SBFin 2019 – Short-Course

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Short Selling: Theoretical and Empirical Impact on Financial Markets

Roadmap

- Mechanics of Short Selling
  - What is it? Why should we care?
  - How does it work? How do we measure short selling activity?
- Theory
  - Miller (77) and Reed, Saffi & Van Wesep (2018)
  - Diamond & Verrecchia (87)
- Empirical - Asset Pricing
  - Desai et al. (2002) and Cohen, Diether & Malloy (2007)
  - Boehmer, Jones & Zhang (2008), Boehmer et al. (2010)
  - Richardson, Saffi & Sigurdsson (2017) and Prado, Saffi & Sturgess (2015)
  - Beber & Pagano (2013)
- Empirical - Corporate Finance
  - Karpoff & Lou (2010)
  - Grullon, Michenaud & Weston (2015)
  - If we have time: Aggarwal, Saffi & Sturgess (2015)

- **Can we speculate on security prices going down?**
  - Yes! This is what short selling is all about.
- **SEC's Definition:** *"The sale of a security that the seller does not own. In order to deliver the security to the purchaser, the short seller will borrow the security, typically from a broker-dealer or an institutional investor."*
- Economically, same as having a negative number of shares in your portfolio.
- **Huge growth of equity lending market and short selling**
  - 1609: First recorded short by Dutch trader Isaac Le Maire.
  - 2018-Oct-16: Short selling accounts for 42% of trading volume in NYSE.
  - However, shorting has a very bad reputation among practitioners.
- However, shorting has a very bad reputation with politicians and the public.

Why do *academics* care about short selling?

- Regulatory Implications
  - Possibility of manipulation.
  - Provision of liquidity.
- Asset Pricing implications
  - Constraints on prices (e.g., stock prices).
  - Constraints as limits to arbitrage.
- Impact on Firms
  - Voting rights.
  - Corporate Policies (e.g., Goldstein & Gumbel (08)).
- Huge literature and still going.

The New York Times

STRATEGIES

Maybe Short-Selling Isn't So Bad, After All

By MARK HULBERT
Published: September 27, 2008

FEDERAL regulators have banned short sales of more than 800 stocks, mostly of financial companies, in an effort to stabilize prices in a shaky market. But the move may have an unintended consequence: reducing the stock market's efficiency and prolonging the current crisis.

Stuart Goldenberg

That's the consensus of several finance professors who have devoted considerable energy to the study of short-selling — a mode of trading in which a profit is made from a price decline. Short-sellers, like investors who go "long" on a stock, make money by buying low and selling high. The difference is that short-sellers reverse the usual chronological order, selling first and buying back later, at what they hope will be a lower price. They accomplish this time switch by selling borrowed shares and agreeing to return them later.

Were short-sellers ganging up on various stocks in the recent tumult, causing prices to plummet? Adam Reed, a finance professor at the University of North Carolina at Chapel Hill who has extensively studied short-sellers' behavior and its effects on the markets, said it was "hypothetically possible" that they were. He added, though, that the question still

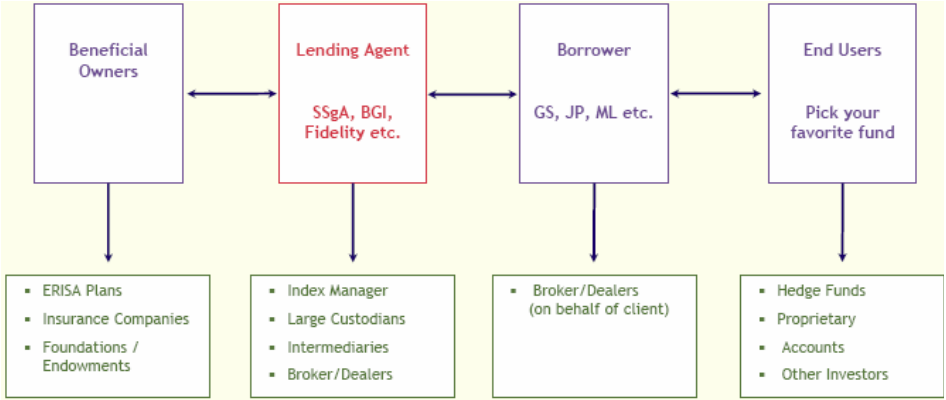
Benefits of Short Selling

- Price manipulation is wrong.
  - It can happen on either long or short sides. Yet...
  - you never see CEOs complaining their stock price is too high due to optimistic buyers.
  - Short sellers can prevent overoptimistic investors from inflating prices.
- Price discovery is good.
  - When retail investors buy a stock, who ensures they get assets worth their prices?
- In financial markets, *the sharks protect the sheep from the wolves*.
  - Short sellers are part of the sharks, most of the times.
- Saffi & Sigurdsson (11): Equity lending improves efficiency.
  - Stocks react faster to new information,
  - have lower levels of downside risk and total volatility,
  - does not increase price occurrence of extreme negative returns.

Bad Reputation Among Non-Academics

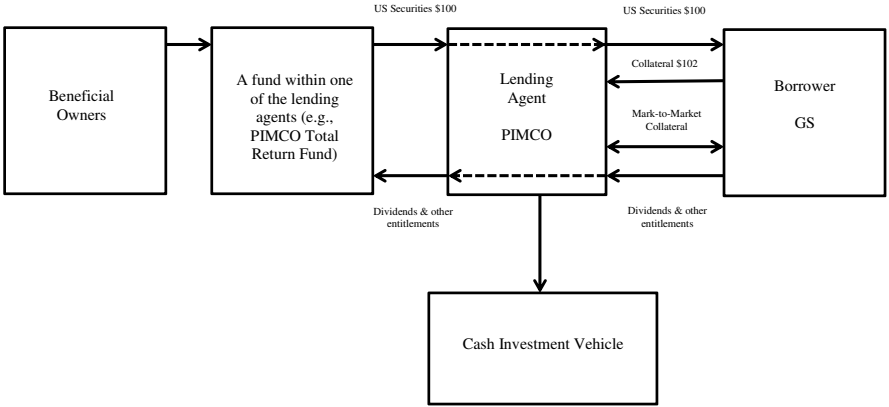
- **1802:** Napoleon decrees a 1-year jail sentence for short-sellers.
- **1992**: Bank of England vs. George Soros:
  - Investors short more than £10 billion against BoE.
  - French Finance minister: *"during the Revolution such people were known as agioteurs, and they were beheaded."*
- **1995**: The Malaysian Finance Ministry proposed mandatory caning as the punishment for short sellers (the beating *"will be light, similar to the punishment carried out on juveniles"*).
- **2008**: Archbishop of York: *"To a bystander like me, those who made £190mi deliberately underselling the shares of HBOS, (...), are clearly bank robbers and asset strippers!"*
- **2017**: Elon Musk: "Short sellers are jerks who want us to die... They're constantly trying to make up false rumors and amplify any negative rumors."
- **Some companies fight short sellers, suing and accusing them of wrongdoing**

Market Participants



- Equity lending provides an extra source of income to lenders.
- Institutional investors are the biggest lenders.

Short Sales and Equity Lending



- Borrower leaves collateral with lender and pays a fee for the loan.
- Lender still receives dividends, but loses voting rights.
- Lender usually has the right to recall shares at any time.

A Taxonomy of Short Sales Data

- **Aggregate Short Interest** (U.S. stock data since 1973):
  - Aggregates all NYSE, AMEX, and NASDAQ open short positions.
  - Available once (now twice) a month, but no individual investor ID.
- **Shorting Flow** (NYSE stock data since 2004):
  - Traded shares in orders involving a short seller.
  - NYSE ticker data, usually aggregated at daily level.
  - Some datasets have investor type, but none has ID.
- **Securities Lending Data** (Global securities data since 2006):
  - Equity loans (*ON LOAN*) and fees can proxy for SS demand.
  - Early papers used single-provider, nowadays Markit is main provider.
  - Daily data, but still no individual investor ID.
- **Large Short Positions** (EU stock data since 2012):
  - EU requires disclosure of large shorts above a certain level.
  - Threshold: 0.5% and 0.1% increase thereafter.
  - Contains date and individual short seller's ID.

Short Sales Constraints and Differences of Opinion

- Short sales affect asset prices in the presence of disagreement.
- Should disagreement affect security prices?
  - No, if investors can trade without frictions.
  - Yes, if investors face limits to arbitrage.
- Miller (77): Pessimistic investors face trading restrictions.
  - With short-sale constraints, pessimistic investors cannot fully incorporate their views.
  - Higher dispersion of opinions leads to higher pricing.
  - Prices are higher than when no constraints are in place.
- Reed et al. (18): Formalize the basic model
  - Also make equity lending fees endogenous.

Basic Setup

Assumptions

- Two investor types $i \in \{1, 2\}$ and one stock A in unit supply N^A.
- Use reduced-form demand to capture main intuition.
- Investors' demands depend negatively on price: higher price, lower demand.
- No need to define utility function.

Supply and Demand

- Stock demands for each investor are given by:
  - $D_1^A = 1 \boxed{+\alpha} - p^A \Rightarrow$ Type-1 investors are optimistic about A.
  - $D_2^A = 1 \boxed{-\alpha} - p^A \Rightarrow$ Type-2 investors are pessimistic about A.
- Stock A's equilibrium: $D_1^A + D_2^A = N^A = 1 \Rightarrow p^A = \frac{1}{2}$
- **Add constraint:** Investor can only short fraction $\lambda \in [0, 1]$.
- If $\alpha \leq \frac{1}{2}$: $p^A = p^B = \frac{1}{2} \Rightarrow$ Constraints don't matter.
- If $\alpha > \frac{1}{2}$: $\boxed{p^A = \frac{\lambda + \alpha(1-\lambda)}{1+\lambda} > \frac{1}{2}} \Rightarrow$ Prices above "normal".
- Prices increase with α and decrease with λ.

Endogenous Equity Lending

- **What if the decision to lend shares is also endogenous?**
  - Investors pay a price to borrow shares (p_S^i).
  - Longs want to own more / shorts want to sell less when p_S^i is high.
  - Fraction of long investors willing to lend: λp_s^i.
- Demands with endogenous equity lending:
  - $D_1^A = 2 - \kappa + \alpha - p^A + \gamma p_s^A \quad | \quad D_2^A = \kappa - \alpha - p^A + \gamma p_s^A$
- Equity market equilibrium:

$$\begin{aligned} D_1^A + D_2^A = N^A \quad &\Rightarrow \quad 2 - 2p^A + 2\gamma p_s^A = 1 \Rightarrow \\ p^A \quad &= \quad 1/2 + \gamma p_s^A \end{aligned}$$

- Equity lending market equilibrium: $\lambda p_s^i D_i^L \geq -D_i^S$

Equilibrium: Stock and Equity Lending Markets

- Both markets are affected by differences of opinion:

Issues with Miller (77)

- Inconsistent with efficient markets:
  - Publicly available information would lead to profitable trading strategy.
- Uninformed investors could serve equally well as the optimists.
- A upward bias in news from the company (if taken literally) could also serve as the driver of optimism.
- Investors are not “rational”: they consistently pay too much for something... in other words, future returns are low.
- If agents know prices are “wrong”, why would they trade?
  - Diamond & Verrecchia (87): Rational expectations model in which market participants take short sale constraints into consideration.

Diamond & Verrecchia (87): Summary

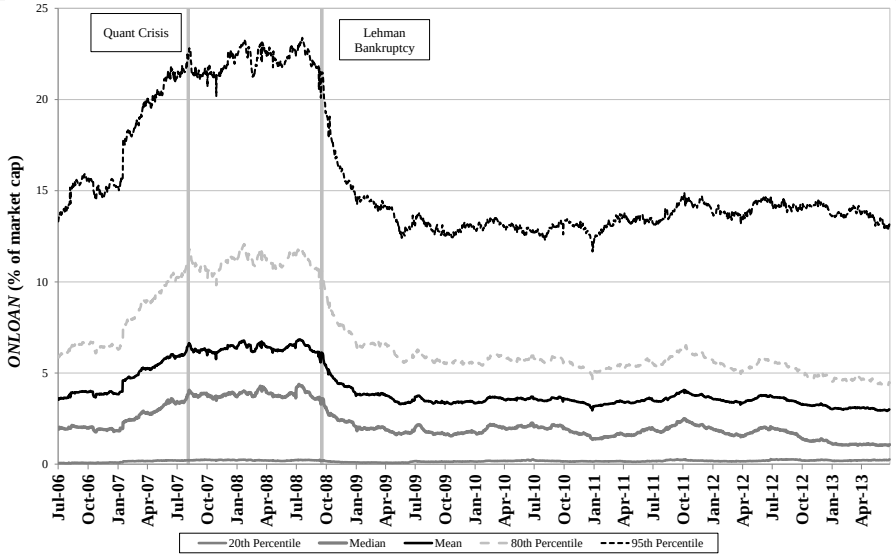
- Short sale constraints lead to:
  - No price bias (i.e. they incorporate SS constraints) but prices are less efficient.
  - Decrease in trading.
  - Prices take longer to adjust to private information.
  - Price adjustment is particularly slow in the presence of negative private information.
- So:
  - Relatively large price reactions when private information is publicized.
  - Since price adjustment to negative private information is particularly slow, large price reactions are more likely in the presence of bad news.
  - Thus, left skewness left skewness is higher for the announcement-day return distribution.
- Empirical Experiment: “Shock” the price adjustment process with news and measure price reactions.

Literature Review

Several articles extend these concepts to more complex and/or realistic settings:

- Duffie, Garleanu & Pedersen (2002, 2003): Short sellers must locate lenders before being able to short. Difficulties in locating lenders generate price imperfections.
- Hong and Stein (2003): Market crashes can happen due to short sales constraints.
- Bai, Chang & Wang (2006): Short-sale constraints can actually lower asset prices and increase volatility.
- Blocher, Reed & Van Wesep (2013): Endogeneize equity lending market.
  Hard-to-borrow stocks have distinct return patterns, responding more to shocks in the supply of shares available.

ONLOAN Time Series



How Do Academics Measure Alpha?

- First, what is "normal"?
  - Use regression controlling for "known" risk factors.
  - What are the these risk factors? Pick your favorite flavor:
    1. CAPM,
    2. Size and Value (FF 3 factor), momentum,
    3. liquidity, investment, quality, etc.

- Ex: Carhart (97)'s model (Fama-French plus momentum):

$$R_t = \alpha + \underbrace{\beta_1 * MKT_t + \beta_2 * SMB_t + \beta_3 * HML_t + \beta_4 * MOM_t}_{E(R_t)} + \epsilon_t$$

- Abnormal is the difference between actual and predicted returns.

- EMH says that $E(\alpha) = 0$, i.e. risk factors fully explain returns.

- No need to pay large fees for $E(R_t)$: Index funds do it cheaply.

Academic Evidence

- **Main Result:** Strong negative relation between short sales intensity and future returns.
- **Basic Strategy**: Buy LOW SS intensity stocks, sell HIGH SS intensity ones.
- What does short selling intensity capture?
  - Private information uncovered by short sellers?
  - Better processing of public information?
  - Liquidity trading?
- Where does performance come from?
  - High SS underperforming (i.e. “bad” stocks)?
  - Low SS outperforming (i.e. “good” stocks)?
  - Combination of both?
- Important to identify lack of shorting demand vs. presence of SS constraints.

Desai et al. (02): Top 2.5% stocks by Short Interest

Table VII

Matching Firm Adjusted Abnormal Returns for the 2.5% Sample

The table reports the mean buy-and-hold (holding period) raw returns for the sample firms (*RAWS*), the corresponding mean returns for the matching firms (*RAWM*), the average abnormal returns (*AHAR*) for the sample firms, the *t*-statistic associated with the mean abnormal returns, and the percentage of firms with positive abnormal returns (*HAR*). The matching firms have the same size decile ranking and the same book-to-market quintile ranking as the sample firm in the month before attaining the threshold level of short interest and are closest in six-month return momentum to the sample firm. The matching firms are selected in month −1 relative to the firm's entry into the short interest sample. Data are available from June 1988 to December 1994, except for February 1990 and July 1990. For these two months, the firms are assumed to have the same level of short interest as the previous month. Short interest is defined as a ratio of shares shorted to the total number of shares outstanding at the end of each month. A firm enters the 2.5 percent short interest sample when its short interest reaches 2.5 percent in a given month and leaves the sample when the short interest level falls below 2.5 percent. EN refers to the month in event time when the sample firm first enters the short interest sample and EX refers to the last consecutive month for which the sample firm's short interest remains at or above the 2.5 percent level. Fewer than 2,726 observations result due to either missing book-to-market values or the firm having fewer than three valid returns in the six-months before entering the sample (EN − 6 to EN − 1).

Subperiod	No. of Obs.	*RAWS* (%)	*RAWM* (%)	*AHAR* (%)	*t*-Statistic	% Positive *HAR*
EN − 6 to EN − 1	1,842	29.76	26.55	3.22	2.77	50.71
EN	1,842	1.18	0.80	0.39	0.51	51.47
EN + 1 to EN + 6	1,841	2.55	7.11	−4.56	−3.30	45.90
EN + 7 to EN + 12	1,829	4.34	5.23	−0.89	−0.63	48.17
EN + 13 to EN + 24	1,785	14.26	15.72	−1.46	−0.59	47.68
EN + 1 to EN + 12	1,841	7.02	13.59	−6.57	−3.03	44.60
EN + 1 to EN + 24	1,841	22.27	31.13	−8.85	−2.28	45.03
EX + 1 to EX + 12	1,802	10.53	17.84	−7.31	−3.11	45.78
EX + 13 to EX + 24	1,687	14.39	18.27	−3.88	−1.55	47.95

- High short interest stocks underperform similar firms.

Identifying Shorting Demand Shocks

- **Use loan fees and quantities from large institution:**
  - Daily contract-level data from Sep/1999 to Aug/2003.
  - Every week (month) compute the *change* in fees and demand.
  - Price-quantity pairs allows for identification of shocks.
- E.g. $DOUT = 1$ if loan fees and loan demand *jointly* increase:
  - An increase in loan demand and fee signal outward demand shock.

$$\text{DOUT}_{i,w-1} = \begin{cases} 1 & \text{if Fee}_{w-1} - \text{Fee}_{w-2} > 0 \\ & \text{and On Loan}_{w-1} - \text{On Loan}_{w-2} > 0 \\ 0 & \text{otherwise.} \end{cases}$$

The baseline model takes the form

$$\begin{aligned} r_{j,t} - R_t^{SB_{j,t-1}} = \alpha_t &+ \beta_1 DIN_{j,t-1} + \beta_2 DOUT_{j,t-1} + \beta_3 SIN_{j,t-1} \\ &+ \beta_4 SOUT_{j,t-1} + \beta_5 r_{j,t-1} + \beta_6 r_{j,t-12,-2} + \beta_7 IO_{j,t-3} \\ &+ \beta_8 Volume_{j,t-7,-1} + \varepsilon_{j,t}, \end{aligned} \tag{1}$$

where $r_{j,t}$ is the return on security j and $R_t^{SB_{j,t-1}}$ is the return on the size/book-to-market-matched portfolio.

DOUT Predicts Negative Returns

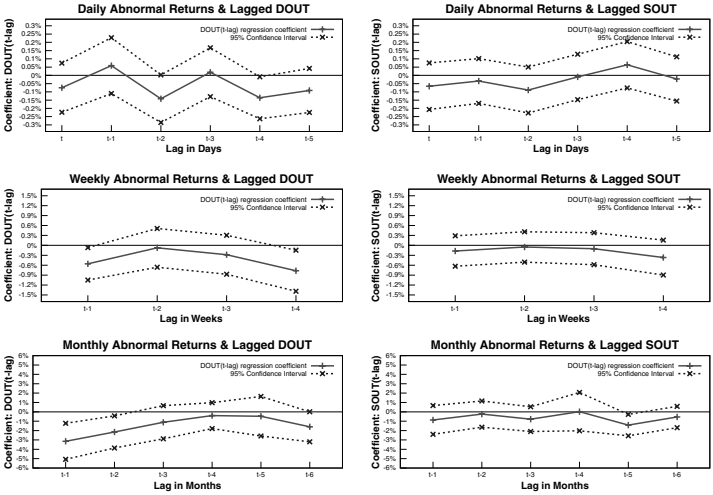
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
DIN	0.281	0.299					0.502		−0.149
	(0.43)	(0.59)					(0.96)		(0.31)
DOUT	−3.144	−2.983					−2.364		−2.485
	(3.20)	(3.96)					(3.27)		(3.19)
SIN	0.006	−0.063					0.443		0.176
	(0.01)	(0.08)					(0.69)		(0.22)
SOUT	−0.869	−0.820					−0.569		−1.225
	(1.11)	(1.23)					(0.85)		(1.81)
r_{-1}		−0.012	−0.012	−0.012	−0.012	−0.012	−0.012	−0.013	−0.012
		(0.49)	(0.50)	(0.49)	(0.48)	(0.48)	(0.48)	(0.51)	(0.50)
$r_{-12,-2}$		0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
		(0.83)	(0.84)	(0.84)	(0.84)	(0.83)	(0.82)	(0.85)	(0.82)
IO		0.309	0.320	0.317	0.276	0.278	0.255	0.419	0.317
		(0.44)	(0.48)	(0.47)	(0.41)	(0.40)	(0.37)	(0.59)	(0.45)
Volume		0.018	−0.004	0.001	0.004	0.006	0.019	−0.024	0.018
		(0.05)	(0.01)	(0.00)	(0.01)	(0.02)	(0.06)	(0.07)	(0.05)
Fee > 3.0%			−0.767	−0.557					
			(0.94)	(0.61)					
Fee > 5.0%					−2.025	−1.585	−1.596		
					(2.09)	(1.66)	(1.63)		
Quantity				−0.138		−0.044			
				(0.48)		(0.19)			
Quantity ∗ (*Fee* > 3.0%)				−0.134					
				(0.34)					
Quantity ∗ (*Fee* > 5.0%)						−0.582			
						(1.05)			
Δ*Fee*								−0.920	−0.912
								(1.95)	(1.76)
Δ*Quantity*								−0.907	−0.343
								(2.45)	(0.77)
Observations/ month	2,100	2,098	2,098	2,098	2,098	2,098	2,098	2,098	2,098

Portfolio Sorts and Long-Short Strategy

	DIN	*DOUT*	*SIN*	*SOUT*	*DIN − DOUT*	*SIN − SOUT*
Panel A: Excess Returns						
Equal-weight						
Mean	1.65	−1.82	0.84	−1.12	3.48	1.96
t-stat	0.79	−1.02	0.49	−0.57	2.34	1.55
Value-weight						
Mean	0.53	−0.53	0.42	−2.15	1.06	2.57
t-stat	0.27	−0.27	0.23	−1.09	0.65	1.92
Panel B: Abnormal Returns (Benchmark Portfolios: 25 Size/Book-to-Market Portfolios)						
Equal-weight						
Mean	0.84	−2.34	0.48	−1.81	3.18	2.28
t-stat	0.67	−2.52	0.56	−1.43	2.17	1.81
Value-weight						
Mean	−0.12	−1.05	0.01	−2.63	0.93	2.65
t-stat	−0.12	−0.88	0.01	−2.23	0.56	1.94
Panel C: Abnormal Returns (Benchmark Portfolios: 75 Size/Book-to-Market/ Momentum Portfolios)						
Equal-weight						
Mean	0.76	−2.11	0.08	−1.63	2.87	1.72
t-stat	0.72	−2.15	0.11	−1.36	2.21	1.34
Value-weight						
Mean	−0.26	−0.88	−0.29	−2.41	0.61	2.12
t-stat	−0.28	−0.75	−0.30	−2.15	0.41	1.58

- Excess returns of *DOUT–DIN*: 50% p.a., BEFORE costs!
- Including trading costs reduces it to 4.5%, but still significant.

Abnormal Returns at Different Frequencies



- Are these results really robust at different frequencies?

Which Shorts Are Informed?

- **Use loan fees and quantities from large institution**
  - Daily short trades from 2000 to 2004 from NYSE.
  - Novelty: Have information on *type* of short-seller.
  - Do all types make money from short sales? Does it vary?
- Shorting accounts for 12.9% of trades. Latest estimates: 30%.

Account Type Designation	Description
Individual	Agency orders that originate from individuals.
Institution	Agency orders that do not originate from individuals.
Proprietary	Orders for which NYSE members are trading as principal. Excludes all trades by the specialist for his own account.
Other	Includes orders by market-makers from options and other markets.

- Also: Split institutional and prop trades by whether an order is a program trade or not.

Double-Sorts: Shorting Flow Forecasts Returns

Table III

Return Differences on Short Sale Portfolios after Controlling for Characteristics

The sample consists of all common stocks listed on the NYSE and extends from January 2000 to April 2004. Firms are first sorted into quintiles based on the given characteristic. Within each quintile, firms are then sorted into quintiles based on the short-selling measure for the past 5 days. Daily value-weighted returns are calculated using a calendar-time approach with a holding period of 20 trading days. Daily Fama and French (1993) three factor alphas are given in percent, multiplied by 20, for the return on the quintile with heavy short selling less the return on the quintile with light short selling. In Panel E, the order imbalance is calculated using Lee and Ready (1991) and is the share of volume initiated by buyers less the share volume initiated by sellers, normalized by total volume. This variable is calculated over the same 5-day interval as the shorting measure.

	Panel A: First sort is market capitalization					Panel B: First sort is book/market				
	Low	2	3	4	High	Low	2	3	4	High
Second sort: number of executed short sale orders										
pf5–pf1	−3.24	−1.60	−0.81	−1.09	−0.76	−1.52	−1.13	−1.67	−1.56	−3.08
t-stat	−7.47	−3.92	−1.70	−2.69	−2.27	−3.57	−2.60	−3.49	−3.52	−5.87
Second sort: shares sold short										
pf5–pf1	−2.20	−1.64	−0.64	−1.20	−0.74	−1.30	−1.09	−1.58	−1.48	−2.44
t-stat	−4.36	−3.61	−1.17	−2.45	−1.97	−3.13	−2.56	−3.26	−3.35	−4.20
Second sort: shorting's share of trading volume										
pf5–pf1	−3.33	−1.80	−1.60	−1.19	−1.16	−1.23	−1.33	−1.14	−1.04	−1.07
t-stat	−9.91	−5.67	−4.95	−4.46	−2.93	−2.43	−2.65	−2.55	−2.23	−1.74
	Panel C: First sort is return volatility					Panel D: First sort is share turnover				
	Low	2	3	4	High	Low	2	3	4	High
Second sort: number of executed short sale orders										
pf5–pf1	−1.10	−1.77	−1.62	−2.27	−4.55	−2.62	−2.19	−1.48	−2.30	−1.81
t-stat	−2.58	−4.13	−3.50	−4.53	−5.82	−5.76	−5.93	−3.49	−4.44	−2.85
Second sort: shares sold short										
pf5–pf1	−1.29	−1.71	−1.62	−2.07	−4.13	−2.38	−1.85	−1.37	−2.04	−1.72
t-stat	−2.99	−4.03	−3.52	−4.04	−5.02	−5.35	−4.98	−3.23	−3.75	−2.54
Second sort: shorting's share of trading volume										
pf5–pf1	−0.77	−0.90	−1.09	−1.64	−1.87	−0.99	−1.43	−0.86	−1.10	−1.38
t-stat	−2.04	−2.03	−2.11	−2.60	−2.48	−2.13	−3.55	−1.81	−1.73	−2.10

Which Shorts are Informed?

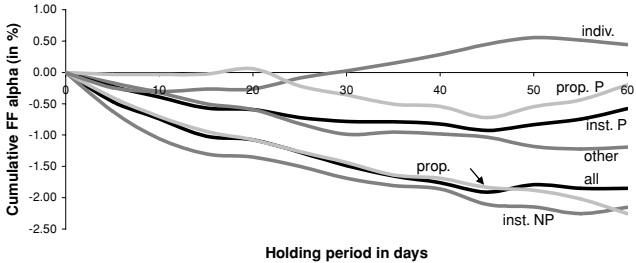
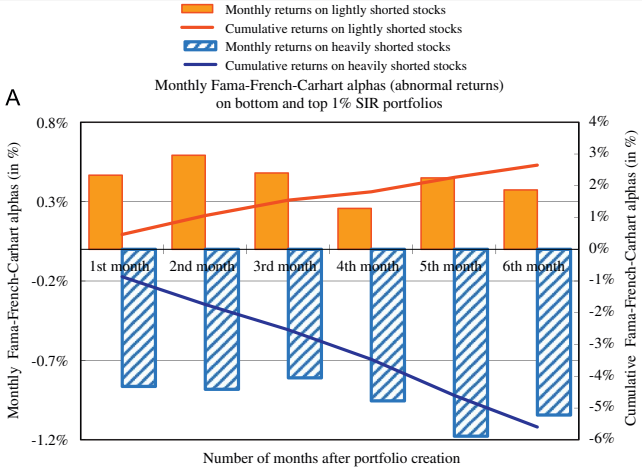


Figure 1. Risk-adjusted return differences on short-sale portfolios of different account types. The sample consists of all common stocks listed on the NYSE and extends from January 2000 to April 2004. Firms are sorted into quintiles based on short selling (shares sold short by the specified account type as a percentage of NYSE trading volume) over the past 5 days. We show average Fama and French (1993) alphas for holding periods up to 60 trading days. Alphas are for the heaviest shorting quintile less the lightest shorting quintile and are expressed in percent.

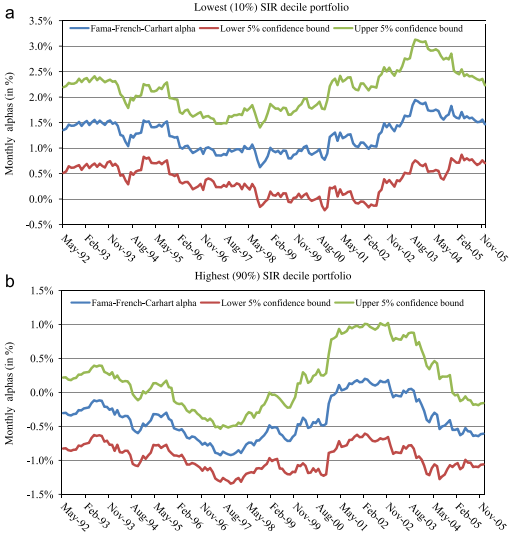
- Short-sellers are very well informed. Some more than others.
- Non-algo institutions and proprietary trades are profitable.
- Individuals are not good at it.

Short Interest (SIR) Portfolios



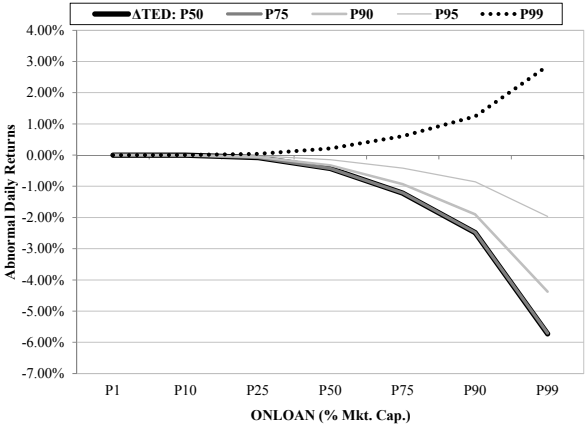
- High SIR stocks underperform, and low SIR outperform as well.
- Long-short alpha: Almost 18% per year.

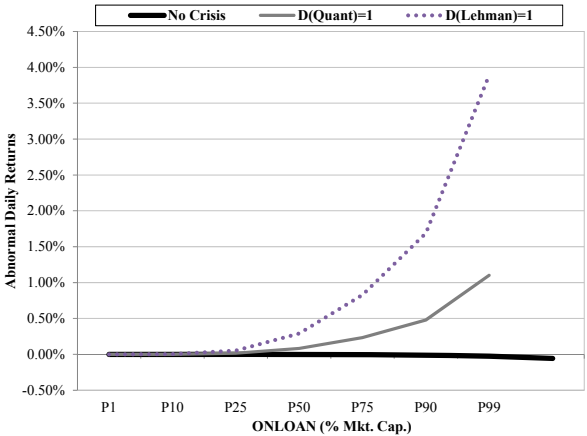
Performance is Stable Over Time



Short Selling & "Deleveraging Risk"

- **During crisis, "deleveraging" risk may affect returns:**
  - Investors are forced to close positions – long OR short – or reduce exposures.
  - High shorts exhibit price increases after funding illiquidity shocks.
- **Higher equity loans forecast negative returns...**
  - Nothing new here. Alpha around 10-12 bps per day (28.6%-35.2% per year).
- **but occasionally very positive relation:**
  - during Quant crisis: -147 bps per day.
  - during Lehman's bankruptcy: -217 bps per day.
  - after increases in TED spreads, CD haircuts, noise in Treasuries.
- **Evidence of systemic short covering due to sudden deleveraging.**
- **You can lose during crashes if shorting the "wrong" stocks.**
  - Returns are partly compensation for tail risk (e.g. "momentum crash").





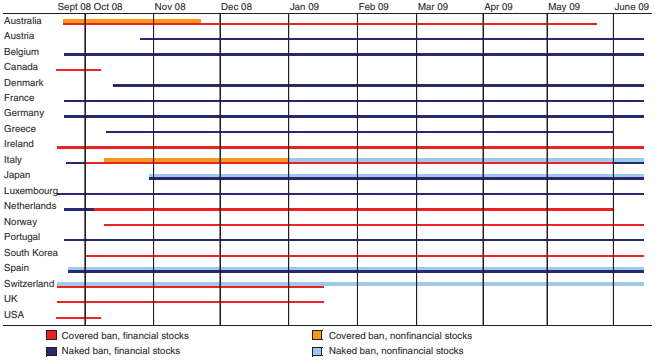
- For "normal" $\Delta(TED)$ days, we see the usual negative relationship.
- During "extreme days", short covering is so strong that returns can be positive.
- Alpha as compensation for tail risk.

Limits to Arbitrage, Equity Lending, and Ownership Structure

1. **Supply of shares decreases with concentration and increases with passive ownership**
   - Larger investors are more likely to be both informed and influential.
   - Passive ownership more likely to lend shares.
2. **Loan fees increase with concentration and decrease with passive ownership.**
   - Shares are more expensive to borrow owing to ownership structure.
3. **Arbitrage risk increases with concentration and decreases with passive ownership.**
   - Higher volatility present riskier opportunities for arbitrageurs.
   - More difficult to arbitrage inefficiencies $\Rightarrow$ Higher arbitrage risk.
4. **Returns following loan demand shocks are more negative for high concentration stocks.**
   - Abnormal returns of 0.42% per week = **22% per year**
   - Estimated transaction costs and loan fees $\sim$ 7.3% per year.
   - Constraints make prices take longer to adjust.

Short Selling Improves Liquidity and Efficiency

- Regulators all over the world reacted to the crisis by banning SS.
- Beber & Pagano (13) examine the impact of these bans:
  - Reduced liquidity, especially for small caps and no options.
  - Slowed price discovery, especially in bear markets.
  - Failed to support prices, except possibly for U.S. financial stocks.



Stocks subject to SS Bans

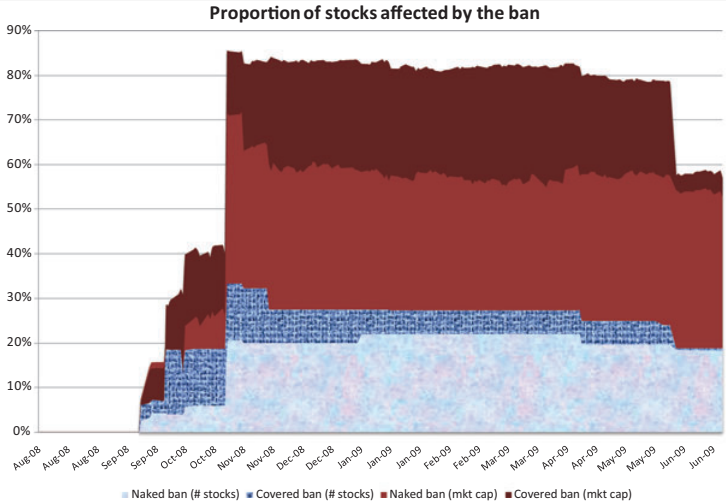


Figure 2. World percentage of stocks subject to short-selling bans. The two darker his-

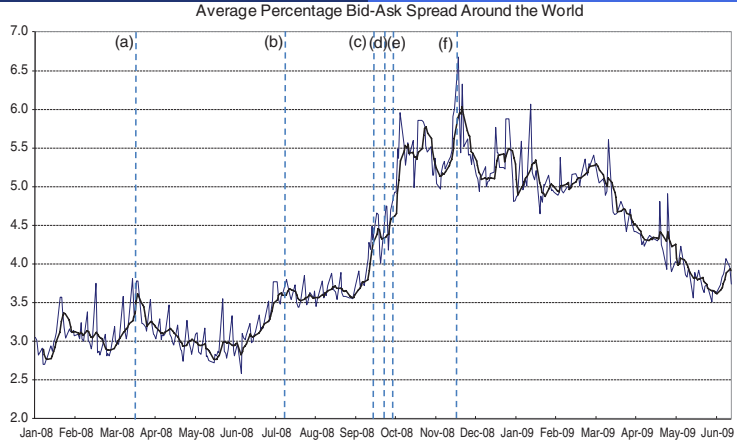


Figure 3. World average bid-ask spread and key events. The thin line plots daily values and the bold line plots the 5-day moving average of the bid-ask spread's cross-sectional average for our sample. The letters in the figure mark the following events: (a) March 16, 2008: Bear Stearns distress sale to JPMorgan Chase; (b) July 11, 2008: failure of IndyMac; (c) September 15 to 16, 2008: failure of Lehman Brothers and AIG rescue announcement; (d) September 29, 2008: rejection of the initial Emergency Economic Stabilization Act (EESA); (e) October 3, 2008: EESA approval; and (f) November 23, 2008: Citibank rescue announcement.

Banned Stocks Became More Expensive to Trade

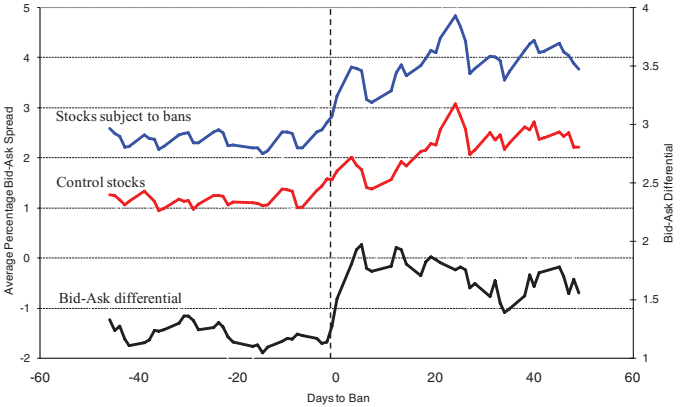


Figure 4. Average bid-ask spread of stocks subject to bans and of matched exempt stocks for countries with partial bans. The lines plots the 3-day moving average of the bid-ask spread's cross-sectional average for stocks subject to bans and control stocks (left scale) and their differential (right scale), in a 50-day window around the ban inception date (date 0). The data correspond to countries with partial bans: Belgium, Canada, Germany, Denmark, France, the Netherlands, Ireland, Norway, Austria, Portugal, the United Kingdom, and the United States.

Bans Did not Support Prices

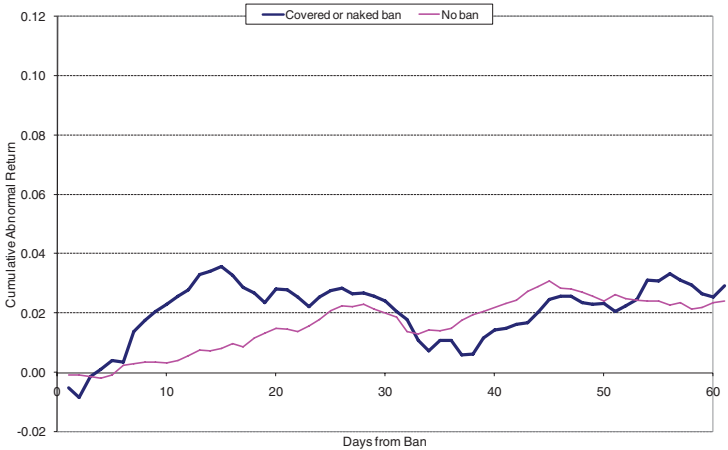
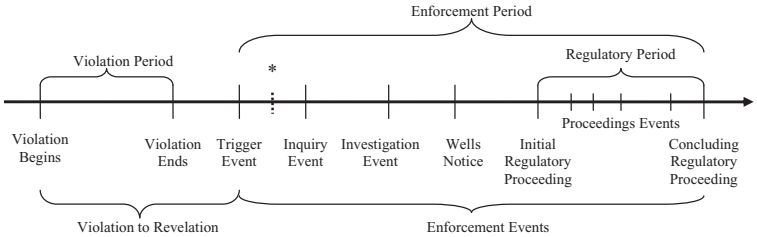


Figure 7. Cumulative abnormal returns in countries with partial bans (except the United States) for stocks subject to ban and exempt stocks. The figure plots cumulative abnormal returns in the 60 trading days after the ban date, which corresponds to date 0 in the graph.

Karpoff & Lou (10): Short Sellers and Misconduct

- **Where do the superior returns of short sellers come from?**
  - This paper: They can anticipate financial misconduct by firms.
  - Abnormal SI increases 19 months before news disclosure.
  - Sample: 454 firms disciplined by the SEC from 1988 through 2005.



* The initial filing of a private lawsuit usually occurs soon after the trigger event.

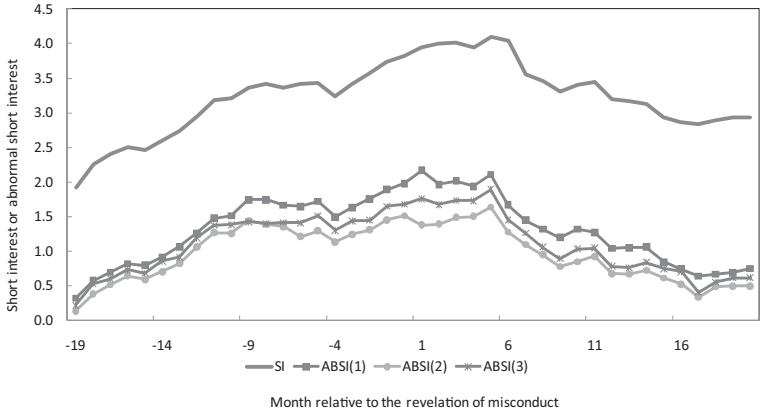
- 28 violations / year. Typically go for 28 months.

Reactions to Revelation of Misconduct

	N	Mean (%)	Median (%)	t-Stat
Panel A: Initial Public Revelation Date				
All initial revelation dates	454	−18.20	−11.10	−19.90
SEC-identified trigger event	359	−20.70	−15.00	−19.00
Other initial revelation events	95	−8.90	−5.77	−8.55
–SEC informal inquiry	15	−12.10	−11.70	−5.17
–SEC formal investigation	22	−9.32	−6.09	−4.62
–SEC Wells Notice	1	−1.03	−1.03	N/A
–Regulatory proceedings begin	12	−6.29	−1.97	−2.98
–Class action lawsuits begin	37	−5.93	−3.73	−5.12
–Bankruptcy	8	−20.40	−14.40	−3.00
Panel B: Important Subsequent Announcements				
2nd announcement	371	−9.61	−4.96	−12.41
3rd announcement	274	−7.22	−3.97	−8.85
4th announcement	147	−3.52	−1.95	−4.88
5th announcement	46	−0.00	−0.90	0
6th or higher announcement	6	−13.76	−6.09	−1.53
All subsequent announcements combined	844	−7.28	−3.69	−15.30

- Large negative price reactions to disclosure.
- Notice different types of revelation.

Short Interest around Revelation of Misconduct



- Increase in SI begins a long time before revelation.
- Robust to several alternatives to compute abnormal SI.
- Remains high for several months afterward. New or old SS?

The Real Effects of Short-selling Constraints

- **How does SS affect *corporate policies?***
  - Use regulatory experiment (Reg SHO) in 2005.
  - Suspension of uptick rule relaxes SS constraints.
  - Do firms change how they invest after that?
  - 85% of surveyed CEOs and CFOs are against. Why?
- Novelty: First to examine impact on corporate investment.
- **Standard data in Corporate Fin. (see Appendix)**
  - Pilot used Russell 3000 index firms.
  - Price data from CRSP / Accounting data from Compustat.
  - Notice usual exclusions (utilities, financials). Why?
  - Examine CAPEX, Changes in Assets, R&D.

Did Short Interest Increase?

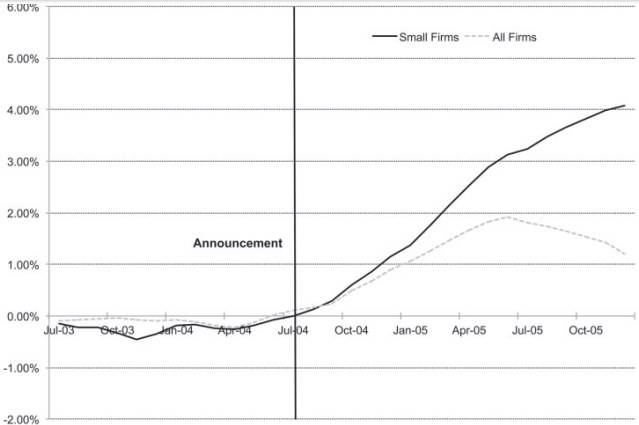


Figure 1

- Pilot and control firms have similar SI before pilot.
- SI different after pilot starts (even more for small firms).

Did It Affect Corporate Policies? Univariate Tests

Panel A: All firms

	CAPX		ΔTotal Assets		CAPXR&D		Equity Issues		Debt Issues	
	Before	After	Before	After	Before	After	Before	After	Before	After
Pilot	5.63	5.82	14.90	12.68	10.85	10.77	4.68	3.45	11.00	10.54
Control	5.37	6.16	13.20	14.14	10.93	11.40	4.70	3.99	9.79	10.71
Diff.	0.26	−0.34	1.71	−1.45	−0.09	−0.63	−0.03	−0.54	1.21	0.17
(pilot - control)	(0.94)	(−1.07)	(1.19)	(−1.50)	(−0.17)	(−1.35)	(−0.06)	(−1.46)	(1.49)	(−0.67)
Diff.-in-diff.		−0.60[a]		−3.16[b]		−0.54		−0.52		−1.38[c]
		(−2.85)		(−2.28)		(−1.62)		(−1.10)		(−1.67)

Panel B: Small firms

	CAPX		ΔTotal Assets		CAPXR&D		Equity Issues		Debt Issues	
	Before	After	Before	After	Before	After	Before	After	Before	After
Pilot	5.46	5.40	18.25	14.07	13.49	12.56	7.59	4.69	8.69	8.31
Control	5.31	6.21	15.31	17.25	13.77	13.88	7.21	5.92	8.34	9.74
Diff.	0.15	−0.82[c]	2.93	−3.18[b]	−0.28	−1.33[c]	0.38	−1.23[c]	0.35	−1.46
(pilot -control)	(0.37)	(−1.71)	(1.50)	(−2.04)	(−0.55)	(−1.76)	(0.43)	(−1.84)	(0.31)	(−1.22)
Diff.-in-diff.		−0.97[a]		−6.12[b]		−1.05[c]		−1.61[c]		−1.80
		(−2.88)		(−2.55)		(−1.81)		(−1.82)		(−1.52)

- Apply diff-in-diff approach.
- Univariate test. What about multivariate results?

Did It Affect Corporate Policies? Multivariate Results

Panel A: Corporate investment

	CAPX		Δ Total Assets		CAPX R&D	
	1	2	3	4	5	6
Treatment	-0.54^{b}	-0.01	-4.10^{b}	0.02	-0.85^{c}	-0.10
	(-2.00)	(-0.06)	(-2.13)	(0.01)	(-1.91)	(-0.40)
Treatment × Small Firms		-0.62^{a}		-2.34^{c}		-0.76^{b}
		(-2.63)		(-1.93)		(-2.05)
Cash Flow	0.03^{a}	0.03^{a}	0.58^{a}	0.57^{a}	-0.07^{a}	-0.07^{a}
	(3.48)	(4.83)	(6.91)	(8.24)	(-3.80)	(-4.38)
Log(Lagged Total Assets)	-0.88^{b}	-0.96^{a}	-36.15^{a}	-34.68^{a}	-5.82^{a}	-5.06^{a}
	(-2.35)	(-3.74)	(-14.70)	(-19.91)	(-7.49)	(-9.86)
Past Profitability	3.68^{a}	5.23^{a}	20.32^{c}	28.20^{a}	0.07	3.03
	(3.80)	(6.39)	(2.33)	(3.83)	(0.04)	(1.92)
Sample	Small	All	Small	All	Small	All
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	5,807	11,929	5,812	11,942	5,807	11,929
Adj. R^2	0.70	0.74	0.31	0.30	0.78	0.79

- Investment seems to have gone down.
- Effect concentrated in small firms. Why could that be?

Did It Affect Corporate Policies? Multivariate Results

Panel B: Financing

	Equity Issues		Debt Issues	
	1	2	3	4
Treatment	−1.43[b]	0.73[b]	−1.09	−1.98[b]
	(−1.97)	(1.96)	(−0.91)	(−2.21)
Treatment × Small Firms		−2.45[a]		1.42
		(−4.62)		(1.27)
Cash Flow	−0.07[c]	−0.04	−0.02	−0.03
	(−1.79)	(−1.57)	(−0.53)	(−0.95)
Log(Lagged Total Assets)	−10.34[a]	−7.66[a]	−3.93[a]	−5.86[a]
	(−9.71)	(−11.07)	(−3.46)	(−6.08)
Past Profitability	2.92	−0.23	4.09	9.13[b]
	(0.68)	(−0.06)	(0.90)	(2.33)
Lagged Leverage	0.08[a]	0.05[a]	−0.07[b]	−0.09[a]
	(4.09)	(3.65)	(−2.48)	(−4.47)
Sample	Small	All	Small	All
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
N	5,560	11,340	5,363	11,099
Adj. R^2	0.42	0.42	0.44	0.48

- Pilot firms also issued less debt and equity.
- SS reduces overvaluation => Issue less shares.

Do Investors Care about Voting?

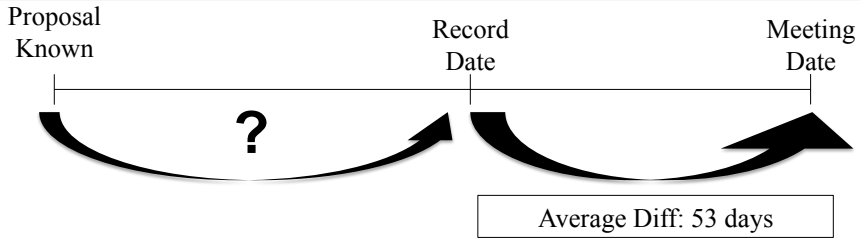
- **What can equity lending reveal about voting behavior?**
  - Do investors value voting? By how much? Heterogeneously?
  - Difficult to uncover investor preferences and actual behavior.
  - Lendable supply helps to uncover institutions' behavior.

- **Investors can affect governance through voting**
  - Willingness to intervene varies across investors.
  - Shleifer & Vishny (1986), Kahn & Winton (1998), Maug (1998).
  - Bushee et al. (13): Investment philosophy, horizon, block size.
  - Engagement takes place where value of intervention is greatest.

Equity Lending

- **Recap: Equity Lending**
  - Shares are borrowed mainly for shorting.
  - Borrower leaves collateral with lender and pays fee for shares.
  - Loans also transfer voting rights to borrowers.
  - Lender usually has the right to recall shares at any time.
- **Lend to earn fees or keep shares to vote?**
  - Lend vs. recall trade-off allows inference about value of voting.
  - Institutions don't recall shares en-masse on all record dates.
  - ISS survey: 38% of respondents review equity lending as part of their proxy voting policies.
- **Lendable supply should decrease on record date if institutions care about voting.**

Timeline of Shareholder Votes



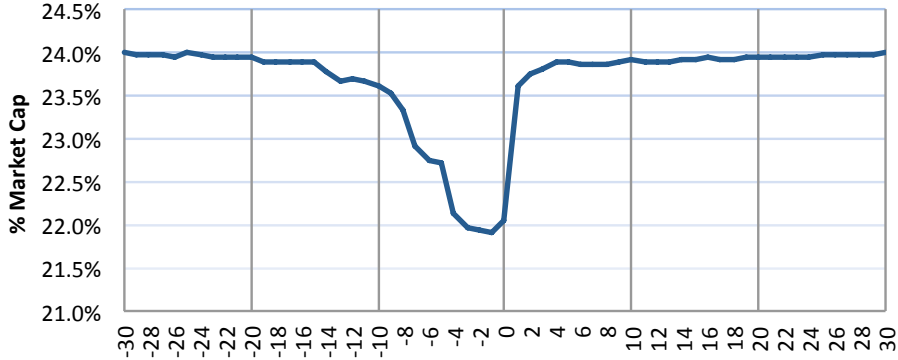
- Record date determines ownership for voting purposes.
- Proposals often known only ***AFTER*** record date.
- ISS advice issued ***AFTER*** record date.

- Most states (e.g. CA and DE) require at least 10 and at most 60 days difference.
- NYSE firms: At least 10 days
- Brokers required to send proxy materials at least 40 days before *meeting date*.

Data Description

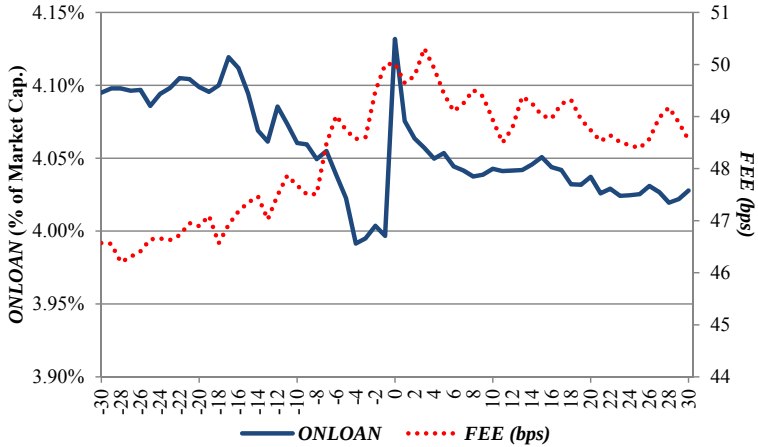
- **Riskmetrics/ISS voting data of Russell 3000 firms**
  - 56.2k proposals on 7,415 record dates for 3k firms.
  - Info on voting outcome, sponsorship, ISS recommendation, etc.
- **Daily equity lending data provided by Markit (2007-2010)**
  - SUPPLY of **lendable** shares (% mkt cap).
  - ON LOAN, loan amount (% mkt cap).
  - FEE in annualized bps.
  - Dec-09: $1.5tri in supply, with $113bil being lent out.
- **GOV41: Corporate governance index from Aggarwal et al. (11)**
- **Proxy contests data from Sharkrepellent.net and SEC fillings**

Supply Around Record Dates



- Lending supply falls by about 8% ahead of voting record date.
- Immediately goes back to previous levels after record date.
- Consistent with investors acting responsibly.

Loan Amount and Fee Around Record Dates



- Unlike supply, loan amount and fee hardly change.
- "Empty voting" doesn't seem to be an issue (Hu & Black (08)).

Empirical Analysis

- **Equity Lending Dynamics around Record Date**
  - Use [-30,+30] window around voting record date.
  - Dependent Variables: SUPPLY, ON LOAN, and FEE.
  - RDATE: Record Date Dummy Variable
  - FEE: Endogeneity addressed through IV setup.
- **Control variables**
  - Inst. Ownership, Liquidity, Size, B/M, Momentum, Governance.
- Price-quantity pairs are endogenously determined.
- Employ instrumental variables framework to quantity variables.

Estimation Strategy & Identification: SUPPLY

- Lendable supply captures willingness to lend:
  - Equity lending usually has lots of slack supply.
  - Institutions opt to take their shares from the pool of lendable shares, regardless of whether they are lent or not.
  - Allow us to infer actions of actual and potential lenders.

$$\begin{aligned} SUPPLY_{i,t} &= \alpha_i^S + \theta_t^S + \beta_1^S FEE_{i,t} + \beta_2^S RDATE * FEE_{i,t} + \gamma^S RDATE_{i,t} \\ &\quad + \delta^S * Controls_{i,t} + \varepsilon_{i,t}^S \end{aligned}$$

- Price (FEE) and quantity (SUPPLY) are endogenous
  - Need to identify exogenous shocks to FEE for identification.
- Instruments for FEE used in SUPPLY equation:
  - Hedging Demand (Hwang et al. (2013))
  - Earnings Surprise (Livnat and Mendenhall (2006))

Estimation Strategy & Identification: ONLOAN

- ONLOAN examines actual demand for shares:
  - Focus of paper by Christoffersen et al. (2006).
  - Lack of demand increase could be due to tighter borrowing costs.
  - Use IV to address endogeneity issue.

$$\begin{aligned} ONLOAN_{i,t} &= \alpha_i^D + \theta_t^D + \beta_1^D FEE_{i,t} + \beta_2^D RDATE * FEE_{i,t} + \gamma^D RDATE_{i,t} \\ &\quad + \delta^D * Controls_{i,t} + \varepsilon_{i,t}^D \end{aligned}$$

- Instruments for FEE used in ONLOAN equation:
  - Passive Fund Ownership (Evans et al. (2013))
  - IO Concentration (Prado et al. (2014))

Table 4: First stage and Endogeneity

	SUPPLY		ONLOAN		FEE
FEE		-0.001**		0.003***	
		[0.000]		[0.000]	
RDATE	-1.636***	-1.634***	0.082***	0.076***	1.776***
	[0.036]	[0.036]	[0.010]	[0.010]	[0.330]
INST	22.837***	22.901***	12.268***	12.080***	54.680**
	[0.896]	[0.896]	[0.618]	[0.598]	[23.860]
GOV41	9.804***	9.786***	-7.021***	-7.018***	-20.278
	[1.875]	[1.873]	[1.221]	[1.204]	[41.791]
PASSIVE	15.945***	15.862***	-0.603	-0.386	-72.003*
	[1.519]	[1.525]	[0.962]	[0.933]	[40.268]
INST CONC	-24.180***	-23.919***	-1.630	-2.400	246.302***
	[2.614]	[2.619]	[1.536]	[1.483]	[82.562]
Hedging Demand	0.297	0.245	-0.024**	-0.023**	-38.727***
	[0.247]	[0.247]	[0.010]	[0.010]	[11.901]
SUE	0.787	0.420	-6.233**	-5.077*	-345.980**
	[4.447]	[4.467]	[2.805]	[2.668]	[154.770]
Controls	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

- FEE has the wrong sign ⇒ Reinforce need to tackle endogeneity.
- Last column used as 1st stage to instrument FEE.

Table 5: 2nd-stage and Value of the Vote

	SUPPLY		ONLOAN	
FEE	-0.006	-0.006	-0.005	-0.005
	[0.006]	[0.006]	[0.006]	[0.006]
RDATE*FEE		**0.007***		**-0.002*****
		[0.004]		**[0.000]**
RDATE	**-1.625*****	**-1.987*****	**0.090*****	**0.164*****
	[0.038]	**[0.207]**	**[0.016]**	**[0.024]**
INST CONC	-22.696***	-22.364***		
	[3.135]	[3.046]		
PASSIVE	15.521***	7.141***		
	[1.670]	[1.602]		
Hedging Demand			-0.026**	-0.026**
			[0.011]	[0.011]
SUE			-1.632***	-1.632***
			[0.578]	[0.578]
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Sargan-Hansen Statistic	0.145	0.940	1.047	1.210

- SUPPLY shows a large decrease, but loan demand not so much.
- Fees don't change much on *RDATE*.
- Sensitivities to FEE also increase on record date.

Table 6: RDATE Coefficients Split by Ownership

Lending Variable	High	Low	Diff
Panel A: Institutional Ownership			
SUPPLY	-1.961***	-2.067***	0.107
ONLOAN	0.170***	0.146***	0.024
Panel B: All Blockholders			
SUPPLY	-2.915***	-1.688***	-1.227***
ONLOAN	0.194***	0.163***	0.031
Panel C: Mutual Fund Blockholders			
SUPPLY	-2.530***	-1.580***	-0.949***
ONLOAN	0.161***	0.169***	-0.008
Panel D: Bank & Insurance Companies Blockholders			
SUPPLY	-2.279***	-1.803***	-0.476***
ONLOAN	0.167***	0.162***	0.004
Panel E: Pension & Endowment Blockholdings			
SUPPLY	-2.450***	-1.909***	-0.541***
ONLOAN	0.209***	0.164***	0.045
Panel F: Long-Term Blockholders			
SUPPLY	-2.401***	-1.736***	-0.665***
ONLOAN	0.155***	0.172***	-0.017

Value of the Vote

- **Equity Lending Market**
  - Unusual OTC market: Positive prices even with excess supply.
  - Price changes may not capture the willingness to pay for a vote.
- **Becker and Elias (2007) on organ donations:**
  - *"How much pay is required to induce an individual to sell an organ? We estimate the value or price of an organ from living donors by computing how much additional income or market consumption an individual requires to be indifferent between selling an organ or not."*
- **Value of the Vote:**
  - FEE such that record date quantity doesn't change relative to "normal" days.
  - $VVOTE = FEE$ such that $\gamma^i + \beta_2^i * FEE = 0$.
- **Intuition:**
  - Bigger recall and smaller price elasticity $\Rightarrow$ VVOTE $\Uparrow$.
  - Equity lenders value vote (268 bps) more than borrowers (115 bps).

Main Results

- **Equity lending reveals institutional voting preferences**
  - Lendable supply decreases, loan demand and fee increase before voting record dates.
- **Heterogeneity in preferences**
  - Institutional investors value voting rights differently.
  - Higher recall for firms with more blockholders, MFs, LT investors.
- **Heterogeneity in firm and proposal characteristics**
  - Higher for small, low governance, and poor performance firms.
  - Higher for more “important” proposals: Mergers, Proxy Contests.
- **Value of the vote**
  - Equity lenders value it (268 bps) more than borrowers (115 bps).
- **Voting outcomes related to recall of lendable supply**
  - Higher recall increases support for shareholder proposals.