\gamma_L(c_H, t)(c_H - J_L(t)) + \frac{\mathrm{d}J_L(t)}{\mathrm{d}t}. \tag{A.2}$$

In this expression, the second term captures the effect of a liquidity shock, while the third term reflects the expected gains from selling the asset at the pooling price. Solving for the continuation values in the steady state yields:

$$\bar{J}_L - \bar{C}_L = \frac{r(v_L - c_L)}{r + \delta + \lambda f_L^G}, \tag{A.3}$$

$$\bar{V}_L - \bar{C}_L = \frac{r(v_L - C_L) + \mu(J_L - C_L)}{r + \upsilon + \delta}. \tag{A.4}$$

$\bar{C}_L$ is identical to the expression in equation (15), which we restate here for ease of reference.

$$\bar{C}_L = \frac{rc_L + \lambda\bar{\gamma}_L(c_H)c_H}{r + \lambda\bar{\gamma}_L(c_H)}. \tag{A.5}$$

The case of $\mu = 0$ corresponds to the baseline model in which unshocked asset holders cannot return to the market to sell. In this case, the necessary and sufficient condition for the reversal of continuation values is $v_L < C_L$. Note that $\bar{J}_L - \bar{C}_L$ is proportional to the flow payoff gain from holding a low-quality asset, $v_L - c_L$, and is therefore weakly positive. Equation (A.4) shows that in the modified model, the reversal of continuation values can still hold for sufficiently small μ. In the special case with "no gains at the bottom," where $v_L = c_L$, the reversal of continuation values remains valid for any $\mu > 0$ given other assumptions in the baseline model.

Next, we turn to the market composition $\theta(t)$ and verify that the cream-skimming effect still holds. The differential equations governing the evolution of the asset distribution in the market now become:

$$\dot{m}_H^S(t) = \delta\left(\frac{\alpha}{1+\alpha} - m_H^S(t)\right) - \lambda\rho_H(t)m_H^S(t), \tag{A.6}$$

$$\dot{m}_L^S(t) = (\delta + \mu)\left(\frac{1}{1+\alpha} - m_L^S(t)\right) - \lambda\rho_L(t)m_L^S(t). \tag{A.7}$$

Note that low-quality assets now return to the market more quickly due to sales by unshocked low-quality asset holders. As a result, the steady-state asset composition becomes:

$$\bar{\theta} = \frac{\delta + \mu + \lambda\bar{\rho}_L}{\delta + \lambda\bar{\rho}_H} \cdot \frac{\delta}{\delta + \mu} \cdot \alpha. \tag{A.8}$$

We retain the notation from the main text, where $\bar{\rho}_H$ and $\bar{\rho}_L$ denote the probabilities of trade upon matching for high- and low-quality assets, respectively. The difference in market composition between steady state S_1 (where $\bar{\rho}_H = \bar{\rho}_L = 1$) and steady state S_2 (where $\bar{\rho}_H = f_H^G$ and $\bar{\rho}_L = f_L^G$) is given by:

$$\bar{\theta}_1 - \bar{\theta}_2 = \delta\alpha \cdot \frac{\lambda^2(f_H^G - f_L^G) + \delta\lambda(f_L^G - 1) - \lambda(1 - f_H^G)(\delta + \mu)}{(\delta + \mu)(\delta + \lambda f_H^G)(\delta + \lambda)}. \tag{A.9}$$

Therefore, the cream-skimming effect of information acquisition is present ($\bar{\theta}_1 > \bar{\theta}_2$) if and only if

$$\mu < \frac{(\lambda + \delta)(f_H^G - f_L^G)}{1 - f_H^G}. \tag{A.10}$$

If the signal generated by the high-quality asset is sufficiently accurate (f_H^G close to 1), the cream-skimming effect persists even for arbitrarily large values of μ.

The above analysis demonstrates that, as long as there is a sufficiently long delay in asset holders' re-trade opportunities, the two key mechanisms leading to an information trap—reversal of continuation values and the cream-skimming effect—remain operative even in an environment where investors' liquidity shocks are unobservable.

B Monotonicity of Paths of Market Composition

Define $\bar{\rho}_{H0}$ and $\bar{\rho}_{L0}$ as

$$\bar{\rho}_{H0} = \frac{\delta}{\lambda}\left(\frac{\alpha}{m_H^S(0)(1+\alpha)} - 1\right), \ \bar{\rho}_{L0} = \frac{\delta}{\lambda}\left(\frac{1}{m_L^S(0)(1+\alpha)} - 1\right). \tag{B.1}$$

Compared with (20), if the initial asset distribution is an stationary distribution, $\bar{\rho}_{H0}$ and $\bar{\rho}_{L0}$ are the corresponding trading probability of high-quality and low-quality assets. A higher $\bar{\rho}_{H0}$ ($\bar{\rho}_{L0}$) is related to a smaller initial mass of high-quality(low-quality) assets in the market. Note that $\bar{\rho}_{H0} > \bar{\rho}_{L0}$ if and only if $\theta(0) < \alpha$, while $\bar{\rho}_{H0} < \bar{\rho}_{L0}$ if and only if $\theta(0) > \alpha$. In the follow lemma, we give two scenarios in which the market composition $\theta(t)$ converges monotonically to a new steady state along an equilibrium path.

Lemma B.1 *Assume $\rho_H(t) = \bar{\rho}_H$ and $\rho_L(t) = \bar{\rho}_L$,*

1. *$\theta(t)$ is decreasing (increasing) in $t \in (0, +\infty)$ if $\bar{\rho}_{L0} \geq \bar{\rho}_{H0} \geq \bar{\rho}_H \geq \bar{\rho}_L$ ($\bar{\rho}_{H0} \geq \bar{\rho}_{L0} \geq$*

$\bar{\rho}_L \geq \bar{\rho}_H$);

2. *if $\bar{\rho}_H = \bar{\rho}_L$, $\theta(t)$ is decreasing (increasing) in $t \in (0, +\infty)$ if and only if $\bar{\rho}_{H0} \leq \bar{\rho}_{L0}$ ($\bar{\rho}_{H0} \geq \bar{\rho}_{L0}$).*

Proof of Lemma B.1. When $\rho_H(t)$ and $\rho_L(t)$ are constants, they can be further simplified as

$$m_H^S(t) = \frac{\delta\alpha}{\delta + \lambda\rho_H} + \left(m_H^S(0) - \frac{\delta\alpha}{\delta + \lambda\rho_H}\right) e^{-(\delta+\lambda\rho_H)t}, \tag{B.2}$$

$$m_L^S(t) = \frac{\delta(1-\alpha)}{\delta + \lambda\rho_L} + \left(m_L^S(0) - \frac{\delta(1-\alpha)}{\delta + \lambda\rho_L}\right) e^{-(\delta+\lambda\rho_L)t} \tag{B.3}$$

Plugging in (B.2) and (B.3), we can show that the sign of $\frac{\mathrm{d}\theta(t)}{\mathrm{d}t}$ is the same as the sign of

$$\frac{(\delta + \lambda\bar{\rho}_{H0}) - (\delta + \lambda\bar{\rho}_H)}{1 + (\delta + \lambda\bar{\rho}_{H0})\frac{e^{(\delta+\lambda\bar{\rho}_H)t}-1}{\delta+\lambda\bar{\rho}_H}} - \frac{(\delta + \lambda\bar{\rho}_{L0}) - (\delta + \lambda\bar{\rho}_L)}{1 + (\delta + \lambda\bar{\rho}_{L0})\frac{e^{(\delta+\lambda\bar{\rho}_L)t}-1}{\delta+\lambda\bar{\rho}_L}}. \tag{B.4}$$

Note that for any $t > 0$ the function $\frac{x-y}{1+x\frac{e^{yt}-1}{y}}$ is strictly increasing in x and strictly decreasing in y for any $y \leq x$. Thus, if $\bar{\rho}_{L0} \geq \bar{\rho}_{H0} \geq \bar{\rho}_H \geq \bar{\rho}_L$ ($\bar{\rho}_{H0} \geq \bar{\rho}_{L0} \geq \bar{\rho}_L \geq \bar{\rho}_H$), (B.4) is non-positive (non-negative), which implies $\theta(t)$ is decreasing (increasing) in t. Similarly, if $\bar{\rho}_H = \bar{\rho}_L$, the sign of (B.4) is the same as the sign of $\bar{\rho}_{H0} - \bar{\rho}_{L0}$. Therefore, $\theta(t)$ is decreasing (increasing) in t if and only if $\bar{\rho}_{H0} \leq \bar{\rho}_{L0}$ ($\bar{\rho}_{H0} \geq \bar{\rho}_{L0}$). ∎

C Non-Stationary Equilibria from the Information Trap

The following proposition provides a necessary and sufficient condition for the existence of an equilibrium path from an asset composition in the overlapping region of the two information-sensitive intervals, $[\theta_2^-(k), \theta_1^+(k))$, to pooling trading.

Proposition C.1 *If $\theta_2^-(k) \leq \theta(0) < \theta_1^+(k)$, there exists an equilibrium path that converges to pooling trading if and only if the dynamics of the asset distribution characterized by (10) and (11) with $\rho_H(t) \equiv f_H^G$ and $\rho_L(t) \equiv f_L^G$ satisfy $\theta(t) = \theta_1^+(k)$ for some $t \geq 0$.*

Proof of Proposition C.1. First, we prove a lemma that gives a necessary condition for an equilibrium path that converges to pooling trading.

Lemma C.1 *If* $\frac{\delta+\lambda f_L^G}{\delta+\lambda f_H^G}\alpha \leq \theta_1^+(k)$*, along any equilibrium path that converges to pooling trading,* $\theta(t)$ *must be weakly increasing whenever* $\theta(t) < \theta_1^+(k)$*.*

Proof of Lemma C.1. This can be proved by contradiction. Suppose there exists an equilibrium path that converges to pooling trading such that there is some $t_1 > 0$ with $\dot{\theta}(t_1) < 0$ and $\theta(t_1) < \theta_1^+(k)$. Let $t_3 = \inf\left\{t : \theta(t') \geq \theta_1^+(t),\ \forall t' > t\right\}$. That is, t_3 is the last time at which $\theta(t)$ enters the region $\theta \geq \theta_1^+(k)$ from below. By continuity of $\theta(t)$, there exists $t_2 \in [t_1, t_3)$ such that $\dot{\theta}(t_2) < 0$ and $\theta(t) < \theta_1^+(k)$ for all $t \in [t_2, t_3)$.

We first show that $m_H^S(t_2) > m_H^S(t_3)$. Since the equilibrium path converges to pooling trading and $\theta(t) \geq \theta_1^+(k)$ for any $t > t_3$, it follows that $V_L(t_3) \in (\bar{V}_{L,2}, \bar{V}_{L,1}]$ and $C_L(t_3) > V_L(t_3)$. This implies that for t slightly less than t_3, $\theta^-(k, V_L(t)) < \theta(t) < \theta^+(k, V_L(t))$, and therefore, buyers acquire information and offer the pooling price only upon observing signal G. Thus, $\rho_H(t) = f_H^G$ and $\rho_L(t) = f_L^G$ in a left neighbourhood of t_3. Since $\theta(t)$ crosses $\theta_1^+(k)$ from below at $t = t_3$, for t slightly less than t_3, we have

$$\frac{\mathrm{d}}{\mathrm{d}t}\ln\theta(t) = \frac{\delta\alpha}{m_H^S(t)(1+\alpha)}\left(1 - \theta(t)/\alpha\right) - \lambda(f_H^G - f_L^G) > 0, \tag{C.1}$$

Taking the limit of $t \to t_3$, it yields

$$\frac{\delta\alpha}{m_H^S(t_3)(1+\alpha)}\left(1 - \theta_1^+(k)/\alpha\right) - \lambda(f_H^G - f_L^G) \geq 0. \tag{C.2}$$

Evaluating the derivative of $\ln\theta(t)$ at $t = t_2$, we have

$$\frac{\delta\alpha}{m_H^S(t_2)(1+\alpha)}\left(1 - \theta(t_2)/\alpha\right) - \lambda(\rho_H(t_2) - \rho_L(t_2)) < 0. \tag{C.3}$$

By construction, $\theta(t_2) < \theta_1^+(k) < \alpha$. Also notice $\rho_H(t_2) - \rho_L(t_2) < f_H^G - f_L^G$. Comparing (C.2) and (C.3), we have

$$m_H^S(t_2) > m_H^S(t_3). \tag{C.4}$$

Yet, for the same t_2 and t_3, we can also derive the opposite inequality. Since $\theta_1^+(k) \geq$

$\frac{\delta+\lambda f_L^G}{\delta+f_H^G}\alpha$, (C.2) implies

$$m_H^S(t_3) \leq \frac{\delta\alpha}{1+\alpha}\frac{1-\theta_1^+(k)/\alpha}{\lambda(f_H^G - f_L^G)} \leq \frac{\delta}{\delta+\lambda f_H^G}\frac{\alpha}{1+\alpha}.$$

Rewrite equation (10) as

$$\frac{\mathrm{d}}{\mathrm{d}t}\left(m_H^S(t) - \frac{\delta}{\delta+\lambda f_H^G}\frac{\alpha}{1+\alpha}\right) = -(\delta+\lambda f_H^G)\left(m_H^S(t) - \frac{\delta}{\delta+\lambda f_H^G}\frac{\alpha}{1+\alpha}\right) - \lambda\left(\rho_H(t) - f_H^G\right)m_H^S(t). \tag{C.5}$$

Since $\theta(t) < \theta_1^+(k)$ for $t_2 \leq t < t_3$, Table 1 implies $\rho_H(t) \leq f_H^G$. Therefore,

$$\frac{\mathrm{d}}{\mathrm{d}t}\left(m_H^S(t) - \frac{\delta}{\delta+\lambda f_H^G}\frac{\alpha}{1+\alpha}\right) \geq -(\delta+\lambda f_H^G)\left(m_H^S(t) - \frac{\delta}{\delta+\lambda f_H^G}\frac{\alpha}{1+\alpha}\right). \tag{C.6}$$

Given $m_H^S(t_3) \leq \frac{\delta}{\delta+\lambda f_H^G}\frac{\alpha}{1+\alpha}$, (C.6) implies that

$$m_H^S(t_2) \leq m_H^S(t_3),$$

contradicting (C.4).

Therefore, $\theta(t)$ must be weakly increasing whenever $\theta(t) < \theta_1^+(k)$ along any equilibrium path that converges to pooling trading. ■

We now proceed to prove the necessity of the stated condition.

First, observe that if $\frac{\delta+\lambda f_L^G}{\delta+\lambda f_H^G}\alpha > \theta_1^+(k)$, then the path with constant $\rho_H(t) = f_H^G$ and $\rho_L(t) = f_L^G$ converges to $\frac{\delta+\lambda f_L^G}{\delta+\lambda f_H^G}\alpha > \theta_1^+(k)$ as $t \to \infty$.

Otherwise, if $\frac{\delta+\lambda f_L^G}{\delta+\lambda f_H^G}\alpha \leq \theta_1^+(k)$, Lemma C.1 implies that any equilibrium path starting from $\theta(0) < \theta_1^+(k)$ and converging to pooling trading can cross $\theta_1^+(k)$ at most once. Define $t_1 = \inf\left\{t : \theta(t') \geq \theta_1^+(k),\ \forall t' > t\right\}$. Then, for any $0 \leq t < t_1$, we must have $\theta_2^-(k) \leq \theta(0) \leq \theta(t) < \theta_1^+(k)$. Using backward induction, it can be shown that $\bar{V}_{L,2} < V_L(t) < \bar{V}_{L,1}$ for all $t \in [0, t_1)$. Therefore, by the monotonicity of $\theta^-(k,\cdot)$ and $\theta^+(k,\cdot)$, we have

$$\theta^-(k, V_L(t)) < \theta_2^-(k) < \theta(t) < \theta_1^+(k) < \theta^+(k, V_L(t)) \quad \text{for all } t \in [0, t_1).$$

Moreover, Assumption 1 implies $V_L(t) < C_L(t)$ for all $t \geq 0$. Referring to Table 1, it follows that buyers acquire information with probability 1, so $\rho_H(t) = f_H^G$ and $\rho_L(t) = f_L^G$ for all $t \in [0, t_1)$. This shows that if we fix $\rho_H(t) = f_H^G$ and $\rho_L(t) = f_L^G$ for all $t \geq 0$, then the path must satisfy $\theta(t_1) = \theta_1^+(k)$.

We now turn to proving the sufficiency of the condition. This is done by construction. Let t_1 denote the first time at which the path with $\rho_H(t) \equiv f_H^G$ and $\rho_L(t) \equiv f_L^G$ reaches $\theta(t) = \theta_1^+(k)$. It is straightforward to verify that the following constitutes an equilibrium: buyers acquire information and offer the pooling price only upon observing G for $t < t_1$, and offer the pooling price unconditionally for $t \geq t_1$. ■

D Proofs

Proof of Lemma 1-3 (Solutions to the Static Trading Game).

$\mathbf{V_L} < \mathbf{C_L}$**, no gains from trade for low-quality assets.** The buyer has lower continuation value of the low-quality asset than the seller. Therefore, no trade will take place at any price lower than C_H. The buyer will compare the expected payoff from offering the lowest pooling price and withdrawing from trading (or offering a price lower than V_L). The buyer finds it optimal to offer the pooling price C_H if and only if

$$\tilde{\theta} V_H + V_L - (1 + \tilde{\theta}) C_H \geq 0.$$

It can be written as

$$\tilde{\theta} \geq \hat{\theta} = \frac{C_H - V_L}{V_H - C_H}. \tag{D.1}$$

where $\hat{\theta}$ is the threshold belief.

If the prior belief $\theta \geq \hat{\theta}$, the optimal strategy of a buyer without information is to offer the lowest pooling offer C_H and get the expected revenue $\frac{\theta}{1+\theta} V_H + \frac{1}{1+\theta} V_L - C_H$. However, when observing the signal, the buyer can make offers conditional on the signal. Specifically, if $\theta \geq \hat{\theta}$ and $\tilde{\theta}(\theta, B) \leq \hat{\theta}$, the buyer will offer pooling price C_H when observing G and withdraw from trade if observing B. The expected revenue is $\frac{\theta}{1+\theta} f_H^G (V_H - C_H) + \frac{1}{1+\theta} f_L^G (V_L - C_H)$.

If $\tilde{\theta}(\theta, B) > \hat{\theta}$, the buyer is willing to offer the pooling price C_H no matter what the signal is. The expected revenue is $\frac{\theta}{1+\theta}V_H + \frac{1}{1+\theta}V_L - C_H$, the same as if there's no information. Therefore, the value of information for the buyer can be written in the form of an option value

$$W(\theta) = \max\left\{-\frac{\theta}{1+\theta}f_H^B(V_H - C_H) + \frac{1}{1+\theta}f_L^B(C_H - V_L), 0\right\}.$$

The intuition is as following. For prior belief $\theta \geq \hat{\theta}$, the signal allow the buyer to avoid loss $C_H - V_L$ from buying a low-quality asset with probability $\frac{1}{1+\theta}f_L^B$. However the signal can be "false negative" with probability $\frac{\theta}{1+\theta}f_H^B$ and by making conditional offers the buyer loses the trade surplus $V_H - C_H$ from buying a high-quality asset.

On the other hand, if $\theta < \hat{\theta}$, there will be no trade for both types if there's no information. Therefore, using the same reasoning as above, we find the value of information for the buyer is

$$W(\theta) = \max\left\{\frac{\theta}{1+\theta}f_H^G(V_H - C_H) - \frac{1}{1+\theta}f_L^G(C_H - V_L), 0\right\}.$$

After observing the signal, the buyer has the option to make conditional offers. Doing so, the buyer gains the surplus of trading with the high type with probability $\frac{\theta}{1+\theta}f_H^G$, but incurs a loss of trading with the low type with probability $\frac{1}{1+\theta}f_L^G$. The buyer will make conditional offers only if the net gain is positive.

$\mathbf{V_L \geq C_L}$, non-negative gains from trade for low-quality assets. There's a non-negative gain if the buyer offers a low price to only buy low-quality assets. Therefore, the buyer compares the expected gain from offering a pooling price with only buying low-quality assets. The buyer find it optimal to offer pooling price if and only if

$$\frac{\tilde{\theta}}{1+\tilde{\theta}}V_H + \frac{1}{1+\tilde{\theta}}V_L - C_H \geq \frac{1}{1+\tilde{\theta}}(V_L - C_L),$$

which translates into

$$\tilde{\theta} \geq \hat{\theta} = \frac{C_H - C_L}{V_H - C_H}.$$

If $\theta \geq \hat{\theta}$, the buyer will offer pooling price C_H without information. By making conditional offers, the buyer can reduce the price paid for a low-quality asset from C_H to C_L with probability $\frac{\theta}{1+\theta} f_L^B$, but with probability $\frac{\theta}{1+\theta} f_H^B$ she will lose the revenue $V_H - C_H$ from buying a high-quality asset. The value of information to the buyer is

$$W(\theta) = \max\left\{ -\frac{\theta}{1+\theta} f_H^B (V_H - C_H) + \frac{1}{1+\theta} f_L^B (C_H - C_L), 0 \right\}.$$

If $\theta < \hat{\theta}$, the buyer will only trade with the low type at price C_L without information. By making conditional offers, the buyer can get revenue of $V_H - C_H$ with probability $\frac{\theta}{1+\theta} f_H^G$ from buying a high-quality asset, while loss $C_H - C_L$ with probability $\frac{1}{1+\theta} f_L^G$ buying a low-quality asset at the pooling price. The value of information to the buyer is therefore

$$W(\theta) = \max\left\{ \frac{\theta}{1+\theta} f_H^G (V_H - C_H) - \frac{1}{1+\theta} f_L^G (C_H - C_L), 0 \right\}.$$

Let $\nu = \min\{V_L, C_L\}$, the value of information can be written in a synthetic form,

$$W(\theta) = \begin{cases} \max\left\{ -\frac{\theta}{1+\theta} f_H^B (V_H - C_H) + \frac{1}{1+\theta} f_L^B (C_H - \nu), 0 \right\}, & \text{if } \theta \geq \hat{\theta}, \\ \max\{ \frac{\theta}{1+\theta} f_H^G (V_H - C_H) - \frac{1}{1+\theta} f_L^G (C_H - \nu), 0 \}, & \text{if } \theta < \hat{\theta}. \end{cases}$$

Notice $W(\theta)$ remains at zero for θ close to 0, then increases to its maximum value $W_{max}(\nu) = (f_L^B - f_H^B)(v_H - c_H) \cdot \frac{C_H - \nu}{V_H - \nu}$ at $\theta = \hat{\theta} = \frac{C_H - \nu}{V_H - C_H}$, and decreases to zero at a finite value of θ. For $k < W_{max}(\nu)$, the boundaries of the information-sensitive region can be solved by equating $W(\theta)$ and k,

$$\theta^-(k, \nu) = \frac{f_L^G (C_H - \nu) + k}{f_H^G (V_H - C_H) - k}, \quad \theta^+(k, \nu) = \frac{f_L^B (C_H - \nu) - k}{f_H^B (V_H - C_H) + k}.$$

■

Proof of Lemma 4. First note that

$$C_L(t) \leq \frac{rc_L + \lambda c_H}{r + \lambda}.$$

If $\gamma_L(c_H, \tau) \geq f_L^G$ for any $\tau > t$,

$$
\begin{aligned}
&(1-e^{-r(\tau-t)})(v_L-c_L) - \int_t^\tau e^{-r(u-t)}\lambda\gamma_L(c_H,u)(c_H - C_L(u))\mathrm{d}u,\\
\leq&(1-e^{-r(\tau-t)})(v_L-c_L) - \int_t^\tau e^{-r(u-t)}\lambda f_L^G\left(c_H - \frac{rc_L+\lambda c_H}{r+\lambda}\right)\mathrm{d}u,\\
=&(1-e^{-r(\tau-t)})(v_L-c_L) - \lambda f_L^G\frac{r(c_H-c_L)}{r+\lambda}\int_t^\tau e^{-r(u-t)}\mathrm{d}u,\\
=&(1-e^{-r(\tau-t)})(v_L-c_L)\left(v_L - c_L - f_L^G\frac{\lambda}{r+\lambda}(c_H-c_L)\right).
\end{aligned}
$$

If Assumption 1 holds, the above expression is negative for any $\tau > t$. Therefore $V_L(t) - C_L(t) < 0$. ■

Proof of Corollary 1. Since $f_L^G < f_H^G$ and $f_L^B > f_H^B$, the interval defined in Proposition 1 has positive measure for small k. Also, when k is small, the condition for the existence of S_1 becomes

$$\alpha \geq \frac{f_L^B(c_H - \bar{V}_{L,1}) - k}{f_H^B(V_H - c_H) + k}.$$

Proposition 1 implies that S_1 and S_2 coexist if and only if $\alpha \in [A_1(k), A_2(k)]$. To show that this interval has positive measure for small k, it is sufficient to verify that

$$\frac{f_L^B(c_H - \bar{V}_{L,1})}{f_H^B(V_H - c_H)} < \frac{\delta + \lambda f_H^G}{\delta + \lambda f_L^G} \cdot \frac{f_L^B(c_H - \bar{V}_{L,2})}{f_H^B(V_H - c_H)}.$$

In fact, the above inequality always holds since $\bar{V}_{L,1} > \bar{V}_{L,2}$ and $f_H^G > f_L^G$. ■

Proof of Lemma 5. Part (a) follows directly from the preceding discussion.

For part (b), consider the case where $k = 0$ and $v_L = c_L$. In this case, the welfare losses in equilibria S_2 and S_3 are given by:

$$
\begin{aligned}
\Delta_2 &= \frac{\alpha}{1+\alpha}\cdot\frac{\delta}{\delta+\lambda f_H^G}(v_H - c_H),\\
\Delta_3 &= \frac{\alpha}{1+\alpha}(v_H - c_H).
\end{aligned}
$$

Since $\lambda f_H^G > 0$, it follows that $\frac{\delta}{\delta+\lambda f_H^G} < 1$, and therefore $\Delta_2 < \Delta_3$. ■

Proof of Proposition 2. Notice

$$A_2(k) = \frac{\delta + \lambda f_H^G}{\delta + \lambda f_L^G} \cdot \theta^+(k, \bar{V}_{L,2}) = \frac{\delta + \lambda f_H^G}{\delta + \lambda f_L^G} \cdot A_3(k) > A_3(k). \tag{D.2}$$

$A_1(k)$ is the maximum of two values. By Lemma 3 we know $\theta^+(k, \bar{V}_{L,2}) > \theta^+(k, \bar{V}_{L,1})$. To show that $\theta^+(k, \bar{V}_{L,2}) > A_1(k)$ for small enough k, it is sufficient to show that

$$\frac{f_L^B(c_H - \bar{V}_{L,2})}{f_H^B(V_H - c_H)} > \frac{\delta + \lambda f_H^G}{\delta + \lambda f_L^G} \cdot \frac{f_L^G(c_H - \bar{V}_{L,2})}{f_H^G(V_H - c_H)}. \tag{D.3}$$

It follows directly from $f_L^B > f_H^B$ and $f_H^G > f_L^G$.

Given any $\alpha \in (A_1(k), A_3(k))$, the no information pooling stationary equilibria features $\bar{\theta}_1 = \alpha > \theta^+(k, \bar{V}_{L,1})$. Suppose the market starts from an initial asset distribution with $\theta(0)$ in the neighbourhood of α. Let's consider two paths. On the first path buyers always offer the pooling price c_H without acquiring information. Therefore, $\rho_H(t) = \rho_L(t) = 1$. Lemma B.1 implies that $\theta(t)$ converges monotonically to α. Since the continuation values are the same as in the no information pooling stationary equilibria, it is easy to verify that $\theta(t)$ falls in the pooling no information region for any $t > 0$. The first path is indeed an equilibrium path converging to S_1.

For the second path, assume buyers always acquire information and offer the pooling price c_H only if a good signal is observed. Thus, the continuation values are the same as in the information stationary equilibria. Moreover, $\rho_H(t) = f_H^G$ and $\rho_L(t) = f_L^G$ for any $t > 0$. Lemma B.1 implies that starting from the initial distribution close to S_1, $\theta(t)$ decreases monotonically to $\bar{\theta}_2$. Notice by assumption

$$\theta(0) = \alpha < A_3(k) = \theta^+(k, \bar{V}_{L,2}),$$

$$\bar{\theta}(+\infty) = \frac{\delta + \lambda f_L^G}{\delta + \lambda f_H^G} \cdot \alpha \geq \frac{\delta + \lambda f_L^G}{\delta + \lambda f_H^G} \cdot A_1(k) \geq \bar{\theta}^-(k, \bar{V}_{L,2}).$$

The whole path of $\theta(t)$ lies within the information sensitive region. Since $\bar{\theta}_2$ is the only sink in the information region, when starting from an initial distribution close to that of S_1, the path of $\theta(t)$ also stays in the information sensitive region. Therefore, the second path is an equilibrium path converging to S_2. ■

Proof of Lemma 6. Assume buyers do not acquire information and always offer the pooling price c_H for any $t > 0$. Therefore, both high-quality and low-quality assets are traded with probability 1. Also, the continuation values of owners of low-quality assets are fixed at $V_L(t) = \bar{V}_{L,1}$ and $C_L(t) = \bar{C}_{L,1}$. To show the assumed path is indeed an equilibrium path, we only need to verify that the whole path of market composition falls in the pooling information-insensitive region. In fact, Lemma B.1 implies that the market composition $\theta(t)$ increases monotonically from $\theta(0)$ to α. Given that $\alpha, \theta(0) > \theta_1^+(k)$, we know $\theta(t) > \theta_1^+(k)$ for any $t > 0$. The assumed path is an equilibrium path that converges to S_1. ■

Proof of Proposition 3. Since $\bar{V}_{L,1} > \bar{V}_{L,2}$, by Lemma 3, $\theta_1^+(k) < \theta_2^+(k)$, therefore $A_4(k) < A_2(k)$. Also, Assumption 2 implies that $\theta_2^-(k) < \theta_1^+(k)$. It immediately follows that $A_1(k) < A_4(k)$ for small $k > 0$. By Proposition 1, we know when k is small, for any $\alpha \in (A_1(k), A_4(k))$, S_1 and S_2 coexist. Moreover, the market composition in the information stationary equilibria S_2 satisfies

$$\theta_2^-(k) < \bar{\theta}_2 < \theta_1^+(k).$$

Therefore, the asset distribution in S_2 falls in the information trap. By Proposition C.1, when the asset distribution is in the neighbourhood of S_2, there's no equilibrium path that converges to S_1. ■

Proof of Proposition 4. An intervention program can induce a given trading pattern with no actual asset purchases ($\tilde{Q} = 0$) if and only if, given the initial asset distribution at the time of the announcement, there exists an equilibrium path absent the intervention that supports the same trading behavior.

Lemma B.1 implies that along the self-fulfilling crisis path from S_1 to S_2, the asset composition deteriorates monotonically from $\bar{\theta}_1$ to $\bar{\theta}_2$. By continuity, there exists a time $\hat{\tau} > 0$ such that $\theta(\hat{\tau}) = \theta_1^+(k)$. Since $\theta_1^+(k)$ is decreasing in k, it follows that $\hat{\tau}$ is increasing in k.

If the intervention program is announced at $\tau \leq \hat{\tau}$, then the market composition at $t = \tau$ satisfies $\theta(\tau) \geq \theta_1^+(k)$, so buyers are willing to offer pooling prices without acquiring information, provided they expect future market liquidity. Moreover, if buyers consistently offer pooling prices for all $t > \tau$, then the asset composition will improve monotonically toward $\alpha > \theta_1^+(k)$, thereby justifying sustained liquid trading. Thus, there exists an equilibrium path with pooling trade from $t = \tau$ onward.

Conversely, if the intervention program is announced at $\tau > \hat{\tau}$, then $\theta(\tau) < \theta_1^+(k)$. Proposition C.1 implies that, starting from this asset distribution, a pooling equilibrium can emerge in the absence of intervention if and only if $\theta(t)$ can rise above $\theta_1^+(k)$ when buyers acquire information in all future periods. However, this is not possible since continued information acquisition causes the asset composition to converge to $\bar{\theta}_2 < \theta_1^+(k)$. Therefore, no equilibrium path converging to full pooling trade exists as $t \to \infty$. ■

Internet Appendix

IA1 Alternative Definition of Equilibrium

Here I provide a formal but less intuitive equilibrium definition which is equivalent to the definition provided in Section 3.

Definition IA1.1 *A equilibrium consists of paths of asset distribution* $\left\{\theta(t), m_H^S(t), m_L^S(t)\right\}$*, buyers' policy functions* $\{i(t), \sigma(p, \psi, t)\}$ *and value functions* $\{V_H(t), V_L(t)\}$*, seller's policy function* $\mu(p, j, t)$ *and value functions* $\{C_H(t), C_L(t)\}$*, which satisfy the following conditions:*

1. *Seller's optimality condition: For any* $j \in \{H, L\}$*,*

$$\mu(p, j, t) = \begin{cases} 1, & \text{if } p > C_j(t), \\ [0,1], & \text{if } p = C_j(t), \\ 0, & \text{if } p < C_j(t). \end{cases} \tag{IA1.1}$$

2. *Buyer's optimality conditions:*

   (a) *For* $\psi \in \{G, B\}$*,* $\sigma(p, \psi, t) > 0$ *only if* p *solves*

$$J(\psi, t) = \max_p \ \frac{\theta(t)}{\theta(t)+1} f_H^{\psi} \mu(p, H, t) \left[V_H(t) - p\right] + \frac{1}{\theta(t)+1} f_L^{\psi} \mu(p, L, t) \left[V_L(t) - p\right];$$

   (b) $\sigma(p, N, t) > 0$ *only if* p *solves*

$$J(N, t) = \max_p \ \frac{\theta(t)}{\theta(t)+1} \mu(p, H, t) \left[V_H(t) - p\right] + \frac{1}{\theta(t)+1} \mu(p, L, t) \left[V_L(t) - p\right];$$

   (c) *The value of information* $W(t)$ *is*

$$W(t) = \max\left\{J(G, t) + J(B, t) - J(N, t), 0\right\},$$

and $i(t)$ satisfies

$$i(t) = \begin{cases} 1, & \textit{if } W(t) > k, \\ [0,1], & \textit{if } W(t) = k, \\ 0, & \textit{if } W(t) < k. \end{cases} \tag{IA1.2}$$

3. *The continuation values of sellers $C_j(t)$ are given by (2),(3) and (4). The continuation values of buyers/holders $V_j(t)$ are given by (5).*

4. *The asset distribution, characterized by $m_H^S(t)$, $m_L^S(t)$ and $\theta(t)$ evolves according to (11)-(13).*

IA2 Mixed-Strategy Stationary Equilibria

Here we provide two useful results that restrict the set of possible mixed strategies in equilibrium.

Lemma IA2.1 *In any equilibrium, if $i(t) > 0$, $\sigma(c_H, G, t) = 1$ and $\sigma(c_H, B, t) = 0$.*

Lemma IA2.1 applies to all equilibrium path. It implies a buyer will offer the pooling price c_H if and only if a good signal is observed. The proof is intuitive. Based on the analysis of the static trading game, it is clear that given any set of continuation values, buyers only choose between two price. Without loss of generality, assume the buyer offers price p_1 after seeing a good signal and mix between p_1 and p_2 after seeing a bad signal. Since the buyer uses mixed strategy after seeing a bad signal, then the expected payoff from offering the two prices based on the posterior belief of seeing a bad signal must be the same. Therefore, the expected payoff doesn't change if the buyer offer p_1 with probability 1 after seeing a bad signal. This makes the buyer's offer independent of the signal. Thus, the buyer can simply offer p_1 without information acquisition and save the fixed cost. The above reasoning shows the sub-optimality of using mixed strategy after acquiring information. We can us Lemma IA2.1 to simplify (2), in any equilibrium,

$$\gamma_L(t) = i(t) f_L^G + (1 - \bar{i}(t))\, \sigma(c_H, N, t). \tag{IA2.1}$$

Do sellers randomize in equilibrium? Obviously, sellers of low-quality assets always accept the pooling price c_H. Also, sellers of high-quality assets always accept the pooling price c_H in any equilibrium. If sellers of high-quality assets accept price c_H with a probability less than 1, a buyer can raise the offer by a tiny amount and increase the surplus by $V_H - C_H$ with a strictly positive probability. Following the same logic, if sellers of low-quality assets randomize when offered a separating price, $\bar{C}_L$ must be equal to $\bar{V}_L$. In stationary equilibria, this implies that $\bar{\gamma}_L = \frac{r}{\lambda}(v_L - c_L)/(c_H - v_L)$. By Assumption 1, $\bar{\gamma}_L < f_L^G$. Using (IA2.1), we immediately have the following lemma.

Lemma IA2.2 *If Assumption 1 holds, in any stationary equilibria with sellers of low-quality assets using mixed strategies, we have* $\bar{i} < 1$ *and* $\bar{\sigma}(c_H, N) < f_L^G$ *.*

If buyers randomize between a separating offer and a no-trade offer, the gains from trade of low-quality assets must be zero, $V_L(t) = C_L(t)$. We say two equilibria are equivalent when sellers and buyers of both high-quality and low-quality assets have the same trading probability and continuation values at any give time. Any equilibrium with buyer mixing between a separating offer and a no-trade offer is equivalent to an equilibrium with buyers only offering the separating price and sellers rejecting the offer with a positive probability. This equivalence allows us to focus on mixed-strategy equilibria in which buyers only choose between the separating offer and the pooling offer.

IA2.1 Mixed-Strategy Stationary Equilibrium without Information Acquisition

Any mixed strategy stationary equilibrium without information acquisition must have buyers using mixed strategies. It is sufficient to consider buyers mixing between the pooling price c_H and the separating price $\bar{C}_L$. Notice in any equilibrium without information acquisition, the probability of buyer offering c_H is equal to γ_L. When buyers do not acquire information, whether they offer the separating price or the no-trade price depends on the relationship between $\bar{V}_L$ and $\bar{C}_L$. Since in a stationary equilibrium, $\bar{V}_L$ is a weighted average of v_L and $\bar{C}_L$, it's equivalent to compare $\bar{C}_L$ and v_L. There are three cases:

1. (S_4) $\bar{C}_L > v_L$. This is the case when buyers offer c_H with probability $\bar{\gamma}_{L,4}$ and the no trade price with probability $1 - \bar{\gamma}_{L,4}$. In each match, either type of asset is traded

with probability $\bar{\gamma}_{L,4}$. (15) implies that $\bar{\gamma}_{L,4} > \frac{r}{\lambda}(v_L - c_L)/(c_H - v_L)$. This stationary equilibria exists when the following conditions are satisfied:

$$\frac{c_H - \bar{V}_{L,1}}{V_H - c_H} < \alpha < \frac{c_H - v_L}{V_H - c_H}, \tag{IA2.2}$$

$$k \geq (f_L^B - f_H^B)(V_H - c_H)\frac{\alpha}{1+\alpha}. \tag{IA2.3}$$

The market liquidity $\bar{\gamma}_{L,4}$ is determined by $\alpha = \frac{c_H - \bar{V}_{L,4}}{V_H - c_H}$ and (15).

2. (S_5) $\bar{C}_L < v_L$. In this stationary equilibrium buyers offer c_H with probability $\bar{\gamma}_{L,5}$ and the separating price $\bar{C}_{L,5}$ with probability $1 - \bar{\gamma}_{L,5}$. Low-quality sellers accept the separating offer for sure. In each match, a high-quality asset is traded with probability $\bar{\gamma}_{L,5}$ and a low-quality asset is always traded. If this stationary equilibrium exists, (α, k) must satisfy the following conditions given a market liquidity $\bar{\gamma}_{L,5} \in (0, \frac{r}{\lambda}(v_L - c_L)/(c_H - v_L))$.

$$\bar{C}_{L,5} = \frac{rc_L + \lambda\bar{\gamma}_{L,5}c_H}{r + \lambda\bar{\gamma}_{L,5}},$$

$$\frac{c_H - \bar{C}_{L,5}}{V_H - c_H} = \frac{\delta + \lambda}{\delta + \lambda\bar{\gamma}_{L,5}} \cdot \alpha,$$

$$k \geq (f_L^B - f_H^B)(V_H - c_H) \cdot \frac{c_H - \bar{C}_{L,5}}{V_H - \bar{C}_{L,5}}.$$

3. (S_6) $\bar{C}_L = v_L$. In this stationary equilibria, buyers offer c_H with probability $\bar{\gamma}_{L,6} = \frac{r}{\lambda}(v_L - c_L)/(c_H - v_L)$ and the separating price $\bar{c}_{L,6}$ with probability $1 - \bar{\gamma}_{L,6}$. Low-quality sellers accept the separating offer with probability $\bar{\mu}(v_L, L) \in (0, 1)$. For the stationary equilibria to exist, (α, k) must satisfy the following conditions

$$\frac{\delta + \lambda\bar{\gamma}_{L,6}}{\delta + \lambda} \cdot \frac{c_H - v_L}{V_H - c_H} < \alpha < \frac{c_H - v_L}{V_H - c_H},$$

$$k \geq (f_L^b - f_H^b)(V_H - c_H) \cdot \frac{c_H - v_L}{V_H - v_L}.$$

where $\bar{\mu}(v_L, L)$ is the solution to

$$\frac{\delta + \lambda\bar{\gamma}_{L,6}}{\delta + \lambda\left[\bar{\gamma}_{L,6} + \bar{\mu}(v_L, L)(1-\bar{\gamma}_{L,6})\right]} \cdot \frac{c_H - v_L}{V_H - c_H} = \alpha. \tag{IA2.4}$$

IA2.2 Mixed-strategy equilibrium with partial information acquisition

Now let's turn to the mixed-strategy stationary equilibria with $\bar{i} \in (0,1)$. In any equilibrium, buyers always offer c_H after observing a good signal.

1. (S_7) First let's consider stationary equilibria with $\bar{\theta}$ located on the right boundary of the information-sensitive region. Since $\bar{\theta} > \hat{\theta}$, when buyers do not acquire information, they offer the pooling price. Therefore $\bar{\gamma}_{L,7} = \bar{i}_7 f_L^G + 1 - \bar{i}_7$. Notice $\bar{\gamma}_{L,7} > f_L^G$. Assumption 1 implies that $\bar{C}_{L,7} > v_L$, so there's no gain from trade for low-quality assets. Low-quality assets will not be traded if a bad signal is observed. High-quality and low-quality assets are traded with probability $\bar{\rho}_{H,7} = \bar{i}_7 f_H^G + 1 - \bar{i}_7$, while low-quality assets are traded with probability $\bar{\rho}_{L,7} = \bar{i}_7 f_L^G + 1 - \bar{i}_7$. The stationary equilibria market composition $\bar{\theta}_7$ is given by (14). S_7 exists if and only if the following conditions are satisfied:

$$\theta^+(k, \bar{V}_{L,7}) \geq \frac{c_H - \bar{V}_{L,7}}{V_H - c_H}, \tag{IA2.5}$$

$$\alpha = \frac{\delta + \lambda\bar{\rho}_{H,7}}{\delta + \lambda\bar{\rho}_{L,7}} \cdot \theta^+(k, \bar{V}_{L,7}) \tag{IA2.6}$$

2. (S_8) The next group of stationary equilibria we investigate has $\bar{\theta}$ located on the left boundary of the information-sensitive region. Since $\bar{\theta} < \hat{\theta}$, buyers never offer the pooling price without information acquisition. Therefore $\bar{\gamma}_{L,8} = \bar{i}_8 f_L^G$. High-quality assets are traded with probability $\bar{\rho}_{H,8} = \bar{i}_8 f_H^G$. The probability that a low type asset is traded depends on whether there's gain from trade. Given different $\bar{i}_8$, there are three cases:

   - If $\bar{i}_8 > \frac{r}{\lambda f_L^G}(v_L - c_L)/(c_H - v_L)$, the gain from trade of low-quality assets is negative. Low-quality assets are traded with probability $\bar{\rho}_{L,8} = \bar{\gamma}_{L,8}$.

- If $\bar{i}_8 < \frac{r}{\lambda f_L^G}(v_L - c_L)/(c_H - v_L)$, the gain from trade of low-quality assets is positive. Low-quality assets are traded with probability $\bar{\rho}_{l,8} = 1$.
- If $\bar{i}_8 = \frac{r}{\lambda f_L^G}(v_L - c_L)/(c_H - v_L)$, the gain from trade of low-quality assets is zero. Sellers of low-quality assets can use mixed strategies when offered the separating price. Low-quality assets are traded with probability $\bar{\rho}_{l,8} \in [\bar{\gamma}_{L,8}, 1]$.

The continuation values of the owners of low-quality assets are given by (15). The stationary equilibria market composition $\bar{\theta}_8$ is given by (14). Let $\bar{\nu}_8 = \min\left\{\bar{V}_{L,8}, \bar{C}_{L,8}\right\}$. S_8 with a given $\bar{i}_8 \in (0,1)$ exists if and only the following conditions are satisfied:

$$\theta^-(k, \nu_8) \geq \frac{c_H - \bar{\nu}_8}{V_H - c_H}, \tag{IA2.7}$$

$$\alpha = \frac{\delta + \lambda\bar{\rho}_{H,8}}{\delta + \lambda\bar{\rho}_{L,8}} \cdot \theta^-(k, \bar{\nu}_8). \tag{IA2.8}$$

3. (S_9) The last group of stationary equilibria features buyer's partial information acquisition and mixed offering strategy when information is not acquired. Buyers acquire information with probability $\bar{i}_9$. In case the buyers do not acquire information, they offer the pooling price with probability $\bar{\sigma}(c_H, N)$. Therefore, $\bar{\gamma}_{L,9} = \bar{i}_9 f_L^G + \bar{\sigma}(c_H, N)$. High-quality assets are traded with probability $\bar{\rho}_{h,9} = \bar{i}_9 f_L^G + \bar{\sigma}(c_H, N)$. The probability that low type assets are traded depends on the gain from trade of low-quality assets. There are three cases depending on $\bar{\gamma}_{L,9}$:

   - If $\bar{i}_9 > \frac{r}{\lambda}(v_L - c_L)/(c_H - v_L)$, the gain from trade of low-quality assets is negative. Low-quality assets are traded with probability $\bar{\rho}_{L,9} = \bar{\gamma}_{L,9}$.
   - If $\bar{i}_9 < \frac{r}{\lambda}(v_L - c_L)/(c_H - v_L)$, the gain from trade of low-quality assets is positive. Low-quality assets are traded with probability $\bar{\rho}_{L,9} = 1$.
   - If $\bar{i}_9 = \frac{r}{\lambda}(v_L - c_L)/(c_H - v_L)$, the gain from trade of low-quality assets is zero. Sellers of low-quality assets can use mixed strategies when offered the separating price. Low-quality assets are traded with probability $\bar{\rho}_{l,9} \in [\bar{\gamma}_{L,9}, 1]$.

   The continuation values of the owners of low-quality assets are given by (15). The stationary equilibria market composition $\bar{\theta}_9$ is given by (14). Let $\bar{\nu}_9 = \min\left\{\bar{V}_{L,9}, \bar{C}_{L,9}\right\}$. S_9 with given $\bar{i}_9 \in (0,1)$ and $\bar{\sigma}(c_H, N)$ exists if and only if the following conditions are satisfied:

$$k = (f_L^B - f_H^B)(V_H - c_H) \cdot \frac{c_H - \bar{\nu}_9}{V_H - \bar{\nu}_9}, \tag{IA2.9}$$

$$\alpha = \frac{\delta + \lambda \bar{\rho}_{H,9}}{\delta + \lambda \bar{\rho}_{L,9}} \cdot \frac{c_H - \bar{\nu}_9}{V_H - c_H}. \tag{IA2.10}$$

IA3 Alternative Assumptions on Buyers' Entry and Exit

In the model, I make a simplifying assumption with respect to buyers' entry and exit. Namely, the inflow of buyers is proportional to the mass of sellers at any given time, and buyers exit the market immediately if no trade happens within matches. This assumption helps me highlight the effect of buyers' trading strategy on market liquidity without considering the changes in the meeting rate. Here I analyze the robustness of the main results in a model with more conventional assumptions on buyers' entry and exit.

Let's consider a market with a fixed inflow of buyers denoted by ϵ. After unsuccessful trade, buyers do not exit the market. Instead, they stay on the market and are matched randomly with sellers. Denote the mass of buyers at time t by $m^B(t)$. The matching function takes a multiplicative form of $\hat{\lambda} m^B(t) \left[m_H^S(t) + m_L^S(t)\right]$. Therefore, each seller meets a buyer at Poisson rate $\hat{\lambda} m^B(t)$, and each buyer meets a seller at Poisson rate $\hat{\lambda} \left[m_H^S(t) + m_L^S(t)\right]$. Since the matching process is random, the prior belief of a seller—the probability of meeting a high-quality seller to the probability of meeting a low-quality seller—is still $\theta(t)$. Compared to the model described in Section 2, the market liquidity is affected by both the endogenous meeting rate and buyers' trading strategy. In addition, buyers now take into consideration the option value of waiting to buy assets later. Both factors complicate the analysis of the model, especially the analytical characterization of the non-stationary equilibria.

To characterize the equilibrium in the revised model, we need to introduce more notations. Let $\hat{J}(t)$ be the ex ante expected value of a matched buyer and $J(t)$ be the continuation value of an unmatched buyer at time t. They are linked through the following expression.

$$J(t) = \int_t^{+\infty} e^{-r(\tau - t)} \hat{J}(\tau) \mathrm{d}\left(1 - e^{-\int_t^{\tau} \lambda m^S(t) \mathrm{d}u}\right).$$

The continuation values $C_H(t)$, $V_H(t)$ and $V_L(t)$ still satisfy (3), (5) and (6), while $C_L(t)$ is different because the matching function is different.

$$C_L(t) = \int_t^\infty \left[(1 - e^{-r(\tau - t)})c_L + e^{-r(\tau-t)}c_H\right] d(1 - e^{-\lambda \int_t^\tau m^B(u)\gamma_L(c_H,u)du}).$$

For the static trading game, the previous analyses still apply if we replace the continuation values with $\hat{C}_H(t) = C_H(t)$, $\hat{C}_L(t) = C_L(t)$, $\hat{V}_H(t) = V_H(t) - J(t)$ and $\hat{V}_L(t) = V_L(t) - J(t)$. Let $\nu(t) = \min\left\{\hat{V}_L(t), \hat{C}_L(t)\right\}$, the expected value of being matching at time t is

$$\hat{J}(t) - J(t) = \begin{cases} \frac{1}{1+\theta(t)}\left(\hat{V}_L(t) - \nu(t)\right), & \theta(t) < \hat{\theta}^-(k,\nu(t)), \\ \frac{1}{1+\theta(t)}\left[\hat{V}_L(t) - f_L^G\hat{C}_H(t) - f_L^B\nu(t)\right]\dots & \\ +\frac{\theta(t)}{1+\theta(t)}f_H^G\left(\hat{V}_H(t) - \hat{C}_H(t)\right) - k, & \theta^-(k,\nu(t)) \le \theta(t) < \theta^+(k,\nu(t)), \\ \frac{1}{1+\theta(t)}\left(\hat{V}_L(t) - \hat{C}_H(t)\right) + \frac{\theta(t)}{1+\theta(t)}\left(\hat{V}_H(t) - \hat{C}_H(t)\right), & \theta(t) \ge \theta^+(k,\nu(t)). \end{cases}$$

Although the characterization is more complicated, the main result still holds—given certain parametric restrictions, there exists two steady states, a liquid one without information acquisition and an illiquid one with information acquisition. Moreover, given the initial condition in the illiquid steady state, there is no equilibrium that converges to the liquid steady state. Here I provide the intuition without giving the details of the analysis. First, since the static trading game can be represented with a set of modified continuation values, the equilibrium of the static trading game does not change qualitatively. Specifically, the information-sensitive region lies to the left of the information-insensitive pooling region. Second, when buyers acquire information, high-quality assets are still traded faster than low-quality assets. Therefore, the cream-skimming effect of information acquisition is still present in the revised model. Third, although the rate at which sellers meet buyers is higher in an illiquid market, it does not offset the low liquidity caused by buyers' information acquisition. To summarize, the above three components that drive the main results are all present in the revised model.

IA4 Stochastic Non-stationary Equilibria

Based on the analyses of the deterministic non-stationary equilibrium path, we can show that a self-fulfilling market freeze can be an expected probabilistic event along the equilibrium path. To show this, we need to introduce a public signal process $\iota(t)$ which equals 0 when $t < \tau$ and equals 1 when $t \geq \tau$. τ is a random variable which follows an exponential distribution $F(\tau) = 1 - e^{-\xi x}$.

We want to show that the following strategy is an equilibrium. Buyers do not acquire information and offer the pooling price when $\iota(t) = 0$, and they acquire information and offer the separating price when $\iota(t) = 1$.

Proposition IA4.1 (Self-fulfilling Market Freeze) *If Assumption 1 holds, for any fundamental $\alpha \in (A_1(k), A_3(k)]$ and a public signal process with $\xi \leq (r+\delta)\frac{\alpha-\theta_1^+(k)}{\theta_2^+(k)-\alpha}$, there is an equilibrium path starting from the initial asset distribution of S_1 along which at any time t,*

a) if $\iota(t) = 0$, buyers do not acquire information and offer pooling price;

b) if $\iota(t) = 1$, buyers acquire information and offer pooling price only when observing good signals.

Proof of Proposition IA4.1. This proposition is proved in three steps. In step 1 we calculate the continuation values of the low type buyers and sellers given the proposed trading strategies. In step 2 we characterize the evolution of the asset composition in the market. In step 3 we verify the optimality of the strategies given the continuation values and the asset compositions.

Step 1: Continuation values. Once the public signal switches to 1 at $t = \tau$, all buyers start to acquire information and only offer the pooling price when they observe a good signal. Therefore, the continuation values of a low-quality seller and a low-quality holder at $t \geq \tau$ are the same as in the information-sensitive steady state S_2.

$$C_{L,t\geq\tau} = \bar{C}_{L,2} = \frac{rc_L + \lambda f_L^G c_H}{r + \lambda f_L^G}, \tag{IA4.1}$$

$$V_{L,t\geq\tau} = \bar{V}_{L,2} = \frac{rv_L + \delta\bar{C}_{L,2}}{r + \delta}. \tag{IA4.2}$$

Before the public signal switches to 1, all buyers do not acquire information and offer the pooling price with probability 1. As in the information-insensitive liquid steady state S_1, a low-quality seller enjoys flow payoff rc_L and receives a pooling offer with Poisson rate λ. In addition, a low-quality seller also expects that the public signal will become 1 with Poisson rate ξ and the continuation value will reduce to $\bar{C}_{L,2}$. So for any $t < \tau$, we can write down the HJB equations for the continuation values of a low-quality seller and a low-quality holder.

$$rC_L(t) = rc_L + \lambda\left(c_H - C_L(t)\right) + \xi\left(\bar{C}_{L,2} - C_L(t)\right), \tag{IA4.3}$$

$$rV_L(t) = rv_L + \delta\left(C_L(t) - V_L(t)\right) + \xi\left(\bar{V}_{L,2} - V_L(t)\right). \tag{IA4.4}$$

Solving for the continuation values, we have for any $t < \tau$,

$$C_L(t) = C_{L,t<\tau} = \frac{rc_L + \lambda c_H + \xi\bar{C}_{L,2}}{r + \lambda + \xi}, \tag{IA4.5}$$

$$V_L(t) = V_{L,t<\tau} = \frac{rv_L + \delta C_{L,t<\tau} + \xi\bar{V}_{L,2}}{r + \delta + \xi}. \tag{IA4.6}$$

In fact, $C_{L,t<\tau}$ and $V_{L,t<\tau}$ can be written as weighted averages of the continuation values in steady states S_1 and S_2.

$$C_{L,t<\tau} = \frac{r+\lambda}{r+\lambda+\xi}\bar{C}_{L,1} + \frac{\xi}{r+\lambda+\xi}\bar{C}_{L,2}, \tag{IA4.7}$$

$$V_{L,t<\tau} = \frac{(r+\delta)(r+\lambda)}{(r+\delta+\xi)(r+\lambda+\xi)}\bar{V}_{L,1} + \left[1 - \frac{(r+\delta)(r+\lambda)}{(r+\delta+\xi)(r+\lambda+\xi)}\right]\bar{V}_{L,2}. \tag{IA4.8}$$

Since $\bar{C}_{L,1} > \bar{C}_{L,2}$ and $\frac{r+\lambda}{r+\lambda+\xi} > \frac{(r+\delta)(r+\lambda)}{(r+\delta+\xi)(r+\lambda+\xi)}$, we have

$$C_{L,t<\tau} > \frac{(r+\delta)(r+\lambda)}{(r+\delta+\xi)(r+\lambda+\xi)}\bar{C}_{L,1} + \left[1 - \frac{(r+\delta)(r+\lambda)}{(r+\delta+\xi)(r+\lambda+\xi)}\right]\bar{C}_{L,2}.$$

In the analyses of stationary equilibria S_1 and S_2, we have shown that Assumption 1 implies $\bar{V}_{L,1} < \bar{C}_{L,1}$ and $\bar{V}_{L,2} < \bar{C}_{L,2}$. Therefore, $C_{L,t<\tau} > V_{L,t<\tau}$.

Step 2: Market compositions. The initial market composition is $\theta(0) = \alpha$, the same as in S_1. Before the public signal switches to 1, both high quality assets and low quality assets are traded with probability 1 in each match. Thus the asset distribution $\theta(t)$ equals α for any

$t < \tau$. Once the sunspot shock arrives, the high quality assets are traded with probability f_H^G and the low quality assets are traded with probability f_L^G in each match. As we show in the proof of Lemma 2, $\theta(t)$ decreases monotonically to $\bar{\theta}_2$.

Step 3: Optimality. Lemma 2 directly implies that the trading strategies are optimal for any $t \geq \tau$. For $t < \tau$, we need to verify that buyers have no incentive to acquire information. By Lemma 3, we only need to verify that the market composition $\theta(t) = \alpha$ is greater than $\theta^+(k, \min\{C_{L,t<\tau}, V_{L,t<\tau}\})$, the right boundary of the information sensitive region.

Since $\theta^+(k, \nu)$ is a linear function of ν, we can write the

$$\theta^+(k, V_{L,t<\tau}) = \frac{r+\delta}{r+\delta+\xi}\bar{\theta}_1^+(k) + \frac{\xi}{r+\delta+\xi}\theta_2^+(k). \tag{IA4.9}$$

This means $\alpha \geq \theta^+(k, V_{L,t<\tau})$ if and only if

$$\xi \leq (r+\delta)\frac{\alpha - \theta_1^+(k)}{\theta_2^+(k) - \alpha}. \tag{IA4.10}$$

The condition $\alpha \in (A_1(k), A_3(k)]$ implies that the right hand side of the inequality is a positive number. ■

IA5 Self-fulfilling Market Freeze in a Finite Horizon Setting

I now consider a simplified two-period version of the model to illustrate that the information trap mechanism can arise in a finite-horizon setting. For ease of exposition, assume there is no time discounting and that the cost of information acquisition is zero. Further assume that $v_H > c_H > v_L = c_L = 0$. Redefine the Poisson parameter $\delta \in [0, 1]$ to represent the probability that an asset owner receives a liquidity shock in period 2. To initialize the game, assume that at the beginning of period 1, all investors who own assets are liquidity shocked and thus actively seek to sell in the market. The composition of assets is given by α, defined as in the infinite-horizon model.

Each period proceeds as follows. At the start of the period, all sellers are matched with buyers with probability one. Trades then take place according to the protocol in the original model. After trading, asset owners receive flow payoffs based on the quality of their asset and their liquidity status.

The following proposition shows that a self-fulfilling market freeze can arise in a finite horizon setting.

Proposition IA5.1 *If $f_L^G > 0$, $\delta > 0$, and $\frac{f_L^G f_H^B}{f_H^G f_L^B} < \min\left\{1 - \frac{\delta}{2}, \delta\right\}$, there exists an interval of α such that the following two equilibria coexist in the 2-period game:*

a) An information-insensitive pooling equilibrium in which buyers offer the pooling price in both periods.

b) An information-sensitive equilibrium in which, in either period, buyers offer the pooling price only following a good signal.

Proof of Proposition IA5.1. The game can be solved with backward induction. Suppose the starting asset composition in period 2 is θ_2. Following Proposition 3, the two bounds of the information sensitive region in period 2 are

$$\theta_2^- = \frac{f_L^G c_H}{f_H^G (v_H - c_H)}, \quad \theta_2^+ = \frac{f_L^B c_H}{f_H^B (v_H - c_H)}.$$

With the period 2 equilibrium in mind, we can analyze trading in period 1. Note that the continuation values after the trading stage in period 1 are given by

$$C_{H,1} = 2c_H, \quad V_{H,1} = (2-\delta)v_H + \delta c_H.$$
$$C_{L,1} = \gamma_2 c_H, \quad V_{L,1} = \delta\gamma_2 c_H.$$

Here, γ_2 is the probability that a low quality asset can be traded at the pooling price c_H in period 2. The two bounds of the information sensitive region in period 1 are

$$\theta_1^-(\gamma_2) = \frac{f_L^G (2-\delta\gamma_2) c_H}{f_H^G (2-\delta)(v_H - c_H)}, \quad \theta_1^+(\gamma_2) = \frac{f_L^B (2-\delta\gamma_2) c_H}{f_H^B (2-\delta)(v_H - c_H)}.$$

The market composition in period 2 depends on the trading patterns in period 1.

$$\theta_2(\rho_H, \rho_L) = \alpha \frac{1 - \rho_{H,1} + \rho_{H,1}\delta}{1 - \rho_{L,1} + \rho_{L,1}\delta}.$$

Now consider a interval $\left[\theta_2^+, \min\left\{\theta_1^+(f_L^G), \theta_2^+\frac{1-f_L^G+f_L^G\delta}{1-f_H^G+f_H^G\delta}\right\}\right]$. The interval is non-empty since $\theta_1^+(f_L^G) > \theta_2^+$ and $\frac{1-f_L^G+f_L^G\delta}{1-f_H^G+f_H^G\delta} > 1$. For any α in this interval:

a) It is easy to verify that pooling trading in both periods is an equilibrium given $\alpha > \theta_1^+(1) = \theta_2^+$ and $\theta_2(1,1) = \alpha$.

b) The necessary and sufficient conditions for such an equilibrium to exist is that $\theta_1^-(f_L^G) \leq \alpha \leq \theta_1^+(f_L^G)$ and $\theta_2^-\frac{1-f_L^G+f_L^G\delta}{1-f_H^G+f_H^G\delta} \leq \alpha \leq \theta_2^+\frac{1-f_L^G+f_L^G\delta}{1-f_H^G+f_H^G\delta}$. It is easy to verify that when $\frac{f_L^G f_H^B}{f_H^G f_L^B} < \min\left\{1-\frac{\delta}{2}, \delta\right\}$, the two left bounds are both lower than θ_2^+. Therefore, for any $\alpha \in \left[\theta_2^+, \min\left\{\theta_1^+(f_L^G), \theta_2^+\frac{1-f_L^G+f_L^G\delta}{1-f_H^G+f_H^G\delta}\right\}\right]$, the information sensitive equilibrium exists.

■