MSc Economics

Intermediaries in Trade

A Master's Thesis submitted for the degree of
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supervised by
Alejandro Cuñat

Simon Neumueller

0926894

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Preface

I want to thank Alejandro Cuñat, Christian Haefke, Tamás Papp, Michael Reiter and Andreas Gulyás for helpful suggestions and useful comments. All errors are mine.

MSc Economics

Affidavit

I, Simon Neumueller

hereby declare

that I am the sole author of the present Master's Thesis,

Intermediaries in Trade

20 pages, bound, and that I have not used any source or tool other than those referenced or any other illicit aid or tool, and that I have not prior to this date submitted this Master's Thesis as an examination paper in any form in Austria or abroad.

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Abstract

This paper develops a simple model of intermediated trade. Exporters and importers want to form a match in order to obtain a type specific surplus. Matching takes place via a direct trade route or via a single intermediary. As information barriers impede direct matching, the intermediary opens up another channel for exchange through its trading network. Establishing a network is costly and hence the intermediary charges a commission rate for participation. In equilibrium, optimal commission rate and network size are determined. Consequently, expected trade and welfare increase.

JEL Classification Numbers: F10,C78,D82,D83,L10

1 Introduction

Intermediaries make trade happen by connecting importers and exporters around the globe. It is hard to imagine how the rise of Chinese exports should have taken off without the links to mainland China by overseas Chinese in Europe and North America. Contrary to this, public opinion is wary about traders in international markets. They are often accused of exploiting producers, workers and farmers in less developed countries to the benefit of themselves and consumers of the developed world. Standard trade theory proceeds on the assumption of centralized markets and neglects the intermediate step of trade.
Recent empirical papers such as Ahn, Khandelwal, and Wei [2010] show that 20% of Chinese exports are accounted for by intermediaries. Feenstra, Hanson, and Lin [2004] find that in the period of 1988 - 1998 an average of 53% of Chinese exports have been re-exported via Hong Kong. One could think of this being due to tariffs that are evaded by this procedure. Clearly this is not the case. If only so called "processing exports" are considered, exports that are duty free, the share of re-exports via Hong Kong even rises to 72%. More recently, Blum, Claro, and Horstmann [2010] find on a firm level, that about 35% of Chilean imports from Argentina are traded via wholesalers.
From an economic theory perspective, trade intermediaries influence aspects such as trade costs, terms of trade and welfare gains. These mechanisms are till today by far not fully understood. Rauch and Watson [2004] develop one of the first models in this field of research. They focus on a situation with incomplete information between importers and exporters. Intermediaries build networks that are able to lower informational costs. Bargaining power and intermediation technology determine the amount of intermediation in a general equilibrium setting. By manipulating the intermediaries bargaining power, policy has a say in this framework. Petropoulou [2010] follows this line of research and builds a model with asymmetric information on both sides of a match. Differentiated products of an exporter and an importer can be traded in a network or outside of it. The former has the advantage that a match is more likely, but firms in the networks have to occur costs. Antràs and Costinot [2010] analyze welfare effects of intermediaries in a North-South environment.
This paper builds on Petropoulou [2010] and focuses on the matching role of an intermediary in the market. Importers and exporters form pairs such that they exchange goods which creates a surplus for each of them. In this setting goods are differentiated , matches are type specific and information costs hinder trade. It follows that agents only match with a certain probability. Another trade route

is via a single intermediary in the market. This intermediary invests in a network of importers and exporters and can match pairs if both of them are part of the network. Traders are charged a commission rate if a match is successful. What is new in this approach, is that the model is set up in a heterogeneous framework. Match surplus of an importer and an exporter, depends on a distribution of surplus. Moreover, direct trading firms have to occur fixed costs in pursuing this trading channel. This is motivated by the cost a firm faces in searching for a trading partner directly, which involves for example time, effort and fees for trade fairs. What makes this setup interesting is the reaction of the intermediary to the cutoff level of firms which are admitted to its network. The intermediary now chooses this value and not only network size in general.

2 The Model

First, the setup is explained in detail. Then the equilibrium concept, which includes optimal network size is depicted. A numerical simulation illustrates the findings.

2.1 Setup

There exists a two-sided market where importers and exporters, both risk neutral, form a match (X_j, M_j) to exchange a single good. These firms are uniformly distributed on the interval $[0,1]$. For each trader, there exists a unique trading partner to match with. A match generates a joint surplus given by the cumulative distribution function $G(S)$, $S \in [0, \bar{S}]$ where $\bar{S}$ is some upper bar for the surplus. If agents fail to locate each other, surplus is zero. All traders draw their surplus at the beginning of the game. A motivation for this setting can be given by trade in differentiated goods, such as specific features or timing of delivery.
Without informational frictions, every pair matches directly ('direct trade') and every surplus is realized. In the case of direct trade, every importer and exporter has to pay a fixed cost F^{DT} to engage in this form of trade. Information asymmetries are present in the sense that traders do not know the location of their partner. This is captured by $q(i)$, the probability of a match in direct trade. Parameter $i \in [0,1]$ represents information costs to direct trade. The higher these costs, the lower is the probability of a match, i.e. $q'(i) < 0$. Without any such costs, matching probability is one ($q(0) = 1$). If there are costs being equal to one, direct trade is impossible ($q(1) = 0$). Moreover, $q(i)$ can be seen as expected trade volume and

$$q(i)\int_{2F_{DT}}^{\bar{S}}(S-2F^{DT})dG(S) \tag{1}$$

is expected joint surplus. Any exporter/importer pair with a joint surplus below $2F^{DT}$ will not engage in direct trade because fixed costs are not covered by the surplus.

The second possibility for trade is to match via a single intermediary ('intermediated trade'). This agent develops a network of importers and exporters to match suitable pairs. The network's size is determined by

$$P=\int_{S_R}^{\bar{S}}dG(S)\in[0,1] \tag{2}$$

where S_R is the surplus cutoff level. Only importer and exporter pairs with a surplus equal or above this value are part of the network. This measure can be seen as the probability that any exporter/importer is part of the network, prior to knowing their match specific surplus. Network formation involves two forms of costs for the intermediary, a fixed cost F^{IT} and marginal costs $c(i,P)$ which are increasing in information costs and overall network size. Total costs, consisting of marginal costs for both members of a match can therefore be written as follows:

$$C(P_X,P_M)=F^{IT}+2c(i,P)(P) \tag{3}$$

After network investment is sunk, matching of network members is costless and occurs with probability 1. Revenues for the intermediary are generated by a commission rate it collects for incorporating a trader into its network.

2.2 Timing

Matching proceeds in the following way:

Stage 1 - Surplus Uncertainty Surplus $S\in[0,\bar{S}]$ is determined by the type of the importer/exporter and they learn their type j at the beginning of the game. The intermediary knows about the surplus of each agent.

Stage 2 - Network Investment The Intermediary contacts importers and exporters to form a network of size $\{P\}$ and demands its commission rate α_I for a successful match.

Stage 3 - Contracting Traders decide whether to accept or decline the offer.

Stage 4 - Indirect Trade All exporters X_j and their unique importers X_M, which are part of the network match.

Stage 5 - Direct Trade Traders outside the network can now decide to occur fixed costs of direct trade F^{DT} and match directly with probability $q(i)$.

2.3 Matching

After intermediary matching takes place in stage 4, unmatched firms in the final stage of the game can engage in direct trade and find a trading partner with probability $q(i)$. To do so they have to pay a fixed cost F^{DT}. Since importers and exporters are assumed to have the same weight in bargaining, each of them gets $\frac{1}{2}$ of the expected surplus and profits are thus:

$$E(\Pi_X^{DT}) = E(\Pi_M^{DT}) = E(\Pi^{DT}) = \frac{1}{2}q(i)S - F^{DT} \tag{4}$$

If exporters and importers choose to deal with an intermediary in the first place, they have no expenses for fixed costs here, but instead have to pay the commission rate α_I. Given information costs i, every agent captures a share α_k where $k = X, M, I$. As in direct trade, traders share there surplus equally and so $\alpha_X = \alpha_M \equiv \alpha_T$. Therefore, surplus shares have to add up to one and the following has to hold:

$$2\alpha_T + \alpha_I = 1 \tag{5}$$

Expected payoff for traders in indirect trade can be written as:

$$E(\Pi_X^{IT}) = E(\Pi_M^{IT}) = E(\Pi^{IT}) = \frac{1}{2}(1 - \alpha_I)S \tag{6}$$

At the outset of the game, an exporter importer pair (X_j, M_j) trades indirectly with probability P, the probability that both of them are contacted by the intermediary. This results in an expected measure of intermediated trade $E(T_I) = P$. A trader considering indirect trade expects the trade partner to be part of the network with probability P and hence, in this case gets $E(\Pi^{IT})$. Otherwise with probability $(1 - P)$ the agent gets $E(\Pi^{DT})$. Expected payoff can be written as:

$$\begin{aligned} E(\Pi_X | X_j \in P) &= E(\Pi_M | M_j \in P) \\ &= \frac{1}{2}P(1 - \alpha_I)S + (1 - P)(\frac{1}{2}q(i)S - F^{DT}) \end{aligned} \tag{7}$$

Trader participation in the intermediary's network can be guaranteed by adjusting α_I in such a way that an importer or exporter is indifferent between the two forms of trade. Equalizing expected surplus for direct and indirect trade and solving for α_I performs this task:

$$\frac{1}{2}q(i)S - F^{DT} = \frac{1}{2}(1-\alpha_I)S$$
$$\alpha_I(S) = min\left\{1 - q(i) + \frac{2F^{DT}}{S}, 1\right\} \tag{8}$$

This implies that $\alpha_I(S)$ is different for every $S \in [0, \bar{S}]$. Any value above 1 would not be accepted by an intermediary because this would mean a trader would give away more than what he receives from the match. This is why the value is bounded by a maximum value of 1. The intermediary adjusts the commission rate for every match specifically. Traders accept an intermediary's offer if $\alpha_I(S) \leq min\left\{1 - q(i) + \frac{2F^{DT}}{S}, 1\right\}$ and reject otherwise. Maximizing profits, an intermediary sets

$$\alpha_I^*(S,i) = min\left\{1 - q(i) + \frac{2F^{DT}}{S}, 1\right\} \tag{9}$$

and all offered contracts are accepted. The analysis in this paper assumes for tractability reasons that direct matching probability is always larger than twice the fixed costs:

$$q(i) > 2F^{DT} \tag{10}$$

It therefore always holds that $\alpha_I^*(S,i) \in [0,1]$:

Therefore $\alpha_I^*(S,i)$ simplifies to:

$$\alpha_I^*(S,i) = 1 - q(i) + \frac{2F^{DT}}{S} \tag{11}$$

The game starts with the trader pair considering all different possibilities of being in the network. With probability P both, importer and exporter are part of the network and with probability $1-P$ none of them is in the network. Weighing profits with the according probability results in:

$$E(\Pi_X) = E(\Pi_M) = (\frac{1}{2}q(i)S - F^{DT})(1-P) + \frac{1}{2}(1-\alpha_I(S))SP \tag{12}$$

This is the probability of not being in the network times the expected profit of direct trade, plus the probability of being contacted by the intermediary times expected profit of indirect trade. Plugging in for $\alpha_I^*(S,i)$ this simplifies to $E(\Pi_X) = E(\Pi_M) \equiv E(\Pi^{DT} = \frac{1}{2}q(i)S - F^{DT}$. Expected surplus above this value is fully absorbed by the intermediary and so importers and exporters are indifferent between the two means of trade. By knowing this fact, I am now considering the influence of an intermediary on expected trade and welfare.

2.4 Trade and Welfare

Direct trade matching takes place after intermediated trade has been resolved. That is the reason why trade in the case where an intermediary is in the market is higher than trade where only direct matching is possible. Lemma 1 shows the fact, that an intermediary raises expected trade, more rigorously.

Lemma 1 *An active intermediary raises expected trade volume unambiguously compared to when only direct trade is possible.*

Proof: $E(T)$ denotes trade with an intermediary in the market and $E(T^{DT})$ the situation where only direct trade is possible. $P = \int_{S_R}^{\bar{S}} dG(S) \in [0,1]$ matches are formed in the intermediated trade case and traders with an expected surplus above its fixed costs $\frac{1}{2}q(i)S \geq F^{DT}$ engage in direct trade.

$$E(T) = \mathbb{1}_{S_R > 2F^{DT}} \left[q(i) \int_{2F^{DT}}^{S_R} dG(S) \right] + \int_{S_R}^{\bar{S}} dG(S) \tag{13}$$

$$= \underbrace{\mathbb{1}_{S_R > 2F^{DT}} \left[q(i) \int_{2F^{DT}}^{S_R} dG(S) \right] + q(i) \int_{S_R}^{\bar{S}} dG(S)}_{E(T^{DT})} \tag{14}$$

$$+ \underbrace{(1 - q(i)) \int_{S_R}^{\bar{S}} dG(S)}_{\text{Intermediated Trade} \geq 0}$$

$$\geq q(i) \int_{2F^{DT}}^{\bar{S}} dG(S) = E(T^{DT})$$

When the intermediary is active, then trade volume is larger than when only direct trade is available. In the case where $P = 0$, expected trade has the same size as $E(T^{DT})$.■

As shown before, traders are indifferent between direct and indirect trade because they are as well off in either case. Hence, the intermediary's profits represent a pure welfare gain. This gain can be thought of as being realized through an expansion of possible trade transactions by the intermediary.

Lemma 2 *An active intermediary raises expected welfare unambiguously compared to when only direct trade is possible.*

Proof: As before $E(W)$ represents expected welfare with an active intermediary and $E(W^{DT})$ is the case without an intermediary. S_R is an intermediary's reservation surplus, which is determined in equilibrium.

$$
\begin{aligned}
E(W) = & \int_{S_R}^{\bar{S}} SdG(S) - 2c(i,P)P - F^{IT} \\
& + \mathbb{1}_{S_R > 2F^{DT}} \left[\int_{2F^{DT}}^{S_R} SdG(S)q(i) - \int_{2F^{DT}}^{S_R} dG(S) 2F^{DT} \right] \\
= & \underbrace{\int_{S_R}^{\bar{S}} \alpha^*(S,i) SdG(S) - 2c(i,P) - F^{IT}}_{\text{Expected profit for the intermediary}=E(\Pi_I)\geq 0} + \underbrace{\int_{S_R}^{\bar{S}} (1-\alpha^*(S,i)) SdG(S)}_{\substack{\text{Expected joint profit} \\ \text{for traders in intermediated} \\ \text{trade}=2E(\Pi^{IT}) \geq 0}} \\
& + \mathbb{1}_{S_R > 2F^{DT}} \underbrace{\left[\int_{2F^{DT}}^{S_R} SdG(S)q(i) - \int_{2F^{DT}}^{S_R} dG(S) 2F^{DT} \right]}_{\text{Expected joint profit for traders in direct trade}=2E(\Pi^{DT})} \\
= & E(\Pi_I) + \underbrace{\int_{S_R}^{\bar{S}} SdG(S)q(i) - \int_{S_R}^{\bar{S}} dG(S) 2F^{DT}}_{\text{Using equation (9) to simplify } 2E(\Pi^{IT})} + \mathbb{1}_{S_R > 2F^{DT}} 2E(\Pi^{DT}) \\
\geq & \int_{2F^{DT}}^{\bar{S}} SdG(S)q(i) - \int_{2F^{DT}}^{\bar{S}} dG(S) 2F^{DT} = E(W^{DT}) \qquad (15)
\end{aligned}
$$

In the case where no intermediary is in the market, $S_R = 0$ and welfare in the intermediated case becomes trivially the one in direct trade. If an intermediary is present, welfare is larger than in the case without an intermediary. This is true, because $E(\Pi_I) \geq 0$, and $2E(\Pi^{IT}) + \mathbb{1}_{S_R > 2F^{DT}} 2E(\Pi^{DT}) \geq E(W^{DT})$.■

2.5 Equilibrium Network Size

The intermediary's costs of network expansion are convex, both in i and P, this is a necessary condition for an optimal network size $P^* \in (0,1)$ in equilibrium for some i and $G(S)$. Otherwise, only corner solutions, where networksize P is either 1 or 0, exist. Further restrictions to these costs apply as follows:

$$
\begin{aligned}
c(0,\cdot) = 0 \quad &; \quad c(\cdot,0) = 0 \qquad (16) \\
c_i(i,P) > 0 \quad &; \quad c_{ii}(i,P) \geq 0 \\
c_P(i,P) > 0 \quad &; \quad c_{PP}(i,P) > 0 \\
c_{iP}(i,P) \quad = \quad & c_{Pi}(i,P) > 0
\end{aligned}
$$

Costs are chosen to have this form to reflect a network that can contact some traders easily, but as the number of traders rises it needs more and more effort to do so. Expected profit of the intermediary can be written as:

$$E(\Pi_I) = \int_{S_R}^{\bar{S}} [1 - q(i) + \frac{2F^{DT}}{S}] S dG(S) - 2c(i,P)P - F^{IT} \tag{17}$$

F^{IT} are the intermediary's fixed costs and S_R is the reservation surplus for matching two traders. Any trader with a surplus below $S < S_R$ is not part of the network. Profits are comprised by the surplus specific commission rate for all traders in the network minus the variable costs and the fixed costs. Let variable costs $c(i,P)$ be described according to the functional form:

$$c(i,P) = \gamma i^{\alpha} P^{\beta} \text{ where } \alpha \geq 1, \beta > 1 \text{ and } \gamma > 0 \tag{18}$$

α and β are the elasticities of marginal cost with respect to information costs i and to network size P respectively. γ is a shifting factor. Total network investment costs, are convex in P and are given by:

$$C(i,P) = F^{IT} + 2\gamma i^{\alpha} P^{\beta+1} \tag{19}$$

. Let the probability of a direct match $q(i)$ be described by:

$$q(i) = 1 - i^{\delta}, \text{ where } \delta \geq 1 \tag{20}$$

Rewriting expected profit more explicitly and plugging in for P yields:

$$E(\Pi_I) = \int_{S_R}^{\bar{S}} [i^{\delta} + \frac{2F^{DT}}{S}] S dG(S) - 2\gamma i^{\alpha} \left[\int_{S_R}^{\bar{S}} dG(S) \right]^{\beta+1} - F^{IT} \tag{21}$$

By choosing S_R, the intermediary maximizes profits. Taking the derivative with respect to S_R and setting it equal to zero achieves this goal:

$$\frac{\partial E(\Pi_I)}{\partial S_R} = i^{\delta}[-S_R g(S_R)] - 2F^{DT} + 2\gamma i^{\alpha} g(S_R)^{\beta}(\beta+1) = 0 \tag{22}$$

In this paper, I consider G(S) to be uniformly distributed between $[0, \bar{S}]$. Therefore, the expressions above simplify to:

$$E(\Pi_I) = i^{\delta} \frac{\bar{S}^2 - {S_R}^2}{2\bar{S}} + 2F^{DT} \frac{\bar{S} - S_R}{\bar{S}} - 2\gamma i^{\alpha} \left(\frac{\bar{S} - S_R}{\bar{S}} \right)^{\beta+1} - F^{IT} \tag{23}$$

The intermediary's profits are increasing in the upper bound of surplus $\bar{S}$ and in fixed costs of the traders F^{DT}.

$$\frac{\partial E(\Pi_I)}{\partial S_R} = -i^{\delta} \frac{S_R}{\bar{S}} - 2F^{DT} + 2\gamma i^{\alpha} \bar{S}^{-\beta}(\beta+1) = 0 \tag{24}$$

Rearranging the partial derivative of profits with respect to S_R gives a closed form solution such that profits are maximized:

$$\tilde{S_R} = 2\gamma i^{\alpha-\delta}\bar{S}^{1-\beta}(\beta+1) - 2i^{-\delta}\bar{S}F^{DT} \tag{25}$$

That this is not a minimum, but really a maximum can be seen by the second derivative:

$$\frac{\partial^2 E(\Pi_I)}{\partial^2 S_R} = -\frac{i^{\delta}}{\bar{S}} < 0 \tag{26}$$

Following the approach of Petropoulou [2010] ('baseline model') an analysis of equilibrium patterns gives more insights to the optimal network size of the intermediary. Given $\tilde{S_R}$, optimal network size $\tilde{P}$ is given by:

$$\tilde{P} = \int_{\tilde{S_R}}^{\bar{S}} dG(S) \in [0,1] \tag{27}$$

Again, for a uniform distribution this simplifies to:

$$\tilde{P} = \frac{\bar{S} - 2\gamma i^{\alpha-\delta}\bar{S}^{1-\beta}(\beta+1) + 2i^{-\delta}\bar{S}F^{DT}}{\bar{S}} \tag{28}$$

In equilibrium, network size is $\min\{\tilde{P}, 1\}$, if fixed costs F^{IT} are covered by the intermediary's revenues and $E(\Pi_I) \geq 0$. In contrast to Petropoulou [2010], there is no clearcut condition such that the intermediary's expected profit is monotonically increasing in information costs i for a certain range of parameter values. This result can be seen in Appendix A.1. Where possible, I use parameter combinations from her paper and compare these results to the outcome of this model.

2.5.1 Equilibrium pattern of intermediation and trade (A)

Parameter values that are used are:

$$\beta = 2 \quad ; \quad \gamma = 1 \quad ; \quad \delta = 4 \quad ; \quad \alpha = 2 \quad ; \quad F^{IT} = 0.001 \quad ; \quad \bar{S} = 5 \quad ; \quad \bar{S} = 8 \tag{29}$$

Expected surplus $E(S) = 2.5$, so this is the same parametrization as in the first example of Petropoulou [2010].In this case, information elasticity of revenues δ is larger than the elasticity of costs α. Deriving 25 with respect to i, F^{DT}, $\bar{S}$, γ

and β yields:

$$\frac{\partial S_R}{\partial i} = \underbrace{(\alpha-\delta)2\gamma i^{\alpha-\delta-1}\bar{S}^{1-\beta}(\beta+1)}_{<0 \text{ for } \alpha<\delta} + \underbrace{\delta 2 i^{-\delta-1}\bar{S}F^{DT}}_{>0} \qquad \gtrless 0 \tag{30}$$

$$\frac{\partial S_R}{\partial F^{DT}} = -2i^{\delta}\bar{S} \qquad < 0 \tag{31}$$

$$\frac{\partial S_R}{\partial \bar{S}} = (1-\beta)2\gamma i^{\alpha-\delta}\bar{S}^{-\beta}(\beta+1) - 2i^{-\delta}F^{DT} \qquad < 0 \tag{32}$$

$$\frac{\partial S_R}{\partial \gamma} = 2i^{\alpha-\delta}\bar{S}^{1-\beta}(\beta+1) \qquad > 0 \tag{33}$$

$$\frac{\partial S_R}{\partial \beta} = 2\gamma i^{\alpha-\delta}\bar{S}^{1-\beta}ln\bar{S}(\beta+1) + 2\gamma i^{\alpha-\delta}\bar{S}^{1-\beta} \qquad > 0 \tag{34}$$

S_R reacts ambiguously to a change in i for the parameters chosen in this case. Looking at figure 2 shows, that depending on the combination of i and F^{DT}, network size is neither monotonically increasing nor decreasing in information costs. Network size is 1 for small values of i, then it drops abruptly until it starts to rise again. What can be seen in figure 1 and is explained by (31), network size increases with trader's fixed costs F^{DT} for every value of information costs i. The same holds for $\bar{S}$, as this value gets larger, S_R is getting smaller and so network size P is increasing (see equation (32)). More intuitively, the rise of network size in F^{DT} and $\bar{S}$ increases revenues captured by the intermediary. Hence, marginal costs are covered easier and P can get larger. This result is, different in comparison to the baseline model, where network size monotonically rises from a certain cutoff value of i onwards.
In contrast, network size decreases in γ and β. These parameters are increasing marginal network costs and so network building becomes costlier. Thus, fewer values of match surplus $S \in G(S)$ are profitable and network size falls.

Total expected trade $E(T)$ for $E(S) = 2.5$ and $E(S) = 4$ is shown in figure 2. Matching via an intermediary is more efficient than direct matching, because traders inside the network match with probability 1. Agents outside the network just meet with probability $q(i)$, which is, apart from the exception of $i = 0$, always smaller than 1. Trade generally increases in F^{DT}, because the intermediary's network size is increasing in this value (see equation (31)). As information costs i rise, direct matching is less likely,so expected direct trade falls. On the other hand, from a certain threshold onwards, the intermediary's network size is increasing again (figure 1) and intermediated trade builds up. Combining these two effects, it is important to consider the distribution of S as well. Looking at figure 2 makes this point clear. When expected surplus is equal to 2.5, ex-

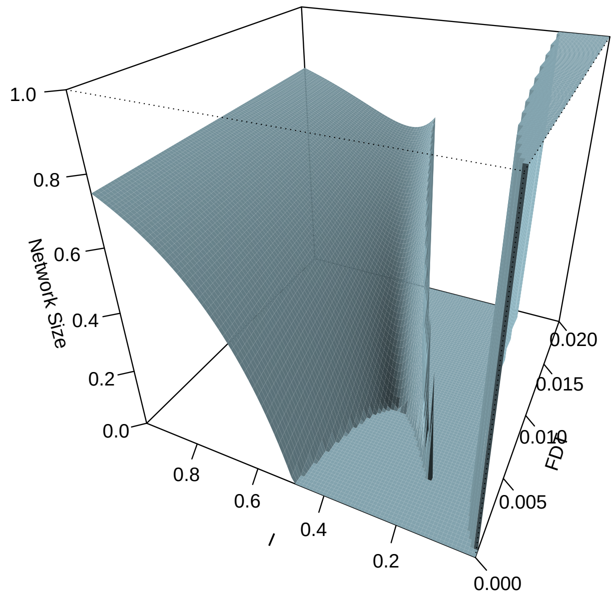

Figure 1: (A) Intermediary optimal network size for different values of i and F^{DT}

pected trade worsens as i begins to rise. Then, the intermediary jumps in and increases its network size, preventing expected trade to fall below values of about 0.8 as i gets closer to 1. Things are different if expected surplus is equal to 4 ($E(S) = 4$).High direct trade fixed costs and rising information costs result in a massive collapse in trade, which is larger than seen before. Market entry of the intermediary is proceeded by a jump in the value of expected trade that stays above 0.90 as i rises further. These differences arise from profit maximizing considerations by the intermediary. Dealing with two different distributions of surplus values results in this behavior.

Welfare in figure 3 looks very similar to the baseline model in Petropoulou [2010]. Additional welfare is greatest for i getting close to 1. This clearly arises from the fact that direct matching is getting more difficult for these values. The intermediary is reducing trade barriers for exporter/importer pairs through its network service. A large network size for small values of i, reflects another, although tiny, welfare gain. One has to notice that gains in welfare corresponds one to one to the intermediary's profit. This is true because the intermediary takes up all surplus above the expected surplus in direct trade.

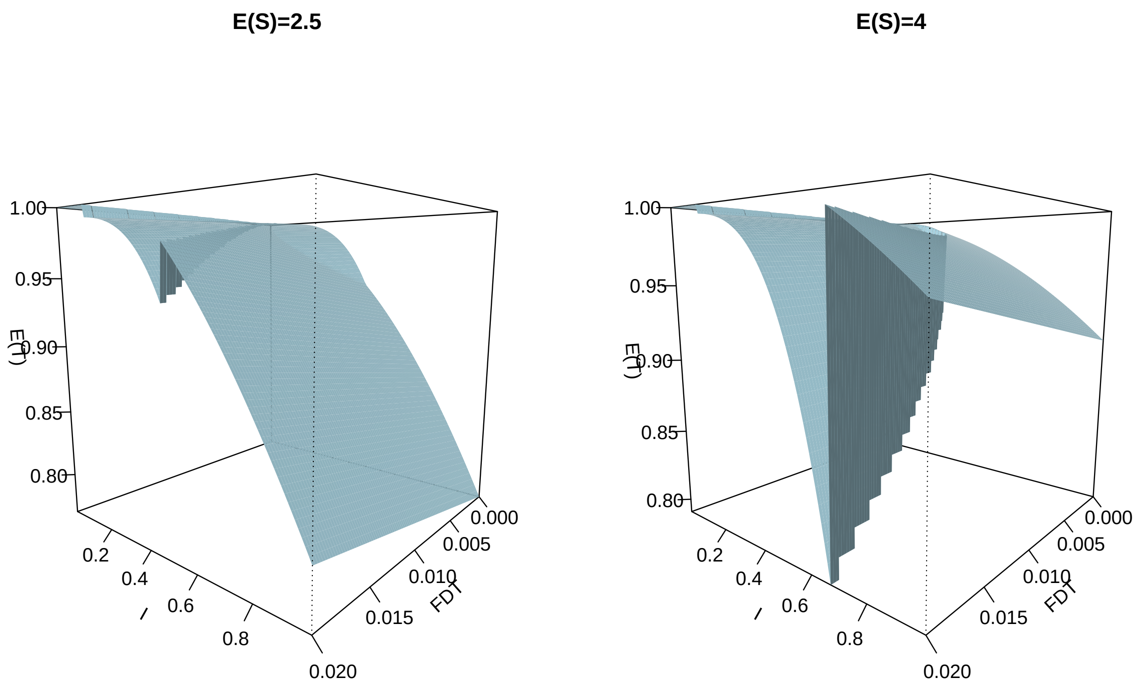

Figure 2: (A) Expected Trade for $E(S) = 2.5$ and $E(S) = 4$

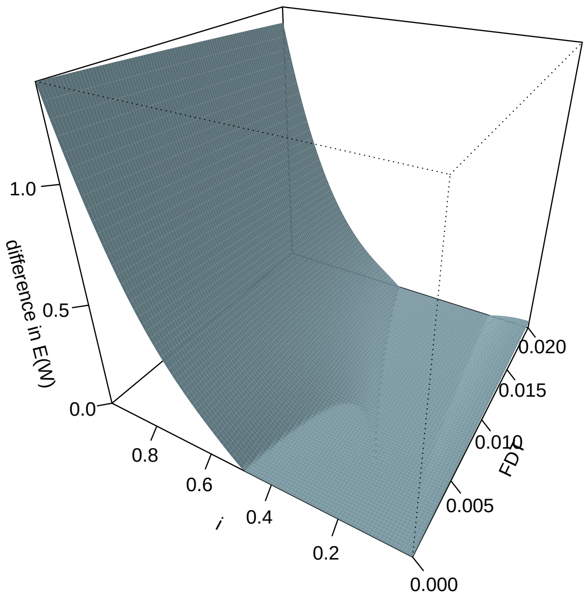

Figure 3: (A)Difference of Expected Welfare $E(W) - E(W^{DT}) = E(\Pi_I)$

2.5.2 Equilibrium pattern of intermediation and trade (B)

Parameter values that are used are:

$$\beta = 2 \quad ; \quad \gamma = 1 \quad ; \quad \delta = 3 \quad ; \quad \alpha = 3 \quad ; \quad F^{IT} = 0.001 \quad ; \quad \bar{S} = 4 \quad ; \quad \bar{S} = 6 \quad (35)$$

These parameter values are chosen such that network size is independent of information costs in the baseline model. In the setup of this paper, this is however not the case. The intermediary's revenues also depend on F^{DT}. This is where i^δ plays a role (see equation 25). Hence, $\alpha = \delta$ is not sufficient for $\tilde{S_R}$ to be invariant to i. The second term of this equation still depends on i and only disappears if $F^{DT} = 0$. Figure 4 illustrates this relationship. When fixed costs of direct trade are zero, network size is zero for small values of i. It then shifts to a certain value and is constant from then on. In this case it resembles the baseline model. As $F^{DT} > 0$, network size is 1 for small values of information costs and decreases as this parameter rises. Network size for $E(S) = 6$ is generally larger. An explanation is that now more trader matches have a profitable surplus for the intermediary.

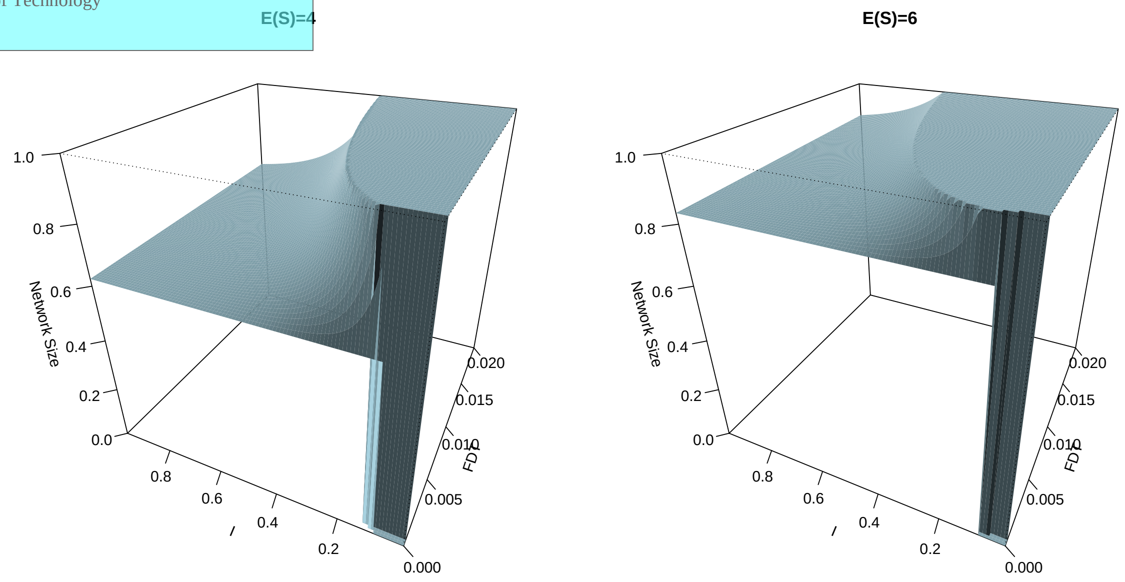

Figure 4: (B) Intermediary optimal network size for different values of i and F^{DT}

2.5.3 Equilibrium pattern of intermediation and trade (C)

Parameter values that are used are:

$$\beta = 2 \quad ; \quad \gamma = 1 \quad ; \quad \delta = 1 \quad ; \quad \alpha = 6 \quad ; \quad F^{IT} = 0.001 \quad ; \quad \bar{S} = 2 \tag{36}$$

As illustrated in figure 5, network size is monotonically decreasing in information costs i for this parametrization. It immediately jumps up to 1 and then begins to fall steadily. Interestingly, network size responds only slightly to fixed costs in direct trade . The reasoning behind this result is that the intermediary's network costs are more reactive to information costs compared to its revenues. Hence, higher information costs reduce optimal network size and in this particular case, direct trade is the more efficient way of trader matching. Intermediary profits, depicted in figure 6, are first increasing and then falling in information costs i. As i tends to 1 the intermediary's revenues are no longer covering its marginal costs and so it exits the market and only direct matching is taking place.

3 Conclusion

In this paper I have built a model where exporters and importers can either match directly or become part of an intermediary's network to match indirectly. The intermediary is more efficient in overcoming information barriers and thus expands

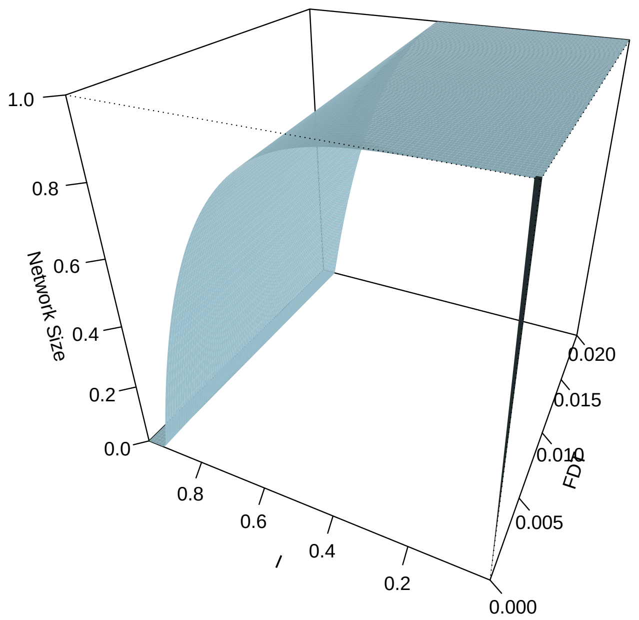

Figure 5: (C) Intermediary optimal network size for different values of i and F^{DT}

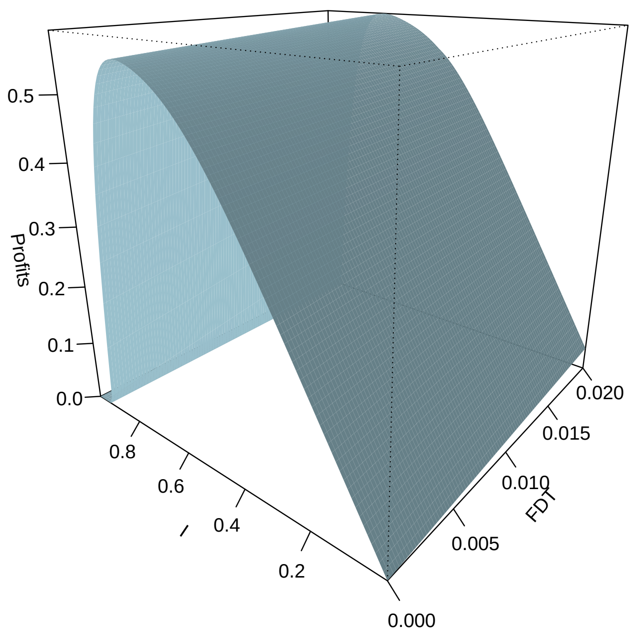

Figure 6: (C) Intermediary profits

possible trade. Match surplus is type specific and every trader pair is drawing its match value from a cumulative distribution function. Acknowledging direct trade as the outside option for exporters and importers, the intermediary chooses its commission rate of surplus in such a way that it extracts all surplus above this option value. Lemma 1 and Lemma 2 show that expected trade and expected welfare are always greater when an intermediary is in the market. In equilibrium, the intermediary chooses its optimal network size and intermediates trade above a particular surplus threshold. Comparative statics show that network size reacts ambiguously to a change in information costs. The upper bound of surplus and traders fixed costs influence the intermediary's revenues positively and so network size increases in these values. Parameterizing the model for different values adds further intuition to the equilibrium outcomes and shows differences to the baseline model of Petropoulou [2010]. Particularly non-monotonicities in the network size should be mentioned here.

A possible avenue of further research is to make information, about the type specific surplus, private knowledge. In this situation, the intermediary has to offer the same commission rate to every importer and exporter. Another thing to consider are how different surplus distributions effect the intermediary's choice of network size.

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A Appendix

A.1 Condition for intermediary's profit

To find a condition such that $E(\Pi_I)$ is monotonically increasing in i, derive (17) with respect to i and substitute values for the uniform distribution, $q(i)$, $c(i, P$, P and $\tilde{S_R}$ to get the following expression:

$$\begin{aligned}
\frac{\partial E(\Pi_I)}{\partial i} =& -\left[q'(i)\int_{\tilde{S_R}}^{\bar{S}} SdG(S) + 2c_i(i,P)P\right] \\
=&\delta i^{\delta-1}\int_{\tilde{S_R}}^{\bar{S}} SdG(S) - 2\alpha\gamma i^{\alpha-1}\int_{\tilde{S_R}}^{\bar{S}} dG(S) \\
=&\frac{\delta i^{\delta-1}}{\bar{S}}\left[\frac{\bar{S}^2-\tilde{S_R}^2}{2}\right] - \frac{2\alpha\gamma i^{\alpha-1}}{\bar{S}}[\bar{S}-\tilde{S_R}] \\
=&\frac{\delta i^{\delta-1}\bar{S}^2}{2\bar{S}} - \frac{\delta i^{\delta-1}[2\gamma i^{\alpha-\delta}\bar{S}^{1-\beta}(\beta+1) - 2i^{-\delta}\bar{S}F^{DT}]^2}{2\bar{S}} \\
&- \frac{2\alpha\gamma i^{\alpha-1}\bar{S}}{\bar{S}} + \frac{2\alpha\gamma i^{\alpha-1}[2\gamma i^{\alpha-\delta}\bar{S}^{1-\beta}(\beta+1) - 2i^{-\delta}\bar{S}F^{DT}]}{\bar{S}}
\end{aligned} \tag{37}$$

It is not feasible to define a clear parameter space in this case and differentiate cases such that this derivative is above or below zero.