

A Multiple Lender Approach to Understanding Supply and Search in the Equity Lending Market

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Introduction:

Borrowing Costs and Short Sellers

- Short sellers tend to be informed traders and they are important contributors to market quality
 - (e.g., Boehmer, Jones, and Zhang (2008, 2009))
- Equity lending does not negatively impact markets
 - (Kaplan, Moskowitz, Sensoy (2013))
- The structure of the equity lending market is very different from many other financial markets
 - OTC, opaque, relationship based (e.g., Duffie, Gârleanu, and Pedersen (2002), Kolasinski, Reed, and Ringgenberg (2012))

Short sale constraints matter

- Theoretically
 - Miller (1977), Hong and Stein (1999), Gallmeyer and Hollifield (2008), Diamond and Verrechia (1987).
- Empirically
 - Asquith, Phatak, and Ritter (2005), Geczy, Musto and Reed (2002), Ofek and Richardson (2003), Boehmer, Jones and Zhang (2009).
- What are the explicit short-sale constraints?
 - Regulatory Requirements: (e.g. Price Tests/Reg SHO)
 - Institution-Specific Rules
 - Borrowing Difficulty
 - » *Pre-Borrowing Requirements*

But little is known about them. Why?

- Although institutional requirements are carefully studied, borrowing difficulty is not
- Share loan market is notoriously opaque
 - D'Avolio (2002)
 - Duffie, Garleanu, and Pederson (2002)
 - Geczy, Musto, and Reed (2002)
 - Other opaque markets:
 - Harris and Piwowar (2004), Green, Hollifield and Schurhoff (2004)
 - Garbade and Silber (1976)
- In fact, some controversy over whether the market drives a constraint at all...
 - Christoffersen, Geczy, Musto and Reed (2007) show that for most cases, increases in quantity borrowed do not correspond to increases in price
 - Cohen, Deither, and Malloy (2006) show large positive shifts in the demand for share loans cause increases in lending fees

Criminal Charges Near In Stock-Lending Cases

By KARA SCANNELL

August 15, 2007; Page C3



WASHINGTON -- Federal authorities are preparing to file criminal charges against nearly a dozen individuals in connection to a years-long investigation into improper stock lending, people familiar with the matter said.

Federal prosecutors in Brooklyn, N.Y., and the Securities and Exchange Commission are investigating whether current or former employees at Janney Montgomery Scott LLC, **Morgan Stanley** and other financial institutions committed fraud by taking kickbacks or engaging in self-dealing while arranging stock-lending agreements, the people said.

The investigation has centered on conduct involving mostly lower-level employees across Wall Street, the people said. The cases involve "finders" or firms that act as intermediaries and assist borrowers and lenders in locating stock to borrow, they said.

The stock-lending market was once a backwater of Wall Street, but has grown into a \$10 billion industry, fueled by the increased use of short-selling...

The NYSE found that from January 2004 to December 2004, Janney employees engaged in a series of transactions that fed money to finder firms that had the effect of driving up the cost of borrowing. Janney paid 24 finders about \$1.4 million in connection with the stock loans, according to the settlement, without any written agreements or invoices that showed the finder performed any services.

HIGH & LOW FINANCE; Stock Loans Are No Place For Secrecy

By FLOYD NORRIS 9/28/2007

The New York Times
nytimes.com

An opaque market is a market that insiders love, simply because they can take advantage of outsiders. It is also a market that produces prices no one can be sure are trustworthy.

The American stock market is as transparent a market as you are likely to find. Trades are posted virtually instantaneously, and so are the prices being sought by buyers and sellers. But a related market -- vital to the operation of the stock market as we know it -- is so opaque that even the insiders can get ripped off.

Last week, the government brought criminal charges against former stock loan employees at a number of brokerage firms, among them Morgan Stanley and A. G. Edwards. Because the market prices were so obscure, the government says, the employees could rip off their own firms by arranging for the firms to overpay when they borrowed shares....

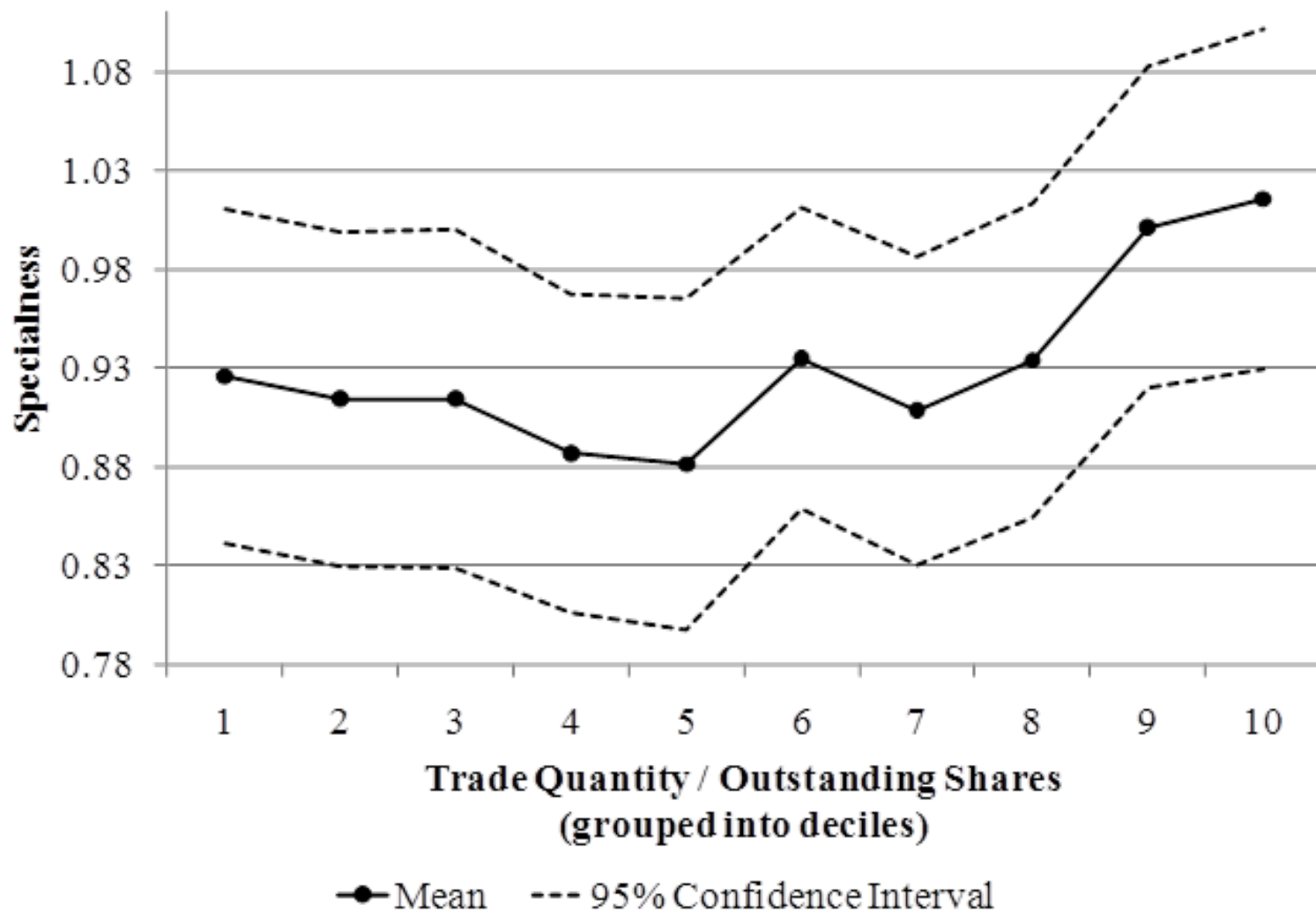
The S.E.C., which also filed civil fraud allegations, says the actions brought in \$12 million for the traders. This is a \$700 million [sic] market, according to calculations by Vodia Group, a research firm, but one that is so hidden from view that this suspected fraud could go on for more than five years without being detected....

...Profits can be lower for market makers in transparent markets, and while institutional investors share in the profits generated by lending their shares, individual investors generally do not. There might be pressures to let them in on the money, which Wall Street would not much like.... This is a market that could use a dose of sunlight.

Structure of the Equity Loan Market

- Transactions only viewed by borrower and lender
 - No central quoting, No central trading, Borrowers call lenders
- Despite lack of transparency, size is large
- Anecdotal evidence suggests market does not function well
 - *Market is always too hot or too cold*
 - Stories of excess supply for most stocks
 - Stories of excess demand for a few stocks
- Difficulty in studying these constraints due to lack of transparency
- We'll try to answer a few questions:
 - How much short selling can take place before shorting difficulty arises?
 - What causes borrowing difficulty?
 - What are the characteristics of the share lending supply curve, and how do these characteristics vary across stocks?
 - Who lends securities?
 - How much price variation could a borrower see across multiple lenders?
 - How does the supply schedule vary across lenders?

Specialness as a Function of Trade Quantity in 2006



Presentation Structure

- Introduction & Motivation
- Search
 - Search Cost Models
 - The Role of Search in the Equity Lending Market
- The Dataset
 - Relationships
 - Specialness
- Estimating Supply
 - Two stage least squares approach
 - Selection of instruments
 - Average Supply Curve
 - Cross Sectional Differences
- Price Dispersion
- Conclusion & Future Work

Search and the Share Lending Market

Duffie, Garleanu, and Pederson (2002)

- i. Use search model to describe share lending market.
- ii. Homogeneous search frictions for borrowers and lenders. As a result: model does not result in a kinked share loan supply schedule.
- iii. Lending fee driven by
 - Search Costs (Like Sirri & Tufano (1998))
 - Lender Bargaining Power

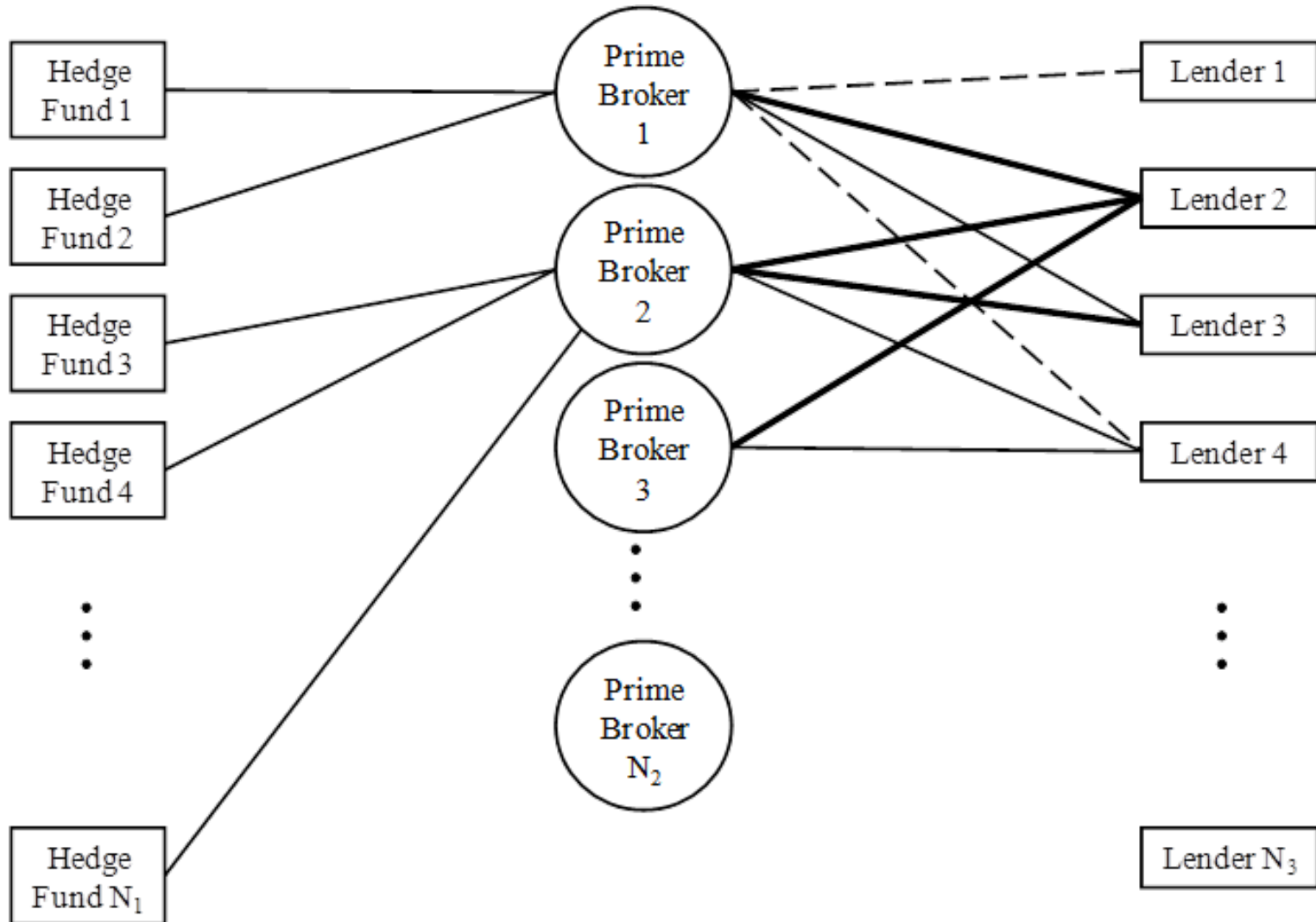
We allow search costs to vary by quantity lent.

- i. When demand is low, brokers match client borrowers with client lenders or obtain shares loans from well-known lenders with whom they have a relationship.
- ii. A large positive shock to demand, however, may require brokers to search for lenders beyond their base of clients and relationships, increasing search frictions.

Search cost models can generate kinked supply curves, but other models can too (Duffie (1996)). Distinguishing features of search (Jung (1960)):

- i. Search cost models also predict price dispersion.
- ii. Another feature of these models is that the level of prices should increase in search costs. While we cannot directly observe search costs, we identify a proxy for total search costs: number of lender relationships. We will examine how this variable varies in average lending fee in the future.

Structure of Equity Lending Market



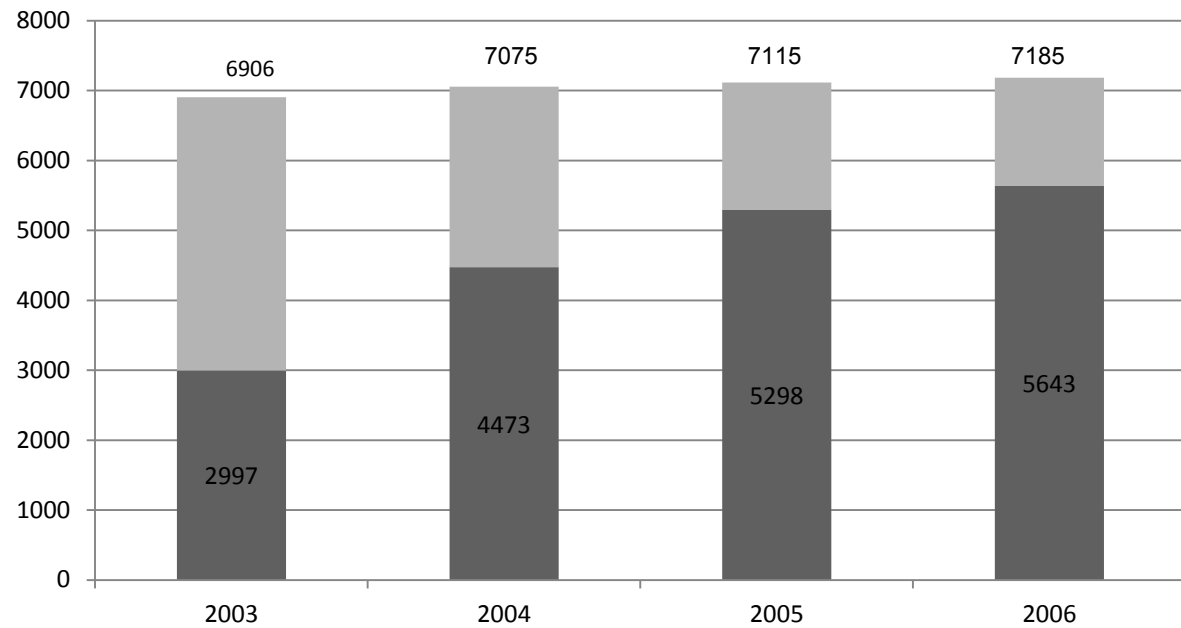
We use data from a 3rd party securities lender

- Provided by a firm that is
 - both a 3rd party securities lender and a data aggregator
 - *Lenders provide own information in return for market wide information.*
- 12 lenders: direct lenders, agent lenders, broker dealers.
- Principal owners of shares lent directly and through agents are from retail brokerages, pension plans, insurance companies, hedge funds and mutual funds.
- These market participants represent 36% of the securities lenders by number.
- 5,042,056 daily observations of loan transactions.
- September 26th, 2003 to May 9th, 2007.

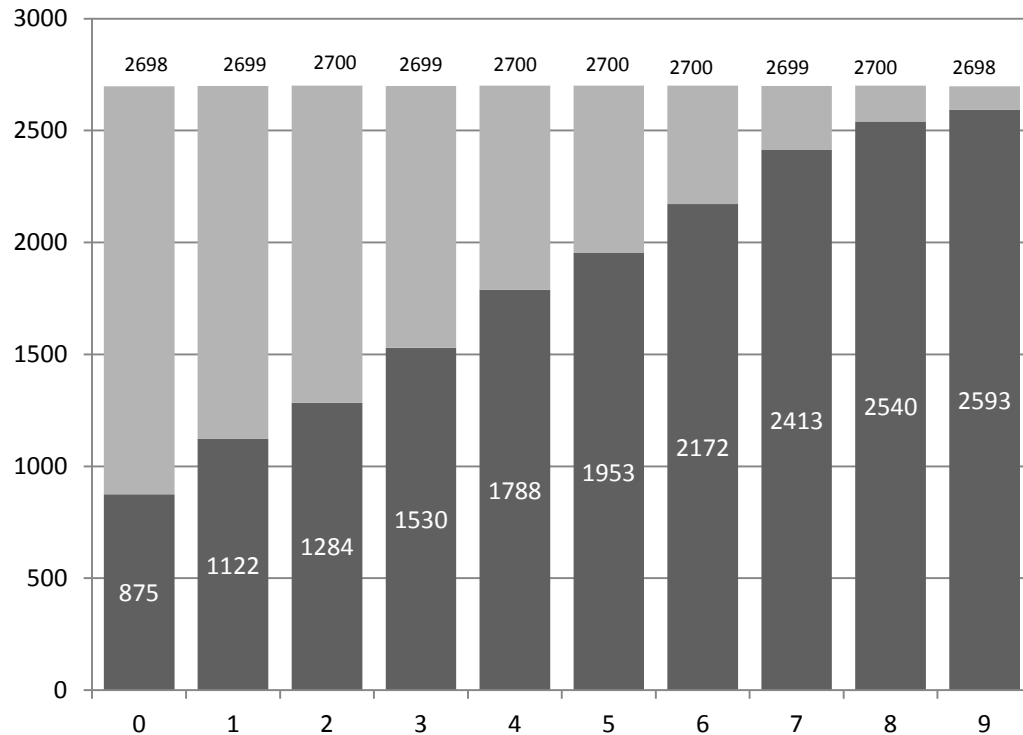
Equity Lending Database Statistics

Lender			Percent of Obs.	Rebate Rate (in percent)		Number of Relationships (stock / day)		
ID	Lender Type	Description		Mean	Median	Mean	Median	Max
1	Broker-Dealer	Broker-dealers box to other broker-dealers, some lending to hedge funds	16.10%	1.63	1.55	2.84	1	225
2	Broker-Dealer	Retail brokerage accounts lent to broker-dealers	7.86%	2.65	1.50	1.27	1	26
3	Broker-Dealer	Broker-dealer box to other broker-dealers, conduit trades	6.85%	4.13	4.25	2.02	1	31
4	Direct Lender	Hedge fund assets lent directly to broker-dealers	0.07%	0.78	1.08	9.92	8	204
5	Broker-Dealer	Broker-dealers box to other broker-dealers, conduit trades	3.52%	2.47	2.00	1.25	1	39
6	Broker-Dealer	Broker-dealers box to other broker-dealers, some lending to hedge funds	31.39%	4.20	4.30	5.74	4	136
7	Broker-Dealer	Broker-dealers box to other broker-dealers, some lending to hedge funds	6.63%	2.53	1.75	5.06	2	232
8	Direct Lender	Mutual fund assets direct to broker-dealers	17.92%	3.19	3.15	1.87	1	102
9	Broker-Dealer	Hedge fund, pension plans assets lent directly to other hedge funds or broker-dealers, some conduit trades	0.83%	4.60	5.15	3.27	2	40
10	Direct Lender	Hedge fund assets lent directly to broker-dealers	0.30%	2.58	1.00	1.01	1	2
11	Agent Lender	Endowments, pension plan assets lent to broker-dealers	4.95%	4.33	4.75	1.43	1	101
12	Agent Lender	Institutional assets lent to broker-dealers	3.58%	2.27	1.02	2.41	1	75

Lending Database Coverage



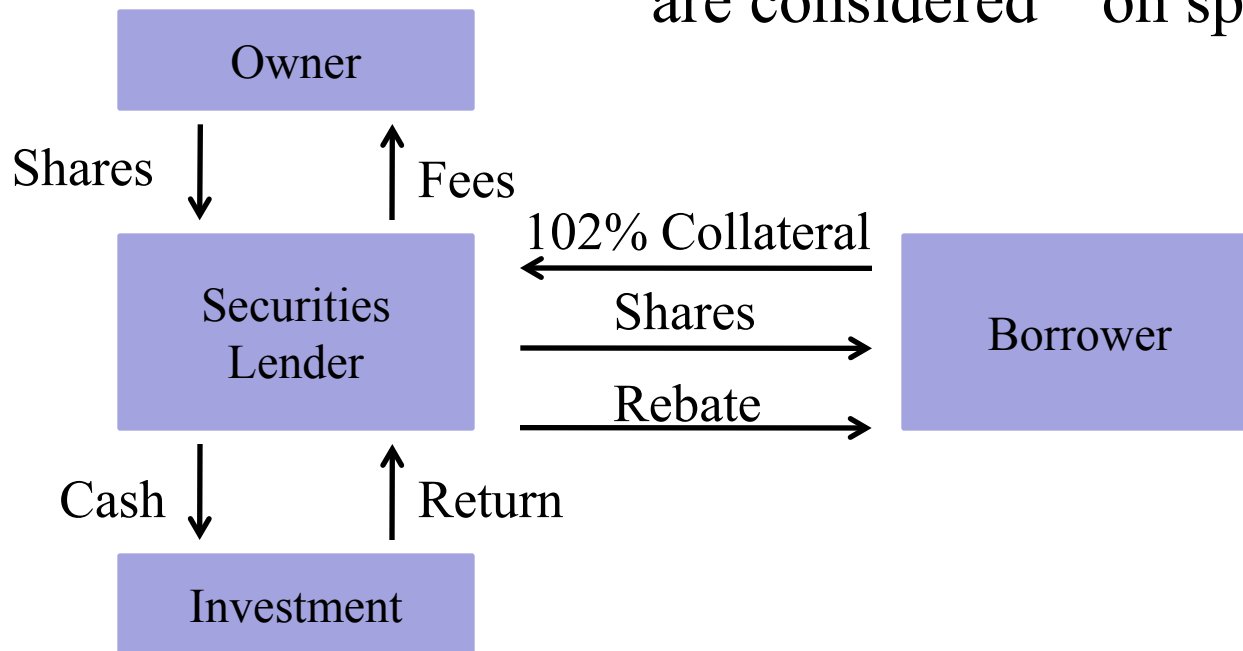
■ Lending Database ■ CRSP Universe



■ CRSP
■ LEND

Overview of Loan Pricing & Specialness

When this rebate rate is low, stocks are considered “on special”



Specialness is the price of borrowing a share

- Difference between a particular stock's loan fee and the prevailing loan rate: Specialness. (D'Avolio (2002) and Geczy, Musto, and Reed (2002))

$$\text{Prevailing Rate (or GC)} = (\text{Federal Funds}) - (\text{Spread})$$

- To estimate the spread, measure loan fee above the federal funds rate, and the mode of this distribution is the spread.
- But...each lender may charge a different prevailing rate.
- So, mode adjusted for outliers and:
 - Lender – Median spread 16bps. IQR 1-50bps
 - Loan Size – 100K and 1M cutoffs. Large IQR 0-25bps.
- Finally, market wide specialness:

$$F_{i,t} = \sum_{l=1 \text{ to } 12} (ff_t - \text{spread}^l - \text{rebate}_{i,t}^l) * (\text{shares}_{i,t}^l / Q_{i,t})$$

Market Loan Quantity

- For each stock & day, we sum all share loans outstanding at the end of the day and divide by shares outstanding
- Two issues
 - We don't observe the whole market
 - We want to compare parameter estimates across stocks
- Therefore we use standardized quantity when estimating supply curves:

$$Q_{\text{standardized}} = \frac{Q - \bar{Q}}{\sigma(Q)}$$

Data Filtering & Summary Statistics

- Sample period: 2003-2007
- Firms:
 - ✓ Exist in CRSP
 - ✓ Have at least 250 daily specialness & quantity observations per stock
- 578,022 observations of market wide specialness and quantity

Variable	N	Mean	Median	Standard Deviation	Skewness
Panel A: Firm					
Discretionary Accruals	8,925	0.060	0.004	0.849	20.076
Short Bollinger	530,363	0.097	0.000	0.295	2.731
Long Bollinger	530,363	0.071	0.000	0.256	3.347
Market Capitalization (in \$ <i>Billions</i>)	578,018	12.515	3.558	30.749	6.544
News Sentiment	528,379	0.004	0.000	0.042	-0.440
Short-Term Momentum	525,260	0.004	0.003	0.055	-0.003
Long-Term Momentum	529,915	0.156	0.149	0.310	0.119
Panel B: Short Sale Transactions					
Aggregate Specialness (<i>in percent</i>)	586,435	0.373	0.042	1.366	5.860
Loan Quantity / Shares Outstanding	578,022	0.049%	0.011%	0.161%	7.542%
Panel C: Macro					
Federal Funds Rate (<i>in percent</i>)	1,558	3.471	3.990	1.647	-0.359
S&P Price/Earnings	52	2.946	2.924	0.118	2.814
VIX	1,073	14.824	14.136	3.366	10.541

Two Stage Least Squares Approach

- Price and quantity are jointly determined in equilibrium
- Need to shock demand to identify supply schedule
 - Similar to Fulton Fish Market: Angrist, Graddy and Imbens (2000)

I. First Stage: Estimate quantity demanded by regressing quantity on instruments that affect demand for share loans but not supply of share loans

$$\begin{aligned} \ln(Q_{it} + C) = & \delta_i + \gamma_1 \ln(S_{it} + D) + \gamma_2 \text{Accruals}_{it} + \gamma_3 \text{ShortB}_{it} + \\ & \gamma_4 \text{LongB}_{it} + \gamma_5 \text{News}_{it} + \gamma_6 \text{STMom}_{it} + \text{Controls}_{it} + \eta_i \end{aligned}$$

– Obtain fitted values: *Fitted values identify demand shocks.*

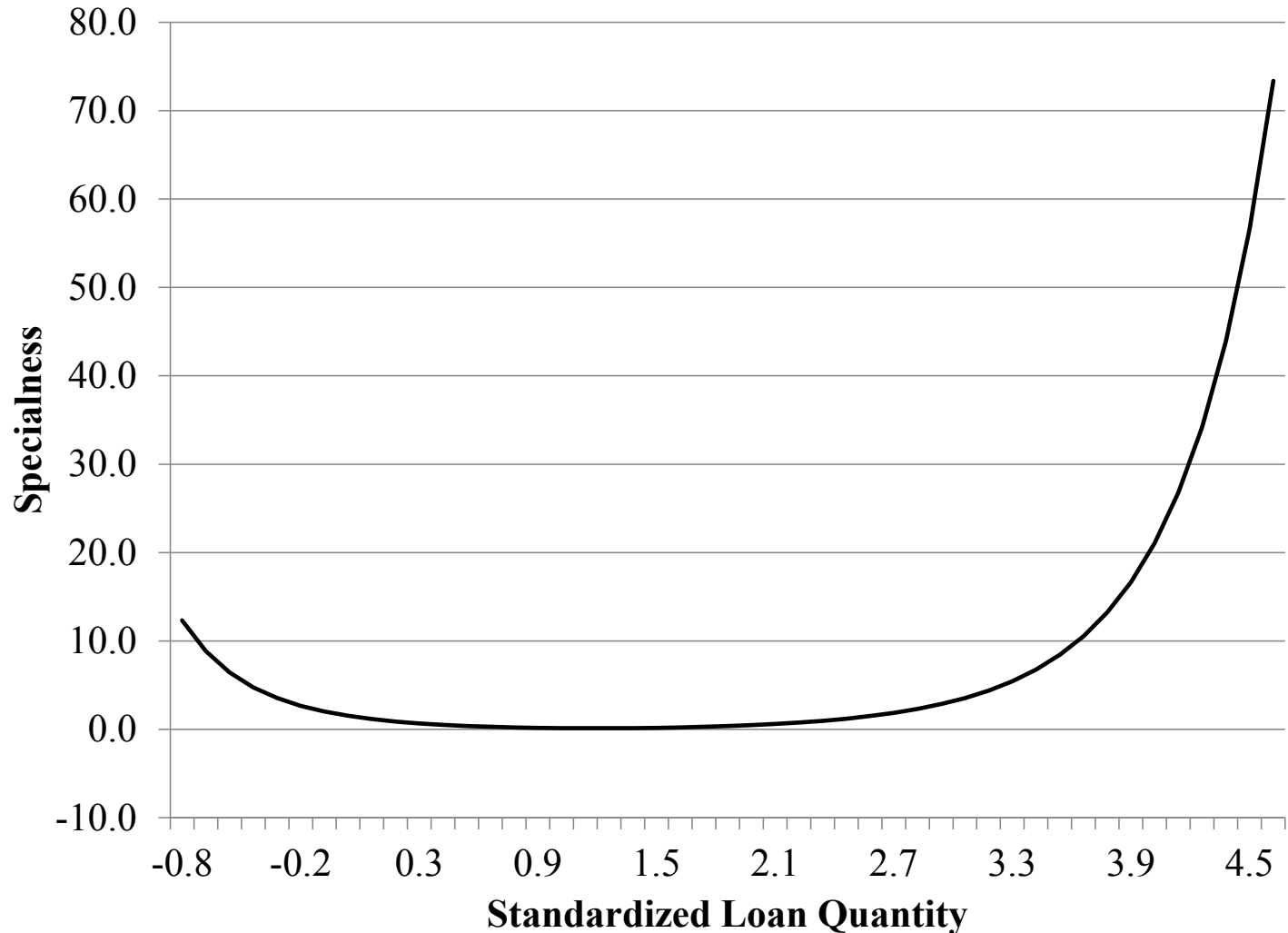
II. Second Stage: Regress share loan prices on levels of quantity demanded

$$\ln(S_{it} + D) = \alpha_i + \beta_1 \ln(Q_{it} + C) + \beta_2 \ln(Q_{it} + C)^2 + \text{Controls}_{it} + \varepsilon_{it}$$

Two Stage Least Squares Estimation

Explanatory Variable	Estimation Method		
	(1) - 2SLS	(2) - Fuller	(3) - LIML
LN(Quantity + C)	-295.6990*** (58.93)	-403.3024*** (110.30)	-411.4129*** (114.98)
LN(Quantity + C) ²	61.1657*** (12.33)	83.8573*** (23.23)	85.5697*** (24.22)
Federal Funds Rate	0.0889*** (0.02)	0.1091*** (0.03)	0.1107*** (0.03)
Long-Term Momentum	-0.1358*** (0.04)	-0.1736*** (0.05)	-0.1764*** (0.05)
S&P Price/Earnings	-0.2588 (0.21)	-0.4758 (0.33)	-0.4923 (0.35)
VIX	0.0162* (0.01)	0.0185 (0.01)	0.0186 (0.01)
Firm Fixed Effect	Yes	Yes	Yes
N	508,744	508,744	508,744
Kleibergen-Paap rK LM Statistic	25.263	25.263	25.263
<i>P-value</i>	0.0001	0.0001	0.0001
Cragg-Donald Wald F Statistic	10.394	10.394	10.394
Sargan-Hansen Statistic	5.885	3.721	3.606
<i>P-value</i>	0.2079	0.4451	0.4619

Two Stage Least Squares Estimation of Specialness as a Function of Trade Quantity



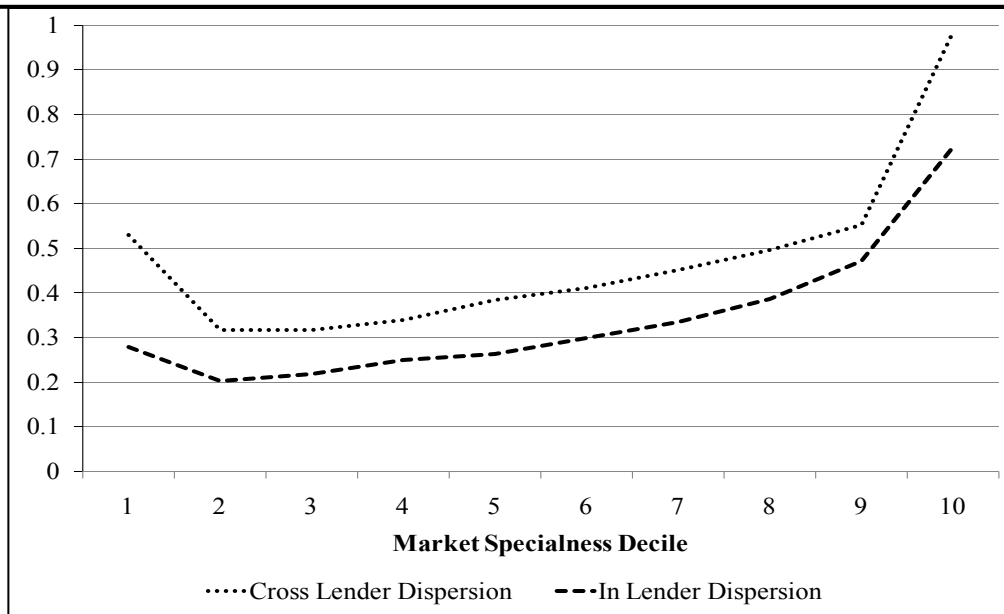
Are there any cross sectional patterns in the supply schedule?

Subsample Definition	LN(Qty + C)	LN(Qty + C) ²	Test Low vs High	Firm Fixed Effect	N
Panel A: Market Capitalization					
Low Market Cap	-232.5745*** (70.76)	48.8247*** (15.05)	27.60*** (0.00)	Yes	508,744
High Market Cap	-186.8668*** (33.49)	38.2192*** (7.23)			
Panel B: Bid-Ask Spread					
Low Bid-Ask Spread	-156.1564*** (38.77)	30.6390*** (8.16)	18.97*** (0.00)	Yes	508,744
High Bid-Ask Spread	-235.3641*** (72.94)	49.4966*** (15.48)			
Panel C: Lender Volume Concentration					
Low Volume Conc.	-211.6295*** (37.42)	44.2605*** (7.97)	19.61*** (0.00)	Yes	507,492
High Volume Conc.	-138.3305*** (30.28)	29.0247*** (6.45)			
Panel D: Number Small Lenders					
Low # Small Lenders	-249.2926*** (64.57)	51.4099*** (13.87)	12.29* (0.06)	Yes	507,492
High # Small Lenders	-196.0426*** (56.33)	40.6479*** (11.65)			
Panel E: Number Large Lenders					
Low # Large Lenders	-139.2103*** (27.76)	29.1954*** (5.82)	26.11*** (0.00)	Yes	507,492
High # Large Lenders	-173.3962*** (43.34)	35.9402*** (9.45)			
Panel F: Lender Capacity Concentration					
Low Capacity Conc.	-299.2151** (119.48)	62.2386** (25.28)	5.58 (0.47)	Yes	507,492
High Capacity Conc.	-328.9796*** (84.27)	66.4139*** (17.19)			

Price Dispersion

- ***Cross-Lender Dispersion*** - The average standard deviation of lender's average prices. Meant to capture differences across lenders.
- ***In-Lender Dispersion*** - The standard deviation of a particular lender's loans in each stock every day. Meant to capture differences across clients at a given lender.

Price Dispersion, the Cost of Borrowing, and Search Frictions



Explanatory Variable	Dependent Variable			
	Cross Lender Dispersion		In Lender Dispersion	
	(1)	(2)	(3)	(4)
Intercept	-0.4529 (3.07)	-2.6990* (1.60)	-0.0552 (0.20)	0.0402 (0.37)
Lender Volume Concentration	0.5288 (2.93)	3.1551** (1.31)	0.2203 (0.20)	0.2711 (0.37)
Market Specialness Decile	0.1713* (0.10)	-0.0177 (0.10)	0.0217*** (0.00)	-0.0535*** (0.02)
Market Specialness Decile Squared		0.0183*** (0.00)		0.0071*** (0.00)
Adj. R ²	0.24	0.35	0.16	0.25

Fee Dispersion & Search Cost Proxies: Dependent Variable is Cross-Lender Dispersion

Intercept	0.8845*** (0.15)	1.2514*** (0.16)	0.3550*** (0.08)	0.2875*** (0.08)	0.8873*** (0.15)
Log(Market Capitalization)	-0.0391*** (0.01)	-0.0293*** (0.01)	-0.0033 (0.00)	-0.0046 (0.00)	-0.0392*** (0.01)
Bid-Ask Spread	3.0114 (4.07)	3.3303 (4.21)	3.5745 (4.40)	3.9085 (4.41)	3.0260 (4.05)
Mean Loan Fee	0.1954*** (0.05)	0.2007*** (0.04)	0.0649 (0.06)	0.0645 (0.06)	0.1936*** (0.05)
Mean Loan Fee Squared	-0.0020 (0.00)	-0.0022 (0.00)	0.0019 (0.00)	0.0020 (0.00)	-0.0020 (0.00)
Number of Small Lenders	0.0340*** (0.00)				0.0312*** (0.00)
Number of Large Lenders	0.0326*** (0.00)				0.0309*** (0.00)
Volume Concentration		-0.4526*** (0.05)	-0.1791*** (0.02)	-0.0931*** (0.03)	
Special Dummy			1.7948*** (0.23)	1.7957*** (0.23)	
Vol. Conc. × Special Dummy			-1.1997*** (0.23)	-1.2063*** (0.23)	
Agent & Brokers Dummy				0.0812*** (0.01)	0.0927*** (0.01)
Agent & Direct Lenders Dummy				-0.0446*** (0.02)	-0.0630*** (0.02)
Broker & Direct Lenders Dummy				0.0233*** (0.01)	-0.0073 (0.01)
All Three Lender Types Dummy				0.0489*** (0.01)	0.0229 (0.02)

Conclusion

- Confirm role of search in equity lending market.
- Findings:
 - With Low Demand, weak relationship between demand and price.
 - With high demand, strong relationship between demand and price.
 - Price dispersion increases with scarcity.
- Usefulness for academics: Conclusion of Coehn, Diether and Malloy...must be seen in the light of the fact that only large movements in quantity demanded give price effects.
- Usefulness for institutional investors in estimation of loan pricing.
- Usefulness for regulators:
 - Past focus has been on exchange barriers (tick test/delivery requirements)
 - More focus should be placed on equity loan market.
 - *Loan Post Existed in 1930s...why did it go away?*