Endogenous Specialization and Dealer Networks

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Over-the-counter Markets

Many financial assets trade in over-the-counter (m)arkets

 Persistent illiquidity especially during crisis, increasing regulatory attention

Average Daily Trading Volumes in Billions, Source: SIFMA 2014
ABS Interdealer Network:

Hollifield, Neklyudov, and Spatt 2016
Heterogeneity is profound, below is the customer volume Lorenz curve:

Hollifield, Neklyudov, and Spatt 2016
Stylized facts about OTC:

- 93% chance of remaining among top 10 dealer from one month to the next.
- 65% of two dealers trading again from one month to the next.
- Core dealers account for most customer-to-dealer and dealer-to-dealer trades.
- Relationships with customers.

Research questions:

1. What explains dealers’ heterogeneity?
2. How core dealers maintain their size and market share?
3. Is core-peripheral network efficient?
Existing Literature

Search and network theory of over-the-counter markets:


Our paper:

- Dealers are ex-ante identical, customers have heterogeneous liquidity needs. We depart from existing work by modeling clients and dealers together and look for asymmetric equilibria.
The Model: Setup

- Continuum of risk-neutral customers, discount rate $r$
- Single asset in positive net supply $S$, pays $\delta$ per unit of time

Customers are born as buyers and can hold up to one unit of the bond. At rate $k$ a customer gets an idiosyncratic liquidity shock and cash flow drops to $\delta - x$. 

Environment: Buyer, Owner, and Seller Clients

Buyers: heterogenous in liq. shock intensity, $k$.

Density: $\hat{f}(k)$

- buy & hold investors long trading horizon $(\frac{1}{k})$
- ”liquidity investors” short trading horizon $(\frac{1}{k})$

Neklyudov & Sambalaibat, Endogenous Specialization and Dealer Networks
Flow of $k$-type customers is $f(k)\,dk$ per unit of time.

Liquidity investors could be, for example, investment funds that track indices, trade frequently, while buy-and-hold investors could be pension funds, individual investors.
Hollifield, Neklyudov, and Spatt 2016
Customer to customer transactions are prohibited

Customers choose among $N = 3$ dealers-intermediaries according to $\nu_i(k)$ decision function

![Diagram](image)

Interdealer market:

- Each dealer $i \in N$ is endowed with two matching technologies:
  - via CDC chains:
    \[ \lambda_D \mu_i^b \mu_i^s \]
  - via CDDC chains with dealer $j$ in its network:
    \[ \lambda_{DD}(\mu_i^b \mu_j^s + \mu_i^s \mu_j^b) \]

- constant return to scale implies $\lambda_{DD} = 2\lambda_D$, Vayanos and Wang (2007) have $\lambda_{DD} = 0$. We study $\lambda_D$ and $\lambda_{DD}$ separately
- we assume an ex-ante complete network
When $\lambda_{DD} > 0$ the steady-state requires:

$$\frac{\mu^{b}_i}{\mu^{s}_i} = 1 + \frac{1}{\mu^{s}_N} \left( \int_{k}^{\bar{k}} \left( \frac{f(k)}{k} \right) dk - S \right) = \text{const}$$

$\int_{k}^{\bar{k}} \left( \frac{f(k)}{k} \right) dk$ is the average holding period of incoming customers-buyers, $S$ is the net supply of the asset.

When two customers are matched, the price is determined via Nash-bargaining:

- $z_{ij}$
- $\frac{1-2z_{ij}}{n}$
- $\frac{1-2z_{ij}}{n}$
- $z_{ij}$

$V^s_i$ end-seller’s reservation value

$\hat{P}^\text{bid}_{i,j}(k)$

$\hat{P}_{i,j}(k)$

$\hat{P}^\text{ask}_{i,j}(k)$

$V^o_j(k) - V^b_j(k)$ end-buyer’s reservation value

Our analysis focuses on the steady state equilibrium.
The dynamic **steady-state equilibrium** is defined in terms of:

- the state-contingent expected value functions $V^o_i(k), V^b_i(k), V^s_i$ for $i \in \{1, \ldots, N\}$
- steady state population masses of agents $\mu^o_i(k), \mu^b_i(k), \mu^s_i$
- bond endowment distributions $s_i$ across dealers
- prices
- customers’ choices of dealers $\nu_i$

such that:

- value functions solve investors’ optimization problems
- population masses solve inflow-outflow equations and are consistent with market clearing and interdealer flows
- prices are outcomes of simultaneous multilateral bargaining
- choices by customers are consistent with their value functions
Proposition

There is a symmetric equilibrium with $\nu_i(k) = 1/3$ for each $i \in N = 3$. This equilibrium is not interesting.
\( \lambda_{DD} z_{DD} < \lambda_{D} z_{D} \) Case: Full Dry-Out

Proposition

There is a full dry-out asymmetric equilibrium with \( \nu_{i}(k) = 1 \) for only one \( i \in N = 3 \). This equilibrium is not interesting.
$\lambda_{DD}z_{DD} > \lambda_{D}z_{DD}$  

Case: Asymmetric Core-Periphery

**Definition**

$i$ and $j$ are defined core vs. peripheral if $M_i > M_j$.

Neklyudov & Sambalaibat, *Endogenous Specialization and Dealer Networks*

**Proposition**

There is an asymmetric equilibrium with a cutoff-strategy of customers $\nu_i(k) = 1$ for a given range of $k$-values for $i \in N = 3$. 

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Asymmetric Core-Periphery

Under the condition: \( \lambda_{DD}z_{DD} > \lambda_{D}z_{D} \) we find asymmetric clientele equilibrium:

<table>
<thead>
<tr>
<th>Customers of Dealer 1</th>
<th>Customers of Dealer 2</th>
<th>Customers of Dealer 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>( k )</td>
<td>( k_1^* )</td>
<td>( k_2^* )</td>
</tr>
</tbody>
</table>

- **Dealers that specialize in liquidity investors** have a larger number of buyers and sellers: \( \mu_i^b > \mu_j^b \) and \( \mu_i^s > \mu_j^s \).

- **Dealers that specialize in buy-and-hold investors** have more owners and a larger supply of bonds in circulation: \( \mu_i^o < \mu_j^o \) and \( s_i < s_j \).

- **Buyers of dealer** \( i \) **face a lower round-trip transaction cost**: \( \hat{\phi}_i(k) < \hat{\phi}_j(k) \) for all \( k \).

- **Dealer** \( j \) **provides a faster execution speed**: \( \lambda \mu_{j,N_j}^s > \lambda \mu_{i,N_i}^s \).
Asymmetric Core-Periphery: Main Results

In this equilibrium dealers become core and peripheral endogenously via a clientele effect:

- peripheral dealers attract buy-and-hold customers,
- core dealers attract customers with short investment horizon,
- customers choose with whom they want to trade via CDC and CDDC chains.

The heterogeneity in dealers’ customer size supports dealer heterogeneity on the interdealer market. Peripheral dealers rely relatively more on the interdealer market and on long intermediation chains to provide liquidity to customers.

What affects buyer’s choice of a core/peripheral:

- Expected wait time to find a seller + buy price
- Holding period and wait time to find a buyer + sell price
1. The periphery has most owners:

\[ \mu_i^o = \int_{k \in i} \left( \frac{1}{k} \right) f(k) \, dk - \mu_i^b \]

- few customer-buyers on the periphery
- long expected holding periods
2. The periphery has few customer-buyers

\[ H_i = \frac{\sum_{j \in N} (\lambda_{ji} z_{ji} \mu_{j}^s)}{r + k + \sum_{j \in N} (\lambda_{ji} z_{ji} \mu_{j}^s)} \]

\[ V_i^b (k) = H_i \left( \left( \frac{k}{r + k} \right) \left( V_i^s - \frac{\delta}{r} \right) - wAv. \left( V_j^s - \frac{\delta}{r} \right) \right) \]

We show that:

- Any consumer prefers the periphery.
- Any consumer prefers the core.

\[ V_i^s = V_j^s \quad \mu_i^b = \mu_j^b \]

\( k^* \) is the point where the preference changes from the periphery to the core.
Asymmetric Core-Periphery: Welfare

Total Welfare, \( z > \bar{z} \)

- Dealer specialization is socially desirable
- Asymmetric equilibrium results in too much specialization
- When \( z_D > z_{DD} \) asymmetric equilibrium dominates symmetric
Conclusion

- We build a search-based model of endogenous dealer network formation

- The main insight: empirically observed core-peripheral network structure arises from a clientele effect

- Endogenous dealer heterogeneity in their weighted network centrality, size, trading immediacy and average chain lengths

- We document the trade-offs of dealers choice by customers and show the interplay between immediacy, trading terms and liquidity need
Thank you for your attention.