Intermediation as Rent Extraction

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Abstract

This paper develops a theory of asset intermediation as a pure rent extraction activity. Agents meet bilaterally in a random fashion. They differ in their flow value derived from holding the asset and in their ability to strike a good deal in a bilateral meeting. In equilibrium, agents who generically trade at favorable terms emerge as intermediaries. This occurs due to their ability to extract more of the gains from trade when offsetting a mismatched asset positions. We endogenize the extent of such rent-driven intermediation by letting ex-ante homogeneous traders invest in a technology that allows them to commit to take-it-or-leave-it offers. We find that multiple equilibria may emerge, with different levels of intermediation and with lower welfare in equilibria with more intermediation. A decline in trading frictions typically leads to a rise in intermediation and, as a consequence, a decline in welfare. A simple transaction tax can restore efficiency.

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1 Introduction

This paper develops a theory of asset intermediation as a pure rent extraction activity, and studies the determinants of this type of intermediation and its consequences for welfare. Intermediaries in asset markets trade frequently, purchase assets at relatively low prices and sell them at relatively high prices. The standard view—first formalized in Rubinstein and Wolinsky (1987)—is that intermediaries are well-connected entities and sellers are hence willing to trade assets to intermediaries at a discount because it would take them longer to find a buyer on their own. In turn, buyers are willing to purchase assets from intermediaries at a markup because it would take them longer to find a seller on their own. According to this view, intermediaries have access to a superior search technology and, as such, they can charge a bid-ask spreads. This paper takes the opposite view of intermediation: if some agents are better than others at extracting gains from trade, intermediation arises endogenously due to dynamic rent extraction motives. A seller is willing to trade an asset to an intermediary at a low price because, even though it would take her the same amount of time to find a buyer on her own, she would trade at worse terms. Likewise, a buyer is willing to purchase an asset from an intermediary because the intermediary can re-acquire the asset at better terms from other market participants. According to the view advanced in this paper, intermediaries charge bid-ask spreads because they generically trade at favorable terms, which is precisely why they take on their role as middlemen. The aim of the paper is to explore both the positive and normative implications of this view of intermediation as a pure rent extraction activity.

We develop our theory in the context of the textbook asset market model of Duffie, Gârleanu and Pedersen (2005). Specifically, we consider a market populated by heterogeneous agents who trade an asset in fixed supply. The trading process is decentralized and frictional, in the sense that agents need to search the market to find a potential trading partner. Agents are heterogeneous along two dimensions. First, some agents enjoy a high flow payoff when holding the asset, while others enjoy a low flow payoff. Tastes change stochastically generating a sustained motive for trade. Second, some agents are particularly able deal-makers: They can commit to take-it-or-leave-it offers when meeting a trading partner, while others cannot commit and end up either on the receiving end of a take-it-or-leave-it offer or bargaining over the price of the asset. As a consequence, whenever a trader with commitment meets one without, the former extracts all gains from trade. This dimension of heterogeneity is permanent and constitutes the main difference between our model and Duffie, Gârleanu and Pedersen (2005). It implies that market participants differ in their ability to extract rents and is the premise of our theory of intermediation as a rent extraction activity.

The first part of the paper characterizes the properties of equilibrium for given measures of agents with and without commitment. We find that the equilibrium displays a rich pattern
of trade. Unsurprisingly, the equilibrium is such that low-valuation agents sell the asset to high-valuation agents irrespective of their commitment type. More surprisingly, the equilibrium is such that low-valuation agents without commitment sell to low-valuation agents with commitment and high-valuation agents with commitment sell to high-valuation agents without commitment. These transactions have strictly positive gains from trade despite the fact that both buyer and seller have the same fundamental valuation. The gains are thus purely redistributional in nature and arise because the intermediary can offset the trade with a future buyer (or seller) at superior terms.

Thus, agents without commitment act as final users—in the sense that they buy the asset only when they have a high valuation for it and only sell the asset when their valuation falls—and agents with commitment act as intermediaries—in the sense that they buy and sell the asset irrespective of their valuation. Further, agents with commitment buy at lower prices and sell at higher prices than agents without commitment. Agents with commitment act as intermediaries not because they are better at finding trading partners but because they are better at extracting rents. In this sense, our model is a theory of intermediation as a pure rent extraction activity.

Intermediation in our environment is thus neutral with respect to the allocation of the asset across agents with different fundamental desires to hold the asset. As a consequence, the trading pattern in our baseline environment is efficient. However, we discuss several natural extensions which render the equilibrium trading pattern inefficient. In particular, we show that intermediation is inefficient in the presence of transaction costs and if the agents with commitment have an inferior search technology. Intermediation is also inefficient under plausible extensions on the preference side since dynamic rent extraction motives can lead an agent with lower fundamental valuation, yet superior bargaining technology, to acquire an asset.

We proceed by endogenizing the extent of intermediation and rent extraction. To this aim, we let an ex-ante homogeneous population of traders acquire the commitment technology at a cost. We show that the returns to investing in such a technology are hump-shaped in the fraction of agents with commitment. This implies that there may be multiple equilibria with different degrees of intermediation. These equilibria can be welfare ranked, with welfare decreasing in the extent of intermediation. Any equilibrium in which agents spend resources to acquire the commitment technology is inefficient. The reason is that intermediation is a pure rent extraction activity which benefits the intermediary but does not affect the quality of the overall allocation in any way. If agents devote any resources to become intermediaries, equilibrium is inefficient. And the more resources the market devotes to acquiring commitment, the lower is welfare.

Our most surprising findings are with regard to the effect of declining trading frictions. It would seem natural to conjecture that, when trading frictions become smaller, the benefits of a rent extraction technology would decline. After all, in a Walrasian Equilibrium, being able
to extract rents is worthless because perfect competition fully protects buyers and sellers from exploitation. On the contrary, we show that, when trading frictions become smaller, the return from acquiring the commitment technology rises and so does the extent of intermediation. The reason is that the decline in the rents that can be extracted per trade is outweighed by the increase in the frequency at which agents encounter opportunities for rent extraction. This finding suggests that, under the view of intermediation as a rent-extraction activity, one should not expect intermediation to disappear as trading frictions become smaller and smaller because of improvements in information and communication technology. On the contrary, under the view of intermediation as a rent-seeking activity, one can explain the rise of the intermediation sector (see, e.g., Philippon (2015)) as the natural consequence of a decline in trading frictions.

Even more surprisingly, we find that, if all agents face the same cost of acquiring the commitment technology, a decline in trading frictions lowers welfare (as long as the fraction of agents with commitment is interior). That is, the welfare gains created by a decline in trading frictions are more than eroded by the welfare costs associated with the rise of intermediation. As frictions vanish further and further the marketplace reaches a point where all traders acquire the commitment technology. At that point, types without commitment never trade gainfully which implies that aggregate welfare net of the cost of acquiring commitment equals welfare under autarky. Thus, the rent extraction motives in our environment have the potential to render all trading a zero-sum activity.

We show that a very similar logic applies when the flow payoff of an outside asset falls since agents increasingly select into rent extraction activities with the same adverse consequences. This formalizes a novel mechanism through which an environment of low returns affects financial activity in unintended and potentially undesirable ways. ¹

We conclude by studying the effects of introducing a tax on the transactions of the asset. This is a natural exercise since the laissez-faire equilibrium is typically inefficient. We show that the equilibrium pattern of trade depends on the size of the transaction tax. When the tax is relatively small, the pattern of trade is the same as in the laissez-faire equilibrium, with sustained fundamental and intermediated trades. When we increase the tax, the fundamental transactions still take place but intermediation breaks down. When we further increase the tax, all trade collapses. We also show that the transaction tax lowers the return from investing in the commitment technology. For any arbitrary distribution of costs to acquire the commitment technology, the tax that maximizes welfare is such that the after-tax surplus in any fundamental trade is zero. Intuitively, this is the optimal tax level because it reproduces a key feature of Walrasian Equilibrium, namely that the surplus in any particular trade between a buyer and a

¹The argument is distinct, yet similar in spirit, to the “reach for yield” mechanism first developed in Rajan (2006) according to which market participants move towards increasingly risky investment when facing a low risk-free rate.
seller is zero and, thus, investing in a technology to extract more surplus is worthless. The optimal tax does not only maximize welfare, but also implements the first-best allocation.

**Relation to Literature.** The paper contributes to the search-theoretic literature on intermediation initiated by Rubinstein and Wolinsky (1987) and Kiyotaki and Wright (1989). Rubinstein and Wolinsky (1987) study the emergence of intermediation in a product market with search frictions, in which agents might differ with respect to the rate at which they meet others. The main finding is that, in equilibrium, intermediaries (agents who do not produce nor consume the good) are active only if they have a higher meeting rate than final users. Kiyotaki and Wright (1989) discover an alternative theory of intermediation while studying the emergence of commodity money. They show that agents who do not produce nor wish to consume the commodity with the lowest storage cost (the commodity that ends up being used as a medium of exchange) act as intermediaries, as they purchase the commodity from producers only to resell it to consumers.²

A related strand of literature has extended the search-theoretic framework of Duffie, Gârleanu and Pedersen (2005) to focus on intermediation in frictional asset markets. Lagos and Rocheteau (2009) study the equilibrium trading pattern in a version of the baseline model with unrestricted asset holdings focusing on liquidity, trading volume, and bid-ask spreads. We share with them a focus on the impact of trading frictions on the equilibrium allocation. Farboodi, Jarosch and Shimer (2016) study the equilibrium pattern of trade in a version of the baseline model where agents differ with respect to their meeting rate. They also study agents’ choice of a meeting rate and find that, in general, ex-ante identical agents make different choices. Hugonnier, Lester and Weill (2016) study the equilibrium pattern of trade in a version of the baseline model where the agent’s valuation for the asset is a continuous variable. They find that agents with average valuations act as intermediaries, in the sense that they purchase the asset from agents with a lower valuation and sell it to agents with higher valuation. Üslü (2016) considers in a rich unified framework heterogeneity in meeting rates and valuation. Other papers in that vein include Chang and Zhang (2016), Neklyudov (2014), Wang (2017), and Lagos, Rocheteau and Weill (2011).

The paper perhaps closest to ours is Masters (2008). The paper studies a version of the frictional product market of Diamond (1982) in which agents differ with respect to their cost of production and bargaining power. It shows that agents with high costs of production and high

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²Wright and Wong (2014) highlight the many similarities between monetary and intermediation theory. Nosal, Wong and Wright (2015) generalize Rubinstein and Wolinsky (1987) by allowing consumers, producers and intermediaries to differ with respect to bargaining power, meeting rates and holding costs and find conditions under which intermediaries are active in equilibrium, as well as conditions under which intermediation is essential. Nosal, Wong and Wright (2016) push the analysis further by allowing agents to choose in real time whether to be producers or intermediaries.
bargaining power become intermediaries, in the sense that they neither produce nor consume the final good, but rather transfer it from producers to consumers. This is the only paper we know that identifies differences in the ability to extract gains from trade as a motive for intermediation. However, this paper focuses on a product market, where the gains from trade are fundamentally static, rather than on an asset market, where the source of the gains from trade is dynamic. This is why, for instance, in Masters (2008) differences in bargaining power are not enough to create intermediation, while they are in our model. Furthermore, we extend the analysis to entry, identifying novel channels through which intermediation driven by rent extraction may harm welfare.

2 Environment

We consider the market for an indivisible asset. The supply of the asset is fixed and of measure $A = 1/2$. The market for the asset is populated by a measure 1 of heterogeneous agents. An agent’s type is described by a couple $\{i, j\}$, where $i = \{S, T\}$ denotes the agent’s commitment power and $j = \{L, H\}$ denotes the agent’s valuation of the asset. The labels $S$ and $T$ stand for Soft an Tough. The labels $L$ and $H$ stand for Low and High. The first dimension of an agent’s type is permanent. The measure of agents without commitment power $S$ is constant and equal to $\phi_S$, with $\phi_S \in [0, 1]$, and the measure of agents with commitment power $T$ is constant and equal to $\phi_T = 1 - \phi_S$. The second dimension of an agent’s type is transitory. In particular, an agent’s valuation switches at Poisson rate $\sigma > 0$.

An agent can either hold 0 or 1 units of the asset. An agent of type $\{i, j\}$ gets flow utility $u_j$ when holding the asset, with $u_H > u_L$ and $\Delta u \equiv \Delta u$. An agent gets flow utility 0 when she does not hold the asset. Agents have linear utility with respect to a numeraire good, which is used as a medium of exchange in the asset market. Agents discount future utilities at the exponential rate $r > 0$.

Trade is bilateral and frictional. In particular, one agent meets another randomly selected agent at Poisson rate $\lambda > 0$. If the meeting involves two agents with identical asset holdings, there is no opportunity to trade. If an agent with the asset meets an agent without the asset, there is a trading opportunity. The terms of trade depend on the commitment power of the two agents. In particular, if an agent of type $T$ meets an agent of type $S$, the agent of type $T$ makes a take-it-or-leave-it offer to the agent of type $S$. The offer consists of $p$ units of the numeraire good to be exchanged for the ownership of the asset. If two agents of type $T$ meet, one is randomly selected to make a take-it-or-leave-it offer to the other. If two agents of type $S$ meet, they play an alternating-offer bargaining game à la Rubinstein (1982) with a risk of breakdown $\delta > 0$. We assume that the bargaining game takes place in virtual time and we consider the limit for $\delta \to 0$. 

6
A few comments about the environment are in order. We assume that agents are heterogeneous along two dimensions. First, we assume that agents differ with respect to their valuation of the asset and that an agent’s valuation changes over time. The assumption is common in the literature and is meant to capture either literally variation across agents and over time in the utility of the services of the asset or, in reduced-form, variation across agents and over time in the ability to hedge any risk associated with the payoff of the asset. This assumption is the fundamental cause for sustained trade in our environment.

Second, we assume that agents differ with respect to their ability to commit to take-it-or-leave-it offers. The assumption is the main novelty of our environment relative to the previous literature and, as we shall see, it leads to non-fundamental trades. The assumption can be interpreted as saying that some agents can commit to posted prices—because, e.g., they can delegate trade to representatives without the authority to accept/propose any price different from the one pre-specified by the agent—while some agents cannot commit to post prices and, hence, end up bargaining over the terms of trade.\(^3\)

We assume that the measure of the asset is half the measure of the population and that the stochastic process for the agent’s valuation guarantees that, in a stationary equilibrium, exactly half of the agents have either valuation. These assumptions are made for analytical tractability, as they imply that the equilibrium will be symmetric, that is the measure of agents with high valuation who do not hold the asset will be equal to the measure of agents with low valuation who own the asset.

The model is deliberately simple and abstract. Its purpose is to provide a framework in which to think about the effect of heterogeneity in commitment power in a decentralized market. There are many examples of decentralized asset market. One fitting example is the housing markets. In this market, trade is decentralized, agents have different and time-varying utilities from living in a particular house, and some agents—say developers and flippers—may be able to commit to take-it-or-leave-it offers, while other agents may bargain. Another example may be the fine art market. In this market, trade is typically decentralized, agents have different and time-varying valuations for the same piece of art, and some agents—say art gallerists—may be able to commit to take-it-or-leave-it offers. Finally, as pointed out by Duffie, Gârleanu and Pedersen (2005), there are some financial assets (over-the-counter markets) that operate in a decentralized fashion. It is not far-fetched to think that, in these markets, some agents have more commitment power than others.

\(^3\)In section 3, we study the equilibrium of the model taking as given the measure of agents with commitment power. In section 4, we study the equilibrium of the model when agents can acquire the technology to commit to posted prices at some cost.
We look for an equilibrium in which trade follows the pattern illustrated in Figure 1. That is, we look for an equilibrium in which agents of type $S$ constitute the end-user, not buying in state $L$ and not selling in state $H$; and where agents of type $T$ intermediate, buying the asset from type $(S, L)$ and selling it to type $(S, H)$, irrespective of their own current preferences.\footnote{This is the pattern of trade that one would naturally expect to emerge in equilibrium. Certainly, one would expect low-valuation agents to sell the asset to high-valuation ones. However, one would also expect low-valuation agents without commitment to sell the asset to low-valuation agents with commitment, as the latter are better at extracting rents than the former.}

In section 3.1, we spell out the conditions for equilibrium. In section 3.2, we formalize the above intuition and prove that an equilibrium with the pattern of trade illustrated in Figure 1 exists and is unique. In section 3.3, we characterize some of the key properties of equilibrium. In Appendix C, we rule out the existence of any other equilibrium trading pattern. The main finding contained in this section is that, from the model, emerges a theory of intermediation as a pure rent extraction activity. Agents with commitment power act as intermediaries—in the sense that they purchase the asset with the intent of reselling it—while agents without commitment power act as final users—in the sense that they purchase the asset and hold it unless their valuation changes. Agents with commitment power intermediate the asset, not because they are better at finding traders who want to change their asset position, but because they are better at extracting rents from traders who want to change their position.

Figure 1: Pattern of Trade

3 Equilibrium
3.1 Equilibrium Conditions

We denote as $V_{i,j}$ the lifetime utility of type $(i, j)$ when holding the asset and as $U_{i,j}$ the lifetime utility of type $(i, j)$ when not holding the asset. Let $D_{i,j} = V_{i,j} - U_{i,j}$ denote the net value of asset ownership. We denote as $P_{i,j}(n,m)$ the price at which an agent of type $(i, j)$ sells the asset to an agent of type $(n,m)$. Finally, let $\mu_{i,j}$ denote the measure types $(i, j)$ with the asset and $\nu_{i,j}$ the measure of types $(i, j)$ without the asset in the stationary distribution.

Given the pattern of trade in Figure 1, we can show that the stationary distribution is symmetric in the following sense: The measure of agents with valuation $j$ who hold the asset is equal to the measure of agents with opposite valuation valuation $-j$ who do not hold the asset. That is, $\mu_i = \nu_i$ and $\mu_i = -\nu_i$ for $i = \{S, T\}$. We then find it useful to define $\lambda_i$ as $\lambda_i \mu_{i,L}$ and $\hat{\lambda}_i$ as $\lambda_i \mu_{i,H}$. That is, $\lambda_i$ is the rate at which an agent meets a trader of type $i$ who has a low valuation but holds the asset. Since the distribution is symmetric, $\lambda_i$ is also the rate at which an agent meets a trader of type $i$ who has a high valuation but does not have the asset. Similarly, $\hat{\lambda}_i$ is the rate at which an agent meets a trader of type $i$ who has a low valuation and does not hold the asset, as well as the rate at which she meets a trader of type $i$ who has a high valuation and owns the asset.

3.1.1 Soft Agent

The lifetime utility of a type $(S, L)$ agent with the asset satisfies

$$rV_{SL} = u_L + \sigma (V_{SH} - V_{SL}) + \lambda_S (P_{SL}(S, H) + U_{SL} - V_{SL}) + \lambda_T (P_{SL}(T, H) + U_{SL} - V_{SL}) + \hat{\lambda}_T (P_{SL}(T, L) + U_{SL} - V_{SL}).$$

(1)

The agent receives a flow utility $u_L$. At rate $\sigma$, the agent’s valuation of the asset switches from $L$ to $H$. At rate $\lambda_S$, the agent meets a trader of type $(S, H)$ without the asset. When this happens, the agent sells the asset at the price $P_{SL}(S, H)$ and experiences a change in lifetime utility of $U_{SL} - V_{SL}$. The remaining two terms correspond to the meetings with types $T$ in either preference state.

When an agent of type $(S, L)$ meets a trader of type $T$, she is on the receiving end of a take-it-or-leave-it offer. The take-it-or-leave offer is such that the agent is indifferent between selling and keeping the asset. That is, $p_{SL}(T,j) + U_{SL} - V_{SL} = 0$ or, equivalently, $p_{SL}(T,j) = D_{SL}$. When the agent meets a trader of type $(S, H)$, an alternating-offer bargaining game takes place. As it is well-known, the outcome of the alternating-offer bargaining game is a price such that the gains from trade accruing to the seller equal the gains from trade accruing to the buyer, that is $p_{SL}(S,H)$ is $(D_{SH} + D_{SL})/2$. Substituting the equilibrium prices in (1), we obtain

$$rV_{SL} = u_L + \sigma (V_{SH} - V_{SL}) + \lambda_S (D_{SH} - D_{SL})/2.$$  

(2)
Second, consider an agent of type \((S, L)\) who does not hold the asset. The agent’s lifetime utility satisfies the Bellman Equation

\[ rU_{SL} = \sigma (U_{SH} - U_{SL}). \]  

(3)

The agent receives a flow utility 0. At rate \(\sigma\), the agent’s valuation of the asset switches from \(L\) to \(H\). At rate \(\lambda\), the agent meets some trader. No matter whom she meets, the agent does not purchase the asset and her lifetime utility does not change.

Third, consider an agent of type \((S, H)\) who currently holds the asset.

\[ rV_{SH} = u_H + \sigma (V_{SL} - V_{SH}). \]  

(4)

As in (3), none of the agent’s meetings leads to trade.

Finally, consider an agent of type \((S, H)\) who does not have the asset. While she buys the asset from a type \(T\) trader those trades do not affect her lifetime utility. Following the same logic as in (1) she pays a price \(P_{SL}(S, H) = (D_{SH} + D_{SL})/2\) when buying from a type \((S, L)\). We thus obtain

\[ rU_{SH} = \sigma (U_{SL} - U_{SH}) + \lambda_S (D_{SH} - D_{SL})/2. \]  

(5)

Subtracting (3) from (2) and (5) from (4), we find that the net value \(D_{SL}\) of asset ownership for types \(S\) is given by

\[ rD_{SL} = u_L + \sigma (D_{SH} - D_{SL}) + \lambda_S (D_{SH} - D_{SL})/2 \]  

(6)

\[ rD_{SH} = u_H + \sigma (D_{SL} - D_{SH}) - \lambda_S (D_{SH} - D_{SL})/2. \]  

(7)

Thus, the net value of holding the asset for soft agents in state \(L\) recognizes the option value of selling the asset gainfully to a type \((S, H)\). In turn, the net value of holding the asset for soft agents in state \(H\) recognizes the foregone option value of gainfully buying the asset from a type \((S, L)\).

3.1.2 Tough Agent

Next, consider the lifetime utility of an agent of type \((T, L)\) who currently holds the asset,

\[ rV_{TL} = u_L + \sigma (V_{TH} - V_{TL}) \]  

\[ + \lambda_S (P_{TL}(S, H) + U_{TL} - V_{TL}) + \lambda_T (E[P_{TL}(T, H)] + U_{TL} - V_{TL}). \]  

(8)

The agent receives a flow utility \(u_L\). At rate \(\sigma\) the agent’s valuation of the asset switches from \(L\) to \(H\). At rate \(\lambda_S\) the agent sells to a trader of type \((S, H)\) at price \(P_{TL}(S, H)\) and experiences a change in lifetime utility of \(U_{TL} - V_{TL}\). At rate \(\lambda_T\), the agent sells to a trader of type \((T, H)\) at
the expected price $E[P_{TL}(T,H)]$.

Similarly, we have

\[
   r_{UTL} = \sigma (U_{TH} - U_{TL}) + \lambda_S (-P_{SL}(T,L) + V_{TL} - U_{TL}).
\]

\[
   r_{VTH} = u_H + \sigma (V_{TL} - V_{TH}) + \lambda_S (P_{TH}(S,H) + U_{TH} - V_{TH}).
\]

\[
   r_{UTH} = \sigma (U_{TL} - U_{TH})
\]

\[
   + \lambda_S (P_{SL}(T,H) + V_{TH} - U_{TH}) + \lambda_T (E[P_{TL}(T,H)] + V_{TH} - U_{TH}).
\]

When an agent of type $(T,j)$ purchases the asset from a trader of type $(S,L)$, she advances a take-it-or-leave-it offer that makes the type $S$ indifferent between selling and keeping the asset. That is, $p_{SL}(T,j) + U_{SL} - V_{SL} = 0$ or, equivalently, $p_{SL}(T,j) = D_{SL}$. Similarly, when an agent of type $(T,j)$ sells the asset to an agent of type $(S,H)$, she advances a take-it-or-leave-it offer that leaves the type $S$ indifferent between buying and not buying. That is, $-p_{T,j}(S,H) + V_{SH} - U_{SH} = 0$ or, equivalently, $p_{T,j}(S,H) = D_{SH}$. When an agent of type $(T,L)$ sells the asset to a trader of type $(T,H)$, the price depends on who gets to make the take-it-or-leave-it offer. If the seller makes a take-it-or-leave-it offer, the price is such that $-p + V_{TH} - U_{TH} = 0$. If the buyer makes a take-it-or-leave-it offer, the price is such that $p + U_{TL} - V_{TL} = 0$. Since the seller and the buyer are equally likely to make the offer, the expected price is $E[P_{TL}(T,H)] = (D_{TH} + D_{TL})/2$.

Subtracting (9) from (8) and (11) from (10) and substituting in the equilibrium prices, we find that the net value of holding the asset for types $T$ are given by

\[
   r_{D_{TL}} = u_L + \sigma (D_{TH} - D_{TL})
\]

\[
   + \lambda_S (D_{SH} - D_{TL}) + \lambda_T (D_{TH} - D_{TL})/2 - \lambda_S (D_{TL} - D_{SL})
\]

\[
   r_{D_{TH}} = u_H + \sigma (D_{TL} - D_{TH})
\]

\[
   + \lambda_S (D_{SH} - D_{TH}) - \lambda_T (D_{TH} - D_{TL})/2 - \lambda_S (D_{TH} - D_{SL}).
\]

The net value from holding the asset is thus given by the agent’s flow utility, $u_j$, plus the change in net value when the agent’s preferences change, plus the value of the option to sell the asset, net of the foregone option to buy the asset.

### 3.1.3 Individual Rationality

We show in Appendix A that the pattern of trade described in Figure 1, and assumed in the Bellman Equations for agents of type $S$ and $T$, is consistent with the individual rationality of buyers and sellers if and only if

\[
   D_{SL} \leq D_{TL} \leq D_{TH} \leq D_{SH}.
\]
In words, the pattern of trade is consistent with individual rationality if and only if the joint surplus in each transaction is positive.

3.1.4 Stationary Distribution

The distribution is stationary if and only if the measure of agents who, during any interval of time, become asset (non-)holders of type \((i, j)\) equals the measure of agents who, during the same interval of time, cease to be asset (non-)holders of type \((i, j)\). In addition, the distribution of agents in the market must be consistent with the measure of agents with commitment power \(S\) and \(T\) and with the measure of the asset circulating in the market.

The inflow-outflow equation for the group of agents of type \((T, L)\) who do not hold the asset is

\[
\nu_{TL} [\sigma + \lambda \mu_{SL}] = \nu_{TH} \sigma + \mu_{TL} \hat{\lambda} (\nu_{TH} + \nu_{SH}).
\] (15)

The left-hand side of (15) is the flow out of the group, which is given by the measure of agents of type \((T, L)\) who purchase the asset or whose valuation switches from \(L\) to \(H\). The right-hand side is the flow into the group, which is given by the sum of two terms. The first term is the measure of agents of type \((T, H)\) without the asset whose valuation switches from \(H\) to \(L\). The second term is the measure of agents of type \((T, L)\) who own the asset and sell it.

There are 7 additional inflow-outflow equations for types \(T\) and \(S\) in either asset position and preference state. As these equations are analogous to (15) we relegate them to Appendix B.

The stationary distribution also needs to satisfy the following adding-up constraints:

\[
\sum_{j=\{L,H\}} (\mu_{T,j} + \nu_{T,j}) = \phi_T, \quad (16)
\]
\[
\sum_{j=\{L,H\}} (\mu_{S,j} + \nu_{S,j}) = \phi_S, \quad (17)
\]
\[
\sum_{j=\{L,H\}} (\mu_{S,j} + \mu_{T,j}) = 1/2. \quad (18)
\]

The first two constraints state that the overall measure of agents of type \(j\) must equal \(\phi_j\). The last constraint states that the overall measure of agents holding the asset must equal the measure of the asset in circulation, assumed to be \(1/2\).

3.1.5 Definition of Equilibrium

We are now in the position to define a stationary equilibrium.

Definition 1 A stationary equilibrium in which trade follows the pattern illustrated in Figure 1 is given by the agents’ net values for holding the asset \(\{D_{ij}\}\), the distribution of agents in the market \(\{\mu_{i,j}, \nu_{i,j}\}\) such that:

(i) Individual rationality of trade: \(\{D_{ij}\}\) satisfies equations (6)-(7) and (12)-(13) and condition (14);
(ii) Stationarity of the distribution: \( \{\mu_{i,j}, \nu_{i,j}\} \) satisfies equations (15)-(18) and the remaining flow-balance expressions (44)-(50).

### 3.2 Existence and Uniqueness of Equilibrium

The first step in establishing the existence of equilibrium is to verify the conditions for the individual rationality of the pattern of trade. To this aim, consider the gains from trade between \((S, H)\) when seeking the asset and \((S, L)\) when owning the asset. From (6) and (7), it follows those are given by

\[
D_{SH} - D_{SL} = \frac{\Delta u}{r + 2\sigma + \lambda_S} > 0. 
\]  

The net value of the trade captures the difference in the valuation of the asset between the buyer and the seller, \(\Delta u\), capitalized by a factor reflecting the rate of time preference \(r\), the fact that both agents’ valuation of the asset varies over time, and the fact that both agents have the outside option to gainfully trade with another type \(s\) trader in the future. Specifically, the buyer gives up the opportunity of purchasing the asset from \((S, L)\), capturing half of the gains from that trade. The seller gives up the opportunity of selling the asset to \((S, H)\), capturing half of the gains from that trade.

Likewise, from (12) and (13), it follows that the gains from trade in a transaction between two types \(T\) with different valuation are given by

\[
D_{TH} - D_{TL} = \frac{\Delta u}{r + 2\sigma + 2\lambda_S + \lambda_T} > 0. 
\]  

The difference in the capitalization factors in (19) and (20) implies that \(D_{TH} - D_{TL} < D_{SH} - D_{SL}\). This reflects that types \(T\) have better outside options: they forgo the outside option to trade—at better terms—with types \(S\) and the outside option to trade gainfully with other types \(T\).

Finally, using (6)-(7) and (12)-(13), it is immediate to show that

\[
D_{TL} - D_{SL} = D_{SH} - D_{TH} = \frac{1}{2} \left[ \frac{\lambda_T (D_{TH} - D_{TL}) + \lambda_S (D_{SH} - D_{SL})}{r + 2\sigma + 2\lambda_S} \right] > 0. 
\]  

We emphasize that the buyer and the seller in these transactions have the same intrinsic valuation for the asset. However, the gains from trade are positive because a type \(T\) can extract more rents than \(S\) going forward.

Specifically, \((T, L)\) buys from \((S, L)\) because she can sell at better terms to agents in state \(H\): She can capture half rather than none of the gains from trade when selling to \((T, H)\). Similarly, \((T, L)\) can capture all rather than half of the gains from trade when selling to \((S, H)\). The same logic applies when \((T, H)\) sells to \((S, H)\). She can capture half rather than none of the gains from trade when re-buying from \((T, L)\). Similarly, \((T, H)\) can capture all rather than half of the
gains from trade when re-buying from \((S, L)\). Given the symmetry of the model, the gains from trade \(D_{SH} - D_{TH}\) are equal to \(D_{TL} - D_{SL}\). Hence, condition (i) in the definition of equilibrium is satisfied and the pattern of trade is individually rational.

The second step in establishing the existence of equilibrium is to show the existence of a distribution of agents \(\{\mu_i, j, \nu_i, j\}\) that satisfies the stationarity and adding-up conditions. To this end, we begin by noting that half of the measure of agents of type \(i\) is in either preference state,

\[
\mu_{i,L} + \nu_{i,L} = \mu_{i,H} + \nu_{i,H} = \phi_i/2, \text{ for } i = \{S, T\}.
\]

This follows directly from the symmetry of the taste-switching process.\(^5\) Furthermore, the measure of agents of type \((i, L)\) with the asset is the same as the measure of agents of type \((i, H)\) without the asset,

\[
\mu_{i,L} = \nu_{i,H}, \text{ for } i = \{S, T\}.
\]

Importantly, this implies that the two types of “misallocation”—agents with a high desire for the asset who do not own it and agents with a low desire who do—are equally common.\(^6\) Next, the measure of agents of type \((S, L)\) with the asset is given by

\[
\mu_{SL} = \sqrt{\left(\frac{\sigma}{\lambda}\right)^2 + \frac{\sigma}{2\lambda} + \frac{\phi_T^2}{16} - \left(\frac{\sigma}{\lambda} + \frac{\phi_T}{4}\right)}.
\]

Notice that \(\mu_{SL}\) is between 0 and \(\phi_S/4\)—which captures random assignment of the asset. The reason is that a measure \(\phi_S/2\) has valuation \(L\). If half of those agents hold the asset it implies that asset holdings and preferences are disconnected. As one would have expected, \(\mu_{SL}\) converges to zero when the ratio \(\sigma/\lambda\) goes to zero, that is when frictions vanish. Also as expected, \(\mu_{SL}\) converges to \(\phi_S/4\) when \(\sigma/\lambda\) goes to infinity, that is when frictions are prohibitive.\(^7\)

Finally, we notice that the measure of agents of type \((T, L)\) with the asset is given by

\[
\mu_{TL} = \frac{\phi_T}{4} + \sqrt{\left(\frac{\sigma}{\lambda}\right)^2 + \frac{\sigma}{2\lambda} - \left(\frac{\sigma}{\lambda} + \frac{\phi_T}{4}\right)}.
\]

Again, we have that \(\mu_{TL}\) is between 0 and \(\phi_T/4\). Likewise, \(\mu_{TL}\) converges to zero when \(\sigma/\lambda\) goes to zero and \(\mu_{TL}\) converges to \(\phi_T/4\) when \(\sigma/\lambda\) goes to infinity.\(^8\)

Clearly, the distribution of agents \(\{\mu_{i,j}, \nu_{i,j}\}\) in (22)-(24) is the only one that may satisfy

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\(^5\)Formally, the result can be obtained by combining the inflow-outflow equations for agents of type \((i, j)\) with and without the asset and by using the adding up constraints (16) and (17).

\(^6\)Intuitively, the result follows from the symmetry of the environment and of the pattern of trade. Formally, the result is derived by combining the inflow-outflow equations for agents of type \((i, L)\) with the asset and for agents of type \((i, H)\) without the asset and by using the symmetry of the preference shock and the fact that there is a measure \(\frac{1}{2}\) of the asset in circulation.

\(^7\)The expression is obtained from the inflow-outflow equation for \(\mu_{SL}\) reported in Appendix equation (45) using \(\mu_{SH} = \frac{\phi_T}{2} - \mu_{SL}\) and \(\nu_{TL} + \nu_{TH} + \nu_{SH} = \phi_T/2 + \mu_{SL}\).

\(^8\)The above expression is obtained by summing (45) and (46) and using the fact that \(\nu_{SH} + \nu_{TH} = \mu_{SL} + \mu_{TL}\).
the stationarity conditions and the adding-up constraints listed in condition \( ii \) in the definition of equilibrium. Moreover, it is immediate to verify that this distribution does indeed satisfy condition \( ii \) in the definition of equilibrium. Finally, since \( \mu_{SL} = \nu_{SH} \) and \( \mu_{TL} = \nu_{TH} \), we have verified the conjecture that the stationary distribution is symmetric.

We have thus established the existence and uniqueness of a stationary equilibrium in the asset market with the pattern of trade illustrated in Figure 1. In Appendix C, we rule out the existence of stationary equilibria with a different pattern of trade within the class of symmetric equilibria. Taken together, this proves

**Proposition 1: Market equilibrium**

(i) There exists a stationary equilibrium with the pattern of trade described in Figure 1.

(ii) There exists no other stationary symmetric equilibrium.

### 3.3 Properties of Equilibrium

We have thus established that types \( S \) behave as final users of the asset, in the sense that they only purchase the asset when their valuation is high, and they only sell the asset when their valuation is low. In contrast, agents \( T \) use their commitment power to gainfully intermediate the asset. They are intermediaries in the sense that they buy the asset even when their valuation is low in order to sell it to someone with a high valuation, and they sell the asset even when their valuation is high in order to buy another unit of the asset from someone with a low valuation.

We now discuss key properties of this marketplace where intermediation is driven by rent extraction motives.

#### 3.3.1 Efficiency

In the next section, we demonstrate how inefficiency emerges when the decision to acquire commitment power is endogenous. Here, we point to sources of inefficiency when the fraction of agents with commitment power is taken as given.

The equilibrium trading is efficient in the sense that it maximizes the sum of the agents’ lifetime utilities if and only if, in any meeting, the asset is given to the agent who has the higher flow payoff from holding it.\(^9\) This follows from the absence of any other dimension of heterogeneity and can readily be verified. The equilibrium trading pattern satisfies this criterion and is hence efficient.

We in turn discuss three simple and natural extensions of the baseline model which leave the equilibrium trading pattern unaltered yet render it inefficient. In each case, the inefficiency

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\(^9\)Put differently, a planner choosing a trading pattern so as to maximize the average flow payoff in the marketplace would dictate that \( L \) always trades towards \( H \) and would be indifferent about all other trades.
is a consequence of the following observation: A trade between agents of identical fundamental
taste for the asset leaves the quality of the allocation unchanged. It neither changes the assets
static payoff nor its expected allocation going forward. Thus, the transaction has no social value
and its private value—if positive—is entirely redistributational and derives from the dynamic rent
extraction motives discussed above.

**Inefficient Trades 1—Transaction Cost:** We maintain all assumptions made thus far but
assume that whenever two agents trade each incurs a resource cost $c$ in terms of the numeraire
good. Appendix D.1 offers the corresponding expressions which govern the trading pattern. It is
straightforward to see that for $c$ small enough the equilibrium trading pattern is unaltered. The
reason is simply that whenever two types with identical fundamentals trade the private gains
from the transaction are strictly positive. Thus, we can always find strictly positive $c$ small
enough such that our benchmark trading pattern is unaltered.

By the same virtue as above, however, a planner would now ask agents with identical prefer-
ences not to trade. The reason is that such trades are still neutral for the quality of the allocation
but now involve real resource costs. As a consequence, as long as $c$ is positive yet small enough
for the full equilibrium trading pattern to be sustained the equilibrium is inefficient.

**Inefficient Trades 2—Preferences:** We maintain the assumption made in the baseline model
but assume that types $T$ desires the asset slightly less than $S$ when in state $L$ and slightly more
when in state $H$. Let $u^T_j$ be the flow utility of type $i$ when in state $j$. The above assumption
responds to $u^T_L = u^S_L - \varepsilon$ and $u^T_H = u^S_H + \varepsilon$ so we have that $u^T_L < u^S_L < u^S_H < u^T_H$. The ineffi-
ciency of the equilibrium trading pattern under this specification is immediate from this chain
of inequalities. Appendix D.2 derives the expressions governing the pattern of trade under this
modification. Using those it is immediately clear that for $\varepsilon$ small enough the full equilibrium
trading pattern is unchanged.

Under this modification of preferences, whenever two traders who are both in state $L$ or $H$
trade, the transaction involves a strict deterioration of the allocation. The buyer of the asset
desires to hold it less and the transaction does nothing to improve the future allocation of the
asset. As a consequence, for $\varepsilon$ positive yet small enough for the full equilibrium trading pattern
to be sustained the equilibrium is inefficient.

While we have illustrated this force in a stylized modification it is easy to see that the
same forces are present in a very general setting. To this end, consider an environment as
in Hugonnier, Lester and Weill (2016) where traders draw their time varying taste in an i.i.d.
fashion from a continuous distribution. A type $S$ asset owner with current flow value $u^S$ would

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10We chose this modification for expositional simplicity. We argue below that the case for inefficiencies driven
by a richer set of preferences is fairly general.
(efficiently) sell to a type $T$ non-owner with higher flow value $u^T \geq u^S$. But the same rent extraction forces would also lead to an inefficient transaction for a range of tastes $u^T < u^S$. Clearly, all such transaction would strictly deteriorate the allocation despite generating private gains from trade. Thus, intermediation as rent extraction naturally leads to inefficient trades in settings with more general preferences.

**Inefficient Trades 3—Search Technology:** The final modification we consider is one where types $T$ have a worse search technology. In particular, we consider a case where types $T$ meet trading partners at relative frequency $\bar{\sigma}$ with $\frac{1}{2} \leq \bar{\sigma} < 1$. Appendix D.3 derives the expressions governing the trading pattern for the general case but the result is perhaps easiest understood by considering the gains from trade when $(S,L)$ sells to $(T,L)$ and $\bar{\sigma} = \frac{1}{2}$, that is types $T$ contact others at half the frequency compared to types $S$. In this case, the value of the transaction is

$$D_{TL} - D_{SL} = \frac{1}{4} \left[ \frac{\lambda_T (D_{TH} - D_{TL})}{r + 2\sigma + \lambda_S} \right] > 0,$$

where $\lambda_i$ now denotes the rate at which types $S$ contact mismatched types $i$ with opposite asset position. By comparison with (21) the intuition becomes clear. Types $S$ contact types $(S,H)$ twice as often but only extract half of the gains from trade, canceling the second term in (21). Types $S$ also contact types $(T,H)$ twice as often but do not share any of the gains from trade. In turn, a type $(T,L)$ can gainfully sell to $(T,H)$ which is why—despite being far slower—she obtains the asset from $(S,L)$. Thus, agents with commitment power will continue to intermedi-ate even in cases where they have a far inferior search technology leaving room for potentially large efficiency losses driven by rent extraction.

**3.4 Bid-Ask Spreads and Pricing**

To study the bid-ask spread at which types $T$ intermediate we study the prices at which the different pairs trade,

$$P_{T,j}(S,H) = \frac{u_H + u_L}{2r} + \frac{1}{2} \frac{\Delta u}{r + 2\sigma + \lambda_S}$$

$$P_{S,L}(T,j) = \frac{u_H + u_L}{2r} - \frac{1}{2} \frac{\Delta u}{r + 2\sigma + \lambda_S}$$

$$EP_{TL}(T,H) = P_{SL}(S,H) = \frac{u_H + u_L}{2r}.$$

The average market price for the asset is $(u_H + u_L)/2r$, which is the value of keeping the asset indefinitely given the average valuation, $(u_H + u_L)/2$. When two identical types trade the asset

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11 This could be a natural outcome when market participants can choose to invest in either search or bargaining skills.
in a transaction driven by fundamentals this is the price they trade at.\footnote{For types T this is of course only true in expectation. The actual price at which types T trade with each other depends on who gets to make the take-it-or-leave-it offer.}

On the other hand types T buy from type S asset owners at a discount and sell at a markup. In other words, the periphery of the trading network pays a bid-ask spread when being intermediated through the core. The rent-extraction nature of the bid-ask spread is evident from the observation that types T do nothing to accelerate the transmission of the asset towards agents in state H. The bid-ask spread is given by

$$\frac{\Delta u}{r + 2\sigma + \lambda S}.$$ 

Naturally, the spread is increasing in the static net gains from reallocating the asset from a type L to a type H. The gains from reallocating the asset are also lower when agents are less patient and when they switch their taste frequently. Most importantly, the bid-ask spread rises when types S have few opportunities to gainfully trade with one another, that is when $\lambda_S$ is low.

Finally, we point out that intermediaries set prices, while final users either take prices as given or bargain over prices. Indeed, agents of type T make take-it-or-leave-it offers—which means that they post prices which depend on the identity of the counterparty. Agents of type S either are on the receiving end of take-it-or-leave-it offers—which means that they take prices as given—or they bargain over the terms of trade.

In summary, our baseline model formalizes a theory of intermediation driven by pure rent extraction motives. While the trading pattern is efficient in our baseline model several plausible and simple extensions render it inefficient. The core of the trading network makes prices while the periphery takes prices and intermediaries extract rents through bid-ask spreads which depend on how isolated the periphery is.

## 4 Extent and Determinants of Intermediation

In this section, we endogenize the measure of agents who commit to posted prices and thus the extent of intermediation through rent extraction. We assume that, before entering the market, agents are homogeneous but can acquire the superior bargaining technology at a cost. This could be a technology that allows the agent to delegate all negotiations to a representative that is given no authority over pricing decision. Alternatively, this could be a technology that allows the agent to make her transaction history public and, in turn, allows the agent to build a reputation for commitment.

These examples tightly connect with the specifics of the environment modeled above. We point out, however, that the results we have highlighted thus far are simply a consequence of one
type of agent receiving more than half of the surplus when trading with the other type of agent. Thus, the basic mechanism at play admits a far broader interpretation of the costly acquisition of a superior bargaining technology. It could, for instance, represent the resource costs associated with an individual taking classwork in negotiation skills, it could represent the resource cost of buying and reading books about the art of deal-making, or it could represent the utility losses from being considered an aggressive dealmaker.\footnote{The Harris Survey of 2014 on occupational prestige lists “real estate broker” at the very bottom of 23 occupations in the survey. Ranks 20-22 are taken by “banker”, “stockbroker” and “union leader”, the latter by definition an occupation that is all about negotiations (\cite{Harris-Poll (2014))}. The same poll in 1978 has “salesman” on its bottom rank (\cite{Harris-Poll (1978)}).

We begin by computing the returns to acquiring the commitment technology in section 4.1. In section 4.2, we compute the equilibrium measure of agents who choose to acquire commitment power and, hence, to act as intermediaries in the asset market. We show that, in general, there are multiple equilibria with different degrees of intermediation and equilibria with more intermediation are associated with lower welfare. Section 4.3 offers comparative statics. First, we consider the effect of a decline in trading frictions and show that, as trading frictions fall, the equilibrium measure of intermediaries increases. At the unique stable interior equilibrium with both types present a reduction in search friction is associated with a decline in welfare. Second, we consider the effect of a decline in the opportunity cost of acquiring commitment power.

4.1 Benefit and Cost of Commitment

In order to sidestep issues related to transitional dynamics, we carry out the analysis in the limit for \( r \) going to zero. As a consequence, agents do not concern themselves with the initial allocation of the asset.\footnote{An alternative approach would be to initiate the marketplace in steady state. The results would be identical.}

4.1.1 Benefit of Commitment

In order to measure the benefit of commitment power, we need to solve for the lifetime utility of agents of type \( T \) and \( S \). The annuitized lifetime utility for an agent of type \((S, j)\) without the asset is

\[
 rU_{S,j} = \lambda_S (D_{SH} - D_{SL})/4. \tag{25}
\]

The above expression is obtained by solving equations (3) and (5) with respect to \( U_{SL} \) and \( U_{SH} \). Conditional on her valuation being \( L \) the agent enjoys a flow utility of zero and no capital gains since she never buys. Conditional on her valuation being \( H \), the agent enjoys a flow utility of zero and an annuitized capital gain of \( \lambda_S (D_{SH} - D_{SL})/2 \) from buying. The annuitized lifetime utility of an agent of type \( S \) is a weighted average of those payoffs. In the limit for \( r \to 0 \), the
weights in the average are equal, as the agent spends fifty percent of her time in either state in the long run.

The expression for $V_{S,j}$ along with the corresponding expressions for types $T$ can similarly be derived and interpreted. They are reported in Appendix E.

From (25) and (51-53), it follows that the net benefit $B$ from being $T$ rather than $S$ is the same whether the agent enters the market with a valuation of $L$ or $H$ and whether the agent enters the market holding the asset or not. That is, $B = r(V_{T,j} - V_{S,j}) = r(U_{T,j} - U_{S,j})$ for $j = \{L, H\}$, a consequence of agents being patient, $r \to 0$. The net benefit $B$ of commitment is given by

$$B = \left[ \lambda_S (D_{SH} - D_{SL}) + \lambda_T (D_{TH} - D_{TL}) \right] / 4. \tag{26}$$

The first term on the right-hand side of (26) is the average of the additional rents that an agent can obtain by buying or selling the asset to a trader of type $S$ if she has commitment power rather than not. These additional rents are equal to the meeting rate $\lambda_S$ times 1/4 of the gains from trade $D_{SH} - D_{SL}$. The second term captures the additional rents that an agent can obtain by trading with a type $T$ if she has commitment power rather than not.

Substituting the gains from trade $D_{SH} - D_{SL}$ and $D_{TH} - D_{TL}$ with equations (19) and (20), we can rewrite $B$ as

$$B = \left\{ \frac{\lambda_S}{2\sigma + \lambda_S} + \frac{\lambda_T}{2\sigma + 2\lambda_S + \lambda_T} \right\} \frac{\Delta u}{4}, \tag{27}$$

where, using the flow-balance equations in Appendix B the meeting rates $\lambda_S$ and $\lambda_T$ are respectively given by

$$\lambda_S = \sqrt{\sigma^2 + \lambda\sigma / 2 + (\lambda \phi_T)^2 / 16} - (\sigma + \lambda \phi_T / 4), \tag{28}$$
$$\lambda_T = \frac{\lambda \phi_T}{4} + \sqrt{\sigma^2 + \lambda\sigma / 2 - \sigma^2 + \lambda\sigma / 2 + (\lambda \phi_T)^2 / 16}. \tag{29}$$

The expression in (27), together with (28) and (29), gives us the benefit $B$ of commitment power as a function on the measure $\phi_T$ of agents of type $T$. We can show that $B$ is strictly increasing in $\phi_T$ over the interval $(0, \phi_T^*)$ and strictly decreasing in $\phi_T$ over the interval $(\phi_T^*, 1)$, where $\phi_T^* \in (0, 1)$. Moreover, we can show that $B$ attains its maximum value $b_h$ for $\phi_T = \phi_T^*$ and its minimum value $b_l$ for $\phi_T = 0$ and $\phi_T = 1$. The properties of $B$ as a function of $\phi_T$ are illustrated in Figure 2 below.

The finding that the benefit of commitment are non-monotonic in the fraction of traders who have commitment is somewhat surprising. In order to understand this finding, it is useful to differentiate $B$ with respect to $\lambda_T$ (which is monotonically increasing in $\phi_T$) taking into account that $\lambda_S$ is equal to the difference between a constant and $\lambda_T$. Formally, we have
\[
\frac{dB}{d\lambda_T} = \left[ \left( \frac{1}{2\sigma + 2\lambda_S + \lambda_T} - \frac{1}{2\sigma + \lambda_S} \right) + \left( \frac{\lambda_S}{(2\sigma + \lambda_S)^2} + \frac{\lambda_T}{(2\sigma + 2\lambda_S + \lambda_T)^2} \right) \right] \Delta \mu  \cdot 4.
\]

The first two terms on the right-hand side capture a composition effect. A higher \(\lambda_T\) increases the rate at which the agent meets traders of type \(T\) and lowers the rate at which the agent meets traders of type \(S\). This effect reduces the returns to commitment for the following reason: The expected net value of a meeting falls when a type \(S\) participant gets replaced by a type \(T\) trader because those have a better outside option. Since the returns to commitment derive from extracting a larger share of the net value of a meeting this composition effect is negative and lowers the returns to commitment.

The third and fourth term capture a price effect. Whenever the fraction of types \(T\) in the marketplace increases the outside option of all traders deteriorates. As a consequence the net value of any transaction increases and being able to extract a larger share hence becomes more valuable which is why this effect increases the returns to commitment.

The hump-shape implies that the price effect dominates for small \(\phi_T\) while the composition effect dominates for large \(\phi_T\). It is instructive to note that the price effect is the same at the corners, that is when either all traders are \(T\) or \(S\). In words, when everyone is \(S\), the effect on prices when replacing one marginal trader with a type \(T\) is exactly symmetric to that when everyone is \(T\) and one marginal trader gets replaced with an \(S\). This symmetry seems very natural in the context of the observation that allocations and average prices are exactly identical at the two corners. On the other hand, the composition effect is not symmetric. Evaluating the composition effect at the corners shows that the returns to commitment suffer more from adding types \(T\) when types \(S\) are having a particularly bad outside option. Finally, we point out that \(B\) must be the same at the two corners: If everyone is \(S\) a marginal \(T\) receives all, instead of half of the surplus of any meeting. If everyone is \(T\) an agent with commitment power receives half, instead of none of the surplus in every meeting. Taken together, these observations illustrate why the returns to commitment are non-monotonic.

**4.1.2 Cost of Commitment**

We assume that individuals at time zero have the option to permanently acquire the superior bargaining technology at some flow cost. The main body of the paper assumes that the cost correspondence is perfectly inelastic, that is every agent faces the same cost \(c > 0\) for acquiring commitment power.

The specification is interesting because it captures the view that commitment power is a technology that can be acquired by any agent at the same cost and that intermediaries and final users in the asset market are, from an ex-ante perspective, identical. This specification is
illustrated in Figure 2 below.

However, the cost of acquiring commitment power may well vary from agent to agent or it may be an innate trait rather than a technology that can be acquired at a cost. In order to accommodate a more general case, Appendix F considers a generic distribution $F(c)$ of costs of acquiring commitment power.

4.2 Equilibrium and Welfare

An interior fraction $\phi_T \in (0, 1)$ of agents with commitment power is an equilibrium if and only if the benefit of commitment, $B(\phi_T)$, equals the cost $c$. The absence of any types $T$, $\phi_T = 0$, is an equilibrium if $B(0) \leq c$. And the case where all agents have commitment power, $\phi_T = 1$ is an equilibrium if $B(1) \geq c$.

Figure 2 illustrates the set of equilibria graphically. If the common cost of commitment $c$ exceeds the minimum benefit of commitment, $b_l$, and falls below the maximum benefit of commitment, $b_h$, there are three equilibria. In the first equilibrium (marked as $E_1$), we have $\phi_{T,1} = 0$. In this equilibrium, none of the agents acquires commitment power since the cost exceed the returns and, hence, the asset market is not intermediated. In the second equilibrium (marked as $E_2$), cost and returns are equated and the measure of type agents $T$ is $\phi_{T,2} > \phi_{T,1}$. In this equilibrium, a relatively small fraction of agents acquire commitment power and act as an intermediary in the asset market. In the third equilibrium (marked as $E_3$), cost and benefits are likewise equated and the measure of agents of type $T$ is $\phi_{T,3}$, with $\phi_{T,3} > \phi_{T,2}$ and $\phi_{T,3} < 1$. In this equilibrium, a relatively larger fraction of agents acquire commitment power and act as intermediary. If the cost of commitment is small enough—specifically smaller than $b_l$—there is a unique equilibrium in which all agents choose to acquire commitment power. Similarly, if the cost of commitment is high enough—specifically greater than $b_h$—there is a unique equilibrium in which none of the agents chooses to acquire commitment power.

Thus, for a range of cost there are multiple equilibria, some of which are interior in the sense that they have types $T$ and $S$ coexist despite agents being ex-ante homogeneous. The multiplicity arises due to the inversely U-shaped benefits from commitment. As discussed above, the non-monotonicity in the incentives to acquire commitment follows from the fact that the composition effect from replacing types $S$ with types $T$ is particularly large when types $S$ are in a weak spot, that is when $\phi_T$ is large.

We highlight that not all equilibria are stable. Using a standard heuristic argument, we say that an equilibrium $\phi_T^*$ is stable if—at $\phi_T^*$—the derivative of the benefit of commitment with respect to $\phi_T$ is smaller than the derivative of the cost of commitment with respect to $\phi_T$. Conversely, we say that an equilibrium $\phi_T^*$ is unstable if the derivative of the benefit of commitment is greater than the derivative of the cost of commitment. The rationale behind this
Figure 2: Equilibrium Intermediation: Inelastic cost

notion of stability is that, if one were to exogenously throw into the market an extra \( \epsilon \) of agents of type \( T \), these agents would be worse off in a stable equilibrium, while they would be better off in an unstable one. Using this notion of stability, it is immediate to see that \( E_1 \) and \( E_3 \) are stable while \( E_2 \) is not. This is why, in the comparative statics below, we focus attention on the unique stable interior equilibrium \( E_3 \).

We summarize our findings in the following proposition.

**Proposition 2.** Equilibrium measure of intermediaries

(i) if \( c \in [0, b_I) \), there is a unique equilibrium with \( \phi_T = 1 \);

(ii) if \( c \in (b_I, b_H) \), there are three equilibria with \( 0 = \phi_{T,1} < \phi_{T,2} < \phi_{T,3} < 1 \);

(iii) if \( c > b_H \), there is a unique equilibrium with \( \phi_T = 0 \).

Note that the proposition omits two cases because they are knife-edge. First, if \( c = b_I \), there are two equilibria with \( 0 = \phi_{T,1} < \phi_{T,2} = 1 \). Second, if \( c = b_H \), there are two equilibria with \( 0 = \phi_{T,1} < \phi_{T,2} < 1 \).

We now turn to examining the welfare properties of equilibrium. Consider an equilibrium with \( \phi_T^* \) agents of type \( T \) and \( 1 - \phi_T^* \) agents of type \( S \). In such an equilibrium, welfare—as measured by the sum of the agents’ annuitized lifetime utilities net of annuitized costs of acquiring commitment power—is given by

\[
W = \frac{u_L + u_H}{4} + (1 - \phi_T^*) \left[ \frac{\lambda_S}{2\sigma + \lambda_S} \frac{\Delta u}{4} \right] + \phi_T^* \left[ \frac{\lambda_S}{2\sigma + \lambda_S} \frac{\Delta u}{2} + \frac{\lambda_T}{2\sigma + 2\lambda_S + \lambda_T} \frac{\Delta u}{4} - c \right].
\]
The first term captures the flow payoff of the average asset in autarky. The second term captures what types $S$ enjoy above and beyond the autarky allocation. The second line captures what types $T$ enjoy above and beyond autarky which is the same as $S$ plus the benefits from commitment, given by $B$ in (27), net of the flow cost $c$.

The key to understand the welfare properties of equilibrium is the following expression

$$W = u_L \left[ \mu_SL + \mu_TL \right] + u_H \left[ \mu_SH + \mu_TH \right] - \phi^*_Tc$$

which states that welfare is equal to $u_L$ times the measure of low-valuation agents who hold the asset plus $u_H$ times the measure of high-valuation agents who hold the asset net of the cost borne by agents of type $T$ to acquire the commitment technology. The key then is to observe that the measure of low and high-valuation agents with the asset is independent of $\phi^*_T$. Using (23) and (24) and the corresponding expressions for types in state $H$ we can write welfare as

$$W = \frac{u_H}{2} - \left[ \sqrt{\left( \frac{\sigma}{\lambda} \right)^2 + \frac{\sigma}{2\lambda} - \frac{\sigma}{\lambda}} \right] \Delta u - \phi^*_Tc$$

which makes it immediate that welfare is a constant minus the resources spent on acquiring the commitment technology. The finding is not surprising. After paying the cost to acquire commitment power, agents of type $T$ enjoy a higher lifetime utility than agents of type $S$. However, agents of type $T$ enjoy a higher lifetime utility not because they improve the allocation of the asset in any way—indeed, the allocation of the asset is entirely unaffected by agents of type $T$—but because they extract rents from agents of type $S$. That is, the higher lifetime utility enjoyed by agents of type $T$ comes entirely at the expense of the lifetime utility enjoyed by agents of type $S$. Therefore, after paying the cost to acquire commitment power, the sum of the lifetime utilities of agents of type $T$ and $S$ is a constant. The only effect of $\phi^*_T$ on welfare is through the cost of acquiring commitment.

Two conclusions follow directly from (30). First, any equilibrium with $\phi^*_T > 0$ is inefficient. An equilibrium in the baseline model always satisfies the efficiency condition on the pattern of trade (as established in Proposition 1) but it satisfies the efficiency condition on entry if and only if $\phi^*_T = 0$. Since intermediation is neutral with respect to the quality of the allocation but involves a resource cost, intermediation reduces ex-ante welfare. Second, whenever there are multiple equilibria, the equilibria can be ranked by welfare. In particular, the equilibrium with the lowest $\phi^*_T$ has the highest welfare, the equilibrium with the second lowest $\phi^*_T$ has the second highest welfare, and so on. That is, the best equilibrium is always the one with the lowest amount of intermediation.

We summarize our findings on welfare in the following proposition.

**Proposition 3. Welfare**
(i) Welfare in an equilibrium with $\phi_{T,i}$ agents of type $T$ is strictly greater than welfare in an equilibrium with $\phi_{T,j}$ agents of type $T$ if $\phi_{T,i} < \phi_{T,j}$.

(ii) Equilibrium is inefficient if and only if $\phi_{T,i} > 0$.

### 4.3 Comparative Statics

The benefit function $B(\phi_T)$ depends on the rate $\lambda$ at which agents meet each other, on the rate $\sigma$ at which an agent changes valuation, and on the difference $\Delta u$ between high and low valuation.\(^{15}\) Comparative statics with respect to $\lambda$ are particularly interesting from both a theoretical and an applied point of view. From the theoretical point of view, the comparative statics are interesting because one would presume that—as trading frictions vanish—the benefit from acquiring commitment power in order to extract more rents would vanish as well. Indeed, in a Walrasian equilibrium where trade is frictionless, there is no value in being able to commit to take-it-or-leave-it offers because the market uniquely pins down price. Any bid below the market price is rejected and any offer above the market price is rejected as well. From the applied point of view, the comparative statics with respect to $\lambda$ are interesting because it seems natural to think that trading frictions have gotten smaller over time and will continue to get smaller due to improvements in communication and information technology.

With regard to the cost of acquiring commitment, it seems natural to think that $c$ depends positively on the rate of return $R$ on alternative investments. Comparative statics with respect to $R$ are particularly interesting because of the recent decline in real interest rates which is why, in section 4.3.2, we study the response of the marketplace to a decline in $c$.

#### 4.3.1 Trading Frictions

If trading friction vanish agents meet more frequently and, as a consequence, the allocation improves. For given $\phi_T$, the derivative of the rate at which one meets a mismatched trader of type $S$ with opposite asset position with respect to an increase in the contact rate is

$$
\frac{d\lambda_S}{d\lambda} = \frac{1/2 + \lambda \phi_T^2 / 8}{2\sqrt{1 + \lambda / 2 + \lambda \phi_T / 16}} - \frac{\phi_T}{4}.
$$

The derivative above is positive. Intuitively, as the normalized meeting rate $\lambda$ increases, there are two effects on $\lambda_S$. On the one hand, the meeting rate increases and this tends to raise $\lambda_S$. On the other hand, the measure $\mu_{SL}$ of mismatched traders of type $S$ fall and this tends to lower

---

\(^{15}\)However, it is easy to see that $B(\phi_T)$ does not depend on $\lambda$ and $\sigma$ separately, but only on their ratio $\lambda / \sigma$, which we can interpret as an inverse measure of trading frictions. We can therefore without loss of generality normalize $\sigma = 1$ for the remainder and study the impact of a reduction in trading frictions by increasing $\lambda$. 

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\( \lambda_S \). Since the measure of mismatched traders of type \( S \) falls less than proportionally with \( \lambda \), the first effect dominates and \( d\lambda_S/d\lambda \) is positive.

The derivative with respect to \( \lambda \) of the rate at which an agent meets a mismatched trader of type \( T \) is given by

\[
\frac{d\lambda_T}{d\lambda} = \frac{\phi_T}{4} + \frac{1}{4\sqrt{1+\frac{\lambda}{2}}} - \frac{1/4 + \lambda\phi_T^2/16}{\sqrt{1+\lambda/2} + (\lambda\phi_T)^2/16}
\]

which is positive for the same reasons. In fact, for types \( T \) it may well be that both the direct and indirect effect point in the same direction since they intermediate more frequently when the contact rate increases.

Taken together, these two derivatives imply that the opportunities for rent extraction become more frequent as frictions decline.

The derivative of the benefit of acquiring commitment power with respect to \( \lambda \) is

\[
\frac{dB}{d\lambda} = \left\{ \frac{1}{(2+\lambda_S)^2} \frac{d\lambda_S}{d\lambda} + \frac{1}{(2+2\lambda_S+\lambda_T)^2} \left[ (1+\lambda_S) \frac{d\lambda_T}{d\lambda} - \lambda_T \frac{d\lambda_S}{d\lambda} \right] \right\} \Delta u \frac{\Delta u}{4}. \tag{31}
\]

The first term on the right-hand side is the response of the additional rents that an agent can extract in meetings with \( S \) if she is \( T \) rather than \( S \). The second is the corresponding response of the additional rents from meetings with \( T \). After substituting in \( d\lambda_S/d\lambda \) and \( d\lambda_T/d\lambda \), we can show that this term is also positive. It follows that the derivative of \( B \) with respect to \( \lambda \) is positive. In other words, the lower are search frictions in the market, the higher is the benefit of having the power to commit to take-it-or-leave-it offers.

The finding that \( dB/d\lambda > 0 \) runs against common intuition. Indeed, one is tempted to approximate the behavior of an economy with small frictions with the behavior of a Walrasian equilibrium. In a Walrasian equilibrium, commitment power is worthless as agents with and without commitment are fully protected from exploitation by market competition. Thus, one might expect a decline in search frictions to reduce the scope for rent extraction. Alas, this logic is flawed. The key mistake is that, while it is true that the rents in any given meeting shrink, it is also true that the rate at which opportunities for rent extraction arrive increases. Equation (31) shows that the latter effect dominates.

The reason the latter always dominates is that the joint surplus of a transaction is generally discounted by the rate of time preference, (twice) the rate of taste-switching and the rate at which the traders involved could alternatively located other traders. As a consequence, if that rate increases, the joint value of a transaction declines but always less than in proportion to the decline in the contact rate. The reason is simple: Outside trading opportunities are not the only reason why the value of a transaction is limited. Agents are also subject to taste shocks (and, in general, impatient) which implies an increase in outside trading options does not reduce the
gains from trade one-for-one. As a consequence, the gains from rent extraction—which are given by the product of the contact rates times the joint value of the transaction as can be seen in equation (26)—are strictly increasing in $\lambda$.

We now turn to examining the impact of diminishing frictions on the fraction of agents with commitment. Figure 3 illustrates the effect of a small increase in the normalized meeting rate from $\lambda$ to $\lambda'$ on the equilibrium $\phi_T$ when all agents face a cost of acquiring commitment power of $c$, with $c \in (b_l, b_h)$. The benefit function $B(\phi_T)$ shifts up as the meeting rate increases from $\lambda$ to $\lambda'$. If the increase is small enough, the number of equilibria does not change. In the first equilibrium, the measure of agents who acquire commitment power is zero for both $\lambda$ and $\lambda'$. In the second equilibrium, the measure of agents who acquire commitment power falls. In the third equilibrium, the measure of agents with commitment power increases. Restricting attention to the stable equilibria (the first and the third), we can then conclude that the increase in the meeting rate unambiguously raises the equilibrium set of agents of type $T$—weakly so for $E_1$ and strictly for the stable interior equilibrium $E_3$. This conclusion generalizes to the case of an arbitrary cost function $C(\phi_T)$.

**Proposition 4: Intermediation and trading frictions**

Let $(\phi_{T,1}, \phi_{T,2}, \phi_{T,3})$ denote the equilibrium measures of types $T$ associated with contact rate $\lambda$ and $c \in (b_l, b_h)$. For sufficiently small $\lambda' > \lambda$, (i) $\phi'_{T,1} = \phi_{T,1}$, (ii) $\phi'_{T,2} < \phi_{T,2}$, (iii) $\phi'_{T,3} > \phi_{T,3}$.
Focusing attention on the stable interior equilibrium, proposition 4 states that, as trading frictions decline, the fraction of agents who acquire commitment power increases. Since agents with commitment power find it optimal to act as intermediaries, the proposition implies that, as trading frictions become smaller and smaller, the fraction of intermediaries in the market grows larger and larger. This rather surprising implication follows directly from two properties of equilibrium: the benefit of rent extraction grows as frictions vanish and the agents who can extract rents are those who act as middlemen. Proposition 4 provides a novel take on the dramatic rise of the financial intermediation sector that has taken place in the US since the 1950s (see, e.g., Philippon (2015)). According to this interpretation, the rise in financial intermediation has not taken place in spite of the decline in trading frictions brought about by improvements in information technology. Instead, the rise in intermediation has taken place precisely because improvements in information technology have reduced trading frictions.

It is then natural to wonder about the effect of diminishing trading frictions on welfare. In general, a decline in trading frictions has two countervailing effects on welfare. On the one hand, a decline in trading frictions makes it easier for agents to adjust their asset inventories in response to preference shocks and, hence, improves the allocation of the asset. On the other hand, a decline in trading frictions induces more agents to spend resources to acquire commitment power and become intermediaries. Differentiating the welfare expression (30) gives

\[
\frac{dW}{d\lambda} = \Delta u \left\{ \left( \frac{1}{\lambda^2} + \frac{1}{2\lambda} \right)^{-1/2} \left( \frac{1}{\lambda^3} - \frac{1}{4\lambda^2} \right) + \frac{1}{\lambda^2} \right\} - \frac{d\phi^*_T}{d\lambda} c.
\]

The first term on the right-hand side is positive and captures the gains from the improved allocation. For a fixed fraction of intermediaries this implies that a decline in search frictions increases welfare as one would expect. However, declining search frictions affect the incentives for rent extraction and the second term hence accounts for the equilibrium response of entry into intermediation.

At any interior equilibrium the benefits of commitment equal the cost so from (27) we must have that

\[
c = \frac{\Delta u}{4} \left\{ \frac{\lambda_S}{2\sigma + \lambda_S} + \frac{\lambda_T}{2\sigma + 2\lambda_S + \lambda_T} \right\}.
\]

Substituting out \(\lambda_T\) with (29), we can rewrite this expression as the following quadratic equation in \(\lambda_S\)

\[
0 = \lambda_S^2 \left[ \frac{4c}{\Delta u} \right] + \lambda_S \left[ 2 + \frac{12c}{\Delta u} + \left( \frac{4c}{\Delta u} - 2 \right) \sqrt{1 + \frac{\lambda}{2}} \right] + 2 + \frac{8c}{\Delta u} + \left( \frac{8c}{\Delta u} - 2 \right) \sqrt{1 + \frac{\lambda}{2}}. \tag{32}
\]

The smaller of the two solution to (32) with respect to \(\lambda_S\) is the rate at which agents meet mismatched traders of type \(S\) in the \(E_3\) equilibrium. When \(\lambda\) increases, the smaller solution to
with respect to $\lambda_S$ falls. Hence, in the $E_3$ equilibrium, an increase in the meeting rate $\lambda$ leads to a decline in the meeting rate $\lambda_S$ of mismatched agents of type $S$.

We again focus on the stable interior equilibrium. Again, the benefits of commitment equal the cost which implies that welfare simplifies to

$$ W = \frac{\lambda_S}{2+\lambda_S} \frac{\Delta u}{4} + \frac{u_L + u_H}{4}. $$

(33)

Since this expression is strictly increasing in $\lambda_S$ and $\lambda_S$ is falling in response to a reduction in search frictions this implies that an increase in the meeting rate $\lambda$ leads to lower welfare. The analysis of the welfare effects of a reduction in search frictions is summarized in the following proposition.

**Proposition 5. Welfare and trading frictions**

(i) For any contact rate $\lambda$ and cost of commitment $c$ such that there exist two stable equilibria, welfare is strictly decreasing in the contact rate $\lambda$ at the unique interior equilibrium $E_3$. It is strictly increasing at $E_1$.

(ii) For any contact rate $\lambda$ and cost of commitment $c$ such that the benefits of commitment are either strictly larger or smaller than the cost, welfare is strictly increasing in $\lambda$.

Proposition 5 implies that, if agents face the same cost $c$ of acquiring commitment power and the equilibrium is the stable interior one, a decrease in trading frictions causes welfare to fall. The result may seem paradoxical, as it means that an improvement in technology leads to worse economic outcomes. However, the result is nothing but a direct implication of our simple model of intermediation as pure rent-extraction. It is perhaps most easily understood by considering the case where the fraction of agents with commitment at the stable interior equilibrium $E_3$ approaches the corner, $\phi_{T,3} \to 1$. In this case, types $S$ are as well off as under the autarky limit with $\lambda \to 0$ since they can (almost) never trade gainfully. But at an interior equilibrium types $T$ are just as well off as types $S$ which means that—net of their expenses on $c$— their well-being also equals its autarky counterpart.

Taken together, this implies the following nonmonotonic response of welfare to an improvement in the search technology: For given cost of commitment $c$ and low enough initial $\lambda$, continuously improving search frictions first increases welfare. Once intermediation becomes profitable further increasing the contact rate increases intermediation but strictly lowers welfare eventually taking welfare all the way back to autarky. From there on, a further reduction of search frictions unambiguously raises welfare.

**Frictionless Limit** Modern financial markets display arguably very little search frictions so one may wonder whether the incentives for rent extraction as modeled here could possibly
continue to play a prominent role in the entry to intermediation. To address this concern we study the incentives for rent extraction as the economy approaches its frictionless limit, $\lambda \to \infty$.

Of course, as the economy approaches its frictionless limit, the mismatch rate among both types $S$ and types $T$ converges to zero, a consequence of our symmetry assumptions along with the assumption that the asset is in supply $\frac{1}{2}$.

Again normalizing $\sigma = 1$ and evaluating equations (28) and (29) in the limit we get

$$
\lim_{\lambda \to \infty} \lambda_S = \frac{1 - \phi_T}{\phi_T},
\lim_{\lambda \to \infty} \lambda_T = \infty.
$$

This result states that, as the meeting rate converges towards its frictionless limit, the opportunities for types $S$ to gainfully trade remain limited. The reason is that the rate at which mismatch convergence towards zero is is strictly slower for intermediaries, eventually allocating almost all mismatch to types $T$. As a consequence, a type $S$ who experiences a taste shock immediately encounters a type $T$ with opposite asset position who gainfully takes on her mismatched asset position. The take-it-or-leave-it offer she receives then reflects that she cannot expect to immediately meet a mismatched type $S$ who is open for trade despite continuously encountering other market participants.

This result also implies that incentives to engage in rent extraction remain in place as frictions vanish. Specifically, the net benefit of the commitment technology is, in the limit,

$$
\lim_{\lambda \to \infty} B = \frac{\Delta u}{2(1 + \phi_T)} \text{ for } \phi_T \in (0, 1)
$$

and

$$
\lim_{\lambda \to \infty} B = \frac{\Delta u}{4} \text{ for } \phi_T = 0.
$$

That is, in the limit the net benefits from commitment jump at $\phi_T = 0$ and then continuously decrease in the fraction of middlemen. As an immediate consequence, there remains a range of costs $c > 0$ such that positive fractions of types $T$ and $S$ coexist. Thus, our theory can reconcile substantial technological progress which has arguably led to a decline in search frictions with sustained entry into intermediation driven by dynamic rent extraction motives.

### 4.3.2 Rate of Return on Alternative Investments

We now carry out comparative statics with respect to the cost parameter $c$. Appendix F again offers the analysis for a more general cost correspondence $C(\phi_T)$. We assume that the correspondence depends on a parameter $R$, which we interpret as the rate of return on the alternative investments that agents forego when they decide to acquire the commitment technology. We assume that $c(R)$ is continuous, differentiable and strictly increasing with respect to $R$. Moreover,
we assume that \( \lim_{R \to 0} c(R) = 0 \) and \( \lim_{R \to \infty} c(R) = \infty \).

Figure 4 illustrates the effect of an increase in the rate of return on alternative investments from \( R \) to \( R' \) on the measure of agents of type \( T \), under the assumption that all agents face the same opportunity cost \( c(R) \in (b_l, b_h) \) for acquiring the commitment technology. If the increase in \( R \) is small enough, the number of equilibria does not change. In the first equilibrium, the measure of agents who acquire commitment power is zero for both \( R \) and \( R' \). In the second, unstable equilibrium, the measure of agents who acquire commitment power increases. In the third, stable equilibrium, the measure of agents with commitment power falls. In summary,

**Proposition 6: Intermediation and return on investments**

Let \((\phi_{T,1}', \phi_{T,2}', \phi_{T,3}')\) denote the equilibrium measures of types \( T \) associated with the opportunity cost \( R \) such that \( c(R) \in (b_l, b_h) \). For sufficiently small \( R' > R \), (i) \( \phi_{T,1}' = \phi_{T,1} \), (ii) \( \phi_{T,2}' > \phi_{T,2} \), (iii) \( \phi_{T,3}' < \phi_{T,3} \).

Focusing attention on the stable interior equilibrium as before, we conclude that the increase in the parameter \( R \) lowers the equilibrium measure of agents of type \( T \).

We now turn to examining the effect of the rate of return on alternative investments on welfare. The rate of return \( R \) affects welfare through two channels. On the one hand, an increase in \( R \) increases the cost borne by the agents who decide to acquire the commitment technology. Through this channel, an increase in \( R \) tends to reduce welfare. On the other hand, an increase in \( R \) lowers the measure of agents who decide to acquire the commitment technology. Through
this channel, an increase in \( R \) tends to increase welfare.

Continuing to focus on the stable interior equilibrium \( E_3 \), the rate \( \lambda_S \) at which agents meet mismatched traders of type \( S \) is given by the smallest solution to

\[
0 = \lambda_S^2 \left[ \frac{4c(R)}{\Delta u} \right] + \lambda_S \left[ 2 + \frac{12c(R)}{\Delta u} + \left( \frac{4c(R)}{\Delta u} - 2 \right) \sqrt{1 + \frac{\lambda}{2}} \right] + \left[ 2 + \frac{8c(R)}{\Delta u} + \left( \frac{8c(R)}{\Delta u} - 2 \right) \sqrt{1 + \frac{\lambda}{2}} \right].
\]

When \( R \) increases, the smaller root of this quadratic equation increases. Hence, in the \( E_3 \) equilibrium, an increase in the rate of return on alternative investments leads to an increase in the rate at which agents meet mismatched traders of type \( S \). In turn, this implies that an increase in \( R \) leads to higher welfare, since (33) shows that \( W \) is an increasing function of \( \lambda_S \). The analysis of the welfare effects of \( R \) is summarized in the following proposition.

**Proposition 7. Welfare and returns on investment**

*Consider a contact rate \( \lambda \) and a cost of commitment \( c(R) \) such that there exist two stable equilibria, \( E_1 \) and \( E_3 \). Welfare is independent of \( R \) at \( E_1 \) and strictly increasing at the interior equilibrium \( E_3 \).*

We point out that, if the equilibrium is such that \( \phi_T = 1 \) then welfare is strictly decreasing in \( R \) since the measure of agents of type \( T \) does not change while the resources they spend on acquiring commitment power increases. In turn, welfare is independent of \( R \) if \( \phi_T = 0 \).

Proposition 7 states that a decrease in \( R \) induces more agents to acquire commitment power and become intermediaries. Even more and perhaps surprisingly, the response of entry is so strong that the overall resources spent on \( R \) increase if \( R \) decreases. Since all other fundamentals of the economy are unaltered it follows that—at the stable interior equilibrium—welfare decreases when the rate of return on outside investment falls.

To see why entry responds overproportionally to a cost reduction briefly consider what would happen if the overall resources spent on acquiring commitment stayed constant (or even fell). In that case, welfare would stay constant (or even increase). But this cannot be the response in equilibrium because types \( S \) are unambiguously worse off since \( \phi_T \) increases when the cost fall. As a consequence, types \( T \) must also be worse off in the new equilibrium and welfare deteriorates. In summary, intermediation as rent extraction is purely redistributional and everyone is worse off if its opportunity cost fall.

The result suggests that a decline in fundamental payoffs leads to an increase in the fraction of agents who choose to acquire commitment power and become intermediaries in the asset market. A reduction in \( R \) could for instance reflect an environment with a declining return
on productive investments; alternatively, it may capture a regime of low real interest rates. Our results capture, in a stylized fashion, the notion that in such circumstances agents will increasingly engage in non-productive activities such as financial intermediation for the purpose of rent extraction. That is, with declining real payoffs, rent seeking becomes a relatively more attractive activity. Proposition 7 then states that, if all agents have equal access to the rent-extraction technology, the shift towards rent extraction associated with a decline in $R$ might well lower welfare, a consequence of the purely redistributional character of rent extraction.

The results is related to the influential notion of “reach for yield” developed in Rajan (2006) which argues that with low risk-free returns investors tend to rebalance their portfolios towards more risky assets.\(^{16}\) We add to this a connected, yet distinct and novel mechanism through which low rates may affect financial activity in an unintended way, namely that financial market participants move towards rent extraction in times of of low-returns. The zero-sum character of such activities makes this response socially undesirable if there is a cost associated with acquiring the necessary skills or technology. This observation naturally leads us to study policy tools that could potentially alleviate the adverse effects of rent extraction in the next section.

5 Transaction Tax

In this section, we consider the effect of introducing a transaction tax in our asset market model. Specifically, we consider a fixed tax $\tau$ that buyer and seller need to pay to the government whenever they trade the asset. The government rebates the revenues of the transaction tax to the market participants in a lump-sum fashion. In subsections 5.1 through 5.3, we study the effect of the transaction tax on the equilibrium pattern of trade taking as given the measures of agents of type $S$ and $T$. We find that, depending on the size of the tax, the equilibrium pattern of trade may be the same as in the laissez-faire equilibrium, it may involve only a subset of the trades that emerge in the laissez-faire equilibrium, or it may lead to a complete shut-down of all trade. In subsection 5.4, we study the effect of the transaction tax on the equilibrium measure of agents of type $S$ and $T$ and on welfare. We then characterize the transaction tax that maximizes welfare. We show that the optimal transaction tax reproduces a key feature of Walrasian Equilibrium. Namely, the optimal transaction tax is such that, just as in a Walrasian Equilibrium, the surplus in any particular transaction between a buyer and a seller is zero. We also show that the optimal transaction makes the equilibrium efficient. Since the optimal transaction tax implements the efficient allocation, we are justified in restricting attention to this particular policy instrument rather than to formulate and solve a general mechanism design problem.

5.1 Intermediation Equilibrium

We first look for conditions on the transaction tax under which there exists an equilibrium in which both fundamental trades between agents with differing tastes for the asset and intermediation trades between agents with identical tastes for the asset take place. This is an equilibrium in which, notwithstanding the presence of a transaction tax, the pattern of trade remains the same as in the laissez-faire equilibrium described in Section 3. We shall refer to this as the intermediation equilibrium.

In an intermediation equilibrium, the trading pattern and hence the allocation are, of course, unaltered. The gains from trade in the various transactions are hence exactly identical to the case where there is a transaction cost studied in section 3.3.1. The relevant expressions for the gains from trade can therefore be found in Appendix D.1. It is then straightforward to verify that, as long as,

\[ \tau \leq \frac{1}{2} \left( \frac{\Delta u (\lambda_S + \lambda_T)}{(\lambda_S + \lambda_T)\sigma + (2\sigma + \lambda_S)(2\sigma + \lambda_S + \lambda_T)} \right) \]

the intermediation equilibrium is consistent with individual rationality.\(^{17}\)

5.2 Fundamental Equilibrium

We now look for conditions on the transaction tax under which there exists an equilibrium in which the fundamental trades remain to be valuable while the intermediated trades break down. We shall refer to this as a fundamental equilibrium.

It is easy to show that the gains from fundamental trades in such an equilibrium can then be written as

\[
D_{SH} - D_{SL} - \tau = \frac{\Delta u - 2\sigma \tau}{2\sigma + \lambda_S} \quad (34)
\]

\[
D_{TH} - D_{TL} - \tau = \frac{\Delta u - 2\sigma \tau}{2\sigma + \lambda_S} \left[ \frac{2\sigma}{2\sigma + \lambda_S + \lambda_T} \right] \quad (35)
\]

\[
D_{SH} - D_{TL} - \tau = D_{TH} - D_{SL} - \tau = \frac{\Delta u - 2\sigma \tau}{2\sigma + \lambda_S} \left[ \frac{2\sigma}{2\sigma + \lambda_S + \lambda_T} \right] \left[ \frac{4\sigma + \lambda_S + \lambda_T}{4\sigma} \right] \quad (36)
\]

The expression in (34) is the same expression as in an intermediation equilibrium. The reason is that types \(S\) never gainfully participate in intermediation trades. However, the remaining expressions (35) differ from an intermediation equilibrium. The reason is that, in a fundamental equilibrium, a \((T,H)\) buyer does not enjoy a capital gain from acquiring the option of selling the asset to \((S,H)\). In turn, a \((T,L)\) seller does not gain the option to re-buy the asset from a type \((S,L)\).

\(^{17}\)Of course, \(\tau\) replaces \(c\) and \(r \to 0\).

\(^{18}\)If the above condition holds with equality the value of an intermediated trade is exactly zero while fundamental trades remain to have strictly positive gains from trade.
Having characterized the gains from trade and the stationary distribution in a fundamental equilibrium, we can now derive the conditions on the transaction tax such that such an equilibrium exists. To this aim, note that the fundamental trades take place if and only if equations (34)-(36) are positive, that is if and only if

$$\tau \leq \frac{\Delta u}{2\sigma}. \quad (37)$$

On the other hand, the intermediation trades do not take place if their gains (net of $\tau$) are negative, which is the case if and only if

$$D_{SH} - D_{TH} - \tau = D_{TL} - D_{SL} - \tau = \frac{\Delta u - 2\sigma \tau}{2\sigma + \lambda_S} \left[ \frac{\lambda_S + \lambda_T}{2(2\sigma + \lambda_S + \lambda_T)} \right]$$

is negative. This is the case if $\tau$ is such that

$$\tau \geq \frac{1}{2} \frac{\Delta u (\lambda_S + \lambda_T)}{(\lambda_S + \lambda_T)\sigma + (2\sigma + \lambda_S)(2\sigma + \lambda_S + \lambda_T)}. \quad (38)$$

Therefore, for any value of the transaction tax $\tau$ satisfying both (38) and (37), there exists a fundamental equilibrium.

We conclude by pointing out that it is straightforward to derive the stationary distribution of the asset in a fundamental equilibrium. It shows that the overall fraction of mismatch is the same as in the intermediation equilibrium, consistent with the observation that intermediation is neutral with respect to the quality of the allocation.\(^{19}\)

### 5.3 No Trade Equilibrium

We now consider an equilibrium in which the asset is never traded. In a no-trade equilibrium, the gains from trade in all fundamental transactions are identical and given by

$$D_{i,H} - D_{i',L} - \tau = \frac{\Delta u}{2\sigma} - \tau. \quad i, i' = S, T \quad (39)$$

This expression is intuitive. In a no-trade equilibrium, the agents expect to never trade the asset again. Hence, in any fundamental transaction, the gains from trade equal the flow value of holding the asset in state $H$ instead of holding it in state $L$, discounted at the rate at which the two traders expect to experience the taste shock and net of the tax $\tau$.

The gains from trade in all intermediation transactions are all identical and given by

$$D_{i,j} - D_{i',j} - \tau = -\tau. \quad i, i' = S, T, j = H, L \quad (40)$$

In a no-trade equilibrium, the agents expect to never trade the asset again. Since the two traders

\(^{19}\)Of course, mismatch is higher among types $T$ and lower among types $S$ in an intermediation equilibrium.
involved in the trade do not differ in terms of their desire to hold the asset the transaction generates no value. However, it generates a cost associated with the tax \( \tau \).

Having characterized the gains from trade and the stationary distribution, we can now find conditions on the transaction tax \( \tau \) under which a no-trade equilibrium exists.\(^{20}\) To this aim, notice that a no-trade equilibrium exists if and only if the gains from trade (39) from any fundamental transaction and the gains from trade (40) from any intermediation transaction are negative. In turn, this is the case if and only if the transaction tax \( \tau \) is such that

\[
\tau \geq \frac{\Delta u}{r + 2\sigma}.
\]

### 5.4 Optimal Transaction Tax

In this section, we study the effect of the transaction tax on welfare. First, we consider the case in which the government sets a relatively small transaction tax. Specifically, we consider the case in which \( \tau \) is such that

\[
0 < \tau < \frac{\hat{\lambda} \Delta u}{2\sigma \hat{\lambda} + 2(2\sigma + \hat{\lambda})^2}, \tag{41}
\]

where \( \hat{\lambda} \equiv \sqrt{\sigma^2 + \sigma \lambda/2} - \sigma \). Using the expression for the distribution of equilibrium mismatch (28) and (29), it is easy to verify that, when the transaction tax \( \tau \) satisfies (41), the unique equilibrium—for any \( \phi_T \)—is the intermediation equilibrium characterized in section 5.1.

Proceeding exactly as in the baseline, we derive the benefits of commitment in an intermediation equilibrium with a tax, given by

\[
B = \left( \frac{\hat{\lambda}_S}{2\sigma \hat{\lambda}} + \frac{\hat{\lambda}_T}{2\sigma + 2\hat{\lambda}_S + \hat{\lambda}_T} \right) \frac{\Delta u}{4} - \left( \frac{\hat{\lambda}_S \sigma}{2(2\sigma + \hat{\lambda}_S)} + \frac{\hat{\lambda}_T (\sigma + \hat{\lambda}_S)}{2\sigma + 2\hat{\lambda}_S + \hat{\lambda}_T} + \hat{\lambda}_S \right) \frac{\tau}{2}.
\]

The first part on the right-hand side is the benefit of commitment in the laissez-faire economy. The second part is a negative term that is linearly decreasing in the transaction tax \( \tau \). Thus, the benefit of commitment is lower than in the laissez-faire equilibrium for any \( \tau > 0 \). As a consequence, the fraction of the population acquiring commitment, \( \phi_T \), is strictly decreasing in the size of the tax at the stable interior equilibrium.\(^{21}\)

Given an equilibrium measure \( \phi_T^* \), welfare is given by

\[
W = \frac{u_H}{2} - \Delta u \left[ \left( \frac{\sigma}{\lambda} \right)^2 + \frac{\sigma}{2\lambda} - \frac{\sigma}{\lambda} \right] - \phi_T^* c,
\]

\(^{20}\) The allocation is such that the asset is essentially randomly allocated across types in state \( H \) and \( L \) and one half of all asset owners are in either preference state.

\(^{21}\) We again focus attention on the stable interior equilibrium. As follows from figure 3 \( \phi_T \) is independent of \( \tau \) at the other stable equilibrium and increasing at the unstable equilibrium.
which is the same as in the laissez-faire equilibrium. As a consequence, the tax generates a welfare gain, not because it improves upon the allocation but simply because it reduces the resources spent on rent extraction abilities.

Next, we consider the case in which the government sets a relatively high value for the transaction tax. Specifically, we consider the case in which \( \tau \) is such that

\[
\frac{\hat{\lambda}\Delta u}{2\sigma \hat{\lambda} + 4\sigma (2\sigma + \hat{\lambda})} < \tau < \frac{\Delta u}{2\sigma}. \tag{42}
\]

When the transaction tax \( \tau \) satisfies (42), the unique equilibrium—for any \( \phi_T \)—is the fundamental equilibrium characterized in subsection 5.2.\(^{22}\)

In a fundamental equilibrium, the benefit of commitment is given by

\[
B = \left[ \frac{\lambda_S + \lambda_T}{2\sigma + \hat{\lambda}} \right] \frac{\sigma (\Delta u - 2\sigma \tau)}{2(2\sigma + \lambda_S)^2}.
\]

Note that the benefit of commitment in a fundamental equilibrium is smaller than in the equilibrium with intermediation. As a consequence, the transaction tax lowers the equilibrium measure of agents of type \( T \) in the stable interior equilibrium. Moreover, note that the benefit of commitment in a fundamental equilibrium is proportional to \( \Delta u - 2\sigma \tau \). Hence, the equilibrium measure of agents of type \( T \) is lower (in all stable equilibria) the higher the transaction tax.

For a given \( \phi_T^* \), welfare is the same as long as the fundamental trades occur simply because the allocation across types \( H \) and \( L \) is unaltered. This implies that the welfare gains generated by the transaction tax again derive from its effect on the measure of agents who decide to acquire the commitment technology and become intermediaries.

Finally, we consider the case of a transaction tax \( \tau \) such that

\[
\tau \geq \frac{\Delta u}{2\sigma}.
\]

In this case, the unique equilibrium is—for any \( \phi_T \)—the no-trade equilibrium characterized in subsection 5.3. The benefits of commitment are zero since superior bargaining abilities are worthless when nobody trades. Hence, the resources spent on acquiring commitment power must be zero. Moreover, in a no-trade equilibrium, the allocation of the asset among low-valuation and high-valuation agents is uniform, as agents do not trade the asset when their valuation changes. These observations immediately imply that welfare is given by \( W = (u_L + u_H)/4 \).

\(^{22}\)The attentive reader may have noticed that there is a gap between the upper bound of (41) and the lower bound of (42). When the transaction tax \( \tau \) falls in this gap, there might be an intermediation equilibrium, a fundamental equilibrium or coexistence between an intermediation and a fundamental equilibrium, depending on \( \phi_T \). We do not present the analysis of this case, as it is not necessary for our results on the optimal transaction tax.
We are now in a position to characterize the transaction tax that maximizes welfare. To this aim, notice that the allocation of the asset is efficient—in the sense that the asset is always passed from low-valuation to high-valuation agents—in an intermediation equilibrium and in a fundamental equilibrium, while it is inefficient in a no-trade equilibrium. Also, notice that the amount of resources used by agents to acquire the commitment technology is efficient—in the sense that it is equal to zero—in the no-trade equilibrium, while it is generally inefficient in an intermediation and in a fundamental equilibrium. This suggests the existence of a trade-off between transaction taxes supporting different types of equilibria. However, when the transaction tax $\tau$ converges from below to $\Delta u/2\sigma$, the fundamental equilibrium exists (uniquely) and is such that the benefit from acquiring commitment power is zero. Hence, the amount of resources wasted on acquiring commitment power goes to zero and both the allocation of the asset and the amount of resources allocated to acquire commitment power are efficient. Since a transaction tax $\tau \to \Delta u/2\sigma$ attains efficiency, it is also welfare maximizing.

We have thus established the following result.

**Proposition 8**: Optimal transaction tax. *Welfare is maximized by setting $\tau = \Delta u/2\sigma - \varepsilon$ for $\varepsilon > 0$ and arbitrarily small. In this case, the equilibrium is efficient.*

We note that the optimal tax $\tau$ is such that the after-tax gains from trade are equal to zero in any fundamental transactions. This property of the optimal tax is intuitive. In a Walrasian Equilibrium, the ability to extract more of the surplus from a trade is completely worthless because the surplus is zero in any trade. The optimal tax reproduces this feature of the Walrasian Equilibrium by making the after-tax gains from trade equal to zero. As a consequence, the optimal transaction tax protects agents without commitment power from exploitation at the hands of agents with the ability to make take-it-or-leave-it offers. However, while a Walrasian benchmark protects agents without commitment by making their outside option better, the tax protects agents without commitment by worsening their inside option through its impact on the net value of trade.

Second, note that the optimal transaction tax is robust to the distribution of costs to acquire commitment power facing different market participants. While we have considered the case with a constant cost $c$ for the most part of the paper, Appendix F studies entry under a more general cost structure. It is straightforward to see that, no matter what the cost correspondence $C(\phi_T)$ might be, the optimal tax is $\tau = \Delta u/2\sigma$. This property means that the optimal tax can be implemented even when the government does not know the commitment cost correspondence and even if the government does not know whether commitment power is an innate individual trait or an acquired skill. This property also means that the government need not change the transaction tax when the commitment cost correspondence changes because of, say, changes in the return on alternative investment opportunities. However, the formula for the optimal
transaction tax does depend on other details of the market, such as the difference in valuation between different agents and the frequency at which these valuations change. Moreover, if there are more than two levels of valuation for the asset, implementing the efficient allocation would require a more sophisticated policy than a single transaction tax.

Third, it is useful to interpret Proposition 8 through the lens of the mechanism design approach to optimal taxation. The optimal transaction tax implements the unconstrained efficient allocation. Moreover, the optimal transaction tax is a very simple instrument, in the sense that it does not require the government to observe the price at which different transactions are executed, the commitment type, or the history of trade of different market participants. The transaction tax only requires the government to observe when the asset is traded. From these observations, it follows that the optimal transaction tax implements the solution to an optimal mechanism problem, as long as the mechanism knows when the asset is traded. One would have thought that the optimal mechanism might involve a transfer to the mechanism that depends on the history of trade of the buyer and the seller. Instead, Proposition 8 shows that, even though formulating the mechanism design problem might be quite complicated, the solution is very simple, at least in our simple environment.

Clearly these findings relate closely to a large body of existing work on financial transaction taxes following Tobin (1978). However, the theoretical foundations have largely been centered around two themes: first, going back to Keynes (1936), excessive price volatility in financial markets (see, for instance, Summers and Summers (1989)); second, and more closely related, around efforts to gain informational advantages that lead to a rat race for information with no aggregate benefits (see Stiglitz (1989)). We share with the latter theme the notion that costly efforts to generate private returns can be wasteful if the private returns exceed the social ones. The mechanism modeled here, however, differs in at least two dimensions. First, it directly formalizes intermediation in a frictional environment as a rent extraction activity. Second, it models rent-extraction in its purest form, namely as a (costly) effort that directly aims at extracting surplus from other market participants. We thus view our results as a cleanly formalized and novel case for potential benefits of a financial transaction tax.

6 Conclusions

We develop a theory of intermediation in asset markets as a pure rent-extraction activity. We consider a frictional market populated by agents who are heterogeneous with respect to their valuation of the asset’s dividend and with respect to their ability to commit to posted prices. We show that the equilibrium pattern of trade is such that agents with commitment act as

23 Burman, Gale, Gault, Kim, Nunns and Rosenthal (2015) point to the claim that a financial transaction tax “would reduce the diversion of valuable human capital into pure rent-seeking activities of little or no social value”. 
intermediaries—in the sense that they buy and sell the asset irrespective of their valuation—while agents without commitment act as end users—in the sense that they buy the asset only when their valuation is high and keep it until their valuation turns low. As typical intermediaries in the real world, ours make profits by trading at a bid-ask spread. Intermediation arises purely due to dynamic rent extraction motives: Intermediaries buy purely with the purpose to sell high and sell purely with the purpose to (re-)buy low. While the equilibrium trading pattern in our baseline model is efficient we offer several simple and plausible extensions that render the equilibrium inefficient.

We then endogenize the measures of agents with and without commitment by studying ex-ante homogeneous agents’ decisions to invest in a commitment technology. We show that the benefits of rent extraction have inverse U-shape in the measure of agents with commitment in the market, giving room to multiplicity with different levels of intermediation. Equilibria with more intermediation have lower welfare and any equilibrium in which resources are devoted to the commitment technology is inefficient. We show that a decline in trading frictions leads to an increase in the return from investing in the commitment technology and, hence, to an increase in the extent of intermediation. We also show that, in natural cases, a decline in trading frictions lower welfare. The same is true for a decline in the rate of return on alternative investments. These comparative statics invite two observations. First, as progress in information and communication technology keeps lowering trading frictions, we should expect the intermediation sector to keep growing. Second, in times of low rates of return on investment, we should expect the intermediation sector to expand. Both phenomena might cause lower welfare.

Finally, we study the effects of introducing a transaction tax. We show that the transaction tax reduces the incentives to acquire commitment. We show that, depending on the size of the tax, the equilibrium pattern of trade might be the same as in the laissez-faire equilibrium, it might involve only fundamental trades, or it might involve no trade at all. We find that the tax that maximizes welfare is such that the after-tax gains from trade in fundamental transactions are zero. That is, the tax that maximizes welfare reproduces a key property of Walrasian Equilibrium: in any meeting between a buyer and a seller, the surplus is zero. The welfare-maximizing tax also implements the first-best allocation and it does so without requiring any information on the history of trade of individual agents, on the price at which individual transactions take place, or on the cost facing individual agents to acquire the commitment technology. Therefore, even though formulating a mechanism design problem for the structure of the asset market might be very complicated, the solution of such problem is not.
References


_ _, _ _, and _ _, “Who Wants to be a Middleman?,” 2016.


Appendix

A Necessary and Sufficient Conditions for Trading Pattern

As a preliminary step, consider a meeting between an agent of type \((i,j)\) who holds the asset and an agent of type \((m,n)\) who does not have the asset. Trade is individually rational if and only if the gains from trade, \(D_{m,n} - D_{i,j}\), are positive. To see why this is the case, note that, if \(i = S\) and \(m = S\) and trade takes place, the price at which \((i,j)\) sells the asset to \((m,n)\) is 
\[
p = \frac{(D_{m,n} + D_{i,j})}{2}.
\]
The seller finds it optimal to trade if and only if 
\[
p - D_{i,j} \geq 0.
\]
The buyer finds it optimal to trade if and only if 
\[
-p + D_{m,n} \geq 0.
\]
These conditions are equivalent to 
\[
D_{m,n} - D_{i,j} \geq 0.
\]
If \(i = T\) and \(m = S\) and trade takes place, the price at which \((i,j)\) sells the asset to \((m,n)\) is 
\[
p = D_{m,n}.
\]
The seller finds it optimal to trade if and only if 
\[
p - D_{i,j} \geq 0
\]
or, equivalently, 
\[
D_{m,n} - D_{i,j} \geq 0.
\]
The buyer finds it optimal to trade because 
\[
-p + D_{m,n} = 0.
\]
Similarly, if \(i = S\) and \(m = T\) and trade takes place, the price at which \((i,j)\) sells the asset to \((m,n)\) is 
\[
p = D_{i,j}.
\]
Then, the seller finds it optimal to trade because 
\[
p - D_{i,j} = 0
\]
and the buyer finds it optimal to trade if and only if 
\[
-p + D_{m,n} \geq 0
\]
or, equivalently, 
\[
D_{m,n} - D_{i,j} \geq 0.
\]
Finally, if \(i = T\) and \(m = T\) the price at which trade takes place depends on whether the buyer or the seller is selected to make a take-it-or-leave-it offer. In either case, both parties find it optimal to trade if and only if 
\[
D_{m,n} - D_{i,j} \geq 0.
\]
Since trade is individually rational for both the buyer and the seller if and only if \(D_{m,n} - D_{i,j}\) are positive, the pattern described in Figure 1 is consistent with individual rationality if and only if 
\[
D_{SL} \leq D_{TL} \leq D_{TH} \leq D_{SH}.
\]

To check necessity, notice that the inequalities in (43) imply that \((S,L)\) selling the asset to \((T,L)\), \((T,H)\) or \((S,H)\) is consistent with individually rationality, and so is \((S,L)\) not buying the asset from \((T,L)\), \((T,H)\) or \((S,H)\). Similarly, \((T,L)\) selling the asset to \((T,H)\) or \((S,H)\) is consistent with individual rationality, and so is \((T,L)\) not buying the asset from \((T,H)\) or \((S,H)\). Finally, \((T,H)\) selling the asset to \((S,H)\) is consistent with individual rationality and so is \((T,H)\) not buying from \((S,H)\). To check sufficiency, notice that if any of the inequalities in (43) is violated, some trade in Figure 1 certainly violates individual rationality.
B  Inflow-Outflow Equations Characterizing Stationarity

Analogous to equation (15) we have the following inflow-outflow equalities for $\nu_{SL}, \mu_{SL}, \mu_{TL}, \nu_{SH}, \mu_{SH}, \mu_{TH}$, respectively,

\[ \nu_{SL} \sigma = \nu_{SH} \sigma + \mu_{SL} \lambda (\nu_{TL} + \nu_{TH} + \nu_{SH}) \]  
\[ \mu_{SL} [\sigma + \lambda (\nu_{TL} + \nu_{TH} + \nu_{SH})] = \mu_{SH} \sigma \]  
\[ \mu_{TL} [\sigma + \lambda (\nu_{TH} + \nu_{SH})] = \mu_{TH} \sigma + \nu_{TL} \lambda \mu_{SL} \]  
\[ \nu_{TH} [\sigma + \lambda (\mu_{SL} + \mu_{TL})] = \nu_{TL} \sigma + \mu_{TH} \]  
\[ \nu_{SH} [\sigma + \lambda (\mu_{SL} + \mu_{TL} + \mu_{TH})] = \nu_{SL} \sigma \]  
\[ \mu_{SH} \sigma = \mu_{SL} \sigma + \nu_{SH} \lambda (\mu_{SL} + \mu_{TL} + \mu_{TH}) \]  
\[ \mu_{TH} [\sigma + \lambda \mu_{SH}] = \mu_{SH} \sigma + \nu_{TH} \lambda (\mu_{SL} + \mu_{TL}) \].

C  Uniqueness

The symmetry restriction imposes that we only study equilibria where $\mu_{i,L} = \nu_{i,H}$, for $i = S, T$. This requires that, if agent $(i, j)$ has the lowest net valuation—and never buys and sells to all other agents—then agent $(i, -j)$ has the highest net valuation—and never sells and buys from all other agents. This immediately implies that the there exist 8 possible trading patterns which could constitute a symmetric equilibrium: 4 with types $T$ intermediating and types $S$ as the end users one of which is the equilibrium we have already shown exists; and 4 others with roles reversed.

We first rule out the existence of an equilibrium trading pattern where type $(S, L)$ buys from type $(S, H)$. This eliminates 4 of the 7 candidate alternatives.\textsuperscript{24} To do so, write the Bellman Equation capturing the lifetime utility of a type $(S, L)$ who owns the asset independently of the trading pattern,

\[ rV_{SL} = u_L + \sigma (V_{SH} - V_{SL}) + \frac{\lambda_i^N}{2} \max\{D_{SH} - D_{SL}, 0\}. \]

$\lambda_i^N$ denotes the rate at which a trader meets a type $(i, H)$ without the asset; by symmetry, it also denotes the rate at which a trader meets a type $(i, L)$ with the asset. In turn, write the Bellman Equation capturing the lifetime utility of a type $(S, L)$ without the asset as

\[ rU_{SL} = \sigma (U_{SH} - U_{SL}) + \frac{\lambda_i^M}{2} \max\{D_{SL} - D_{SH}, 0\} \]

where $\lambda_i^M$ denotes the rate at which a trader meets a type $(i, H)$ with the asset and, by symmetry, the rate at which a trader meets a type $(i, L)$ without the asset.

\textsuperscript{24}Namely the ones governed by the following chains of inequalities: $D_{SH} \leq D_{TL} \leq D_{TH} \leq D_{SL}, D_{SH} \leq D_{TH} \leq D_{TL} \leq D_{SL}, D_{TL} \leq D_{SH} \leq D_{SL} \leq D_{TH}$, and $D_{TH} \leq D_{SH} \leq D_{SL} \leq D_{TL}$. 

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It is straightforward to verify that the second to the fifth line of the prior expression is each net valuations $D_{Sj}$ we get
\[(r + 2\sigma) (D_{SH} - D_{SL}) = \Delta u - \lambda^N_S \max\{D_{SH} - D_{SL}, 0\} + \lambda^M_S \max\{D_{SL} - D_{SH}, 0\}.\]

Now conjecture that $D_{SH} \leq D_{SL}$. Then, the prior equation implies
\[(r + 2\sigma) (D_{SH} - D_{SL}) = \Delta u - \lambda^M_S (D_{SH} - D_{SL}).\]

I deviated from G’s notes here, so might want to doublecheck last line Rearranging, it follows immediately that $D_{SH} > D_{SL}$, a contradiction. As a consequence, we can rule out any equilibrium where type $(S, H)$ sells to type $(S, L)$. Next, write the corresponding Bellman Equations for types $T$ as
\[
rV_{TL} = u_L + \sigma (V_{TH} - V_{TL}) + \lambda^N_S \max\{D_{SH} - D_{TL}, 0\} + \lambda^M_S \max\{D_{SL} - D_{TL}, 0\} + \frac{\lambda^N_T}{2} \max\{D_{TH} - D_{TL}, 0\}
\]
\[
rU_{TL} = \sigma (U_{TH} - U_{TL}) + \lambda^M_S \max\{D_{TL} - D_{SH}, 0\} + \lambda^N_S \max\{D_{TL} - D_{SL}, 0\} + \frac{\lambda^M_T}{2} \max\{D_{TL} - D_{TH}, 0\}.\]

Proceeding identically for the type $(T, H)$ and taking the difference to compute the respective net valuations $D_{Tj}$ we get
\[(r + 2\sigma) (D_{TH} - D_{TL}) = u_L - u_H + \lambda^M_T \max\{D_{TL} - D_{TH}, 0\} - \lambda^N_T \max\{D_{TH} - D_{TL}, 0\}
+ \lambda^N_S \max\{D_{SH} - D_{TH}, 0\} + \lambda^M_S \max\{D_{SL} - D_{TH}, 0\}
- \lambda^N_S \max\{D_{SH} - D_{SL}, 0\} - \lambda^M_S \max\{D_{SL} - D_{TH}, 0\}
+ \lambda^N_S \max\{D_{TL} - D_{SL}, 0\} + \lambda^M_S \max\{D_{TL} - D_{SH}, 0\}
- \lambda^N_S \max\{D_{TH} - D_{SL}, 0\} - \lambda^M_S \max\{D_{TH} - D_{SH}, 0\}.\]

Now conjecture that $D_{TH} \leq D_{TL}$. Then, the prior equation implies
\[(r + 2\sigma) (D_{TH} - D_{TL}) = u_L - u_H - \lambda^M_T (D_{TH} - D_{TL})
+ \lambda^N_S (\max\{D_{SH} - D_{TH}, 0\} - \max\{D_{SH} - D_{TL}, 0\})
+ \lambda^M_S (\max\{D_{SL} - D_{TH}, 0\} - \max\{D_{SL} - D_{TL}, 0\})
+ \lambda^N_S (\max\{D_{SL} - D_{SH}, 0\} - \max\{D_{TH} - D_{SL}, 0\})
+ \lambda^M_S (\max\{D_{TL} - D_{SH}, 0\} - \max\{D_{TH} - D_{SH}, 0\}).\]

It is straightforward to verify that the second to the fifth line of the prior expression is each strictly positive. It the follows immediately that $D_{TH} > D_{TL}$, a contradiction. As a conse-
quence, we can rule out any equilibrium where type \((S,H)\) sells to type \((S,L)\). This rules out all symmetric equilibria with a trading pattern where type \((T,H)\) sells to type \((T,L)\).\(^{25}\)

The last equilibrium trading pattern we need to rule out is the one where types \(S\) intermediate and types \(T\) act as end users. To do so, we can proceed as in the previous two cases to derive a general expression net value of a transaction from a type \((S,L)\) to a type \((T,L)\),

\[
\begin{align*}
    r(D_{TL} - D_{SL}) &= \sigma(D_{TH} - D_{TL}) - \sigma(D_{SH} - D_{SL}) \\
    &+ \frac{\lambda_T^N}{2}(D_{TH} - D_{TL}) - \frac{\lambda_S^N}{2}(D_{SH} - D_{SL}) \\
    &+ \lambda_S^M \max\{D_{SL} - D_{TL}, 0\} - \lambda_S^N \max\{D_{TL} - D_{SL}, 0\} \\
    &+ \lambda_S^N \max\{D_{SH} - D_{TL}, 0\}
\end{align*}
\]

where we use that we have already shown that \(D_{iH} > D_{iL}\) for \(i = S, T\).

Note that the last line is strictly positive. If the opposite was true, it would imply that \(D_{SL} \leq D_{SH} \leq D_{TL} \leq D_{TH}\), a non-symmetric trading pattern.\(^{26}\) Using this observation conjecture that \(D_{TL} \leq D_{SL}\) and \(D_{TH} \geq D_{SH}\) to get

\[
\begin{align*}
    \left( r + \lambda_S^M \right) (D_{TL} - D_{SL}) &= \sigma(D_{TH} - D_{TL}) - \sigma(D_{SH} - D_{SL}) \\
    &+ \frac{\lambda_T^N}{2}(D_{TH} - D_{TL}) - \frac{\lambda_S^N}{2}(D_{SH} - D_{SL}) + \lambda_S^N (D_{SH} - D_{TL}).
\end{align*}
\]

Rewrite the last term as \(\lambda_S^N (D_{SH} - D_{SL} - (D_{TL} - D_{SL}))\) to get

\[
\begin{align*}
    \left( r + \lambda_S^M + \lambda_S^N \right) (D_{TL} - D_{SL}) &= \sigma((D_{TH} - D_{TL}) - (D_{SH} - D_{SL})) \\
    &+ \frac{\lambda_T^N}{2}(D_{TH} - D_{TL}) + \frac{\lambda_S^N}{2}(D_{SH} - D_{SL}).
\end{align*}
\]

Since we conjectured a trading pattern where types \(S\) intermediate the right hand side is strictly positive, implying \(D_{TL} > D_{SL}\), a contradiction. Thus, we have shown that no other symmetric equilibrium trading pattern exists, proving uniqueness.

**D Efficiency**

**D.1 Transaction Costs**

Whenever an agent trades, she incurs a resource cost \(\xi_2\). One can then easily derive the following expressions for the value of trade (net of the resource cost) between different types

\(^{25}\)Namely the ones governed by the following chains of inequalities: \(D_{SL} \leq D_{TH} \leq D_{TL} \leq D_{SH}\) and \(D_{TH} \leq D_{SL} \leq D_{SH} \leq D_{TL}\).

\(^{26}\)It can be shown separately that this non-symmetric trading pattern cannot constitute an equilibrium either.
\[ D_{SH} - D_{SL} - c = \frac{\Delta u - 2\sigma c}{r + 2\sigma + \lambda_S} \]
\[ D_{TH} - D_{TL} - c = \frac{\Delta u - 2\sigma c}{r + 2\sigma + \lambda_T + 2\lambda_S} \]
\[ D_{TL} - D_{SL} - c = D_{SH} - D_{TH} - c = \frac{1}{2} \left[ \frac{\Delta u - 2\sigma c}{r + 2\sigma + 2\lambda_S} - \lambda_T + \lambda_S \right] \]

which are all strictly positive for small enough \( c \).

### D.2 Modified Preferences

Under the modification of preferences the net value of trade between different types is given by

\[ D_{SH} - D_{SL} = \frac{\Delta u}{r + 2\sigma + \lambda_S} \]
\[ D_{TH} - D_{TL} = \frac{\Delta u - \varepsilon}{r + 2\sigma + \lambda_T + 2\lambda_S} \]
\[ D_{TL} - D_{SL} = D_{SH} - D_{TH} = \frac{1}{2} \left[ \frac{\Delta u (\lambda_T + \lambda_S)}{r + 2\sigma + 2\lambda_S} - \varepsilon \right] \]

which are all strictly positive for small enough \( \varepsilon \).

### D.3 Differential Contact Rates

Let \( \lambda_i \) continue to denote the rate at which types \( S \) locate a mismatched counterparty with opposite asset position. Assume that types \( T \) locate a meeting partner at relative frequency \( \frac{1}{2} \leq \sigma \leq 1 \) so that they meet the same counterparty at rate \( \hat{\lambda}_S \equiv \sigma \lambda_i \). The relevant equations become

\[ D_{SH} - D_{SL} = \frac{\Delta u}{r + 2\sigma + \lambda_S} > 0 \]
\[ D_{TH} - D_{TL} = \frac{\Delta u}{r + 2\sigma + \omega (\lambda_T + 2\lambda_S)} > 0 \]
\[ D_{TL} - D_{SL} = D_{SH} - D_{TH} = \frac{1}{2} \left[ \frac{\Delta u \omega (\lambda_T + 2\lambda_S) - \lambda_S}{r + 2\sigma + 2\lambda_S} \right] \]

which are all strictly positive for small enough \( \frac{1}{2} \leq \sigma < 1 \).
E Deriving the Benefits of Commitment - Values

The annuitized lifetime utility for an agent of type \((S, j)\) with the asset is

\[
rV_{S,j} = \frac{(u_H + u_L)}{2} + \lambda_S (D_{SH} - D_{SL}) / 4. \tag{51}
\]

The above expression is obtained by solving equations (2) and (4) with respect to \(V_{SL}\) and \(V_{SH}\). Conditional on being in state \(L\), type \(S\) who owns the asset enjoys a flow utility of \(u_L\) and an annuitized capital gain of \(\lambda_S (D_{SH} - D_{SL}) / 2\), which reflects the option value of selling the asset. Conditional on her valuation being \(H\), the agent enjoys a flow utility of \(u_H\). The annuitized lifetime utility of the agent is the average of the two conditional payoffs. Similarly,

\[
rU_{T,j} = \lambda_S (D_{TL} - D_{SL}) / 2 + \lambda_S (D_{TH} - D_{SL}) / 2 + \lambda_T (D_{TH} - D_{TL}) / 4 = \lambda_S (D_{SH} - S_{SL}) / 2 + \lambda_T (D_{TH} - D_{TL}) / 4. \tag{52}
\]

where the first line is obtained by solving equations (9) and (11) with respect to \(U_{TL}\) and \(U_{TH}\) and the second line is obtained by noting that \(D_{TH} - D_{SL} = D_{SH} - D_{TL}\). The annuitized lifetime utility for an agent of type \(T\) without the asset is the average of the agent’s flow payoff conditional on having a valuation of \(L\) and of \(H\). Conditional on a valuation of \(L\), the agent’s flow payoff is \(\lambda_S (D_{TL} - D_{SL})\). Conditional on a valuation of \(H\), the agent’s flow payoff is \(\lambda_S (D_{TH} - D_{SL}) + \lambda_T (D_{TH} - D_{TL}) / 2\). Finally,

\[
rV_{T,j} = \frac{(u_L + u_H)}{2} + \lambda_S (D_{SH} - D_{SL}) / 2 + \lambda_T (D_{TH} - D_{TL}) / 4. \tag{53}
\]

The above expression is obtained by solving equations (8) and (10) with respect to \(V_{TL}\) and \(V_{TH}\). The agent’s flow payoff when her valuation is \(L\) is given by the sum of the flow utility \(u_L\) and the annuitized option value of selling the asset \(\lambda_S (D_{SH} - D_{TL}) + \lambda_T (D_{TH} - D_{TL}) / 2\). The agent’s flow payoff conditional when her valuation is \(H\) is given by the sum of the flow utility \(u_H\) and the option value of selling the asset \(\lambda_S (D_{SH} - D_{TH})\).

F Entry with a General Cost Function

Should we make this an Online Appendix?

Let \(F(c)\) denote the measure of agents who face a cost non-greater than \(c\). Associated with the cost distribution \(F(c)\), there is a correspondence \(C(\phi_T) = \{c : F(c) = \phi_T\}\), where \(C(\phi_T)\) denotes the \(\phi_T\) quantile of the cost distribution. It is natural to think of \(C(\phi_T)\) as the cost correspondence of acquiring commitment power.

The baseline model has cost distribution \(F(c)\) which is degenerate at \(c\). Here, we are sometimes going to focus on another particular specification of the cost correspondence, namely the one where the cost correspondence is perfectly elastic. In that case, we assume that a fraction
\(\phi_T\) of agents can acquire commitment power at no cost and a fraction \(1 - \phi_T\) of agents faces an infinite cost to acquire commitment power. That is, the cost distribution \(F(c)\) is such that \(F(c) = \phi_T\) for all \(c \geq 0\). Thus, the cost correspondence \(C(\phi_T)\) is such that \(C(\phi_T) = 0\) for all \(\phi_T \in [0, \phi_T]\) and \(C(\phi_T) = \infty\) for all \(\phi_T \in (\phi_T, 1]\). The specification is interesting because it captures the view that commitment power is an innate trait rather than a technology that can be acquired at some cost. This specification is illustrated in the left panel of figure 5.

The figure illustrates the set of equilibria in the case of a cost correspondence that is perfectly elastic at some \(\phi_T\). Obviously, in this case, the unique equilibrium is such that the measure of agents of type \(T\) is \(\phi_T\). Furthermore, figure 5(b) illustrates the set of equilibria in the case of a generic cost correspondence. Depending on the shape of the correspondence, there can exist a unique equilibrium in which no agent acquires commitment power, a unique equilibrium in which all agents acquire commitment power, or multiple equilibria with cardinality \(2N + 1\) and varying measures of agents with commitment power. Also in this case, all the odd-numbered equilibria are stable and all the even-numbered equilibria are unstable.

The following proposition states Proposition 2 in terms of the more general cost structure assumed here.

**Proposition 2*. Equilibrium measure of intermediaries.** (i) Suppose that \(C(\phi_T)\) is perfectly inelastic at \(c\). Then: (a) if \(c \in (0, b_1]\), there is a unique equilibrium with a measure \(\phi_T = 1\) of agents of type \(T\); (b) if \(c \in (b_1, b_h]\), there are three equilibria with, respectively, measures \(\phi_{T,1}, \phi_{T,2}\) and \(\phi_{T,3}\) of agents of type \(T\), where \(0 = \phi_{T,1} < \phi_{T,2} < \phi_{T,3} < 1\); (c) if \(c > b_h\), there is a unique equilibrium with a measure \(\phi_T = 0\) of agents of type \(T\). (ii) Suppose that \(C(\phi_T)\) is perfectly elastic at \(\hat{\phi}_T\). Then, there is a unique equilibrium with a measure \(\phi_T = \hat{\phi}_T\) of agents of type \(T\). (iii) For any \(C(\phi_T)\), there are \(2N + 1\) equilibria with, respectively, measures \(\phi_{T,1}, \phi_{T,2}, \ldots, \phi_{T,2N+1}\) of agents of type \(T\), for some \(N \geq 0\).

Welfare is now given by
\[ W = \Delta u \left( \frac{\phi_T^* \left[ \frac{2\lambda_S}{2\sigma + \lambda_S} + \frac{\lambda_T}{2\sigma + 2\lambda_S + \lambda_T} \right] + (1 - \phi_T^*) \frac{\lambda_S}{2\sigma + \lambda_S}}{4} \right) + u_L + u_H - \int_0^{\phi_T^*} C(x)dx \]

or, alternatively,

\[ W = \left[ \mu_{SL} + \mu_{TL} \right] u_L + \left[ \mu_{SH} + \mu_{TH} \right] u_H - \int_0^{\phi_T^*} C(x)dx \]

\[ = \frac{u_H}{2} - \left( \sqrt{\frac{\sigma}{\lambda}} + \frac{\sigma}{2\lambda} - \frac{\sigma}{\lambda} \right) \Delta u - \int_0^{\phi_T^*} C(x)dx. \]

Again, it follows that any equilibrium with \( \phi_T^* > 0 \) is inefficient unless \( \int_0^{\phi_T^*} C(x)dx = 0 \). The reason, of course, is the same as in the baseline: Intermediation is neutral with regard to the quality of the allocation. Thus, any resources spent on acquiring the commitment technology are purely redistributational and socially wasteful.

The case of a perfectly elastic cost function that is illustrated in Figure 5. Here, the equilibrium is efficient because, even though, the measure of intermediaries is positive none of them has paid a cost to acquire commitment power.

The following proposition summarizes our welfare implications in the context of the more general cost structure assumed here and is hence the counterpart to proposition 3 in the main text.

**Proposition 3*. Welfare.** Suppose there are \( 2N + 1 \) equilibria with, respectively, \( \phi_{T,1}, \phi_{T,2}, \ldots, \phi_{T,2N+1} \) measures of agents of type \( T \), where \( \phi_{T,1} < \phi_{T,2} < \ldots < \phi_{T,2N+1} \). (i) Welfare in an equilibrium with \( \phi_{T,i} \) agents of type \( T \) is strictly greater than welfare in an equilibrium with \( \phi_{T,j} \) agents of type \( T \) for all \( i < j \). (ii) An equilibrium with \( \phi_{T,i} \) agents of type \( T \) is inefficient if and only if \( \int_0^{\phi_{T,i}} C(x)dx = 0 \).

### F.1 Comparative Statics

In this section we offer counterparts to propositions 4-7 for the baseline case.

#### F.1.1 Trading Frictions

The following proposition generalizes the relation between trading frictions and the extent of entry into intermediation and can be derived in exactly the same fashion as its counterpart for the perfectly inelastic cost.

**Proposition 4*. Intermediation and trading frictions.** Let \( (\phi_{T,1}, \phi_{T,2}, \ldots, \phi_{T,2N+1}) \) denote the equilibrium measures of agents of type \( T \) given the normalized arrival rate \( \lambda \), and let \( (\phi'_{T,1}, \phi'_{T,2}, \ldots, \phi'_{T,2N'+1}) \) denote the equilibrium measures of agents of type \( T \) given \( \lambda' \). (i) For any \( \lambda' > \lambda \), \( \mu'_{T,1} \geq \mu_{T,1} \) and \( \mu'_{T,2N'+1} \geq \phi_{T,2N+1} \). (ii) If
\( N = N', \text{ then } \phi_{T,j}' \geq \phi_{T,j} \text{ for all stable equilibria } j = 1, 3, 5, \ldots. \) The derivative of welfare with respect to \( \lambda \) is given by

\[
\frac{dW}{d\lambda} = \Delta u \left\{ \left( \frac{1}{\lambda^2 + 1} \right)^{-1/2} \left( \frac{1}{\lambda^3} - \frac{1}{4\lambda^2} \right) + \frac{1}{\lambda^2} \right\} - C(\phi_T^*) \frac{d\phi_T^*}{d\lambda}
\]

(54)

where the only difference to the baseline model is the last term. The sign of (54) depends on the shape of the cost correspondence \( C(\phi_T) \). For the case where the cost correspondence is infinitely elastic we have

\[
\frac{dW}{d\lambda} = \Delta u \left\{ \left( \frac{1}{\lambda^2 + 1} \right)^{-1/2} \left( \frac{1}{\lambda^3} - \frac{1}{4\lambda^2} \right) + \frac{1}{\lambda^2} \right\}
\]

which is positive because, when the cost correspondence is infinitely elastic, the measure of agents with commitment is constant and the only effect of lowering \( k \) on welfare is to improve the allocation of the asset.

Thus, if the measure of agents with commitment power is independent of the returns a decline in search frictions unambiguously increases welfare as one would expect.

**Proposition 5*. Welfare and trading frictions. **Suppose \( C(\phi_T) \) is perfectly elastic. Welfare is strictly increasing in \( \kappa \).

**F.1.2 Rate of Return on Alternative Investments**

Here we briefly carry out comparative statics with respect to the correspondence \( C(\phi_T) \). Similarly to the baseline case where we study an inelastic cost function, we assume that the correspondence depends on a parameter \( R \), which we again interpret as the rate of return on the alternative investments that agents forego when they decide to acquire the commitment technology. We assume that \( C(\phi_T; R) \) is continuous, differentiable and strictly increasing with respect to \( R \). Moreover, we assume that \( \lim_{R \to 0} C(\phi_T; R) = 0 \) and \( \lim_{R \to \infty} C(\phi_T; R) = \infty \).

The following proposition generalizes the link between the extent of intermediation and the returns on alternative investments to the general cost structure.

**Proposition 6*. Intermediation and return on investments.**

Let \( (\phi_{T,1}, \phi_{T,2}, \ldots, \phi_{T,2N+1}) \) denote the equilibrium measures of agents of type \( T \) given the rate of return \( R \), and let \( (\phi_{T,1}', \phi_{T,2}', \ldots, \phi_{T,2N'+1}') \) denote the equilibrium measures of agents of type \( T \) given the rate of return \( R' \). (i) For any \( R' > R \), \( \mu_{T,1}' \geq \mu_{T,1} \) and \( \mu_{T,2N'+1}' \geq \phi_{T,2N+1} \). (ii) If \( N = N' \), then \( \phi_{T,j}' \geq \phi_{T,j} \) for all stable equilibria \( j = 1, 3, 5, \ldots \).