Endogenous Specialization and Dealer Networks

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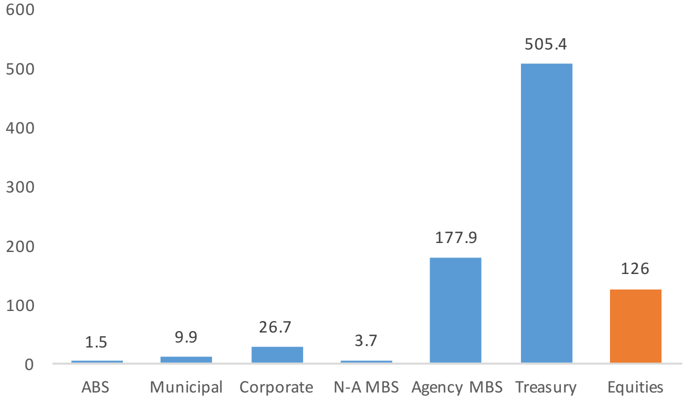
Over-the-counter Markets

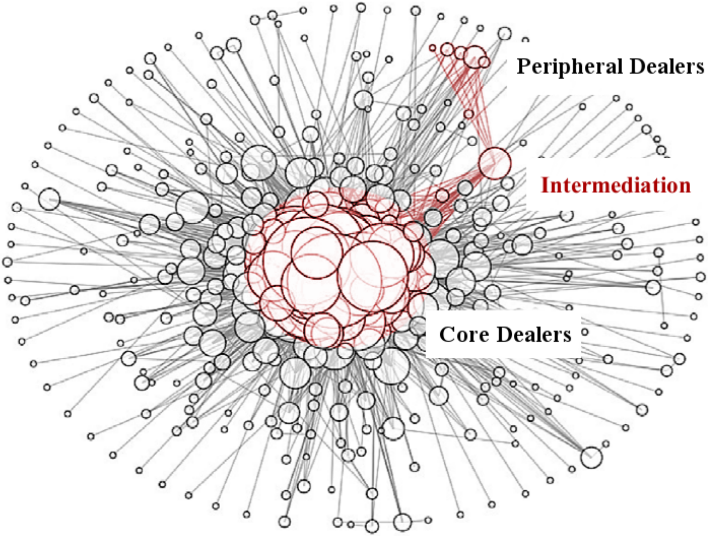
Many financial assets trade in over-the-counter (▬) markets



Average Daily Trading Volumes in Billions, Source: SIFMA 2014

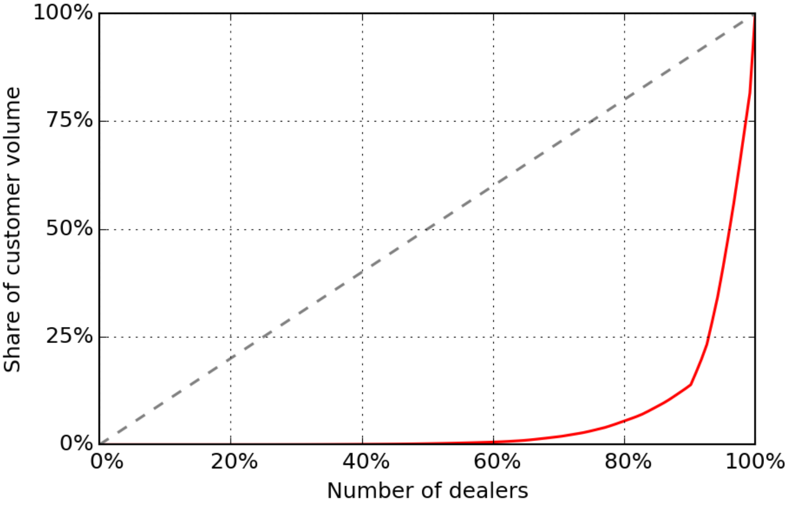
- Persistent illiquidity especially during crisis, increasing regulatory attention

ABS Interdealer Network:



Hollifield, Neklyudov, and Spatt 2016

Heterogeneity is profound, below is the customer volume Lorenz curve:



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Our Motivation

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:

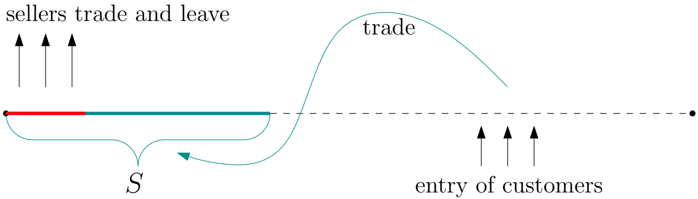
- Duffie, Gârleanu, and Pedersen 2005, 2007: two types of investors (high and low). A model of liquidity discount, homogeneous dealers.
- Atkeson, Eisfeldt, and Weill 2015, Hugonnier, Lester, and Weill 2014, Shen, Wei, and Yan 2015, Neklyudov 2013, Farboodi, Jarosch, and Shimer, 2016: continuum of different investor types, investors with some middle characteristic become intermediaries.
- Vayanos and Wang (2007): we add dealers and interdealer trades.
- Gofman 2011, 2012: fixed network connections. Babus and Kondor 2013, Malamud and Rostek 2014. Endogenous networks: Babus 2012, Zhong 2015, Wang 2015, Chang and Zhang 2015.

Our paper:

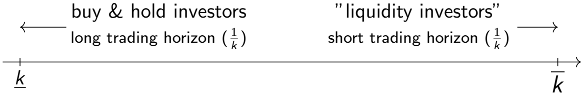
- Dealers are ex-ante identical, customers have heterogeneous liquidity needs. We depart from existing work by modeling clients and dealers together and look for asymmetric equilibria.

The Model: Setup

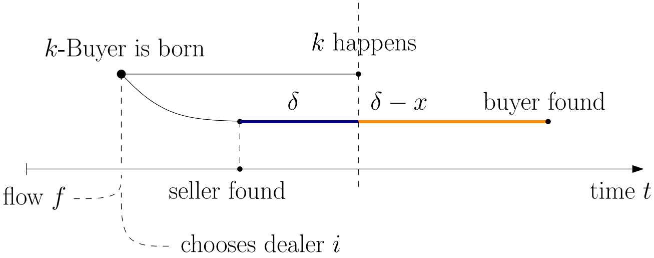
- Continuum of risk-neutral customers, discount rate r
- Single asset in positive net supply S, pays δ per unit of time



- 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 $\delta - x$.

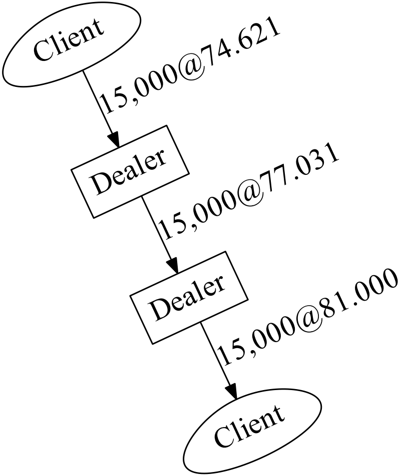


- Flow of k-type customers is $f(k)dk$ per unit of time.



$$\mu_N^s + \left(\int_{\underline{k}}^{\overline{k}} \left(\frac{f(k)}{k} \right) dk - \mu_N^b \right) = S$$

- Liquidity investors could be, for example, investment funds that track indices, trade frequently, while buy-and-hold investors could be pension funds, individual investors.



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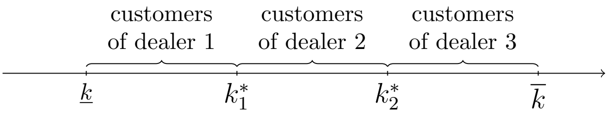
- Customer to customer transactions are prohibited
- Customers choose among $N = 3$ dealers-intermediators according to $\nu_i(k)$ decision function



- 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:

$$\lambda_{DD}(\mu_i^b \mu_j^s + \mu_i^s \mu_j^b)$$

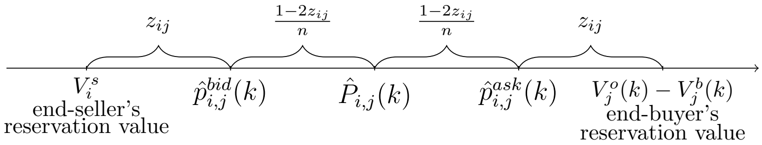
  - constant return to scale implies $\lambda_{DD} = 2\lambda_D$, Vayanos and Wang (2007) have $\lambda_{DD} = 0$. We study λ_D and λ_{DD} separately
  - we assume an ex-ante complete network

- When $\lambda_{DD} > 0$ the steady-state requires

$$\frac{\mu_i^b}{\mu_i^s} = 1 + \frac{1}{\mu_N^s}\left(\int_{\underline{k}}^{\overline{k}}\left(\frac{f(k)}{k}\right)dk - S\right) = const$$

- $\int_{\underline{k}}^{\overline{k}}\left(\frac{f(k)}{k}\right)dk$ 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:



The Model: Equilibrium

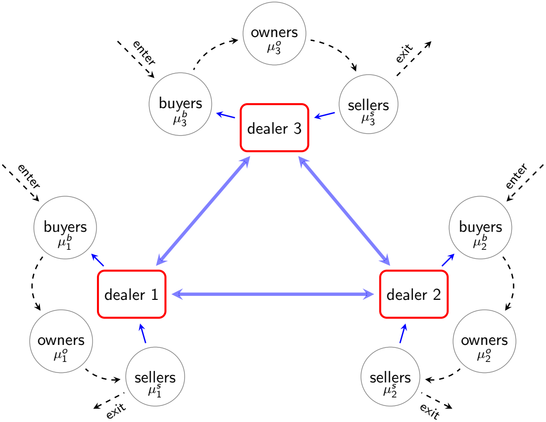
The dynamic **steady-state equilibrium** is defined in terms of:

- the state-contingent expected value functions $V_i^o(k)$, $V_i^b(k)$, V_i^s for $i \in \{1, \dots, N\}$
- steady state population masses of agents $\mu_i^o(k)$, $\mu_i^b(k)$, μ_i^s
- bond endowment distributions s_i across dealers
- prices
- customers' choices of dealers ν_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

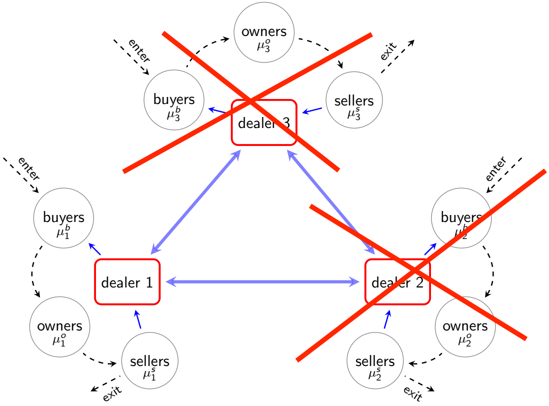
Symmetric Equilibrium



Proposition

There is a symmetric equilibrium with $\nu_i(k) = 1/3$ for each $i \in N = 3$. This equilibrium is not interesting.

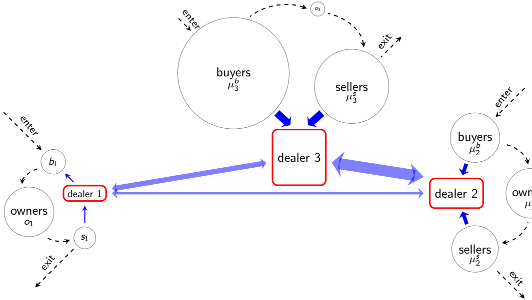
$\lambda_{DD} z_{DD} < \lambda_D z_D$ Case: Full Dry-Out



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

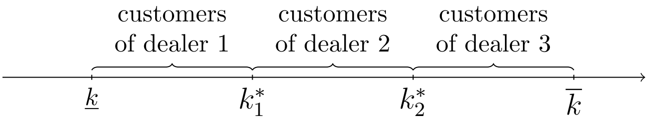


Proposition

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

Asymmetric Core-Periphery

Under the condition: $\lambda_{DD} z_{DD} > \lambda_D z_D$ we find asymmetric clientele equilibrium:



- *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

Asymmetric Core-Periphery: Intuition

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

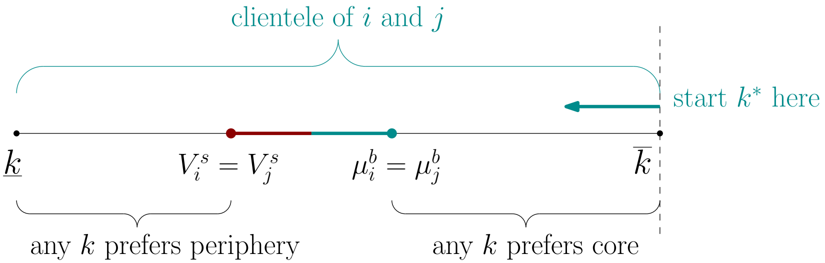
Asymmetric Core-Periphery: Intuition

2. The periphery has few customer-buyers

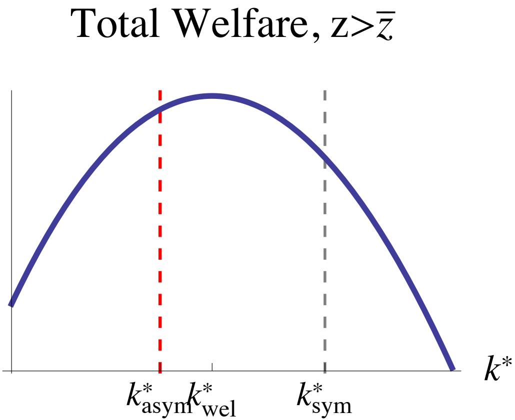
$$\mathbb{H}_i = \frac{\sum_{j\in N}\left(\lambda_{ji} z_{ji} \mu_j^s\right)}{r + k + \sum_{j\in N}\left(\lambda_{ji} z_{ji} \mu_j^s\right)}$$

$$V_i^b(k) = \mathbb{H}_i\left(\left(\frac{k}{r+k}\right)\left(V_i^s - \frac{\delta}{r}\right) - wAv.\left(V_j^s - \frac{\delta}{r}\right)\right)$$

We show that:



Asymmetric Core-Periphery: Welfare



- 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

Thank you for your attention.