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# The market for borrowing stock ☆

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**Abstract**

To short a stock, an arbitrageur must first borrow it. This paper describes the market for borrowing and lending U.S. equities, emphasizing the conditions generating and sustaining short-sale constraints. A large institutional lending intermediary provided eighteen months (4/2000–9/2001) of data on loan supply ("shortability"), loan fees ("specialness"), and loan recalls. The data suggest that while loan market specials and recalls are rare on average, the incidence of these short-sale constraints is increasing in the divergence of opinion among investors. Beyond some threshold, investor optimism itself can limit arbitrage via the loan market mechanism.
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## 1. Introduction

The SEC defines a short sale as "the sale of a security that the seller does not own or that the seller owns but does not deliver. In order to deliver the security to the purchaser, the short seller will *borrow* the security, typically from a broker-dealer or

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an institutional investor."[1] The ease of selling a stock short is crucial for effective arbitrage. Finance theory often makes strong assumptions about the ability of rational arbitrageurs to costlessly borrow and short arbitrarily large amounts of stock. In essence, this short selling represents the creation of new supply that arbitrageurs can bring to bear on exuberant but downward-sloping demand. Friedman (1953), Fama (1965, 1970), and Ross (1976) are classic examples of a literature that relies on unfettered arbitrage. In contrast, Diamond and Verrecchia (1987), De Long et al. (1990), Shleifer and Vishny (1997), Hong and Stein (1999) and Chen et al. (2002) focus on implications of constrained short selling or, more generally, the limits of arbitrage. Miller (1977) shows that when short selling is constrained, the marginal investor will be an optimist when a divergence of opinion exists.

The goal of this paper is to describe the market for borrowing and lending stock — the very mechanism of short selling. After detailing its institutional and regulatory aspects, I present an informal explanation of how the securities loan market reaches equilibrium along with the spot and derivative markets. This approach places short-sale constraints, typically treated simply as "transactions costs," into a supply and demand framework where economic intuition can be mobilized. The short seller's cost (lender's income) is recognized as a market-clearing loan fee and short interest as a market-clearing loan balance.

The brief description of equilibrium is useful for isolating the conditions required to sustain high loan fees (i.e., "specialness"). For the market to clear, the outstanding securities must come to rest with non-lending investors willing to hold these securities despite forgoing the loan fees capitalized into the equilibrium price. This implies that non-lending investors in special (high lending fee) securities, for any number of reasons, place a relatively higher value on the securities and have limited access to "cheaper" substitutes such as forwards or options. It also suggests that the cost of borrowing stock is increasing in the dispersion of investor valuations. While short sales constraints might be small on average, they are *systematically* high when differences of opinion are high — a dynamic that broadens the applicability of Miller's (1977) model of optimistic prices.

The paper also describes how a stock lender's option to cancel the loan ("recall" the shares) at any time imposes risk on the short seller. Without a guaranteed term loan, the short seller is exposed to changes in the relative valuations of the marginal investor and the marginal lender. When the correlation between these changes is high, the expected costs of covering or replacing a recalled loan are minor. When this correlation is low or negative, the recalled short seller might need to cover the short position in a rising market — thus being stripped of expected profits and potentially "squeezed" for additional losses. We also see that differences of opinion, by increasing the turnover that dislocates loans, make recall more likely. Theory thus suggests that short sellers might prefer certain lenders (passive indexers) to others.

Duffie et al. (2002) provide related work with a multiperiod model of the equity loan market that emphasizes the search process faced by borrowers and lenders. In addition, Duffie (1996) and Krishnamurthy (2002) derive equilibrium models of the

[1] This definition can be found on the SEC website, http://www.sec.gov/rules/concept/34-42037.htm.

market for borrowing US Treasury bonds (the "repo" market). A common element in these models is investor heterogeneity, which generates borrowing (short selling) demand and explains why non-lenders hold securities despite forgoing the loan income impounded into prices.

The primary task of this paper is to describe the market empirically. Eighteen months of data (April 2000 through September 2001) from a large financial institution provide detailed information on loan supply, variation in fees, and the incidence and nature of lender recall. Key findings include:

- The aggregate market is easy to borrow: the value-weighted cost to borrow the sample loan portfolio is 25 basis points per annum and only 7% of loan supply (by value) is borrowed.
- Most stocks can be borrowed. While at most 16% (1,267 of 7,879) of the stocks found in the monthly Center for Research in Security Prices (CRSP) file are potentially impossible to short, these stocks account for less than 1% of the market by value (1,093 of these are in the bottom size decile and 719 are under $5).
- About 10% of stocks (813) are never shorted despite being available to borrow. These tend to be small, highly illiquid stocks that in aggregate account for less than 1% of U.S. market value.
- The holdings of institutional investors who lend are even more biased towards large, liquid stocks than the holdings of institution investors in general. This reflects higher loan market participation by passive indexers.
- Ninety-one percent of the stocks lent out in the sample cost less than 1% per annum to borrow. These "general collateral" stocks have a value-weighted mean fee of 17 basis points. S&P 500 constituents, provided in excess supply by indexing lenders, are almost always general collateral.
- Only 9% of stocks (about 206 stocks per day) have loan fees above 1% per annum. These "specials" (stocks with high lending fees) have a mean fee of 4.3% per annum.
- Fewer than 1% of stocks (roughly seven per month) on loan become extremely special, demanding negative rebate rates (i.e., loan fees in excess of the risk-free rate). Krispy Kreme Doughnuts and Palm Inc. are examples of such stocks, exhibiting loan fees as high as 50% and 35%, respectively.
- The probability of being special decreases with size and institutional ownership.
- Several proxies for disagreement among investors (high turnover, high dispersion in analyst forecasts, increased message board activity, and low cash flows) seem to predict specialness.
- Recall is rare. In an average sample month, 2% (61) of the stocks on loan are recalled.
- Having been recalled, the mean (median) time before the short can be reestablished with the lender is 23 (nine) trading days.
- Days on which recalled borrowers might be forced to cover shorts are marked by extraordinary trading volume (more than twice the recalled stock's overall sample mean) and intraday volatility.

- Returns earned during periods of involuntary or forced short covering in this sample are lower than average; this is evidence against widespread squeezes during this period in that short sellers can buy back shares at falling prices.

Several recent studies employ security loan rate data to directly measure the effects of short-sale constraints. Reed (2001) finds that the returns to special stocks are more negatively skewed, providing novel empirical support for Diamond and Verrecchia (1987). Geczy et al. (2002) use one year of data (November 1998 through October 1999) from a U.S. custody bank to study borrowing costs for IPOs, risk arbitrage (merger speculation), and the construction of "factor" portfolios (long-short strategies sorting on size, book-to-market, and momentum). The authors find that IPOs are initially expensive to short (3% fees on average), but that costs drop significantly over the first six months (to about 1%) as the float expands with lockup expirations. They also find that shorting acquirers is more expensive. Lastly, they show that loan fees in their sample are five times higher for low book-to-market ("glamour") stocks than high book-to-market ("value") stocks, but that these fees do not have an economic impact on the returns earned from shorting the former and buying the latter. Ofek and Richardson (2001) survey potential explanations for the Internet bubble. Using a snapshot of rebate data from February 2000, they report that loan fees on Internet stocks were 1% per annum higher than on non-Internet stocks. Jones and Lamont (2002), employing extensive time-series data from an earlier era (1926 through 1933), show that stocks that are expensive to short and hard to borrow (as evidenced by their entering the NYSE "loan crowd" — the loan market of last resort) earn low subsequent returns. In addition, this overpricing is large enough to make shorting profitable even after fees.

This paper contains facts that corroborate the above findings (namely increased borrowing costs among IPOs, Internet firms, and glamour stocks) in a nonoverlapping sample. The focus, however, is largely complementary. I give significant emphasis to non-fee data such as the composition of loan supply and the nature of supply shocks and subsequent recall episodes.

While the level of loan market fees and risks described in this sample (and those cited above) do not appear high enough on average to fully explain return anomalies or short sale reluctance, they remain helpful to understanding the limits to arbitrage. For example, this paper shows that the mechanism for short selling is most constricted when differences of opinion are high and institutional ownership is low. This observation can be used to reinforce assumptions of short-sale constraints in a model like Chen et al. (2002) that relates reductions in breadth among institutional owners to optimistic prices. It also facilitates the interpretation of current empirical research such as Cohen et al. (2002) that shows an apparent reluctance by large institutions to exploit the inability of small investors to process negative cash flow news. More generally, loan fees are interesting because they are not simply transaction costs, but also market-determined prices. Like any prices, they provide researchers and practitioners with valuable information on the preferences and expectations of economic agents.

Section 2 describes the institutional details of the equity loan transaction. Section 3 discusses the conditions required to sustain special loan fees in equilibrium and then defines recall risk using this framework. Section 4 presents empirical evidence on the supply of lendable shares (shortability), the incidence of costly and constrained loan markets (specials), and the nature of negative shocks to loan supply (recalls). Section 5 concludes.

## 2. The U.S. equity lending market: institutional details

As of June 2001, the NYSE, NASD, and AMEX reported short interest with a market value in excess of $260 billion, just over 1.7% of total market capitalization. This short interest is also a loan balance. The nine billion shares shorted were borrowed from investors participating in equity lending. A securities lending industry survey shows that only 7% of the loan capacity in U.S. equities is currently utilized.[2] Applying this estimate to total short interest implies aggregate loan supply in the neighborhood of $3.7 trillion, or about one-quarter of the U.S. market capitalization. This section outlines the institutional and regulatory details of a stock loan.

### 2.1. The transaction

The clearest way to illustrate the mechanics of the prerequisite equity loan behind each short sale is by way of example. Like most things on Wall Street, the terms of the loan contract are negotiable; the facts presented here reflect prevailing market convention among large institutional traders. Where U.S. regulations apply (e.g., recall or margin requirements), this is noted.[3]

To short a share of Krispy Kreme Doughnuts (KKD), arbitrageur A must find an existing owner of KKD, denoted investor B, who is willing and able to lend shares. Having negotiated ("located") a loan, A may short sell the borrowed share to any willing buyer, denoted investor C. The critical features of this transaction are as follows.

#### 2.1.1. A posts collateral with B

A must leave collateral with lender B equal to 102% of the market value (marked and settled daily) of the borrowed share. According to the Risk Management Association, a securities lending trade group, 98% of U.S. equity loans are collateralized with cash; the remaining 2% use Treasury securities. Under Federal Reserve Regulation T, A needs to post an additional 50% in margin when the lender,

[2] The Risk Management Association, Q2 2001 aggregate data, http://www.rmahq.org/Sec_Lending/seclending.html.

[3] The primary sources for institutional and regulatory facts are Perold (1995a, b), Souder (1996) and the Investment Company Institute (1998). See Brooks (1992) for a detailed treatment of international security lending.

B, is a U.S. broker–dealer. Any long securities may be pledged towards the 50%, substantially reducing this friction.[4]

*2.1.2. A pays B a fee*

For cash-collateralized loans, the fee is embedded in the level of the "rebate" rate, the interest that B pays A for use of the cash collateral. This is analogous to the "repo" rate in the market for lending bonds and the "lease" rate in the market for lending gold. If the market rate for cash funds were 5% and the stock loan fee were 1.50%, then B would rebate A only 3.50%. The fee is not bounded by the cash rate and thus negative rebate rates can and do occur. If A and B agree to a rebate of −45%, then A in effect pays B a stock loan fee of 50% (45% direct payment and 5% sacrificed interest). Note that if A instead posts Treasury securities as collateral, she would simply pay an explicit loan fee to B. Interest is calculated each business day by applying the rate to the market value of the collateral. Interest is typically settled monthly. Practitioners refer to stocks with high fees (and low rebates) as being "special" and those with baseline fees (about 15 basis points) as "general collateral" or "GC." Reinterpreting the transaction reveals the origin of these names. A lends B cash and B pledges stock as collateral. If B can replace the collateral at will with any stock, then A holds general collateral. If A requests that B specifically pledge KKD, then A will hold special collateral — and will charge a lower rate on the cash loan.

*2.1.3. A pays B any dividends/distributions made to owners of KKD during the loan*

By having A replicate and pay any interim distributions on KKD stock, B retains the cash flow profile of an actual shareholder. In certain cases, however, these manufactured payments are subject to different taxation than the security's actual distributions. For example, if B were a corporation, it could not claim the corporate dividend exemption on manufactured payments received from A. This places corporate lenders at a cost disadvantage in the U.S.

*2.1.4. B has the right to recall the share from A at any time*

Most institutional lenders in the U.S. maintain the right to terminate a stock loan at any time. If B were a pension fund, this would be an explicit ERISA requirement. If B were a mutual fund, this would be required under the Investment Company Act of 1940. Alternatively, B might retain recall rights for tax motivations: the IRS (Section 1058) requires a recall provision for manufactured dividend payments to remain nontaxable income (for certain exempt funds) and for the loan not to be treated as a sale. Loans are therefore "open" and effectively rolled over each night until either B wants the shares returned or A voluntarily returns them. Given notice of recall, A has three days to return the share of KKD. A can try borrowing another share from some other lending investor, or else "cover" the short by purchasing the

[4]The 1996 Market Improvement Act exempted trades among US broker-dealers from Reg. T margin requirements: Goldman Sachs need not post an additional 50% margin when borrowing stock from Morgan Stanley. Large investors can avoid Regulation T requirements by booking transactions with "off-shore" domiciled branches of dealers.

share. If A does not return the share to B after five days, B has the legal right to use posted collateral to "buy in" the borrowed share on the open market.

#### 2.1.5. The lender, B, is no longer the shareholder of record and thus has no voting rights

To participate in a shareholder vote, B must recall the share lent to A. Christoffersen et al. (2001) discuss borrowing for votes. Apfel et al. (2001) explore the legal standing of lenders and the complications that lending poses for certifying classes and measuring damages in 10b-5 actions.

### 2.2. The players

Big custody banks (e.g., Bank of New York or State Street Bank) are the largest lenders in the U.S. market. These intermediaries lend as agents on behalf of large institutional owners such as pension funds, public retirement funds, mutual funds, and endowments.[5] Among these institutional investors, it is the passive indexers who participate most extensively in their custodian's lending program. Intermediaries provide a clearinghouse function that dampens the noise associated with positions held by individual money managers. Their ability to replace loans from a client who is selling with idle shares held in other customer accounts reduces the temporary disruptions and search costs faced by borrowers. In addition, broker–dealers (such as Goldman Sachs or Morgan Stanley) lend from an internal supply of securities held by their market makers and proprietary trading desks, the accounts of institutional customers, and the margin accounts of individual retail investors (Section 8 of the Exchange Act of 1934 prohibits brokers from lending shares held in retail cash or non-margin accounts). Interviews with professional short sellers suggest that custody banks are the largest and most reliable source of stock loans, and discount brokerage accounts the smallest and least dependable.

Security borrowers are an eclectic group. Specialists and market makers have obvious shorting needs in balancing buy orders with sells. Traders of equity options, index futures, equity return swaps, and convertible bonds routinely sell short to hedge their positions. Much of the "arbitrage" done by hedge funds requires borrowing and shorting shares — notably such "long-short" strategies as risk arbitrage and statistical pairs trading. Even when hedge funds use derivative short positions (e.g., return swaps), which as described in Perold (1999) are often advantageous from a capital perspective, dealers typically pass along the costs and risks associated with the actual shorting required for hedging these products. For example, return swap agreements typically contain language that allows the terms of the contract to be adjusted for increases in security loan fees. Speculators trading on

[5] Securities lending is often bundled with custody services as a way to generate income to cover these costs and reduce the expense base of these funds. The most common arrangement is for all security lending income to be split with custody bank such that the owner retains about 70%. Perold (1995a, b) and Swensen (2000) provide detailed discussion of the reinvestment and credit risks of security lending programs.

negative fundamental information or technical rules take outright short positions. Most borrowers use broker–dealers to reduce search costs and for credit intermediation, collateral management, and clearing.

## 3. Equilibrium, specials and recall risk

Of central interest to this paper are the conditions that generate and sustain short-sale constraints. In order to motivate the empirical tests and to provide an economic framework for interpreting the loan data, this section provides an informal description of a security loan market in equilibrium.[6] This exercise highlights the fact that loan market prices are jointly determined along with spot and derivative prices. Supply and demand in the loan, spot, and derivative markets are functions of each other's prices and participation constraints. The discussion identifies the determinants of the two loan market regimes that can obtain: the costless and unconstrained general collateral equilibrium and the costly and constrained special equilibrium. A similar analysis of recall and squeeze risk is also presented. The chief insight of this section is that short-sale constraints are increasing in differences of opinion.

### *3.1. Sustainable specials*

It is not obvious why loan market specials with significant fees are sustainable. On any given day, not every investor can lend — the physical float of shares must come to rest with investors who will hold on to them. If all investors were institutionally and legally able to participate in lending, holding idle shares (i.e., not lending them) when fees are positive would be inconsistent with universal optimization and equilibrium (unless, as in the multiperiod search model of Duffie et al. (2002), some investors hold shares in anticipation of future lending opportunities). A loan market participation constraint (or search problem) is thus critical to sustaining positive loan fees. In practice, we observe that many individual investors are so constrained. For example, retail brokers only lend shares from individual margin accounts. Further, an investor who could not lend would typically find that buying a forward, future, or option "synthetic" dominates a spot purchase. This is because these derivatives, priced to preclude simple "carry" arbitrage, are discounted to spot by an amount equal to expected term borrowing costs. Access to these economic substitutes depletes the pool of non-lenders available to absorb the float and can eventually unravel the special equilibrium.[7]

[6] A formal model of loan market equilibrium derived in an earlier version of this paper is available at: http://www.people.fas.harvard.edu/~davolio/papers.html.

[7] Spot market investor defections might lower spot prices to a level where borrowing demand falls below loans supplied at a zero fee, or, in the limit, might leave no non-lenders to clear the market for actual shares. This is a way in which option listing reduces short sales constraints. Danielson and Sorescu (1999) document empirical evidence of this "optioning" phenomenon.

In a sustainable special equilibrium, all shares held by the subset of potential lenders are lent out. The negative demand of short sellers exactly nets out the positive demand of these lenders. Market clearing requires that the intersection of investors who cannot (or will not) participate in the loan and derivative markets hold the entire float. Further, the spot price set by these constrained investors must be high enough to generate short seller borrowing demand that exceeds loan supply at a zero fee. As such, differences of opinion between the marginal investor and the short seller are critical to sustaining special equilibrium. Relative biases in the beliefs of lenders can also be important. Loan supply increases and loan fees decrease with the security valuation of these agents. When lenders are optimistic, they require smaller lending income to hold balances sufficient to meet short seller demand. As an empirical matter, one might expect this latter effect to be of second order. The likelihood and degree of specialness increase with investor optimism when (the presumably less sophisticated) non-lending long investors are equally or more likely to hold extreme valuations or when short sellers are sufficiently aggressive.

These differences of opinion can be interpreted as the bias from drawing dispersed private valuations from a distribution truncated to include only ex post long investors, as in Miller (1977). Alternatively, they can represent any real friction that renders different effective values to different agents. For instance, an important driver of international stock loan activity is the differential dividend taxation of domestic and foreign owners of record. For the relevant asset classes, this bias might represent different preferences among investor types for liquidity (Treasury bonds) or a convenience yield (commodities).

The special regime, with its costly short selling, obtains once the valuation bias of non-lenders exceeds some threshold. It is easy to show that this threshold is increasing in the size of the float and the bias of lenders, and decreasing in the relative risk-bearing capacity of non-lenders. Once special, the stock's price is increasing in the bias of these restricted investors who hold the entire float and so alone determine its price. This is true regardless of the risk tolerance of rational short sellers. Miller (1977) shows that with short-sale constraints and a divergence of opinion, prices are optimistic. We now see that the divergence of opinion can endogenously deliver the short-sale constraints crucial to this model.

### *3.3. The nature of recall risk and squeezes*

In a multiperiod setting, a short seller is concerned not only with the level of fees, but also with fee variance. This is because current regulations stipulate that lenders maintain the right to cancel a loan at any time and hence preclude most large institutions from providing guaranteed term loans. When a lender's valuation of the security falls relative to the marginal investor's, the lender will recall (or cancel) the loan to the short seller in order to sell the shares to a more optimistic investor or to re-lend them at a new equilibrium fee. The recalled borrower has two alternatives: to "cover" the short by buying back the shares and returning them to the lender, or to reestablish the short at a higher loan fee. Either way, the short seller's expected profits are diminished when the spread between the valuation of the marginal

investor and the marginal lender widens (as when the former becomes more deluded or the latter becomes smarter). This suggests that short sellers are exposed to variance in investor beliefs as well as to correlation therein, making more precise the way in which short sellers are exposed to "noise trader risk," as in De Long et al. (1990).

Loan recall in practice is associated with a more disruptive episode than theory describes. The reason is that supply shocks leave the loan market temporarily out of equilibrium. One source of rigidity is a market convention for existing lenders not to reprice outstanding loans; lenders receiving negative information will normally recall and sell shares rather than renegotiate. In addition to "sticky prices," short-run supply is essentially vertical. This is due to a separation of authority at many fund complexes between portfolio allocation and lending and by the lack of high-frequency transparency in loan rates (e.g., no quote screens for potential new lenders to monitor). The resulting sluggishness explains numerous accounts by professional short sellers of not being able to reestablish recalled loans "at any price." In these situations, short covering (buying shares back) is the only alternative.

The cost of forced short covering is also decreasing in the correlation between the valuations of lenders and marginal investors. A short "squeeze" occurs when increasingly optimistic investors compete with recalled borrowers to buy shares being sold by lenders. These involuntary closeouts of short trades just when their expected profits are nominally at their highest provide another channel for the limits of arbitrage described in Shleifer and Vishny (1997). In contrast, when lenders are selling and recalling shares in an already falling market, the borrower, while suffering an opportunity cost, is relatively better off. This implies that passive fund managers make safer lenders (with regard to squeeze risk) — they tend to recall shares in response to fund outflows, which are often positively correlated with stock price declines. Note that the refinancing aspect of recall risk remains even if prices and quantities could adjust instantaneously to eliminate involuntary displacement. Only a market for guaranteed term loans eliminates this price risk.

### *3.4. Implications*

The following hypotheses summarize and review the potentially testable implications.

*Hypothesis 1. The likelihood of being special (high lending fees) increases with differences of opinion between non-lenders and short sellers.*

Borrowing demand increases with the short sellers' perception that the stock is overpriced. Proxies for these differences can include high share turnover (which captures disagreement in general), characteristics associated with complexity in valuing the stock (especially those more likely to confuse unsophisticated investors), and measures of increased visibility among non-lending investors. Miller (1977) describes the divergence of opinion as being driven both by uncertainty and "visibility." By the latter, he refers to the size of the *potential* investor pool from which optimists might emerge.

*Hypothesis 2. The likelihood of being special decreases with the size of the float.*

Increasing the float (i.e., the number of tradable shares outstanding) reduces the probability that non-lending optimists alone can absorb the shares. A larger float generally increases breadth of ownership and lowers the spot price, thereby increasing loan supply and decreasing short seller borrowing demand.

*Hypothesis 3. The likelihood of being special increases with the relative risk-bearing capacity of non-lenders*

A relative increase in the non-lending investor base (perhaps evidenced by low institutional ownership or high visibility among message board contributors) can increase the spot price and therefore borrowing demand by short sellers. A relative decrease in institutional ownership reduces loan supply.

*Hypothesis 4. Recall risk is higher for stocks with large share turnover.*

This follows directly from the increased probability that the trading includes lender sales that dislocate loans. Additionally, shocks to investor information sets that induce high trading volume can also increase the variability of borrowing costs. This is another way for differences of opinion to increase short-sale constraints.

## 4. Empirical facts about the loan market

### *4.1. The sample and the ability to short*

A leading financial institution — one of the largest security lenders in the world — provided daily loan position and transaction information for every U.S. equity security on its books over the 18-month period April 2000 through September 2001. In particular, this loan database specifies the bank's supply (both idle and lent) of shares (POS), number of shares out on loan (LOAN), and the loan rate (REBATE) and contract size of the individual open loans constituting the balance. The supply of shares and the shares on loan figures for each stock represent the aggregation of thousands of individual customer accounts. These institutional customers are among the largest mutual funds, pension funds, public retirement funds, and endowment funds in the world. Only stocks with a supply of shares or shares on loan with a value greater than $10,000 are included. While the precise numbers are proprietary, the aggregate market value of outstanding loan balances represents significantly more than 10% of total market short interest in each month of the sample. In many categories of stock, the provider has sufficient supply to cover total short interest on its own. The scale and scope of the loan database provide a unique opportunity to study not only loan fees, but several non-cost features of supply as well.

Table 1 divides the universe of stocks contained in the CRSP files over the 18-month period into four portfolios according to whether or not the stock has been shorted and then whether or not the stock is in the loan database. A stock is deemed "shorted" in a given month if it appears in the monthly short interest reported by the exchanges. Only short interest in excess of $10,000 or 0.01% of total market equity is given shorted status. Panel A reports equal-weighted portfolio means for several stock characteristics and Panel B provides the percentage of stocks from various subcategories (e.g., S&P 500 or IPO) that appear in each portfolio. See Appendix A

Table 1
Breakdown of the universe of stocks contained in the Center for Research in Security Prices (CRSP) files over the sample period (April 2000–September 2001)
Each month the CRSP universe is divided into four portfolios: (1) shorted and in loan database, (2) shorted and not in loan database, (3) not shorted and in loan database, and (4) not shorted and not in loan database. A stock is "shorted" in a given month if monthly short interest reported by the exchanges exceeds min ($10,000, 0.01% of market equity). Panel A reports summary statistics (18-month average). Panel B shows the percent of stocks from various subcategories that fall into portfolios (1) through (4).[a]

| | (1) Shorted | (2) | (3) Not shorted | (4) |
|---|---|---|---|---|
| | In loan database | Not in loan database | In loan database | Not in loan database |
| *Panel A* | | | | |
| Number of stocks | 4,717 | 1,082 | 813 | 1,267 |
| % CRSP (equal) | 59.9 | 13.7 | 10.3 | 16.1 |
| % CRSP (value) | 97.4 | 1.2 | 0.8 | 0.6 |
| ME ($MM) | 3,315 | 172 | 156 | 82 |
| TURN | 15.7% | 16.4% | 4.2% | 4.6% |
| IO | 41.0% | 9.2% | 21.6% | 7.3% |
| SIG | 4.7% | 5.0% | 4.4% | 6.0% |
| SISO | 2.3% | 1.6% | NA | NA |
| SI ($MM) | 53 | 7 | NA | NA |
| AUTHORS | 54 | 21 | 8 | 8 |
| POSTS | 264 | 105 | 26 | 31 |
| *Panel B* | | | | |
| S&P500 | 97.6% | 0.6% | 0.8% | 1.0% |
| Smallest decile | 27.8% | 21.7% | 18.3% | 32.2% |
| Under $5 | 32.4% | 19.4% | 14.7% | 33.5% |
| IPO | 85.7% | 5.6% | 3.0% | 5.8% |
| Internet | 85.3% | 8.8% | 2.3% | 3.6% |
| Glamour | 91.4% | 4.6% | 2.2% | 1.8% |
| Loser | 90.2% | 4.1% | 4.0% | 1.7% |
| ADRs | 66.0% | 15.5% | 7.0% | 11.5% |
| Closed-end funds | 6.1% | 65.7% | 1.6% | 26.6% |

[a] Market equity (ME) is calculated using prices and shares outstanding from the CRSP monthly file. Using the same source, monthly turnover (TURN) is calculated by scaling monthly trading volume by shares outstanding. Institutional ownership (IO) is the number of shares held by 13F filing institutional investors (from Thomson/Spectrum/CDA quarterly tapes) as a percentage of shares outstanding for the quarter to which the given month belongs. Historical return volatility (SIG) is the standard deviation of the trailing six months of CRSP daily returns. SISO is monthly short interest as a percent of shares outstanding. SI is the exchange-provided monthly short interest expressed in dollars using CRSP prices. POSTS are the number of messages posted to a stock's Yahoo Finance message board in a month. AUTHORS are the number of unique contributors to that stock's message board in a given month. POSTS and AUTHORS were collected using a proprietary web crawler program written by the author. Smallest decile are stocks in the bottom decile of ME using NYSE breakpoints. UNDER$5 stocks have CRSP price less than $5 at month end. IPOs are stocks within one year of their issue date as provided by the Securities Data Company (SDC) database. INTERNET category includes any stock that appears in the portfolio of 400 Internet pure plays compiled by Ofek and Richardson (2001). GLAMOUR category includes stocks in the bottom three deciles of book equity/ME (using NYSE breaks, and positive book values). LOSER category includes any stock that would be a prescribed short in the Jegadeesh and Titman (1993, 2001) rolling momentum strategy (using a six month performance window and holding period). The stock must be in the bottom decile of MOM6 in at least one of the last six months. Stocks under $5 or in the bottom NYSE decile at the beginning of each formation period are excluded. American Depository Receipts (ADRs) represent stocks with CRSP share codes $\geqslant 30$ and $< 40$. Closed-end funds have CRSP two-digit share codes ending in 4 or 5.

for sources and definitions of all stock characteristic variables. Some market data for American Depository Receipts (ADRs) are excluded because shares outstanding are unreliably measured for these stocks.

The data show that stocks without short interest are generally small, illiquid stocks. Their monthly turnover is four times smaller (4% vs. 16%) than shorted stocks and they constitute only 1.4% of the market by value. Forty percent of these stocks appear with lendable supply in the loan database and definitely can be shorted. The remaining 60% (1,267 per month) are potentially unshortable or at least difficult to locate among institutional lenders. These unshortable stocks have a mean market value of only $82 million and constitute less than 0.6% of total market value. Notably, about one-third of the stocks in the bottom (NYSE) size decile and one-third of stocks priced under $5 appear unshortable. This provides another reason (beyond liquidity and bid–ask bounce) to exclude these categories from empirical studies of trading strategies that might prescribe short positions in these stocks (e.g., momentum). Finally, 27% of the closed-end funds and 11.5% of the ADRs in the CRSP universe are possibly unshortable.

Eighty-one percent of shorted CRSP stocks appear in the loan database (99% on a value-weighted basis). I use this broad sample to explore the variation in borrowing costs (Section 4.2) and the nature of recall events (Section 4.3). One way to see the biases of this sample is to look at the portfolio of shorted CRSP stocks that are not contained in the loan database. These omitted stocks have small market values ($172 million vs. $3,315 million mean market equity value) and low institutional ownership (means of 9.2% vs. 41%). Similarly, 92% of shorted closed-end funds and 44% of shorted stocks from the bottom size decile do not appear in the loan database. On average, however, the stocks not lent by the institutional data provider account for only 3% of the dollar value of monthly short interest. Despite a bias toward large, index component stocks, the loan database is not deficient in its representation of more interesting categories like IPOs and Internet stocks; it carries positions in more than 90% of those that are shorted.

The customers of the data provider are primarily large mutual fund complexes, public and private sector pension funds, and endowments. The loan database consequently inherits the portfolio biases of institutions documented by Gompers and Metrick (2001). These authors find a pronounced tilt towards large-capitalization and liquid stocks in the holdings of institutional investors, suggesting conservative index-tracking strategies. This is manifest in the fact that 99% of shorted S&P 500 stocks appear in the loan database. Table 2 presents direct evidence on how much variation in the sample loan supply can be explained by overall institutional holdings. Cross-sectional ordinary least-squares regressions (Model 1) show that quarterly 13F holdings (reported by Thomson/Spectrum) explain better than half of the variation in sample loan supply (POS as a % of shares outstanding). A multivariate specification (Model 2) tests for biases exhibited by lending institutions compared to the average institutional investor. The evidence suggests that after controlling for institutional ownership, lenders are additionally biased in favor of large stocks with high turnover, high book-to-market values, low momentum (prior 6-month returns), and prices above $5. The investment style of

Table 2
Quarterly cross-sectional OLS regressions of sample loan supply on institutional ownership (Model 1) as well as other stock characteristic variables (Model 2)
The dependent variable is the ratio of loan supply to shares outstanding (POS/SHROUT). All variables are standardized by calculating a $z$ score for each variable measured at quarter-end; e.g., standardized $\mathrm{IO} = (\mathrm{IO}_i - \overline{\mathrm{IO}})/\sigma_{\mathrm{IO}}$, where the mean and standard deviation are cross-sectional.[a]

| | Model 1 | | Model 2 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Quarter | IO | R-SQ% | IO | SIZE | Under5 | TURN | BM | MOM6 | R-SQ (%) |
| 2000:2 | 0.71 | 49 | 0.63 | 0.21 | −0.05 | 0.08 | 0.06 | −0.04 | 52 |
| | [71.16] | | [53.18] | [12.29] | [−1.90] | [6.80] | [5.47] | [−3.24] | |
| 2000:3 | 0.74 | 53 | 0.67 | 0.18 | −0.03 | 0.06 | 0.04 | −0.01 | 57 |
| | [76.63] | | [57.45] | [10.89] | [−1.08] | [5.05] | [3.88] | [−1.16] | |
| 2000:4 | 0.75 | 55 | 0.66 | 0.17 | −0.06 | 0.08 | 0.05 | −0.00 | 58 |
| | [78.97] | | [55.57] | [9.33] | [−2.17] | [7.31] | [4.37] | [−0.09] | |
| 2001:1 | 0.78 | 59 | 0.68 | 0.14 | −0.09 | 0.07 | 0.02 | −0.04 | 61 |
| | [84.94] | | [58.78] | [8.46] | [−3.52] | [5.93] | [1.93] | [−3.20] | |
| 2001:2 | 0.79 | 62 | 0.69 | 0.16 | −0.03 | 0.14 | 0.01 | −0.08 | 64 |
| | [88.23] | | [62.07] | [9.68] | [−1.15] | [7.88] | [1.08] | [−8.17] | |

[a] Institutional ownership (IO) is the number of shares held by 13F filing institutional investors (from Thomson/Spectrum/CDA quarterly tapes) as a percentage of shares outstanding for the quarter to which the given month belongs. SIZE is equal to the log of ME where market equity (ME) is calculated using prices and shares outstanding (SHROUT) from the CRSP monthly file. Under5 is an indicator set to one when the CRSP month-end price is less than \$5, zero otherwise. Using the same source, monthly turnover (TURN) is calculated by scaling monthly trading volume by shares outstanding. Book-to-market (BM) is the ratio of book equity to ME where book equity is constructed from Compustat data. In particular, book equity is defined as the book value of stockholders' equity, plus balance sheet deferred taxes and investment tax credit (if available), minus the book value of preferred stock. Momentum (MOM6) is the cumulative total return (again using CRSP) from the prior six months.

the representative institutional lender is best characterized by passive indexation. This bias also reveals the type of institutional investors who do not lend: funds who hold small, positive momentum, or glamour stocks.

### 4.2. Specials

Apart from some very illiquid stocks from the bottom size decile, the evidence suggests that most stocks can be borrowed and shorted. Having located the stock, the short seller's next concern is cost. Section 3 describes two distinct loan market regimes: general collateral (GC), characterized by zero fees, and special with positive fees. I interpret a "zero" fee loosely to mean economically negligible after any operational and administrative costs of lending. The GC equilibrium seems to describe most — but not all — stocks. This subsection explores cross-sectional variation in the likelihood that a stock is among the high-priced specials. The key result is that proxies for differences of opinion appear positively correlated to this likelihood, confirming the main hypothesis of Section 3.

An implied fee is constructed for each individual open loan contained in the loan database by subtracting the associated loan rate (REBATE) from the Fed Funds (effective) rate for that date. The loan fee variable (FEE) assigned to a given stock each day is the implied fee (an annualized percent) on the most recent loan of more than $1 million. When all open loans are smaller than $1million, the loan fee is the implied fee on the largest loan.[8] The loan fee variable attempts to capture the marginal cost faced by a professional short seller. A dummy variable (SPECIAL) is set to one for stocks with loan fees greater or equal than 1% per annum, and zero otherwise. In practice there is a single GC rebate each day, which is applied to all GC stocks. This rate is easy to identify in the sample: it is the daily mode. Any stock with a lower rebate (even just five basis points) could be considered special. The 1% level of loan fees stratifies the sample into the "costless" and "costly" in an economically significant sense.

Table 3 contains average loan fee values over the 18-month (373 trading days) sample. Excluding any securities that do not have at least $100,000 in loan balances, the loan database contains on average 2,372 stocks per day with loan fee observations. The equal-weighted mean loan fee is 60 basis points per annum, and the value-weighted just 24 basis points per annum. Ninety-one percent of stocks are general collateral. The value-weighted mean loan fee for GC stocks is 17 basis points per annum. On average, 206 stocks per day (about 8.7% of open loans) are designated as special. The value-weighted mean loan fee for all specials is 4.69%. The roughly six special stocks per day with negative rebates have an average implied loan fee of 19%.[9] Table 4 provides a partial list of those negative rebate stocks and their highest measured loan fee in the loan database. The fees that short sellers pay for these stocks are startling (e.g., 55% for Krispy Kreme or 50% for Stratos Lightwave). Several other stocks highlighted in Lamont and Thaler's (2001) account of the carve-outs puzzle also appear in the loan database with double digit loan fees (e.g. Palm, Retek Inc., and PFSweb). General Motors, with its immense float, is a surprising addition to this hard to borrow list. In May 2000, this otherwise uniformly GC stock briefly became the focus of intense borrowing demand by hedge funds and others betting on allocations of the Hughes spin-off.

Fig. 1 plots the mean loan fee and the percent of special stocks of portfolios formed by dividing the loan database into short interest (% of shares) deciles. While deciles 9 and 10 are the most expensive to borrow, the figure illustrates the potential difficulty with interpreting short interest in isolation and the limited use of this measure as a proxy for short-sale constraints. Across the first three short interest

[8] This data provider, to meet fix costs, typically gives a zero rebate on "nuisance" loans of less than $100,000. It is extremely rare that these are the only open loans for a stock in the database. To be conservative, I do not use these for calculation of implied fees unless the bank's overall position was less than $1 million. In this case, these fees actually would be representative of the marginal cost of the professional short seller — regardless of the size one intends to borrow. As such, I do not disregard fee data on several very special (negative rebate) stocks that are rationed by the provider in small blocks to several brokers.

[9] Note that during the year following this sample, with Fed Funds below 2%, the incidence of negative rebates has roughly doubled.

Table 3
Average daily loan fee (FEE in % per annum) of stocks on loan during sample period (April 2000–September 2001).[a]

| | All | "GC" FEE <1% | "Special" FEE > 1% | Negative rebates FEE > Fed Funds |
|---|---|---|---|---|
| Daily count of stocks on loan | 2,372 | 2,166 | 206 | 6 |
| % of stocks on loan | | 91.3 | 8.7 | 0.3 |
| Mean FEE (equal-weighted) | 0.60 | 0.20 | 4.72 | 18.86 |
| Mean FEE (value-weighted) | 0.24 | 0.17 | 4.30 | 22.37 |

[a] An implied loan fee (FEE) is constructed for each individual outstanding loan contained in the loan database by subtracting the associated rebate from the Fed Funds effective rate for that date (as reported by the Federal Reserve http://www.federalreserve.gov/releases/). The FEE variable for each day is the implied fee (% per annum) on the most recent loan of more than $1 million. When all open loans are smaller than $1 million, the implied fee on the largest loan is used. FEE attempts to capture the marginal cost faced by a professional short seller. Only stocks with loan balances in excess of $100,000 are included in calculations.

deciles, mean loan fees and the percent of special stocks actually decrease. In the middle deciles short interest is uninformative, consistent with the reasoning of Chen et al. (2002) who argue that changes in short interest can be an ambiguous measure of borrowing constraints. An increase in price can be driven by either positive demand or negative supply shocks — the former will result in an observed increase in quantity (short interest), the latter a decrease.

In addition to size and institutional ownership, which proxy for supply drivers, there are several other stock characteristics and categories that theory suggests should be associated with a higher likelihood of being special. In particular, the main hypothesis of Section 3 is that the incidence of specials should be increasing in variables that proxy for differences of opinion or valuation controversy among investors. The work of Varian (1989), Harris and Raviv (1993), and others argues that trading volume or turnover is driven in large part by heterogeneity of investor beliefs. As recently employed by Scherbina (2001), dispersion in analyst forecasts is a good measure of differences of opinion. A characteristic that makes stocks particularly difficult to value is low (or nonexistent) cash flows. Houge and Loughran (2000) show that a trading strategy that buys firms with high cash flow and short sells firms with low cash flow generates significant returns. They interpret this as evidence of cognitive failure among many investors when it comes to unraveling fundamental value from (often misleading) accounting earnings. The valuation of Internet firms has been among the most controversial topics in years. Miller (1977) argues that differences of opinion should be pronounced among IPOs. Miller also argues that increased investor attention or "visibility" can promote optimism in prices when agents differ in beliefs. This follows mechanically from an observed asymmetry in trading behavior — most optimistic investors will buy, but few pessimists sell short. Visibility among unsophisticated, less experienced investors who do not lend their stock may be particularly important for predicting specials. I

Table 4
Selected negative rebate stocks (April 2000 through September 2001).[a]

| Ticker | Company | Fee (%) | Month |
|---|---|---|---|
| CNH | CNH GLOBAL | 79.0 | 200105 |
| GM | GENERAL MTRS CORP | 63.0 | 200005 |
| TOT | TOTAL FINA SA[d] | 55.0 | 200006 |
| KREM | KRISPY KREME DOUGHNUTS INC[b] | 55.0 | 200102 |
| STLW | STRATOS LIGHTWAVE INC[b] | 50.0 | 200009 |
| UN | UNILEVER N V | 46.0 | 200105 |
| PRKR | PARKERVISION INC | 45.0 | 200005 |
| MCDT | MCDATA CORPORATION[b] | 40.0 | 200106 |
| RD | ROYAL DUTCH PETE CO[d] | 35.0 | 200108 |
| PPD | PRE PAID LEGAL SVCS INC | 35.0 | 200109 |
| PLMD | POLYMEDICA CORP | 35.0 | 200109 |
| PLCE | CHILDRENS PL RETAIL STORES INC | 35.0 | 200105 |
| PALM | PALM INC[b] | 35.0 | 200008 |
| ABX | BARRICK GOLD CORP | 27.0 | 200005 |
| BCE | BCE INC | 26.5 | 200006 |
| NOK | NOKIA CORP.[d] | 25.0 | 200103 |
| HAND | HANDSPRING INC[b] | 25.0 | 200102 |
| INRG | INRANGE TECHNOLOGIES CORP[b] | 25.0 | 200010 |
| COH | COACH INC[b] | 25.0 | 200104 |
| AREM | AREMISSOFT CORP DE | 22.0 | 200107 |
| ERICY | ERICSSON[b] | 20.5 | 200104 |
| ABY | ABITIBI CONSOLIDATED INC | 20.0 | 200012 |
| OWC | OWENS CORNING | 20.0 | 200106 |
| RAD | RITE AID CORP | 20.0 | 200103 |
| PCL | PLUM CREEK TIMBER CO INC | 20.0 | 200109 |
| SFP | SALTON INC | 20.0 | 200109 |
| PRCM | PROCOM TECHNOLOGY INC | 20.0 | 200106 |
| PPRO | PURCHASEPRO COM INC[c] | 20.0 | 200107 |
| LNUX | VA LINUX SYS INC[b] | 20.0 | 200006 |
| MSTR | MICROSTRATEGY INC | 15.0 | 200007 |
| WBVN | WEBVAN GROUP INC[b,c] | 14.0 | 200009 |
| SWZA | SUIZA FOODS CORP | 12.5 | 200104 |
| PFSW | PFSWEB INC[b,c] | 10.0 | 200007 |
| WEBM | WEBMETHODS INC[b,c] | 10.0 | 200008 |
| RETK | RETEK INC[b] | 10.0 | 200010 |

[a] Fee (defined by: Rebate − Fed Funds) is the highest recorded by each stock throughout the sample period.

[b] IPO, stocks within one year of their issue date as provided by the Securities Data Company (SDC).

[c] INTERNET, stocks that appear in the portfolio of 400 Internet "pure plays" compiled by Ofek and Richardson (2001).

[d] American Depository Receipts (ADRs).

use the number of contributors to Yahoo! Finance message boards as a measure of such visibility. Finally, borrowing demand should be high for glamour stocks and momentum losers, both popular short-sale targets.

Partitioning the loan database by loan status reveals variation in cross-sectional characteristics. Unborrowed stocks are markedly smaller and less liquid than

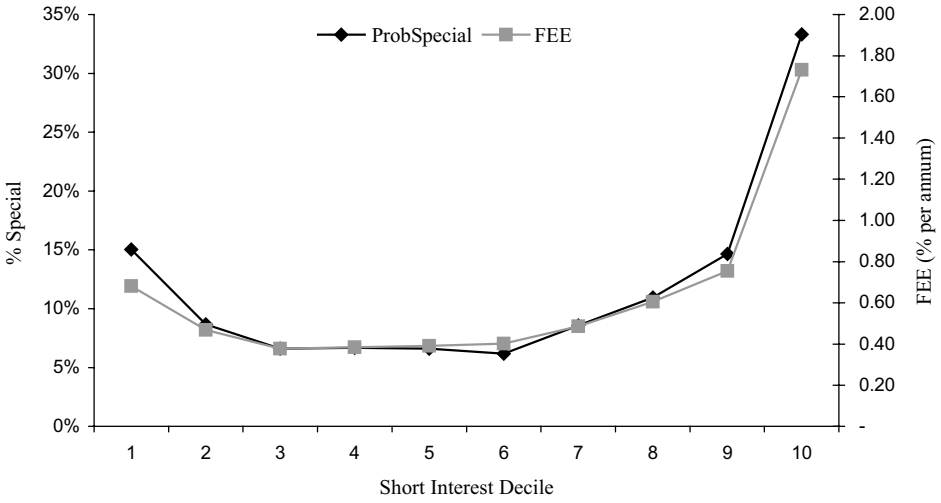



Fig. 1. Each month the loan portfolio is sorted by short interest decile. The mean loan fee (FEE) and the percentage of stocks that are special (ProbSPECIAL) are recorded and the figure plots their average values for the sample period (April 2000 through September 2001).

borrowed stocks. The average market equity value of special stocks is six times smaller than that of general collateral stocks (roughly \$1billion vs. \$6 billion). Specials have half the institutional ownership of GC stocks (26% vs. 50%). Monthly turnover increases monotonically from 7.8% for unborrowed stocks, to 19.5% for GC stock, to 32% for specials, to 49% for negative rebate stocks. Special stocks are 1.5 times more volatile than GC stocks (6.9% standard deviation of daily returns vs. 4.5%), have twice the dispersion in analyst forecasts (41% vs. 19%, see Appendix A for definitions), and have significantly more message board activity as measured by postings or contributing authors. The special portfolio has much lower six-month momentum than the GC stocks (–21% vs. 4%), lower cash flows per assets (−21.9% vs. 5.7%), and a higher median book-to-market ratio. While the precise relation between these variables and short-sale constraints are potentially confounded by correlations among them (e.g., size and book-to-market), the data present an interesting picture of the type of stocks that short sellers are willing to pay large fees to borrow.

Table 5 provides a series of two-way sorts of the loan portfolio. This simple methodology accommodates the changing rotation of stocks on loan in any given month and allows for isolation of various relations while controlling for size. The table is constructed as follows. Each month every stock in the loan database with an average open loan balance of at least \$100,000 is assigned a size ranking: small (market equity deciles 1, 2, and 3 using NYSE breakpoints), medium (deciles 4, 5, 6, and 7), and large (deciles 8, 9, and 10). The stocks are also assigned low, medium, and high ranks for institutional ownership, turnover, analyst dispersion, cash flows, message-board activity, and book-to-market (using NYSE breakpoints). Indicators

Table 5
Two-way sorts of the percentage of stocks that are special (ProbSPECIAL) and loan fee (FEE)
Each month every stock in the loan database with an average open loan balance of at least $100,000 is assigned a market equity (ME) ranking: small (ME deciles 1, 2, 3 using NYSE breakpoints), medium (deciles 4, 5, 6, 7), and large (deciles 8, 9, 10). Stocks are also assigned the ranks low, medium, and high for institutional ownership (IO), turnover (TURN), analyst dispersion (DISPERZ), cash flows (CF), message-board contributors (AUTHORS), and book-to-market (BM, using NYSE breaks). Indicators are set for INTERNET, IPO, and LOSER. The interaction of size rank with the rank (indicator) of any other characteristic subdivides all stocks on loan into nine (six) portfolios each month. ProbSPECIAL for each portfolio is the number of specials divided by the number of stocks in that portfolio. The portfolios are re-formed each month and ProbSPECIAL and mean FEE recalculated. The table presents their 18-month average.[a,b]

| | Prob SPECIAL | | | FEE | | |
|---|---|---|---|---|---|---|
| | Small | Medium | Large | Small | Medium | Large |
| *Panel A*: IO | | | | | | |
| Low | 31.5% | 16.6% | 8.4% | 1.47 | 1.00 | 0.51 |
| Medium | 24.0% | 14.8% | 7.1% | 1.10 | 0.79 | 0.42 |
| High | 9.7% | 3.0% | 1.1% | 0.58 | 0.29 | 0.21 |
| *Panel B*: TURN | | | | | | |
| Low | 20.3% | 4.4% | 2.0% | 0.97 | 0.33 | 0.23 |
| Medium | 24.6% | 6.8% | 1.6% | 1.15 | 0.46 | 0.23 |
| High | 29.1% | 12.0% | 5.0% | 1.31 | 0.71 | 0.35 |
| *Panel C*: DISPERZ | | | | | | |
| Low | 11.9% | 4.0% | 0.5% | 0.66 | 0.35 | 0.17 |
| Medium | 17.4% | 5.9% | 2.2% | 0.91 | 0.45 | 0.24 |
| High | 20.4% | 8.8% | 4.6% | 0.94 | 0.52 | 0.37 |
| *Panel D*: CF | | | | | | |
| Low | 28.2% | 10.1% | 4.1% | 1.30 | 0.58 | 0.30 |
| Medium | 14.8% | 3.4% | 1.4% | 0.75 | 0.31 | 0.22 |
| High | 15.1% | 4.7% | 1.3% | 0.75 | 0.41 | 0.24 |
| *Panel E*: AUTHORS | | | | | | |
| Low | 17.0% | 5.4% | 3.1% | 0.81 | 0.38 | 0.27 |
| Medium | 25.5% | 6.1% | 1.1% | 1.18 | 0.40 | 0.20 |
| High | 38.6% | 15.4% | 3.7% | 1.80 | 0.93 | 0.32 |
| *Panel F*: BM | | | | | | |
| Glamour | 22.0% | 9.6% | 2.0% | 1.05 | 0.63 | 0.25 |
| Medium | 16.1% | 2.8% | 1.2% | 0.81 | 0.28 | 0.20 |
| Value | 16.4% | 3.7% | 2.9% | 0.88 | 0.28 | 0.26 |

Table 5 (*continued*).

| | Prob SPECIAL | | | FEE | | |
|---|---|---|---|---|---|---|
| | Small | Medium | Large | Small | Medium | Large |
| *Panel G*: | | | | | | |
| Not Internet | 19.0% | 6.7% | 2.1% | 0.94 | 0.46 | 0.25 |
| Internet | 37.2% | 16.1% | 8.2% | 1.65 | 0.78 | 0.39 |
| *Panel H*: | | | | | | |
| Not IPO | 19.6% | 5.2% | 1.6% | 0.96 | 0.38 | 0.21 |
| IPO | 32.2% | 28.7% | 21.2% | 1.43 | 1.53 | 1.07 |
| *Panel I*: | | | | | | |
| Not LOSER | 20.6% | 6.7% | 2.2% | 0.97 | 0.45 | 0.25 |
| LOSER | 21.0% | 9.6% | 3.6% | 1.05 | 0.57 | 0.27 |

[a]Two-way ANOVA rejects the hypothesis that the means are constant across all sort categories at the 5% level in each panel provided above.

[b]ME is calculated using prices and shares outstanding (SHROUT) from the CRSP monthly file. Institutional ownership (IO) is the number of shares held by 13F filing institutional investors (from Thomson/Spectrum/CDA quarterly tapes) as a percentage of shares outstanding for the quarter to which the given month belongs. IPO is an indicator set to one for stocks within one year of their issue date as provided by the Securities Data Company (SDC). Monthly turnover (TURN) is calculated by scaling CRSP monthly trading volume by shares outstanding. Dispersion in analyst forecasts (DISPERZ) is the standard deviation of annual earnings estimates divided by the absolute value of the mean earnings forecast as provided by the Summary History dataset of the Institutional Brokers Estimate System (I/B/E/S). INTERNET is an indicator set to one for any stock that appears in the portfolio of 400 Internet pure plays compiled by Ofek and Richardson (2001). AUTHORS are the number of contributors to the stock's Yahoo! Finance message board in a given month. AUTHORS are collected using a proprietary web crawler program written by the author. Cash flows as a percent of assets (CF) are calculated using annual Compustat data. Cash flows are defined as operating income after depreciation (Compustat data item 178) less accruals. Accruals are annual changes in non-cash net working capital less depreciation. Non-cash net working capital is (Compustat data item 4 − data item 1) less (Compustat data item 5 − data item 34 − data item 71) and depreciation is data item 14. CF equals cash flows scaled by total book assets (average of Compustat data item 6 at the beginning and end of the year). LOSER is an indicator set to 1 for any stock that would be a prescribed short in the Jegadeesh and Titman (1993, 2001) rolling momentum strategy (using a six-month performance window and holding period). The stock must be in the bottom decile of MOM6 in at least one of the last six months. Stocks under $5 or in the bottom NYSE decile at the beginning of each formation period are excluded. Momentum (MOM6) is the cumulative total return (again using CRSP) from the prior six months. Book-to-market (BM) is the ratio of book equity to ME where book equity is constructed from Compustat data. In particular, book equity is defined as the book value of stockholders' equity, plus balance sheet deferred taxes and investment tax credits (if available), minus the book value of preferred stock.

are created for Internet, IPO, and "loser" stocks. The interaction of size rank with the rank (indicator) of any other characteristic subdivides all stocks on loan into nine (six) portfolios each month. The percent of special stocks for each portfolio is the number of specials divided by the number of stocks in that portfolio. This ratio is an estimate of the conditional likelihood that a stock is special given its two-way

ranking. The portfolios are re-formed each month and the percent of specials and mean loan fees tabulated. The table presents the average of these portfolio statistics across the 18 months.

In every sort, regardless of the secondary variable, the percent of specials and mean loan fees decline monotonically in size, revealing the strength of this effect. Panel A of Table 6 shows that within every size ranking, loan fees and the percent of specials decrease monotonically with institutional ownership. Within large stocks, the likelihood of being special increases from 1.14% to 8.38% moving from high down to low institutional ownership. Within small stocks, moving from high to low institutional ownership increases the likelihood of being special from 9.72% to 31.46%.

Panels B through G all provide support for the premise that specialness is associated with differences of opinion. Controlling for size, higher ranks for turnover, analyst dispersion, and message-board activity, and lower ranks for cash flows increase loan fees and the likelihood of specialness. Finally, Internet firms, IPOs, and, to a lesser extent, glamour stocks and momentum losers, are all more likely to be special. The hypothesis of constant means across portfolios is rejected at the 5% level in every sort.

In order to better measure the robustness of the explanatory variables, I use a series of logit regression specifications. The dependent variable in every regression is the dummy indicator for special stocks. All specifications control for the "supply side" drivers market equity, institutional ownership, and IPO.[10] In addition, each specification includes historical volatility in order to control for short selling motivated by hedging. For example, constrained shareholders often enter into off-balance sheet derivatives (e.g., collars) that force dealers to borrow and short. Justification for including volatility is also found in McDonald and Baron (1973), who discuss why portfolio theory predicts larger shorting demand for riskier stocks, and Shleifer (2000), who describes why idiosyncratic risk might limit arbitrage activity.

First, various proxies for divergence of opinion (turnover, analyst dispersion, Internet, message board activity, and cash flows) are tested one at a time. The specifications are run for each of the 18 sample months. The results for the control variables are as follows: size and institutional ownership are always negative and significant, IPO is positive and significant in all but one of the 90 regressions (18 months with five specifications), and volatility is positive and significant only half the time. The results for the proxies for dispersion in beliefs are as follows: out of 18 months sampled, turnover is positive (significant) in 18 (14), analyst dispersion is positive in 11 (3), Internet is positive in 17 (6), message-board activity is positive in 18 (17), and cash flow is negative in 18 (13). None of the specifications generate a significant coefficient with a sign that contradicts the Section 3's hypotheses.

[10] While IPOs are potentially related to differing opinions, they also uniformly exhibit severe structural loan supply constraints. See Geczy et al. (2002) for a discussion of the impact of small floats and lockups on the IPO loan market.

Table 6
Logit regressions of the likelihood of specials. The categorical dependent variable is the indicator SPECIAL.[a,b]

| MONTH | SIZE | IO | SIG | IPO | TURN | DISPERZ | INTERNET | AUTHORS | CF | LOSER | GLAMOUR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Panel A. Monthly coefficient estimates* | | | | | | | | | | | |
| 200004 | −0.336 | −2.545 | 0.117 | 0.404 | 0.039 | 0.075 | −0.027 | 0.026 | −0.167 | 0.814 | 0.255 |
| 200005 | −0.360 | −2.648 | −0.062 | 0.326 | 1.067 | 0.012 | 0.006 | 0.058 | −0.180 | 0.363 | 0.318 |
| 200006 | −0.547 | −2.867 | −0.096 | 0.847 | 1.224 | −0.152 | 0.035 | 0.124 | −0.104 | 0.395 | 0.528 |
| 200007 | −0.373 | −2.519 | −0.002 | 0.755 | 1.072 | −0.294 | −0.359 | 0.177 | −0.086 | 0.298 | 0.168 |
| 200008 | −0.329 | −2.295 | 0.031 | 0.520 | 1.297 | −0.076 | 0.006 | −0.006 | −0.100 | 0.350 | 0.195 |
| 200009 | −0.417 | −2.385 | −0.137 | 0.975 | 1.976 | −0.053 | 0.376 | 0.093 | −0.151 | 0.460 | 0.607 |
| 200010 | −0.397 | −2.346 | −0.075 | 1.074 | 1.763 | −0.011 | −0.417 | −0.071 | −0.103 | 0.559 | 0.981 |
| 200011 | −0.348 | −2.318 | −0.117 | 0.554 | 1.635 | −0.016 | −0.258 | −0.061 | −0.177 | 0.515 | 0.453 |
| 200012 | −0.558 | −2.860 | −0.038 | 1.347 | 1.505 | 0.049 | 0.280 | 0.078 | −0.008 | −0.082 | 0.101 |
| 200101 | −0.438 | −3.398 | 0.045 | 1.100 | 1.063 | −0.315 | −0.703 | 0.133 | −0.082 | −0.068 | −0.012 |
| 200102 | −0.500 | −3.697 | −0.016 | 0.847 | 0.967 | −0.240 | −0.815 | 0.406 | −0.158 | −0.187 | 0.152 |
| 200103 | −0.346 | −4.022 | 0.022 | 1.221 | 1.292 | −0.314 | −0.535 | 0.359 | −0.137 | −0.313 | −0.095 |
| 200104 | −0.501 | −3.113 | 0.008 | 1.115 | 1.749 | 0.017 | −0.119 | 0.154 | −0.070 | −0.646 | 0.650 |
| 200105 | −0.380 | −2.685 | −0.134 | 1.433 | 2.204 | −0.012 | −0.400 | 0.165 | −0.060 | −0.525 | 0.633 |
| 200106 | −0.502 | −3.422 | −0.083 | 0.352 | 1.872 | 0.022 | −0.004 | 0.152 | 0.001 | −0.116 | 0.705 |
| 200107 | −0.664 | −1.952 | −0.185 | −0.522 | 1.767 | 0.315 | −0.269 | 0.236 | −0.028 | 0.519 | 0.681 |
| 200108 | −0.509 | −2.132 | −0.162 | 1.198 | 2.500 | 0.264 | 0.167 | 0.219 | −0.016 | −0.098 | 0.377 |
| 200109 | −0.801 | −3.115 | −0.246 | 1.874 | 3.542 | 0.083 | 0.141 | 0.342 | −0.033 | 0.003 | 0.618 |
| *Panel B. Monthly t-statistics* | | | | | | | | | | | |
| 200004 | −2.89 | −4.15 | 1.38 | 1.20 | 0.07 | 0.41 | −0.08 | 0.41 | −3.04 | 2.85 | 0.82 |
| 200005 | −3.64 | −5.21 | −0.89 | 1.10 | 1.97 | 0.06 | 0.02 | 0.91 | −3.75 | 1.54 | 1.20 |
| 200006 | −5.19 | −5.36 | −1.26 | 2.82 | 2.47 | −0.83 | 0.11 | 1.54 | −2.24 | 1.66 | 1.84 |
| 200007 | −3.69 | −4.88 | −0.02 | 2.44 | 2.08 | −1.35 | −1.11 | 1.98 | −1.97 | 1.23 | 0.63 |
| 200008 | −3.18 | −4.48 | 0.41 | 1.66 | 2.43 | −0.39 | 0.02 | −0.08 | −2.18 | 1.41 | 0.70 |
| 200009 | −4.03 | −4.45 | −1.72 | 3.28 | 4.03 | −0.29 | 1.29 | 1.36 | −3.22 | 1.75 | 2.18 |
| 200010 | −3.96 | −4.72 | −0.93 | 3.37 | 4.05 | −0.06 | −1.27 | −0.97 | −2.36 | 2.05 | 3.57 |
| 200011 | −3.10 | −4.07 | −1.31 | 1.38 | 3.07 | −0.07 | −0.68 | −0.65 | −3.29 | 1.62 | 1.57 |
| 200012 | −4.51 | −5.03 | −0.41 | 3.47 | 2.80 | 0.26 | 0.69 | 0.70 | −0.16 | −0.24 | 0.34 |
| 200101 | −3.42 | −5.81 | 0.44 | 2.50 | 1.99 | −1.26 | −1.39 | 0.94 | −1.63 | −0.20 | −0.04 |
| 200102 | −3.95 | −5.93 | −0.17 | 1.87 | 1.54 | −1.17 | −1.94 | 2.60 | −3.07 | −0.54 | 0.52 |
| 200103 | −2.61 | −6.03 | 0.21 | 2.60 | 2.16 | −1.45 | −1.10 | 2.46 | −2.45 | −0.81 | −0.29 |
| 200104 | −3.70 | −4.91 | 0.07 | 2.53 | 2.81 | 0.08 | −0.21 | 1.47 | −1.22 | −1.64 | 2.06 |
| 200105 | −2.96 | −4.53 | −1.29 | 2.97 | 3.99 | −0.06 | −0.61 | 1.74 | −1.09 | −1.33 | 2.11 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 200106 | −3.57 | −5.04 | −0.74 | 0.52 | 2.86 | 0.09 | −0.01 | 1.74 | 0.02 | −0.29 | 2.14 |
| 200107 | −3.87 | −2.52 | −1.48 | −0.46 | 2.33 | 1.38 | −0.41 | 1.97 | −0.42 | 1.21 | 1.84 |
| 200108 | −3.16 | −2.97 | −1.38 | 1.08 | 3.69 | 1.09 | 0.26 | 1.94 | −0.24 | −0.22 | 1.00 |
| 200109 | −4.31 | −4.01 | −1.44 | 1.58 | 4.60 | 0.30 | 0.22 | 2.60 | −0.53 | 0.01 | 1.62 |

*Panel C. Summary*

| | SIZE | IO | SIG | IPO | TURN | DISPERZ | INTERNET | AUTHORS | CF | LOSER | GLAMOUR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Average coefficient | −0.46 | −2.80 | −0.06 | 0.86 | 1.59 | −0.03 | −0.16 | 0.14 | −0.09 | 0.12 | 0.41 |
| Months positive | 0 | 0 | 5 | 17 | 18 | 8 | 7 | 15 | 1 | 10 | 16 |
| [Significant at 5%] | [0] | [0] | [0] | [11] | [16] | [0] | [0] | [8] | [0] | [4] | [7] |
| Months negative | 18 | 18 | 13 | 1 | 0 | 10 | 11 | 3 | 17 | 8 | 2 |
| [Significant at 5%] | [18] | [18] | [1] | [0] | [0] | [0] | [1] | [0] | [10] | [0] | [0] |

[a] The economic interpretation of a reported coefficient is that a unit change in the variable adjusts the odds of being special by a factor of $e^{\text{coefficient}}$.

[b] SIZE is equal to the log of ME where market equity (ME) is calculated using prices and shares outstanding (SHROUT) from the CRSP monthly file. Institutional ownership (IO) is the number of shares held by 13F filing institutional investors (from Thomson/Spectrum/CDA quarterly tapes) as a percentage of shares outstanding for the quarter to which the given month belongs. IPO is an indicator set to one for stocks within one year of their issue date as provided by the Securities Data Company (SDC). Historical return volatility (SIG) is the standard deviation of the trailing six months of CRSP daily returns. Monthly turnover (TURN) is calculated by scaling CRSP monthly trading volume by shares outstanding. Dispersion in analyst forecasts (DISPERZ) is the standard deviation of annual earnings estimates divided by the absolute value of the mean earnings forecast as provided by the Summary History dataset of the Institutional Brokers Estimate System (I/B/E/S). INTERNET is an indicator set to one for any stock that appears in the portfolio of 400 Internet pure plays compiled by Ofek and Richardson (2001). AUTHORS are the number of contributors to the stock's Yahoo! Finance message board in a given month. AUTHORS are collected using a proprietary web crawler program written by the author. Cash flows as a percent of assets (CF) are calculated using Annual Compustat data. Cash flows are defined as operating income after depreciation (Compustat data item 178) less accruals. Accruals are annual changes in non-cash net working capital less depreciation. Non-cash net working capital is (Compustat data item 4 − data item 1) less (Compustat data item 5 − data item 34 − data item 71) and depreciation is data item 14. CF equals cash flows scaled by total book assets (average of Compustat data item 6 at the beginning and end of the year). LOSER is an indicator set to one for any stock that would be a prescribed short in the Jegadeesh and Titman (1993, 2001) rolling momentum strategy (using a six month performance window and holding period). The stock must be in the bottom decile of MOM6 in at least one of the last six months. Stocks under $5 or in the bottom NYSE decile at the beginning of each formation period are excluded. Momentum (MOM6) is the cumulative total return (again using CRSP) from the prior six months. GLAMOUR is an indicator set to one for stocks in the bottom three deciles of book equity/ME (using NYSE breaks, and positive book values). Book-to-market (BM) is the ratio of book equity to ME where book equity is constructed from Compustat data. In particular, book equity is defined as the book value of stockholders' equity, plus balance sheet deferred taxes and investment tax credits (if available), minus the book value of preferred stock.

Table 6 reports monthly coefficient estimates and *t*-statistics for the full specification that includes the previous control variables, all five dispersion proxies, and dummy variables for glamour stocks and for stocks in the short loser portfolio prescribed by Jegadeesh and Titman (1993, 2001). The number of months the coefficient is positive and negative, and the number of times these results are significant at the 5% level, are summarized in Panel C.

The results for the 18 monthly runs are as follows: size and institutional ownership coefficients are always negative and significant and IPO is positive (significant) 17 (11) times. Volatility is negative 13 times, but only significant once. Among the proxies for differences of opinion, turnover is the most robust: it is positive (significant) in 18 (16) months. Cash flow reduces the likelihood of being special in 17 (10) months. Attention on the message boards contributes positively in 15 (8). Analyst dispersion and Internet provide no incremental explanatory power — both exhibit unexpected negative coefficients on average, but are never significantly different from zero. Finally, the glamour dummy increases the likelihood of being special in 16 (7) months and the loser dummy in just ten (four).

While conclusions need to be tempered because of the limited time series of this sample and the slightly unusual nature of the period (the deflation of a bubble), the data seem consistent with prevailing views on short-sale constraints. First, the tests document that smaller stocks with low institutional ownership are relatively more likely to be special. This intuitive finding offers a partial explanation for the universal tendency of return anomalies to be more pronounced in smaller stocks. For example, Jegadeesh and Titman (2001) report that in the 1990s their momentum strategy generated 77 basis points more per month in small stocks than in large stocks. Seventy basis points of this difference is found in the losers constituting the short leg. Additionally, the tests show that IPOs and glamour stocks are more likely to be special, extending evidence from nonoverlapping samples reported by Geczy et al. (2002) and Jones and Lamont (2002).

Empirically linking turnover, cash flows, and message board activity to short sales constraints supports the hypotheses of Section 3, and also has import beyond. A tempting intuition is that liquid stocks must be easier to short. While this may have merit along some dimensions (e.g., execution), it is misguided when it comes to borrowing cost: high-turnover stocks have the highest fees. These costs could contribute to findings by Lee and Swaminathan (2000) that momentum trading can apparently be made more profitable by shorting high turnover losers. The fact that negative cash flow stocks are harder to short could relate to findings by Cohen et al. (2002) that institutions sell to retail investors on bad cash flow news — but not as aggressively as they might. It also suggests that short-sale constraints may reduce realizable profits from the Houge and Loughran (2000) strategy of selling cash flow losers. The ability of message board traffic to retain significance in predicting specials for several months in the full specification presents intriguing evidence of its informational content. This variable might capture Miller's (1977) concept of visibility or perhaps changes in investor sentiment — both capable of supporting optimistic prices and arousing short seller interest.

The explanatory ability of the Internet dummy does not survive in the final logit specification. This suggests that the reason Internet stocks become special can be mostly explained by their size, low institutional ownership, low cash flows, popularity among inexperienced traders, etc. It is somewhat ironic that analyst dispersion, the variable with a direct interpretation as differences of opinion, is subsumed. One explanation is that herding and conflicts of interest among analysts and the increasing irrelevance of the accounting figures they forecast make this metric only tangentially related to the divergence of beliefs among non-lenders, lenders, and short sellers.

### 4.3. Recalls

The goal of this section is to describe the experience of short sellers whose loans are recalled during this sample period. Before proceeding, the terminology for recalls and a methodology for measuring them need to be made precise. When any lender sells shares, the loan supply in the loan database (a real time inventory management system) immediately falls. It is possible to observe "negative availability," or days when supply is less than the level of outstanding loans (POS $<$LOAN).[11] This does not refer to an actual physical shortfall until three days after the lender's sale when delivery of the sold shares is expected. Upon realizing negative availability, the bank issues recall notices to borrowers and calls in loans until balance is regained (loan supply equals the level of outstanding loans). I interpret any decline (of at least \$100,000) in the loan balance of a stock with negative availability as a forced return and set an indicator variable (FORCEDCOVER) equal to one for the date three trading days prior. If the short seller covers or buys back the shares, she must do so three days prior to delivery given U.S. equity market settlement. Alternatively, the short seller can deliver reborrowed or "relocated" shares using same-day settlement. An indicator variable named RECALL is set to one in any calendar month containing a forced cover day. An indicator variable DISPLACED is set to one on every day after the forced cover day until (but not including the day) the loan database next exhibits loan supply in excess of outstanding loans by more than \$100,000. This displacement period is economically interesting in that no new shorts can be established with this data provider. It is reasonable that this will correspond to a time of general shortage given the market share that this sample represents.

One critique of this approach is that the forced cover indicator does not distinguish between idiosyncratic and marketwide supply shocks, the latter being more likely to induce repurchasing (forced short covering) rather than re-borrowing from other lenders. As a robustness check, I try interacting the FORCEDCOVER, RECALL, and DISPLACED dummies with an indicator variable that equals one only during short interest reporting periods in which that stock's short interest falls.

[11] When aggregate supply exceeds loans outstanding, the intermediary assigns the lender's liability to another lender in the queue and delivers the new lender's shares in execution of the prior lender's sale. If outstanding loans exceed supply, the lender is still allowed to sell the shares based on the right to recall. However, if the borrower does not return the shares in three days the lender will commit a sell "fail."

This does not materially change any of the results reported in the following analysis. Monthly reported short interest is a single snapshot in time, which many practitioners claim is subject to window dressing. The refinement of relying on month-on-month declines in short interest to proxy for negative systematic loan shocks is thus severely limited and likely misses important variation in supply between reporting dates.

Table 7 contains a variety of facts about recall episodes observed during the sample period. Panel A shows that that the incidence of recall is low. On an average day, 23 different stocks experience short covering. During an average month, the number is 61, and for the total sample period (18 months) the number is 489. These numbers reveal persistence in recall episodes for some stocks: decreases in supply, and subsequent borrower returns, tend to be staggered over several days. A very naïve calculation of (unconditional) probability says that the short seller of any given stock has a 1% chance of being forced to cover over the span of a day, 2% over the span of a month, and about 10% over the span of 18 months. Panel B provides information on the distribution of displacement periods. After covering a recalled short, the median (mean) displacement period is nine (23) trading days. Panel C contains the distribution of changes in loan fees from the beginning to the end of the displacement periods. This is a proxy of refinancing risk in that it measures the increase in borrowing cost associated with reestablishing recalled short positions. The mean (and median) refinancing risk is essentially zero ($-1$ basis point). Further, in fewer than 1% of the episodes does the required fee to reestablish a recalled short position increase by more than 6%. One possible interpretation is that by the time the loan market returns to equilibrium, temporary increases in the differences in valuations of investors and lenders disappear.

Panel D compares daily turnover, intraday volatility, and market-adjusted returns for stocks that have at least one forced cover day over the sample (the "recall portfolio") and the entire loan portfolio. Stocks under \$5 (80 of the 489 stocks in the recall portfolio) are excluded to minimize bid–ask noise in returns; while not materially changing the means, the standard errors are reduced and inference improved. On each of the 373 trading days, the recall portfolio is subdivided into (equal-weighted) subportfolios of stocks subject to forced cover (FORCEDCOVER $=1$) or displacement (DISPLACED $=1$), and "shortable" (neither forced cover nor displaced) stocks.

While the mean daily turnover of stocks in the recall portfolio is higher than that in the loan database overall on days when they are shortable (1.6% compared to 0.8%), the difference during forced covering and displacement is extraordinary. Mean daily turnover rises to 3.7% and 3.1% for stocks during forced cover and displacement, respectively. Intraday volatility, calculated as (hi-low)/close, shows a similar pattern. Within the recall portfolio, intraday volatility is 10.2% for forced cover stocks, 9.6% for displaced stocks, and 8.3% for shortable stocks. This compares to mean intraday volatility of 5.58% for the entire loan database overall. We can reject the hypotheses that mean daily turnover and intraday volatility of forced cover and displaced stocks are equal to the means for shortable stocks or the loan database at the 1% level.

Table 7
Selected statistics on recall episodes
Recall occurs when lender sales push loan supply below loan balances, requiring borrowers to return (at least $100,000 worth of) shares. The recall portfolio consists of all stocks that experience a recall event in the sample. A "forced cover" is defined to take place three trading days prior to the actual return of the shares while the number of shares on loan exceeds the supply of lender shares (LOAN > POS). A stock is "displaced" from the forced cover day until the next trading day in which the loan database has availability (POS-LOAN) in excess of $100,000 (excluding these end points). A stock is "shortable" on days not marked FORCEDCOVER or DISPLACED.[a]

*Panel A. Incidence*

| | Mean number of recalls | % Of stocks on loan |
|---|---|---|
| Per day | 23 | 1.0% |
| Per month | 61 | 2.0% |
| Total sample | 489 | 9.8% |

*Panel B. Length of displacement*

| Percentile | Displaced trading days |
|---|---|
| 95% | 102 |
| 90% | 67 |
| 75% | 28 |
| 50% | 9 |
| 25% | 4 |
| 10% | 3 |
| 5% | 3 |
| Mean | 23 |

*Panel C. Refinancing risk*

| Percentile | Change in FEE (% p.a.) over DISPLACEMENT period |
|---|---|
| 99% | 6.31 |
| 95% | 2.66 |
| 90% | 0.25 |
| 75% | 0.06 |
| 50% | (0.01) |
| 25% | (0.11) |
| 10% | (0.51) |
| 5% | (1.16) |
| 1% | (6.34) |
| Mean | (0.02) |
| Obs. | 920 |

Table 7 (*continued*)

*Panel D. Turnover, volatility, and returns*[b]

| | Recall portfolio $N = 373$ | | | |
|---|---|---|---|---|
| | FORCEDCOVER stocks | DISPLACED stocks | SHORTABLE stocks | All stocks (N = 7201) |
| Daily turnover | | | | |
| Mean | 3.70% | 3.10% | 1.60% | 0.70% |
| Median | 1.30% | 1.20% | 0.80% | 0.50% |
| Intra-day volatility | | | | |
| Mean | 10.20% | 9.60% | 8.30% | 5.58% |
| Median | 7.60% | 7.50% | 6.50% | 4.35% |
| Market adjusted returns | | | | |
| Mean | −0.70% | −0.20% | −0.10% | −0.01% |
| Median | −0.70% | −0.40% | −0.20% | 0.01% |

[a] Daily turnover (DTURN) is calculated by scaling daily trading volume by shares outstanding from the CRSP daily files. Intraday volatility (IDV) is the difference between the CRSP daily high (ASKHI) and low (BIDLOW) scaled by the closing price. Returns reported in Panel E are adjusted using the value-weighted market (VWRETD) from the CRSP daily file. Results for the raw returns are not materially different.

[b] All means reported for daily turnover and intraday volatility are significantly different (pairwise) at the 5% level. For market-adjusted returns, only the differences between FORCEDCOVER stocks and the other categories are significant at the 5% level.

During the sample, market-adjusted returns are worst for stocks facing involuntary short covering. Mean (median) daily returns are –0.7% (−0.7%) for forced cover stocks compared to –0.2% (−0.4%) for displaced stocks, −0.1% (−0.2%) for shortable stocks, and 0% for the entire loan database. Pairwise differences in the mean returns of either shortable or loan database stocks and forced cover stocks are statistically significant at the 5% level. Differences between these and displaced stocks are not.

In order to characterize the months surrounding these episodes, the recall portfolio is sorted by "recall event time," the number of months from a month with a forced cover day. Equal-weighted averages for several variables are then calculated for each recall time portfolio and plotted. Figs. 2A and B echo patterns seen in daily turnover and intraday volatility, clearly indicating that recall months are local peaks in trading volume and price movement. Figs. 2C and D provide evidence that selling decisions by the sample lenders are correlated to marketwide reductions in holdings by large institutions. 13F ownership — whether measured by number of owners or as a percent of shares — declines in the quarter following recall months. The number of posted messages (Fig. 2E) and the number of message-board contributors (Fig. 2F) roughly double during recall months. This may indicate that recall events often coincide with a "buzz" generated by news or rumors. This, along with high trading volume, is consistent with increased heterogeneity in beliefs and shifting investor sentiment. Providing further support of the systemic nature of the sampled recall episodes, both loan fees (Fig. 2G) and short interest (Fig. 2H) reach a local peak on recall months.

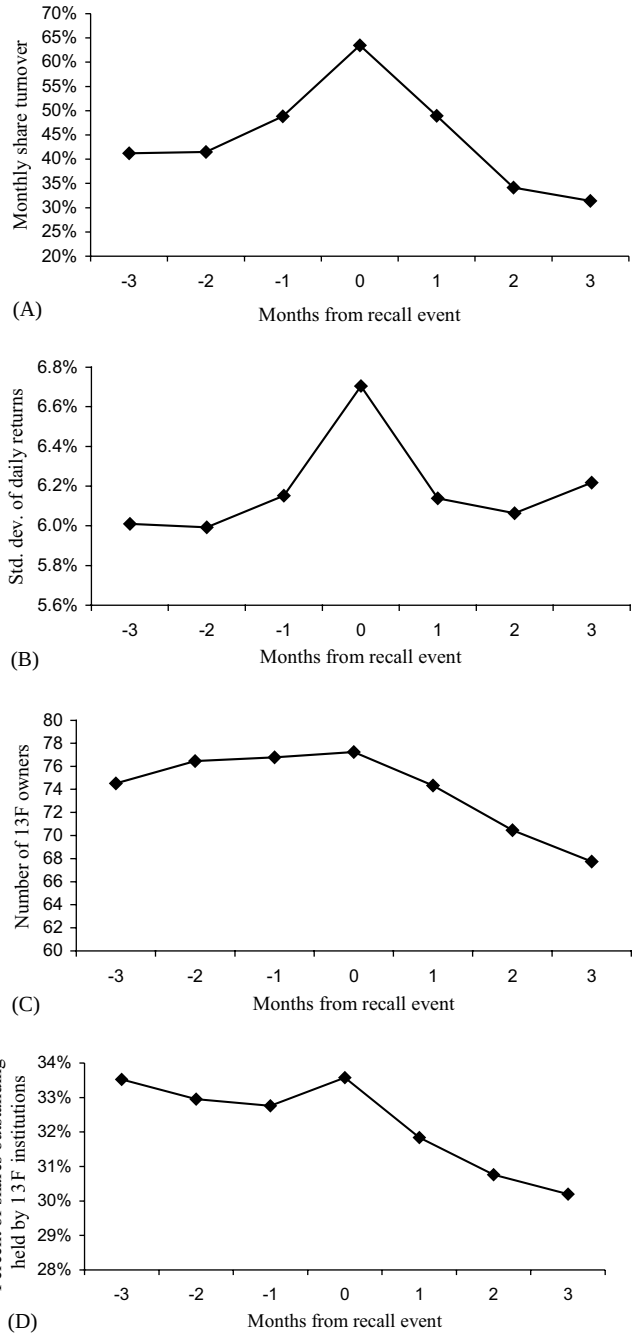
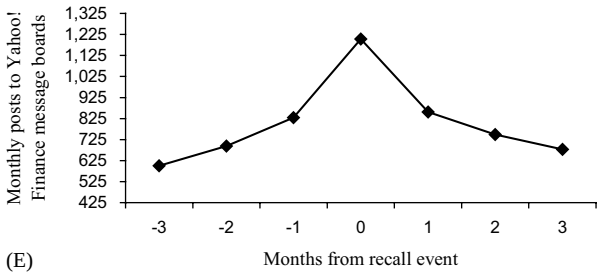
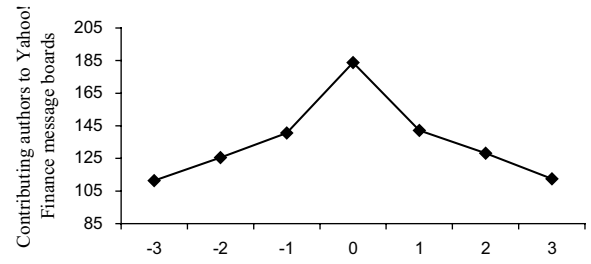


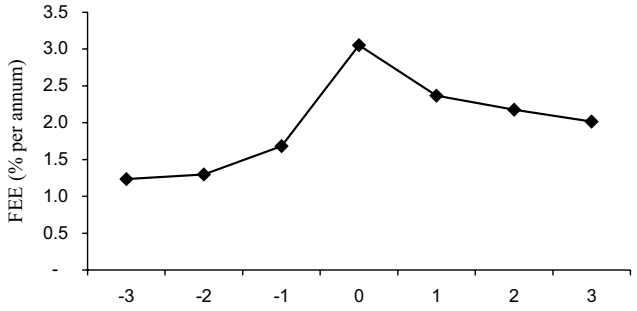

Fig. 2. Characterizing the months surrounding recall. The portfolio of 489 stocks in the loan database with at least one recall month (when lender selling reduces loan supply below loan balances, requiring borrowers to return shares) are sorted according to "recall time" (months from a recall month). The figure plots equal-weighted means for various stock characteristic variables by recall time.



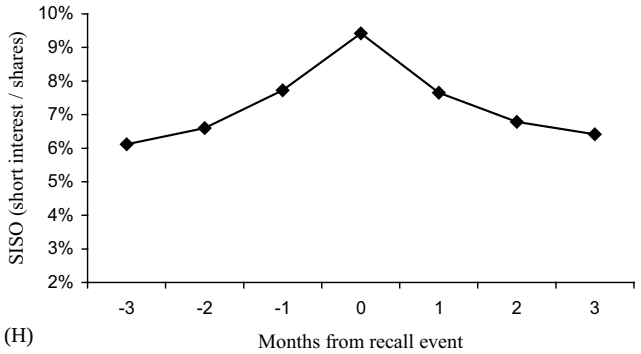

(E)




(F)




(G)




(H)

Fig. 2 (*continued*).

In contrast to the idea that short sellers are squeezed when lenders recall loans, the opposite seems to be true for this period.[12] Stock returns actually appear to be lower on days with forced short covering and the increased cost of refinancing a displaced loan is close to zero on average. While certainly not decisive, the decline in institutional ownership in the quarter following recall events is consistent with the idea that these sample negative loan supply shocks (alternatively, stock demand shocks) are not exogenous or idiosyncratic. Institutional selling could drive prices lower, or could be in response to redemptions triggered by the declines; either allows borrowers to close out positions in a falling market. Here it is important to note the small size of short seller positions in relation to the tremendous volume observed on these days. Fig. 2H shows that short interest in recalled stocks falls by an average of 3% (of shares outstanding) over three months. Table 7 shows that almost 4% of shares outstanding trade on an average short cover day. Other trading would seem to swamp forced short covering volume.

It would be wrong, however, to conclude that short sellers have it easy during this period. First, many are displaced from profitable short positions. Recall generates an opportunity cost of 20 basis points a day over an average displacement period of 23 trading days. It also leaves relative value or "pairs" traders unhedged on their long legs. If the volatility of the naked long is positively correlated to that of the recalled short (Fig. 2B), the risk is that much higher. Furthermore, the abnormal intraday volatility subjects the short seller to potentially large execution costs during forced repurchases.

Again, we see that high turnover is related to increased short-sale constraints. Not only are heavily traded stocks more likely to be special, they are more likely to be recalled. This is quite mechanical. Increased trading increases the probability that any given loan is dislocated — especially for stocks where institutions are net sellers. If differences of opinion increase trading, then they also increase recall risk.

Out of sample, the nature of recall risk may be different. During the formation of the NASDAQ bubble in the late 1990s, decisions by institutional lenders to sell shares in order to take profits would be negatively correlated to the beliefs of the marginal investor. In this setting, recall risk includes the possibility of being forced to cover shorts in a rapidly rising market. Both this squeeze scenario and the truncation of downside profits described above could contribute to ex ante short-sale reluctance.

## 5. Conclusion

This paper describes the cost and ability to short stock in terms of prices and quantities determined by an active securities lending market. Prior research in this

[12] There is at least one recall episode that resembles a short squeeze. From mid-August through September 2000, 1-800 Contacts (CTAC) experienced a negative shock to loan supply that resulted in a 25% contraction in both sample loan balances and reported short interest. The stock rose roughly 100% over the corresponding period (without any identifiable news) on abnormally high trading volume and subsequently returned all gains in October 2000.

area focuses exclusively on short interest quantities without addressing loan prices. An understanding of how loan fees are determined in equilibrium provides sharper predictions as to how short-sale constraints vary cross-sectionally and over time.

The borrowing demands of short sellers (e.g., arbitrageurs, market makers, risk managers, and speculators) generate a downward-sloping aggregate demand schedule. The long holdings of investors willing and able to lend their securities represent aggregate supply. The market-clearing quantity of loans is observable as short interest. The market-clearing loan fee is simultaneously the cost to the short seller and a source of income (akin to a dividend) for the lender. For the loan market to clear, not all investors can lend. This trivial fact has a profound implication. Given that the equilibrium stock price reflects capitalized lending income that they will not receive, non-lenders must value the stock more highly for some alternative reason lest it seem overpriced. Thus, loan fees (short-sale costs) are ultimately sustained by, and increasing in, the divergence of opinion in investor valuations. More precisely, fees increase with the spread in valuations between non-lenders and other agents (namely, short sellers and lenders).

This is theoretically interesting when applied to a Miller (1977) equilibrium in which a divergence of opinion leads to optimistic prices. The economic mechanisms described here and in recent work by Duffie et al. (2002) offer endogenous support for Miller's critical assumption of short-sale constraints. While short-sale costs might be quite low on average, they are systematically high exactly when they are critical—i.e., when investors disagree most.

Theory also suggests that a lender's continuous right to recall loans limits a short seller's ability to profit from negative information. Recall risk is increasing in the variance of the spread between investor and lender valuations. Low or negative correlation between the beliefs of lenders and investors can significantly increase the expected costs of covering or replacing a recalled short position. Recall risk is also increasing in differences of opinion, which generate the turnover that displaces security loans.

The paper also provides empirical facts about the loan market. I show that most stocks are shortable. The 16% of the stocks in CRSP that are potentially impossible to borrow are mostly tiny, illiquid stocks priced below $5 and account for less than 0.6% of total market value. I document that institutional ownership explains about 55% of the variability in loan supply (as percent of shares) across stocks. Controlling for institutional ownership, loan supply remains significantly biased towards large stocks with higher turnover, higher book-to-market ratios, and lower momentum.

Of stocks borrowed, 91% are deemed general collateral, generating loan fees of only 17 basis points per annum on average. The other 9% (about 200 stocks per day) are loan market specials, with fees averaging 4.30% per annum but reaching spectacular heights in some rare instances (e.g., Krispy Kreme at 55%). The likelihood of being special decreases with firm size and institutional ownership, but increases in several proxies for differences of opinion (the latter relation supporting the major implication of the loan fee setting process described in this paper). High turnover, high dispersion of analyst forecasts, high visibility among unsophisticated investors (i.e., a large following on the message boards), high price multiples, and

low cash flows are all associated in the data with an increased potential for loan specialness. IPOs and Internet firms are perfect examples to support the theory — but the empirical evidence of these patterns is robust to their exclusion from the sample.

Recall events — when borrowers must return securities to lenders — are rare. In an average month, the data provider recalled loans in 61 different stocks. The median (mean) time required to reestablish a dislocated short was nine (23) trading days. The events identified in the sample coincide with periods of extraordinary trading volume and intraday volatility. Returns on sample forced short covering days are lower than average. While it is possible that this last fact is due to structural correlations that mitigate squeeze risk, an assessment of the ex ante perception of recall risk is premature.

Normative prescriptions include increasing the transparency and reporting frequency of loan rates so that all investors can consider lending income when making portfolio decisions. This will allow the loan market to reach equilibrium more quickly via a more responsive supply curve. Regardless of the amount of sluggishness removed from the market, recall risk will not go away until a term loan market for specials is developed.

According to Almazan et al. (2000), 70% of investment managers are precluded by charter and strategy restrictions from short selling. Fewer than 10% of those eligible actually engage in short selling. Market short interest is typically only 1.5% of market value. This paper and similar work by Duffie et al. (2002), Geczy et al. (2002), and Jones and Lamont (2002) provide useful analyses of the equity loan market, but the field has yet to resolve an intriguing short sales reluctance puzzle. While specialness and recall risk could be onerous for many mid- to small-sized stocks, they cannot explain low short interest among S&P 500 stocks. To fully understand the observed reluctance, researchers must explore less explicit measures of short seller costs and risks — ones that extend beyond the loan market. Avenues of promise include the coordination failure model of Abreu and Brunnermeier (2002), reluctance of fund managers to incur tracking error (relative to the market index or other long benchmarks), and the cultural pressures of a society that often vilifies short sellers.

## Appendix A. Definition of stock characteristic variables

Market equity (ME) is calculated using prices and shares outstanding from the CRSP monthly file. SIZE is equal to the log of ME. Using the same source, Monthly turnover (TU34RN) is calculated by scaling monthly trading volume by shares outstanding. Daily turnover (DTURN) is calculated as TURN, instead using CRSP daily data. Intraday volatility (IDV) is the difference between the CRSP daily high (ASKHI) and low (BIDLOW) scaled by the closing price. Historical return volatility (SIG) is the standard deviation of the trailing six months of CRSP daily returns. Daily volatility (DSIG) is the standard deviation of CRSP daily returns in that month. Momentum (MOM6) is the cumulative total return (again using CRSP) from

the prior 6 months. Dispersion in analyst forecasts (DISPERZ) is the standard deviation of annual earnings estimates divided by the absolute value of the mean earnings forecast as provided by the Summary History dataset of the Institutional Brokers Estimate System (I/B/E/S). Institutional ownership (IO) is the number of shares held by 13F filing institutional investors (from Thomson/Spectrum/CDA quarterly tapes) as a percentage of shares outstanding for the quarter to which the given month belongs. IOWNERS is the number of institutions listed as holding the stock in that quarter. Book-to-market (BM) is the ratio of book equity to ME where book equity is constructed from Compustat data. In particular, book equity is defined as the book value of stockholders' equity, plus balance sheet deferred taxes and investment tax credit (if available), minus the book value of preferred stock. GLAMOUR is an indicator set to one if stock's BM is in deciles 1, 2, or 3 (using NYSE breaks). IPO is an indicator set equal to one in the one-year period following the issue date as provided by the Securities Data Company (SDC) database. SI is the exchange- provided monthly short interest expressed in dollars using CRSP prices.[13] SISO is monthly short interest as a percent of shares outstanding (CRSP). POSTS are the number of messages posted to a stock's Yahoo Finance message board in a month. AUTHORS are the number of unique contributors to that stock's message board in a given month. POSTS and AUTHORS were collected using a proprietary web crawler program written by the author. Cash flows as a percent of assets (CF) are calculated using annual Compustat data. Cash flows are defined as operating income after depreciation (Compustat data item 178) minus accruals. Accruals are annual changes in non-cash net working capital less depreciation. Non-cash net working capital is (Compustat data item 4 − data item 1) less (Compustat data item 5 − data item 34 − data item 71) and depreciation is data item 14. CF equals cash flows scaled by total book assets (average of Compustat data item 6 at the beginning and end of the year). The indicator variable INTERNET is one if a stock appears in the portfolio of 400 Internet pure plays compiled by Ofek and Richardson (2001), zero otherwise. The indicator variable LOSER is one in any month that the stock would be a prescribed short in the Jegadeesh and Titman (1993, 2001) rolling momentum strategy (using a six-month performance window and holding period). The stock must be in the bottom decile of MOM6 in at least one of the last six months. Stocks under $5 or in the bottom NYSE decile at the beginning of each formation period are excluded.

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[13] For short interest see: www.marketdata.nasdaq.com/mr4c.html#2000, www.amextrader.com/asp/short_interest.asp, and www.nyse.com. NASDAQ and AMEX provide downloadable text files dating back to 1995. The NYSE posts a pdf file each month to their press release web page.

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