The Intermediary Rat Race

(Draft available upon request; comments welcome)

Yu An, Yang Song, and Xingtan Zhang

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Motivation

Many over-the-counter (OTC) markets feature

- Dealer intermediation
- Interdealer network
- Brokers and dealers

[Li and Schurhoff (2014): Municipal bonds trade in decentralized OTC networks of more than 2,000 broker-dealer firms that intermediate between buyers and sellers and actively trade among themselves. See Wang (2017) for evidence on corporate bond market.]
This Paper

How to compete for order flow in a dealer-intermediated OTC market?

When a seller arrives at the market, a dealer can

- buy directly from the seller upon contact (principal intermediation)
- wait until a buyer is found and then buy from the seller (riskless principal intermediation)
This Paper

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Understanding this question can help explain many characteristics of OTC markets.

We will mainly focus on trade efficiency.
Preview of Results

- We show that intermediaries can **over-compete** with each other to become a principal dealer.

  - The price in the interdealer market is higher than the price in the dealer-seller transaction.

  - Principal dealer imposes a negative externality on non-holding dealers.

- The intermediary rat race leads to **inefficient principal intermediation**, inefficiently long intermediation chains, and excessive interdealer trading compared to the first best.
Model Setup

Segmented OTC market in a continuous-time model

- Three types of risk-neutral agents with common discount rate $r$
  - one seller with an indivisible asset, which pays 0 per unit of time.
  - a finite number $n \geq 2$ of intermediaries
  - an infinite number of buyers, with Poisson arrival rate $\lambda$

- Buyers are the efficient holders of the asset
  - Buyers enjoy $v$ per unit of time.
  - Potential sources of gains to trade: heterogeneity in liquidity, inventory, diversification, preferences, etc.

- Intermediaries have a per-unit cost $c$ of holding the asset in their inventories
  - Intermediaries enjoy $-c$ per unit of time.
Trading in a Segmented OTC Market
**Principal Trading**

1. Seller sells to dealer
2. Dealer holds the asset while searching for buyer
3. Dealer sells to buyer

**Riskless Principal Trading**

1. Seller discloses trading intention to dealer
2. Seller continues to hold the asset while dealer is searching for buyer
3. Seller sells to dealer and dealer immediately sells to buyer
Intermediation

**Principal intermediation:** A holding intermediary commits his balance sheet by taking the asset into his own inventory.

**Riskless principal intermediation:** The asset is still in the hands of the seller, and the seller does not commit to sell the asset through a given intermediary.

**Agency intermediation:** The asset is still in the hands of the seller, and the seller commits to sell the asset through a given intermediary.
Assumptions

- The seller does not have commitment.
  - Around 2% of trade is done by agency intermediation. [Source: TRACE]
- Today mainly focus on $c \geq 0$.
- Buyers are willing to pay $V_B = \frac{v}{r}$.
- Rubinstein and Wolinsky (1985) bargaining (more soon)
Bidding Stage
The seller contacts all dealers for quotes

Seller accepts the highest bid

Principal Trading
All dealers search for buyers. Once non-holding dealers find a buyer, they contact the holding dealer for bilateral bargaining

Seller rejects all bids and holds the asset

Riskless Principal Trading
All dealers search for buyers. Once they find a buyer, they contact the seller for bilateral bargaining

The asset goes to the buyer
Principal intermediation

Lemma

In the case of Principal Intermediation, as the frequency of alternating-offer goes to infinity, the equilibrium price in the interdealer market is given by

\[ P_{ID}(c) = \frac{v}{r} - \frac{v + c}{2r + n\lambda}. \] (1)

Proof.

Let \( P_A \) be the price proposed by the dealer with the asset, and \( P_B \) be the price proposed by the dealer with the buyer. Given that the dealer’s cost is \( c \), for discrete bargaining problem with \( \Delta \) time interval, the set of equations are

\[
P_B = (-c)\Delta + \exp(-r\Delta)[\lambda\Delta V_B + (1 - \lambda\Delta)(1/2P_A + 1/2P_B)],
\]

\[
V_B - P_A = \exp(-r\Delta)(1 - (n - 1)d\Delta)(V_B - 1/2P_A - 1/2P_B).
\]

Solve the equation and take \( \Delta \to 0 \), then

\[ P_{ID}(c) = \frac{v}{r} - \frac{v + c}{2r + n\lambda}. \]
Riskless Principal Intermediation

Lemma

In the case of Riskless Principal Intermediation, as the frequency of alternating-offer goes to infinity, the equilibrium price is given by

\[ P_D = \frac{v}{r} - \frac{v}{2r + (n - 1)\lambda}. \]  

(2)
In the case of Riskless Principal Intermediation, as the frequency of alternating-offer goes to infinity, the equilibrium price is given by

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**Observation:**

\[ P_{ID}(0) = \frac{v}{r} - \frac{v}{2r + n\lambda} > P_D. \]
Intuition of $P_{ID}(0) > P_D$

When the principal dealer enjoys the same flow utility as the seller, he is able to bargain for a better price from another dealer.

- If the holding dealer himself found a buyer, he enjoys all the surplus without the need to bargain with another dealer. In other words, a holding dealer has a better outside option than a seller.

- Consistent with several empirical papers.

[Di Maggio, Kermani, and Song (2017): Dealers profit more when trading with clients instead of other dealers. On average, similar bonds in the same industry traded by the same dealer go at a significantly higher price to non-dealer clients, an extra markup of about 50 basis points; Similar results in Li and Schurhoff (2014) and Edwards, Harris, and Piwowar (2007, JF)]

This is the force that pushes the market away from the efficient benchmark towards principal trading.
Externality

Conditional on an intermediary not holding the asset, he can be better off if the seller holds it than other intermediaries hold it.

- If the seller holds the asset, the non-holding intermediary’s value is

\[ b \equiv \frac{1}{n} E \left[ e^{-r \tau (n \lambda)} (V_B - P_D) \right] \]

- If other intermediaries hold the asset, the non-holding intermediary’s value is

\[ \beta(c) \equiv \frac{1}{n} E \left[ e^{-r \tau (n \lambda)} (V_B - P_{ID}(c)) \right] \]

If \( P_{ID}(c) > P_D \), which is true if \( c = 0 \), then \( \beta(c) < b \), i.e., a holding intermediary imposes a negative externality on non-holding intermediaries.
Inefficient Principal Intermediation

Proposition

There exists $\bar{c} > 0$ such that if $c \leq \bar{c}$, in equilibrium the seller chooses principal intermediation, which is socially inefficient.

The seller is willing to sell the asset for a one-time price that is higher than

$$a \equiv E \left[ \int_0^{\tau(n\lambda)} e^{-rt} v dt + e^{-r\tau(n\lambda)} P_D \right].$$

The principal dealer’s value is

$$\alpha(c) \equiv E \left[ \int_0^{\tau(n\lambda)} (-c)e^{-rt} dt \right] + E \left[ e^{-r\tau(n\lambda)} \left( \frac{1}{n} V_B + \frac{n-1}{n} P_{ID}(c) \right) \right].$$

Willingness to pay for becoming a principal dealer is $\alpha(c) - \beta(c)$. We want to show that $\alpha(0) - \beta(0) > a$.

- Suppose $c = 0$ so that the welfare of principal intermediation and riskless principal intermediation are same: $\alpha(0) + (n - 1)\beta(0) = a + nb$. Since $\beta(0) < b$, $\alpha(0) - \beta(0) > a$. 
Implications

First best: Principal Intermediation          Riskless Principal Intermediation

Equilibrium: Principal Intermediation          Riskless Principal Intermediation

Due to the intermediary rat race, the equilibrium has

- Excessive principal intermediation
- Excessive interdealer trading
- Long intermediation chains
Testable predictions

- Consistent with Schultz (2017), sellers receive higher prices selling to intermediaries in riskless principal intermediation than in principal intermediation.

- Dealer inventory costs $\uparrow$

  $\implies$ principal intermediation volume $\downarrow$, riskless principal intermediation $\uparrow$, intermediation chain length $\downarrow$,

  [Broadly consistent with Trebbi and Xiao (2017) and Adrian, Fleming, Shachar, and Vogt (2017)]

- Number of dealers $\uparrow$

  $\implies$ principal intermediation volume $\downarrow$, riskless principal intermediation $\uparrow$, intermediation chain length $\downarrow$. 
Separation of Intermediation Rights from Ownership

Intermediaries over-compete for the **intermediation right**.

In the case of *Agency Intermediation*, a commission is determined at time 0, but payable only when the seller actually sells the asset.

**Proposition**

*In the case of Agency Intermediation, the commission is given by* \( \frac{V_B - P_{ID}(0)}{n} \).

- If the seller has commitment, efficiency can be restored.
- The combination of principal and agency intermediation achieves the social optimum.
- Testable prediction: large “seller” are more likely to use agency intermediation, compared to small “seller”.
Extension and Future Work

- Intermediaries’ costs are private information
- Divisible asset
Conclusion

- We show that intermediaries can over-compete with each other to become a principal dealer.

- The intermediary rat race leads to inefficient principal trading, inefficiently long intermediation chains, and too much interdealer trading compared to the first best.

- Commitment can restore efficiency.
Proof of Lemma

Proof.

We consider the bargaining in discrete time with $\Delta$ time interval. Let $P_D$ be the price proposed by the dealer and $P_S$ be the price proposed by the seller. The set of equations are

$$P_D = \exp(-r\Delta)(\frac{1}{2}P_D + \frac{1}{2}P_S) + (0)\Delta,$$

$$V_B - P_S = \exp(-r\Delta)(1 - (n - 1)\lambda\Delta)(V_B - \frac{1}{2}P_D - \frac{1}{2}P_S).$$

We can derive an explicit expression for $P_D$ as

$$P_D = \frac{\nu}{r} - \frac{\nu}{2r + (n - 1)\lambda}.$$