

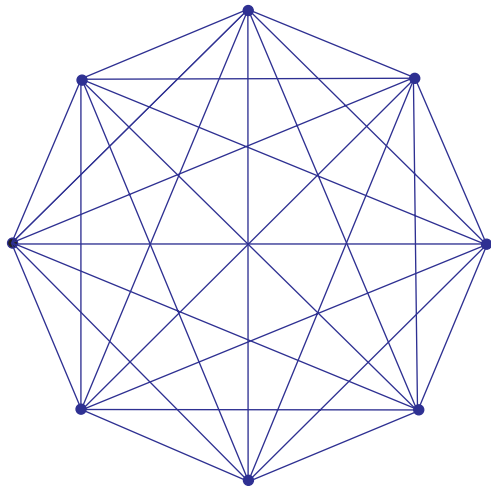
# Dark Markets

## Part 3. Evidence from Federal Funds Markets

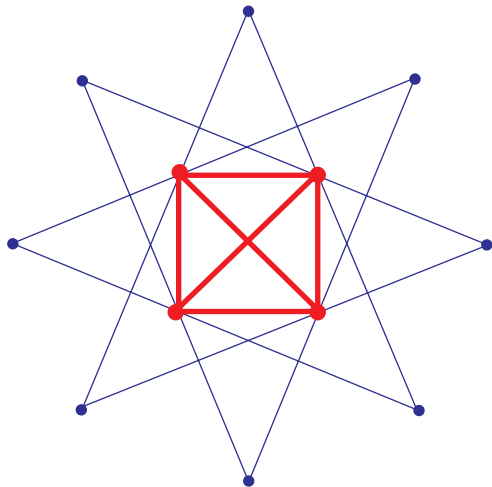
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Stanford University

Fields Institute Lecture  
April, 2010

Collaboration: Adam Ashcraft and Jamie McAndrews, New York  
Federal Reserve Bank



**Figure:** An over-the-counter market.



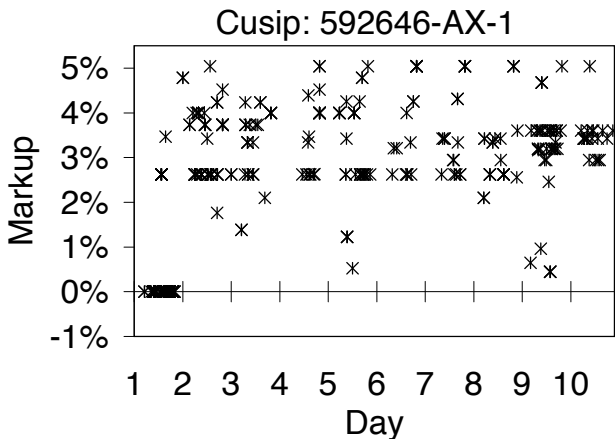
**Figure:** A dealer-Intermediated over-the-counter market.

## Example Evidence from Fixed-Income Markets

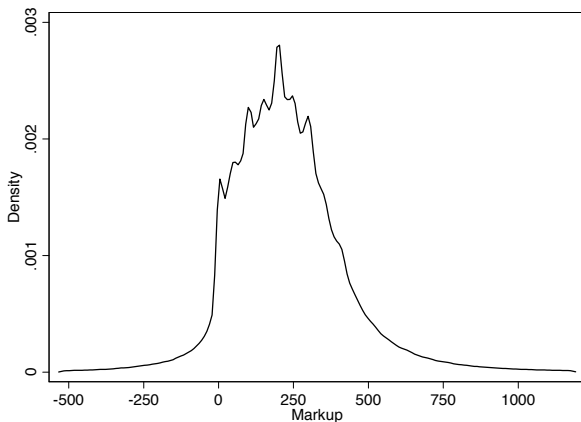
- ▶ European Telecom bond issuances cause sectoral bulges in yield spreads: Newman and Rierson (2004).
- ▶ Repo specials and on-the-run richness in treasuries: Duffie (1996), Barclay, Hendershott, and Kotz (2006).
- ▶ Treasury yield elevation into issuance, declining afterward, Yan (2010).
- ▶ Price runups at default on cheapest to deliver debt instruments on credit derivatives (Colins-Aikman, Delphi).
- ▶ Cross-sectional price dispersion of trades: **government bonds** (Garbade and Silber (1976), Dunne, Hau, and Moore (2007)); **municipal bonds** (Harris and Piwawar (2005), Green, Hollifield, and Schürhoff (2007a,b), Green, Li, and Schürhoff (2007a,b)); **federal funds**: Ashcraft and Duffie (2007).

## Municipal Bond Dealer Market Power and Cross-Sectional Price Variation

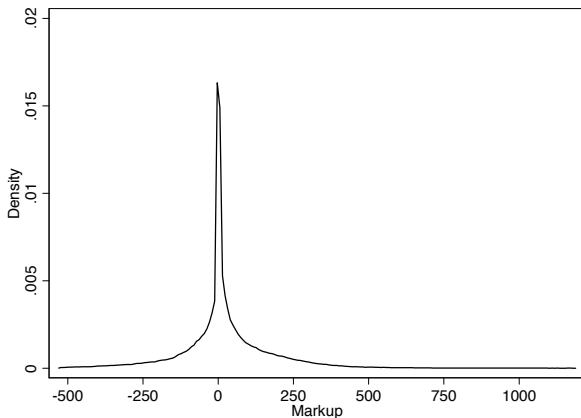
- ▶ In a series of papers, Green, Hollifield, and Schürhoff (2006a,b) and Green, Li, and Schürhoff (2007a,b) structurally model and empirically fit data bearing on dealer market power and cross-sectional price variation in municipal bond markets.
- ▶ For example, Green, Li, and Schürhoff (2007b) find that retail muni execution yields react immediately downward (about 26 basis points on the first day) to Fed easings, and react slowly upward (about 1 basis point on the first day) to Fed tightenings. Dealer-to-dealer trades execute at yields that follow treasury yields closely.



**Figure:** Execution price dispersion after muni issuance. Source: Green, Hollifield, and Schürhoff (2007b).



**Figure:** Asymmetric dealer margins on small (up to \$100K) trades. Source: Green, Hollifield, and Schürhoff (2007a).

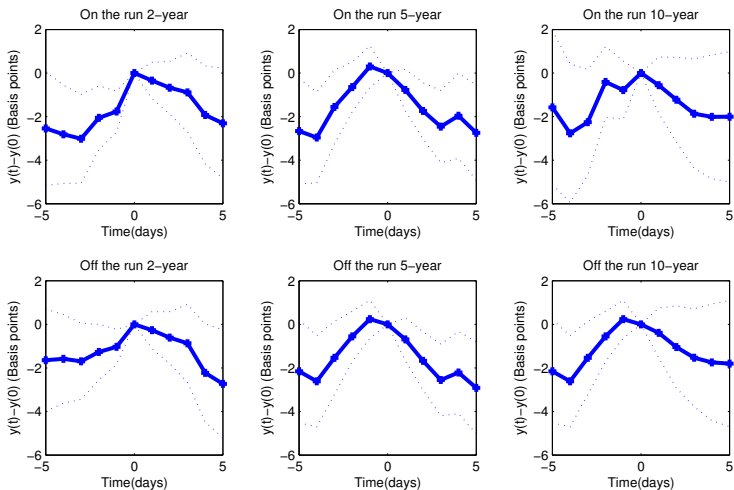


**Figure:** Dealer margins on large (over \$500K) trades. Source: Green, Hollifield, and Schürhoff (2007a).

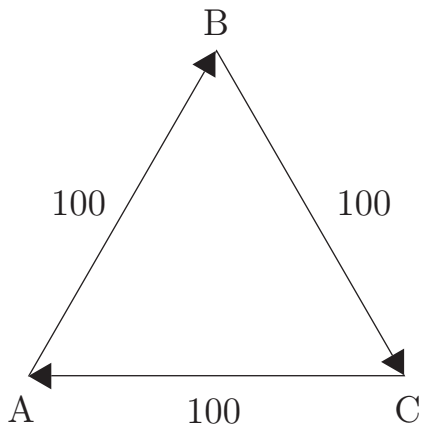


**Treasury and Federal Funds markets**  
are benchmarks for high liquidity.

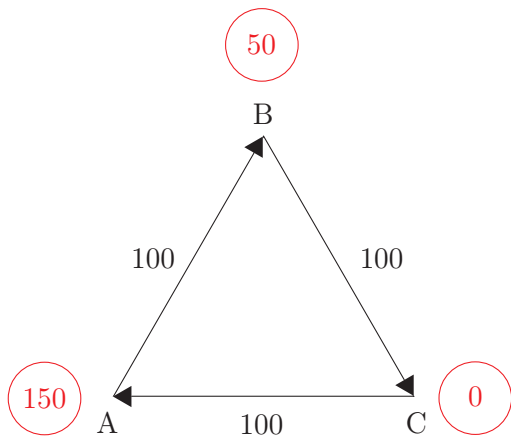
**How could search frictions matter?**



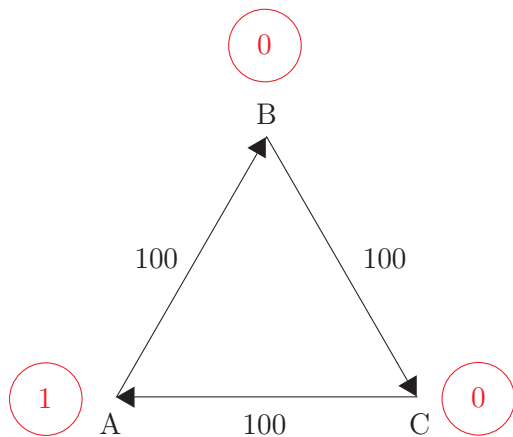
**Figure:** Yield elevation at the issuance of U.S. Treasuries, with one-standard-deviation bands. Source: Honjun Yan (2010).



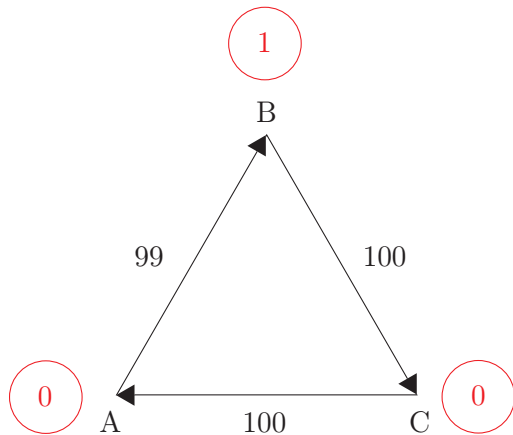
**Figure:** How can A, B, and C all send 100 with no initial inventory? One cannot ignore the dynamics.



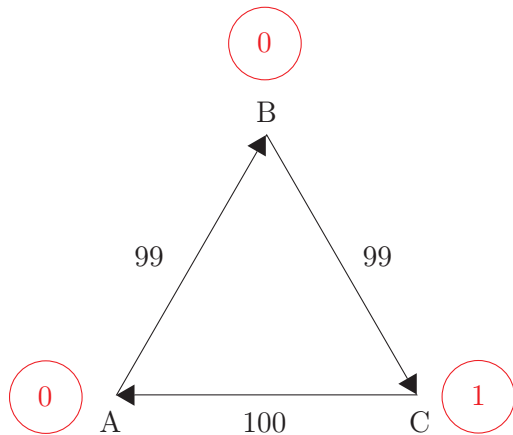
**Figure:** These trades can be implemented in one round, starting with the circled inventories.



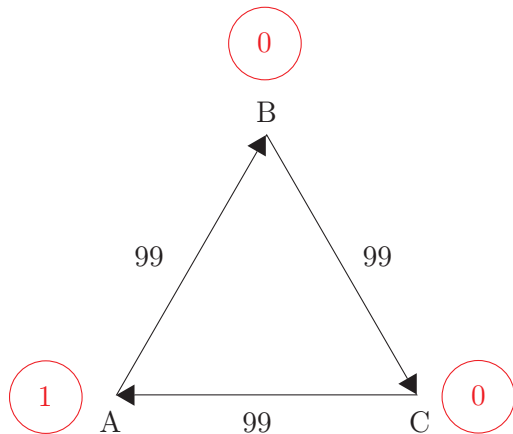
**Figure:** The same trades can also be implemented in many trades from much smaller inventories.



**Figure:** After the first of many trades.



**Figure:** After the second of many trades.



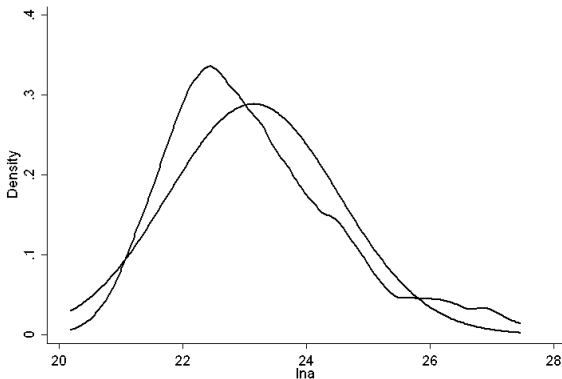
**Figure:** After the third of 300 trades.



## Search in Federal Funds Markets

From Ashcraft and Duffie (AER, 2007) and work in progress with Adam Ashcraft and Jamie McAndrews.

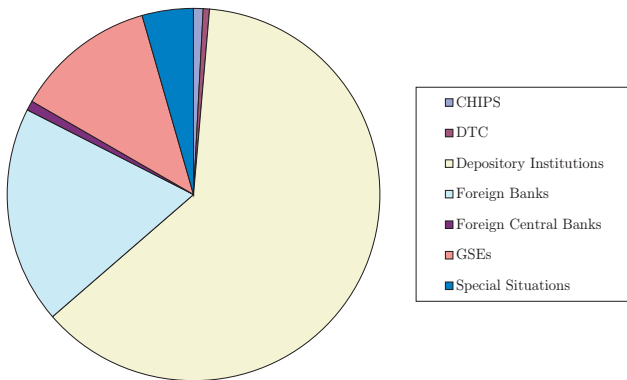
- ▶ Our data on Federal Funds loans among 8,000 banks have rare advantages:
  - Joint identification of counterparties, trade amounts, trade times, execution prices.
  - Knowledge of minute-by-minute counterparty positions.
  - Relatively well defined end-of-day utility for position.
- ▶ We provide evidence that price execution improves with access to counterparties and deteriorates with time pressure to trade.



**Figure:** The cross-sectional distribution of fed-funds senders by total volume in December 2005.

**Table:** Average Behavior of Sends in the Fed Funds Market during December 2005. “Big” means top-ten by volume.

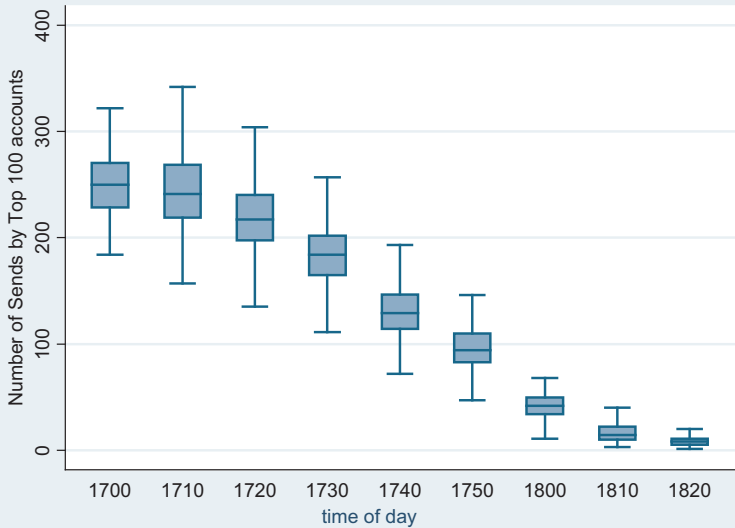
| Sender | Receiver | Median number of receivers | Median monthly volume (\$ millions) |
|--------|----------|----------------------------|-------------------------------------|
| Small  | Big      | 3.1                        | 14.4                                |
| Small  | Small    | 1.4                        | 2.4                                 |
| Big    | Small    | 2006.4                     | 645,796                             |
| Big    | Big      | 7.0                        | 1,487,043                           |



**Figure:** Breakdown of largest-by-volume 100 master account types, by number of accounts.



**Figure:** Targeting balances in the crucial period: 17:30 to 18:00.



## Probabilistic model of transactions

- ▶ Over 225 million observations in 2005, top 100 master accounts.
- ▶ Logit estimator of the probability that  $i$  sends (or lends) to  $j$  in minute  $t$ :

$$p_{ij}(t) = L \left( V_i, V_j, \frac{B_i(t)}{V_i}, \frac{B_j(t)}{V_j}, \sigma(t), 1_{\{t \in [17:30, 18:30]\}} \right),$$

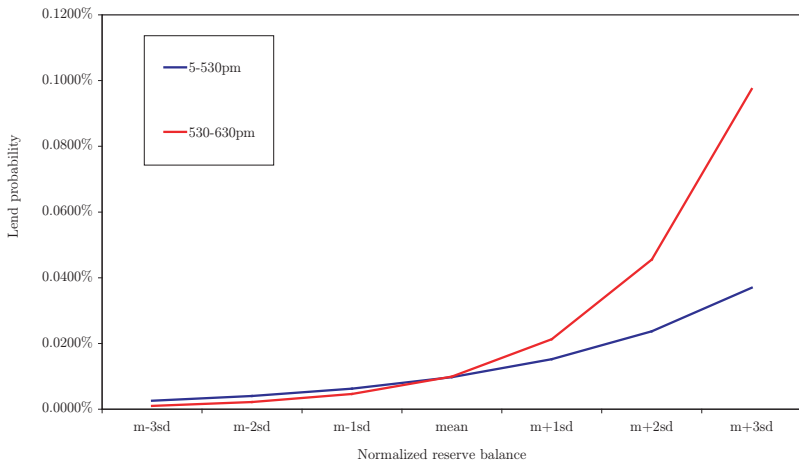
where

- $V_i$  is log of monthly volume of bank  $i$  during 17:00 to 18:30.
- $B_i(t)$  is the balance of bank  $i$  at the beginning of minute  $t$  minus median-over-days balance of  $i$  at  $t$ .
- $\sigma(t)$  is the trailing 30-minute historical volatility of the fed funds rate (dollar-weighted across all included transactions).

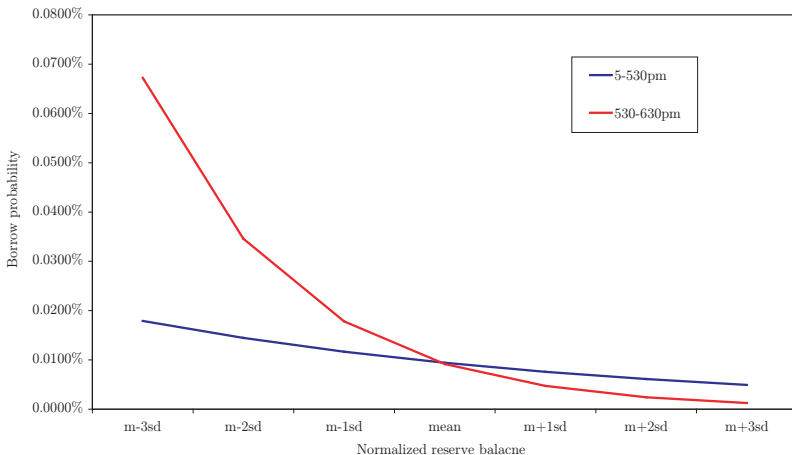
## Results

- ▶ Precautionary targeting of balances.
- ▶ Lending and borrowing are far more sensitive to balances than are other transactions for federal funds.
- ▶ Balance targeting is more active when rate volatility is higher.
- ▶ Sensitivity of targeting goes up after 17:30.





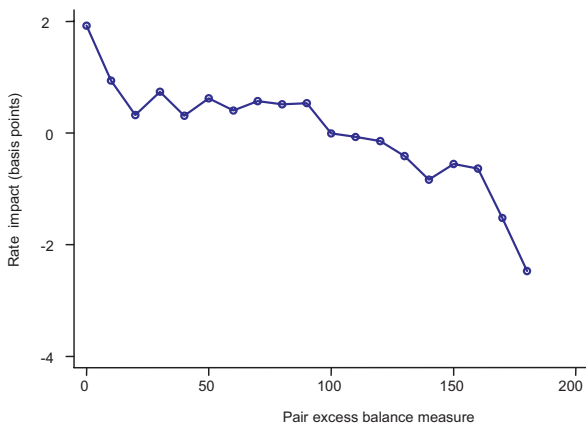
**Figure:** Probability of lend is more sensitive to balances in the last hour.



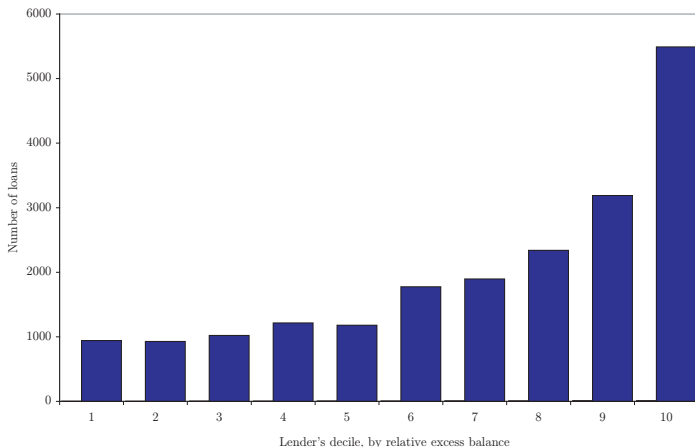
**Figure:** Probability of borrow is more sensitive to balances in the last hour.

**Table:** The interest rate negotiated depends on the excess balances of the borrower and the lender banks. Here is the mean negotiated rate less the average rate in the market at this minute, for banks with low (10%-ile) and high (90%-ile) excess balances.

|                     | Low Borrower     | High Borrower     |
|---------------------|------------------|-------------------|
| Low-Balance Lender  | 1.8 basis points | 0.2 basis points  |
| High-Balance Lender | 1.1 basis points | −2.6 basis points |



**Figure:** The rate negotiated, relative to the mean market rate at that minute, depending on the sum of the excess-balances percentiles of the borrower and the lender banks.



**Figure:** For loans to borrowers most in need of federal funds (the lowest decile by relative excess balances), the number of loans made by each decile of lenders, sorted by the lender's relative excess balances.

## Negotiating a rate late in the day

$$R_{ij}(t) - r(t) = c - 11.0^{***} q_{ij}(t) + 0.8 L_{ij} + 2.3^{**} B_{ij} \\ + 11.6^{***} s_L - 4.3^{***} s_B + \epsilon_{ij}(t)$$

- ▶  $R_{ij}(t) - r(t)$ , excess rate (basis points) of pair  $(i, j)$ , minute  $t$ .
- ▶  $q(k, t)$ , sum of the cross-sectional quantile ranks of lender and borrower, in forecasted relative balances.
- ▶  $L_{ij}$ , prior fraction of loans by  $i$  to  $j$ .
- ▶  $B_{ij}$ , prior fraction of borrows by  $j$  from  $i$ .
- ▶  $s_L, s_B$ , cross-sectional size quantiles, lender ( $L$ ), borrower ( $B$ ).