Tough Middlemen*

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Abstract

We study a decentralized asset market in the spirit of Duffie, Petersen and Garleanu (2005). We assume that agents are heterogeneous with respect to their valuation of the asset, and with respect to their bargaining ability. Specifically, a tough agent can make a take-it-or-leave it offer to the soft agents and (with probability 1/2) to another tough agent. A soft agent makes (with probability 1/2) a take-it-or-leave-it offer to another soft-agent. In this environment, we show that tough agents become intermediaries, in the sense that a tough agent buys and sells the asset from a soft agent even when the two have the same valuation. We show that, in the presence of positive transaction costs, the non-fundamental trades carried out by tough agents is socially inefficient. We then show that, if tough agents cannot distinguish the identity of their trading partners (i.e. they post bid and ask prices), then intermediaries do not trade with each other even when they have different valuations. The unexecuted fundamental trades between tough agents are a second source of inefficiency. Finally, we show that—if agents can choose whether to pay a cost to become tough—the equilibrium involves mixing: a positive measure of agents is soft and a positive measure of agents is tough.

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1 Introduction

The mechanism through which prices and trade patterns are jointly determined in markets with bilateral meetings has long been a central question in economics. Such markets have been studied through the lens of different models including bargaining models, search models, and network models. An important component of these bilateral trading markets that has received increasing attention in recent years are intermediaries; i.e. agents who acquire the good or asset not (only) for own consumption, but also in the expectation of passing it on to other agents in the market.

Intermediaries are prominent players in a multitude of bilateral markets, including markets for physical goods such as housing and cars, as well as asset markets. The gross market value of outstanding derivative contracts at the end of December 2014 amounted to $21 trillion dollars, the highest level since 2012. These OTC derivatives include securitized products, interest rate swaps, municipal and corporate bonds, as well as foreign exchange instruments. Similar to more traditional brokers, intermediaries in asset markets stand ready to take the opposite side of trades that other market participants want to execute. The traditional view is that by so doing, intermediaries potentially improve the allocation by facilitating trade among market participant, while being (over)compensated for their role.

In this paper, we provide a novel explanation for the emergence of such intermediaries, and argue that the persistent presence of these entities does not guarantee that they have any positive contribution to welfare. We consider a random search model in the spirit of Duffie et al. (2005), and allow agents to have different bargaining powers. When agents with similar bargaining powers meet they share the generated surplus equally, while when agents with different bargaining powers meet the agent with higher bargaining power captures a larger fraction of the surplus. We argue that agents with high bargaining power, tough agents, endogenously arise an intermediaries. This is best understood by re-examining the reasons intermediaries take on assets. Importantly, they are partly motivated by the prospects of reselling the asset on the market, and how they are compensated for such trade. They will be highly compensates if either these future trades generate a large surplus, and/or if they capture a large share of the surplus. When agents have differential bargaining powers, the second mechanism is solely at work: the motive for trade is driven not by generating large surplus, but by capturing a larger part of the same surplus which would anyway be generated even without the intermediaries. As a result, tough agents buy the asset from soft agents (agents with low bargaining power) even if the tough agents do not like the asset, and sell it to soft agents who do like it (as well as other tough agents who like the asset). In this sense, tough agents act as intermediaries. Absent any transaction costs, such longer trading chains do not affect the welfare and serve as a mere redistribution channel. However, if there are any transaction costs, which is the more empirically plausible assumption, this intermediation activity reduces welfare.

Furthermore, we show that when bargaining power is chosen through ex-ante investment, the market features a positive fraction of both soft and tough agents. In other words, not every agent wants to be an intermediary. As we just argued that intermediation by high bargaining power agents destroys welfare, any ex-ante investment in bargaining power is inefficient. Moreover, we show that if agents cannot trade at type contingent prices then trade among tough agents break down, even when one party like the asset better than the other. This introduces a second source of inefficiency: not only there is too much trade among tough and soft agents, but also there is too little trade among tough agents. This market break down is due to a classical adverse selection problem: for a tough buyer, the price set by a tough seller is too high because it is set to extract surplus from soft agents. Finally, we show that this inability to post contingent prices can explain co-existence of OTC markets and centralized exchanges. Tough agents choose to only post prices, which acts as a centralized exchange. Soft agents trade in centralized exchange with tough agents taking the posted prices as given, while they trade with other soft agents on a bilateral basis where they negotiate prices.

The literature on intermediation started by seminal work of Rubinstein and Wolinsky (1987). A large part of the existing literature take the existence of intermediaries as given, and studies the implications for allocations, prices, and efficiency (see Manea (2015); Glode and Opp (2015); Gofman (2011); Duffie et al. (2014); Di Maggio and Tahbaz-Salehi (2014); Wright and Wong (2014) for recent examples). There is a growing literature on the endogenous emergence of intermediaries which provide different rationales for a intermediary sector to arise (Farboodi (2014); Farboodi et al. (2016); Babus and Hu (2015); Chang and Zhang (2015)). We contribute to this literature by providing a new rational for existence of intermediaries, which we further apply to explaining the coexistence of centralized and bilateral trade within the same market.

2 Model

The economy is populated by a measure 1 of agents who have time-varying taste for an asset as in Duffie et al. (2005): When in state h, agents receive a flow value of 1 from holding the asset, when in state l agents receive a flow value of 0. Taste changes stochastically at rate γ so at any point in time half of the agents are in either state. There is a perfectly divisible endowment of the asset of measure $\frac{1}{2}$ and agents asset holdings are restricted to $\{0,1\}$. We call agents whose asset holdings are aligned with their preference state *matched*; otherwise agents are *mismatched*.

Agents meet bilaterally at rate $\tilde{\lambda}$ and have the opportunity to trade each incurring a fixed cost $\frac{c}{2}$. Search is random, that is an individual's meeting partner is randomly drawn from the population. The key deviation we take from the literature in the spirit of Duffie et al. (2005) is that we assume that individuals differ in their abilities to negotiate. In particular, we assume that a fraction μ_s of individuals are soft negotiators and a fraction μ_t are tough negotiators. As is standard in the literature, we assume that when two identical negotiators meet they split the surplus equally. In turn, if a soft type meets a tough type the latter extracts all the surplus. The type of an agent is time-invariant.

Finally, time is continuous, individuals live forever, and discount the future at rate ρ. We restrict attention to steady states.

Equilibrium Trading Pattern

We next show that in this environment, the tough agents arise naturally as intermediators. To do so, we first conjecture the equilibrium trading pattern. We then spell out the value functions and confirm that the conjectured trading pattern is consistent for sufficiently small transaction costs c. Specifically, we conjecture that agents of identical types only trade if doing so aligns their asset holdings with their preferences. In other words, identical types trade when an agents in state h who does not hold the asset meets and agent in state

l who holds the asset. In this event, the state-h agent buys the asset. If the two agents in a meeting are of different types they engage in the same type and direction of trade but they also trade when their current taste is identical. A tough agent acquires the asset from a soft one if both are in state l and sells it to the soft one when both are in state h.[1]

We first validate these claims before turning to a discussion.

Value Functions

Denote by $V_{i,j}$ the value of holding the asset to an agent of type $i \in \{s,t\}$ and current taste $j \in \{l,h\}$ and by $U_{i,j}$ the corresponding value of not holding the asset. Let α_i denote the (endogenous) fraction of types i who are currently mismatched. Given the symmetry of the model, it is easy to verify that $\mu_i \frac{\alpha_i}{2}$ is both the measure of mismatched types i that currently hold the asset and that do not hold the asset. Let $\lambda_i \equiv \tilde{\lambda} \mu_i \frac{\alpha_i}{2}$ denote the frequency at which an individual meets such a type. We then have that

$$\rho V_{s,l} = 0 + \gamma \left(V_{s,h} - V_{s,l}\right) + \lambda_s \frac{1}{2} \left(U_{s,l} - V_{s,l} + V_{s,h} - U_{s,h} - c\right).$$

A soft type in state l that holds the asset receives no flow utility, changes taste stochastically and receives half of the gains from trade if she meets a soft type in state h that holds the asset. She also gives up the asset whenever she meets a tough type but in that case she is held to her outside value since the tough type extracts the full gains from trade. In turn, if the soft type does not hold the asset she never trades while she is in state l and we have that

[1]When characterizing the steady state allocation we make the tie-breaking assumption that when two agents of identical type and taste meet they never trade. Further, we assume that soft-types always trade although they are held to their outside option.

$$\rho U_{s,l} = \gamma\left(U_{s,h} - U_{s,l}\right).$$

It is then helpful to define the net benefit from holding the asset as $\Delta_{i,j} \equiv V_{i,j} - U_{i,j}$. We get

$$\rho \Delta_{s,l} = \gamma\left(\Delta_{s,h} - \Delta_{s,l}\right) + \frac{\lambda_s}{2}\left(\Delta_{s,h} - \Delta_{s,l} - c\right).$$

Proceeding identically for the other three combinations of taste and type, we get

$$\rho \Delta_{s,h} = 1 + \gamma\left(\Delta_{s,l} - \Delta_{s,h}\right) - \frac{\lambda_s}{2}\left(\Delta_{s,h} - \Delta_{s,l} - c\right)$$

$$\rho \Delta_{t,l} = \gamma\left(\Delta_{t,h} - \Delta_{t,l}\right) + \frac{\lambda_t}{2}\left(\Delta_{t,h} - \Delta_{t,l} - c\right) + \lambda_s\left(\Delta_{s,h} - \Delta_{t,l} - c\right) - \lambda_s\left(\Delta_{t,l} - \Delta_{s,l} - c\right).$$

That is, the net value of holding the asset to a tough type with taste l comes with the option value of selling to both tough and soft types of taste h but with the foregone option value of buying from a soft type with taste l. Note that the tough type extracts all surplus from the soft types. Finally,

$$\rho \Delta_{t,h} = 1 + \gamma\left(\Delta_{t,l} - \Delta_{t,h}\right) - \frac{\lambda_t}{2}\left(\Delta_{t,h} - \Delta_{t,l} - c\right) + \lambda_s\left(\Delta_{s,h} - \Delta_{t,h} - c\right) - \lambda_s\left(\Delta_{t,h} - \Delta_{s,l} - c\right).$$

To confirm the conjectured trading pattern holds under sufficiently small c, we next show that

$$\Delta_{s,h} > \Delta_{t,h} > \Delta_{t,l} > \Delta_{s,l}. \tag{1}$$

(2) $$\Delta_{s,h} - \Delta_{s,l} = \frac{1+\lambda_s c}{\rho + 2\gamma + \lambda_s} > 0$$

(3) $$\Delta_{t,h} - \Delta_{t,l} = \frac{1+\lambda_t c}{\rho + 2\gamma + \lambda_t + 2\lambda_s} > 0$$

(4)
$$(\rho+\gamma+2\lambda_s)\left(\Delta_{t,l}-\Delta_{s,l}\right) = -\gamma\left(\Delta_{s,h}-\Delta_{t,h}\right) + \frac{1}{2}\left(\lambda_t\left(\Delta_{t,h}-\Delta_{t,l}\right)+\lambda_s\left(\Delta_{s,h}-\Delta_{s,l}\right)\right) - \frac{c}{2}\left(\lambda_t-\lambda_s\right)$$

(5)
$$(\rho+\gamma+2\lambda_s)\left(\Delta_{s,h}-\Delta_{t,h}\right) = -\gamma\left(\Delta_{t,l}-\Delta_{s,l}\right) + \frac{1}{2}\left(\lambda_t\left(\Delta_{t,h}-\Delta_{t,l}\right)+\lambda_s\left(\Delta_{s,h}-\Delta_{s,l}\right)\right) - \frac{c}{2}\left(\lambda_t-\lambda_s\right)$$

Using that we have already established that $\lambda_t\left(\Delta_{t,h}-\Delta_{t,l}\right)+\lambda_s\left(\Delta_{s,h}-\Delta_{s,l}\right) > 0$, it is straightforward to use this system of equations to verify that both $\Delta_{t,l}-\Delta_{s,l} > 0$ and $\Delta_{s,h}-\Delta_{t,h} > 0$ for c small, for any positive γ.

Inefficient Trades

We next show that the equilibrium displays two distinct sources of inefficiencies. First, all of the pure intermediation trades between agents of identical taste j are inefficient. Second, we show that trade between tough individuals of different type j can break down.

Excessive Intermediation

We first argue that any trades between agents of with identical taste j are inefficient. While we have not yet fully solved the planner's problem, the intuition is straightforward. Consider a meeting between agent (s,l) and (t,l). The previous subsection proves that if the former owns an asset and the latter does not, the two agents trade in equilibrium. To see that this is socially inefficient note that both agents have the same current flow valuation, the same taste-switching rate, and meet agents with a currently high flow valuation for the asset at the same pace. Thus, from a social perspective, the trade is neutral without any transaction cost c. In turn, it follows that for arbitrarily small $c > 0$ such trades are inefficient. Since equation (4) shows that, for small enough c such trades take place, we conclude that there is a range of transaction cost c for which the equilibrium displays excessive intermediation. The argument for trades from (t,h) to (s,h) is exactly equivalent.

Lacking Trades

At this point, we reinterpret the tough individuals as having access to a price posting technology: In particular, we assume that posted prices are non-contingent so tough agents simply post one bid price p_B^j, $j \in \{l,h\}$, in case they do not own the asset and one ask price p_A^j in case they own the asset.[2]

Consider meetings between tough agents of different current taste. Clearly, if their current taste is mismatched with their asset holdings there is room for gains from trade. Such trades, however, do not occur if $p_B^h < p_A^l$. To see why this can be the case, consider

[2] We suspect that the argument goes through if individuals get imperfect signals about their meeting partner's type. For simplicity, we assume here that agents have no information about their partner's type.

a case where there is only a small fraction of tough types. In this case, p_A^l will be set with a focus on extracting all surplus from meetings with types (s,h). In turn, p_B^h will be set so as to attract all surplus from meetings with types (s,l). For simplicity, consider the case where both $\tilde{\lambda}$ and γ are small. In this case, p_B^h goes to zero since tough type buyers hold type (s,l) sellers at their outside option. In turn, p_A^l goes to one, since tough type sellers hold type (s,h) buyers at their outside option. It follows that $p_B^h < p_A^l$ and tough types forgoing socially valuable trading opportunities in order to extract rents from soft types.

Note that this source of inefficiency adds to the inefficiencies pointed out in the prior subchapter. Not only are all intermediated trades inefficient, they here cause socially desirable trading options to break down.

Coexistence of Tough and Soft Agents

We next show that the coexistence of both tough and soft agents is a natural outcome if agents can choose to become tough by making an ex ante investment. In particular, assume that agents can pay a fixed cost $\kappa > 0$ to become tough. To show that an interior fraction μ_t is a natural outcome, consider a deviation both when $\mu_t = 0$ and $\mu_t = 1$. Clearly, if $\mu_t = 1$ a deviation is profitable since a marginal soft type does not alter the prices posted by the tough types. In turn, if $\mu_t = 0$, investing κ has a strictly positive return since it allows one to reap the full gains from trade from virtually every single meeting. While we have not yet proved the continuity of the payoff function we believe an interior solution (for small enough κ) follow naturally.

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