Periphery Dealers in Over-the-counter Markets

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Figure: Inter-dealer network for securitized product (Hollifield et al (2017)), corporate bonds (Di Maggio et al (2017)), and municipal bonds (Li & Schürhoff (2019))

Persistent core-periphery dealer network:
- core (supplier) → market-making (principal)
- periphery (distributor) → pre-arrange trades between central dealers and investors (riskless principal/agency)
**Question:** Why some buy-side investors prefer trading with periphery dealers (distributors) instead of core dealers (suppliers)? Why periphery dealers can co-exist with core dealers?

**Objective:**
1. construct a game-theoretic model to study strategic dealer choice of buy-side investors.
2. implications of vertical market fragmentation on market efficiency and stability.

**Theoretical Framework:**
- **Literature:** (random) search and matching model.
- **This paper:** long-term non-binding relationship formation model
This Paper

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Outline

1. Basic model.
   ▶ Why/how do investors form long-term relationship with dealers?
2. The model with agency dealer.
   ▶ When will investors prefer trading with periphery dealers?
3. The model with heterogeneous investors (SKIP)
4. Discussion on allocative efficiency and market stability.
5. Conclusion
Basic Model – Primitives

- A market for indivisible goods – liquidity provision service.
- Infinite periods, discount factor $\delta$.
- Players:
  - $n$ number of homogeneous long-lived investors
  - a long-lived principal dealer $P$ (supplier).
  - a non-strategic long-lived principal dealer $P'$ (supplier).
Basic Model – Investors

Investor $i \in I$
- i.i.d. one-unit liquidity demand $l_{it} \in \{0, 1\}$ with $Pr(l_{it} = 1) = q$.
- Private valuation of liquidity service
  
  \[
  V_{it} = \begin{cases} 
  0 & \text{if } l_{it} = 0 \\
  V & \text{if } l_{it} = 1.
  \end{cases}
  \]

- Cash endowment $V_L$
- Payoff = $\hat{1}(obtain\ liquidity)V_{it} +$ net cash holding
Basic Model – Principal Dealers

A principal dealer $P$ (i.e core dealers)

- Can provide liquidity service at per-unit cost of

$$C_t = \begin{cases} 
0 & \text{if } \theta_t = G \\
C & \text{if } \theta_t = B.
\end{cases}$$

where $\theta_t$ = random market state with $Pr(\theta_t = G) = p$

- Payoff = profits from providing liquidity service.

A non-strategic principal dealer $P'$

- Same cost function with $P$

- Always quote price = $C_t$ (outside option of investors)
Trading Timeline – Take-it-or-leave-it Bargaining

For each period $t$,

1. $\theta_t$ realized and $l_{it}$ observable to $i$.
2. Principal dealer $P$ quotes a price $\beta_{it} \geq 0$ to every investor.
3. Each investor $i$ decides $\gamma_{it} \in \{0, 1\}$.
4. $P$ observes $l_t = \{l_{it}\}_i$.

- Equilibrium: $P$ and $I$ maximize their discounted sum of all future payoffs.
Basic Model – Trade Friction

Assumption: $V > C > V_L$

- Urgent asset demand with insufficient cash.
- Urgent needs to sell asset to meet high cash target.

Implication: no trade/asset fire-sale phenomenon during bad states
Result I: Trade Occurs With Long-term Relationship

Non-binding agreement between $P$ and $i$

- $P$ provides liquidity at price $x_B$ in bad states.
- $i$ pays $x_G$ in good states.
- relationship continues as long as no one deviates...
Result II: But Investors Must Be **Frequent** Customers...

 Commitment problem $\rightarrow$ relationship failure.

* Proposition: investors must have frequent liquidity shock for successful relationship.

What if investors rarely need liquidity...?
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What if investors rarely need liquidity...?
Rationale of Agency Dealers

(a) No relationship

(b) Coalition under full information

(C) A as facilitator under limited information

- No relationship when \( Q \) low.
- What if \( I \) forms coalition \(\rightarrow\) pool of liquidity demand \(\rightarrow\) \( Q \) high.
- BUT \( i \) must know what others did for collective punishment
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- **(C)** $A$ as facilitator under limited information

- Currently: post-trade information **without trader identity**.
- A third party $A$ (i.e. periphery dealers) as an agent for $P$ (i.e. core dealers) and $I$ in partially-transparent market.
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The Model with Agency Dealer

Add an agency dealer $A$ (i.e. periphery dealers) to the model

- Intermediate trades between $P$ and $I$
- No intermediation cost and can charge fees to investors.
- Payoff: profits from intermediation fees

Trading: Sequential take-it-or-leave-it bargaining.

Relationship: informal agreement on wholesale price, fees, and maximum quantity to sell in bad times (quota).
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Result III: Agency Dealer Helps **Infrequent** Investors Obtain Liquidity in Bad Times...

**How:** liquidity shock aggregation + low quota
Result III: Agency Dealer Helps *Infrequent* Investors Obtain Liquidity in Bad Times...

**How:** liquidity shock aggregation + low quota

**But:**

1. must leave enough surplus (intermediation fees) to incentivize $A$ (agency cost).
2. effective only when the investors rarely demand liquidity simultaneously – HERE.
Result III: Agency Dealer Helps Infrequent Investors Obtain Liquidity in Bad Times...

Corollary: Provided that the probability of liquidity shock is low enough, A can help excluded investors form relationship if \( \frac{\text{quota}}{n(\text{investors})} \) is sufficiently low.
Empirical Implication: Longer Intermediation Chain ≠ Higher Price

Let $x_G =$ minimum price that would induce $P$ to form direct relationship.

Direct relationship

Indirect relationship via $A$

Provided that the investors cannot form direct relationship with $P$

- Finding: $X_G + F_G < x_G$
- Tradeoff between execution cost and trading speed.
- Infrequent investors can only commit to relationship contract offered by agency dealer.
Implications on Market Efficiency and Stability

Efficiency – improving!

Stability (likelihood of first-trigger event of systemic crisis) – ambiguous!
- ↑ as existing investors get liquidity during bad times.
- ↓ as ↑ participation of new investors facing liquidity shortage during extremely bad events.

Normal bad period

Extremely bad event
This paper: construct a game-theoretic model to study strategic dealer choice of buy-side investors in OTC secondary asset markets.

Key insight: Infrequent investors trade with periphery dealers to obtain the benefit of long-term relationship.

Takeaway point: periphery dealers can improve market efficiency but might create market instability.
THANK YOU VERY MUCH!
Appendix
The Model with Heterogeneous Investors

What we know so far...

- Low-liquidity-need investors choose agency dealer (i.e. periphery dealers) to obtain the benefit of long-term relationship (i.e. costly liquidity in future bad states).

- What about high-liquidity-need investors?

\[
\begin{array}{c}
P \\
A \\
\text{L L L L L} \\
\end{array} \quad \begin{array}{c}
P \\
A \\
\text{L L L L L H} \\
\end{array}
\]

Separating equilibrium
Pooling equilibrium

→ High-type investor: price & insurance coverage.
The Model with Heterogeneous Investors

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- What about high-liquidity-need investors?

\[ \text{Separating equilibrium} \rightarrow \text{Pooling equilibrium} \]

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The Model with Heterogeneous Investors

Setting:
- Investors \( \{H, L_1, L_2, \ldots, L_n\} \) with \( q_H, q_L \).
- \( q_L \in \mathcal{N}_\epsilon(0) \rightarrow \) (almost) full insurance with \( n^* = 1 \).
- \( n \) sufficiently high to sustain any equilibrium.
- Lowest possible payoff for \( \{P, A\} \).
- Investors pay \( F \) for only their trades \( \rightarrow \) no cross-subsidy.

Equilibrium:
- liquidity quota = 1 under separating equilibrium
### Pooling Equilibrium: Existence

<table>
<thead>
<tr>
<th></th>
<th>$n^*$ increases one unit</th>
<th>$n^*$ unchanged</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficiency</td>
<td>pooling $&gt;$ separating</td>
<td>separating $&gt;$ pooling</td>
</tr>
<tr>
<td>Existence</td>
<td>$nQ_L \geq \frac{2+Q_H}{2p-1}$</td>
<td>$q_H$ low &amp; $nQ_L \in [Q, \bar{Q}]$</td>
</tr>
<tr>
<td>Payoff</td>
<td>$\bar{P}, L \downarrow$</td>
<td>$P \downarrow$, $L$ unknown</td>
</tr>
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- $A$ and $P$ are complementary if $A$ not too big.
- $A$ may have too much power on the low-type.

BACK
Extra: Probability of Liquidity Shock ($q$) Matters

Low prob of liquidity shock

High prob of liquidity shock