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Short-sale constraints and stock returns ☆

Charles M. Jones[a], Owen A. Lamont[b,c,*]

[a] *Graduate School of Business, Columbia University, New York, NY 10027, USA*
[b] *Graduate School of Business, University of Chicago, 1101 E 58th Street, Chicago, IL 60637, USA*
[c] *National Bureau of Economic Research, Cambridge, MA 02138, USA*

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Abstract

Stocks can be overpriced when short-sale constraints bind. We study the costs of short-selling equities from 1926 to 1933, using the publicly observable market for borrowing stock. Some stocks are sometimes expensive to short, and it appears that stocks enter the borrowing market when shorting demand is high. We find that stocks that are expensive to short or which enter the borrowing market have high valuations and low subsequent returns, consistent with the overpricing hypothesis. Size-adjusted returns are 1–2% lower per month for new entrants, and despite high costs it is profitable to short them.

JEL classification: G14

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*Corresponding author. Graduate School of Business, University of Chicago, Chicago, IL 60637, USA. Tel: +1-773-702-6414; fax: +1-773-702-0458.

E-mail addresses: cj88@columbia.edu (C.M. Jones), owen.lamont@gsb.uchicago.edu (O.A. Lamont).

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Introduction

Selling short can be expensive. In order to sell short, one must borrow the stock from a current owner, and this stock lender charges a fee to the short seller. The fee is determined by supply and demand for the stock in the stock loan market. In addition to these direct costs, there are other costs and risks associated with shorting, such as the risk that the short position will have to be involuntarily closed due to recall of the stock loan. Finally, legal and institutional constraints inhibit investors from selling short. In financial economics, these impediments and costs are collectively referred to as *short-sale constraints*.

The presence of short-sale constraints means that stocks can become overpriced. Consider a stock whose fundamental value is \$100 (i.e., \$100 would be the share price in a frictionless world). If it costs \$1 to short the stock, then arbitrageurs cannot prevent the stock from rising to \$101. If the \$1 is a holding cost that must be paid every day that the short position is held, then selling the stock short becomes a gamble that the stock falls by at least \$1 a day. In such a market, a stock could be very overpriced, yet if there is no way for arbitrageurs to earn excess returns, the market is still in some sense efficient. Fama (1991) describes an efficient market as one in which "deviations from the extreme version of the efficiency hypothesis are within information and trading costs." If frictions are large, "efficient" prices may be far from frictionless prices.

In this paper, we explore overpricing and market efficiency using new, direct evidence on the cost of shorting. Specifically, we introduce a unique data set that details shorting costs for New York Stock Exchange (NYSE) stocks from 1926 to 1933. In this period, the cost of shorting certain NYSE stocks was set in the "loan crowd," a centralized stock loan market on the floor of the NYSE. A list of loan crowd stocks and their associated loaning rates was printed daily in the *Wall Street Journal* (WSJ).

From this public record, we have collected eight years of data on an average of 90 actively traded stocks per month, by far the most extensive panel data set on the cost of shorting ever assembled. There is substantial variation in the cost of shorting, both in the cross-section and over time for individual stocks. Furthermore, new stocks periodically appear in the loan crowd, and we are able to track the behavior of these stocks both before and after they first appear on the list. Stocks appear on the list when shorting demand cannot be met by normal channels, and when stocks begin trading in the centralized borrowing market, they usually have high shorting costs. Thus the list conveys important information about shorting demand.

This paper makes two contributions. First, we characterize the cost of borrowing securities during this period, and are able to say which of the patterns observed circa 2000 are repeated in our sample, thus broadening the facts presented in D'Avolio (2001) and Geczy et al. (2001). For example, as in current markets, most large-cap stocks can be shorted fairly inexpensively, but sometimes even large-cap stocks become expensive to short. Small stocks tend to be more expensive to short, but only during the first half of the sample. We also quantify the extent to which the value effect is explainable by shorting costs. Second, and most importantly, we show that stocks that are expensive to short have low subsequent returns, consistent with the hypothesis that they are overpriced. Stocks that newly enter the borrowing market exhibit especially substantial overpricing. Prices rise prior to entering the loan list, peak immediately before a stock enters the loan list, and subsequently fall as the apparent overpricing is corrected.

By itself, this return predictability is important because it shows that transactions costs keep arbitrageurs from forcing down the prices of overvalued stocks. However, we also find that loan crowd entrants underperform by more than the costs of shorting, so it appears that shorting these stocks is a profitable strategy even after paying the associated costs. Thus not only are these stocks overpriced, they are more overpriced than can be explained by measured shorting costs alone. It must be that unwillingness to short (or some other unobserved shorting cost) is partially responsible for the low returns on stocks entering the loan crowd for the first time.

This paper is organized as follows. Section 2 describes the basic hypothesis and reviews the literature. Section 3 discusses the institutions and history of short-selling. Section 4 describes how we build the sample and shows its main characteristics. Section 5 shows that stocks that are expensive to short and stocks that enter the loan crowd for the first time have high prices and low subsequent returns. Section 6 summarizes and presents conclusions.

2. Theory and existing evidence

Short-sale constraints can prevent negative information or opinions from being expressed in stock prices, as in Miller (1977). Although shorting costs are necessary in order for mispricing to occur, they are not sufficient. Shorting costs can explain why a rational arbitrageur fails to short the overpriced security, but not why anyone buys the overpriced security. Thus two things, trading costs and some investors with downward-sloping demand curves, are necessary for substantial mispricing.

The Diamond and Verrecchia (1987) model illustrates this point. In their noisy rational expectations model, short-sale constraints impede the transmission of private information, but no stock is overpriced conditional on public information. Rational uninformed agents take the constraints into account, and prices are unbiased because there is common knowledge that negative opinion may not be reflected in order flow.

When shorting a stock, the short seller pays a fee to someone who owns shares. Thus one investor's cost is another investor's income. For example, suppose a stock is currently overpriced at \$101 and will fall to \$100 tomorrow. Suppose that in order to short one share, the short seller must pay the lender (the owner of the stock) a fee of \$1. In this example, both the owner and the short seller are breaking even. However, high shorting costs predict low subsequent returns, where returns are calculated in the traditional way (that is, ignoring income from stock lending). We call this stock "overpriced" at $101, although both the owner and the lender are at equilibrium.[1]

However, an important equilibrium condition is that not all shares can be lent out. Somebody must ultimately own the shares and not lend them, so some type of investor heterogeneity is necessary to support this equilibrium. One specific type of heterogeneity is that the owning investors are simply uninformed or irrational. For example, Lamont and Thaler (2001) examine a small number of technology IPOs that they argue are clearly overpriced, have high shorting costs, and are probably the result of errors made by investors.

To the best of our knowledge, we have assembled the first sample of shorting costs that covers a long period of time, so ours is the first paper that can look at cross-sectional return differences with any sort of power. D'Avolio (2001), Geczy et al. (2001), Mitchell et al. (2001), Ofek and Richardson (2001), and Reed (2001) all have data covering about a year or less around the year 2000.

Because most other researchers have not had direct evidence on the cost of shorting, they have instead used indirect measures of shorting costs. One measure is the existence of exchange-traded options. Options can facilitate shorting, because options can be a cheaper way of obtaining a short position and allow short-sale constrained investors to trade with other investors who have better access to shorting. Figlewski and Webb (1993) show that optionable stocks have higher short interest. Sorescu (2000) finds that in the period 1981–1995 the introduction of options for a specific stock causes its price to fall, consistent with the idea that options allow negative information to become impounded into the stock price.

2.1. Shorting demand

Instead of looking at shorting costs, an alternative approach is to look at proxies for shorting demand. If short sellers are better informed or more rational than other investors, their trades reveal mispricing. It could be that unwillingness to short, as opposed to shorting costs or inability to short, limits the ability of short sellers to drive prices down to the correct levels.

There are many potential short-sale constraints. First, institutional or cultural biases might prevent shorting. For example, Almazan et al. (2000) find that only about 30% of mutual funds are allowed to sell short, and only 2% actually do sell short. Second, for non-centralized shorting markets one must find a stock lender. This search can be costly and time-consuming. Third, as discussed in Liu and Longstaff (2000) and Mitchell et al. (2001), short sellers are required to post additional collateral if the price of the shorted stock rises. If they run out of capital, they will need to close their position at a loss. Fourth, stock loans are usually not

[1] Duffie (1996) develops a model along these lines that examines the impact of lending fees on a security's price, focusing on the US Treasury market (see also Duffie et al., 2001). His main result is that lending fees will be capitalized into a security's price. Jordan and Jordan (1997) and Krishnamurthy (2001) provide empirical evidence from the US Treasury market that is broadly consistent with these implications.

term loans, giving rise to recall risk or buy-in risk. The lender of the stock has the right to demand the return of his shares at any time. If the stock lender decides to sell his shares (or for some other reason calls in his loan) after the shares have risen in price, the short sellers are forced to close their position at a loss if they are unable to find other shares to borrow.

One measure of shorting demand is short interest, that is, the level of shares sold short. Figlewski (1981), Figlewski and Webb (1993), and Dechow et al. (2001) show that stocks with high short interest have low subsequent returns. Unfortunately, using short interest as a proxy for shorting demand is problematic, because the quantity of shorting represents the intersection of supply and demand. Demand for shorting should respond to both the cost and benefit of shorting the stock, so that stocks that are very costly to short will have low short interest. Stocks that are impossible to short have an infinite shorting cost, yet the level of short interest is zero. Lamont and Thaler (2001), for example, examine a sample of technology carve-outs that appear to be overpriced. In their sample, the apparent overpricing and the implied cost of shorting fall over time, while the level of short interest rises. Thus short interest can be negatively correlated with shorting demand, overpricing, and shorting costs. The problematic nature of short interest leads to weak empirical results. Figlewski and Webb (1993), for example, find that short interest predicts stock returns in the 1973–1979 period but not in the 1979–1983 period.

An alternative measure of shorting demand is breadth of ownership. If short-sale constraints prevent investors from shorting overpriced securities, then all they can do is avoid owning overpriced stocks. With dispersed private information or differences of opinion, overpriced stocks will tend to be owned by a few optimistic owners. Chen et al. (2001) find evidence in favor of this hypothesis.

3. Institutional and historical background

The mechanics and institutional details of short sales in US equity markets have changed little in the past century. Unlike the Treasury market and the derivatives markets, the equity shorting market has actually regressed in some respects. In this section, we describe the process of selling short, comparing the evidence circa 2000 and the evidence from our sample period of 1926–1933.

3.1. The market for borrowing stock

Borrowing shares in order to sell short can be complex. If the investor's broker has other margin accounts that are long the stock (or owns the stock himself), the broker accomplishes the loan via internal bookkeeping. Otherwise, the investor's broker needs to find an institution or individual willing to lend the shares. Circa 2000, brokers, mutual funds, and other institutions do much of this lending. Circa 2000, it can be difficult or impossible to find a willing lender for some equities, especially illiquid small-cap stocks with low institutional ownership.

Suppose A lends shares to B and B sells short the stock. When the sale is made, the short sale proceeds do not go to B but rather to A. The actual term of the loan is one day, though the loans can be renewed in subsequent days. Because A is effectively using collateral to borrow, A must pay interest to B. When the loan is closed, A repays cash to B and B returns the shares to A. Although sometimes various terms of this transaction (such as the amount of collateral provided) are negotiated between the two parties, in most cases the interest rate received by B is the only important variable. This one-day rate, called the "loan rate" or "loaning rate" during our sample and the "rebate rate" now, serves to equilibrate supply and demand in the stock lending market. The rate can be different across stocks and changes from day to day. Stock lending between institutions is economically almost identical to the securitized borrowing and lending that takes place in the fixed income market via repurchase agreements or "repos." The repo rate corresponds to the rebate rate as the variable that equilibrates supply and demand in the borrowing market.

Stocks that are cheap to borrow have a high rebate rate. Circa 2000, most large cap stocks are both cheap to borrow (the rebate rate is high) and easy to borrow (one can find a stock lender). D'Avolio (2001) and Reed (2001) report that most stocks in their sample are cheap to borrow, and they trade at the general collateral rate, a rate that tracks overnight Fed Funds and other very short-term rates quite closely.

Stocks that are expensive to borrow have a low or possibly negative rebate rate. In modern lingo, stocks with low or negative rebates are "hot" or "on special." A negative rate means that the institution that borrows shares must make a daily payment to the lender for the right to borrow (instead of receiving interest on the cash collateral posted with the lender). In our sample, rebate rates of zero are called "flat" and negative rebate rates are "premiums."

Finally, this discussion applies mainly to institutions. Individuals who short (through their brokers) typically receive a rebate rate of zero, both in modern times and in the 1920s (Huebner, 1922, p. 169), with the broker keeping any rebate (unless the stock is loaning at a premium, in which case the individual pays). Further, individual investors who hold stocks in margin accounts typically do not receive any benefit when their stock is lent out either circa 2000 or in our sample (Meeker, 1932, p. 91). In this paper we treat returns from the perspective of a broker trading for himself.

In modern data, short-selling is relatively rare and the amount of shares sold short is small. Our sample is similar. Meeker (1932) reports that total short interest as a percent of total NYSE shares outstanding was less than 1%, 1929–1931, and on November 12, 1929 short interest was 0.15% of all shares and 0.12% of market-capitalization. Similarly, Figlewski and Webb (1993) report average short interest as a percent of shares outstanding of 0.2% for the 1973–1983 period. As of January 1, 1929, Meeker (1932) reports out of 1,287 NYSE stocks, with an average market equity of $55 million, only 33 had short interest greater than $0.5 million. Similarly, Dechow et al. (2001) report that between 1976 and 1993, less than 2% of all stocks have short interest of greater than 5%.

3.2. The loan crowd

In our sample period of 1926–1933, stock lending was done for some stocks through a centralized market on the floor of the NYSE. A loan crowd met regularly throughout the trading day on the NYSE floor at the "loan post" in order to facilitate borrowing and lending of shares between members. This market was most active just after the 3:00 p.m. close, as brokers assessed their net borrowing needs at the end of the day's trading. The result of this centralized lending market was a market-clearing overnight loan rate on each security, which was reported in the next day's WSJ.

Table 1 shows two days of stock loan rates, for the last trading day of January 1926 and February 1926. Consider first the data for January. Many of the included stocks, e.g., U.S. Steel, are the largest and most liquid stocks of the time. Next to each stock is printed the loan rate. The example displays the typical features of the

Table 1
Stock loan rates, January and February 1926

	Jan 26	Feb 26		Jan 26	Feb 26
AMERICAN BRAKE SHOE		−54	GENERAL MOTORS CORP	3.5	4
AMERICAN BROWN BOVERI		0	GIMBEL BROS INC		0
AMERICAN CAN CO	4.5	5	JONES BROTHERS TEA CO		0
AMERICAN SMLT & REFNG	4.5	5	JORDAN MTR CAR INC		0
AMERICAN SUGAR REFNG	0	0	LEHIGH VALLEY RR CO	3.5	4
AMERICAN TOB CO		0	MISSOURI PAC RR CO	3.5	4
AMERICAN WOOLEN CO	0	0	NATIONAL CLOAK & SUIT		0
ANACONDA COPPER MNG	4.5	0	NATIONAL LEAD CO	0	0
ARMOUR & CO		0	NEW YORK CENT RR CO	3.5	4
ATCHISON TOPEKA & SANTA FE	3.5	4	NY NH & HARTFORD RR	3.5	4
BALDWIN LOCOMOTIVE	3.5	4	NORTHERN PACIFIC RY	3.5	4
BALTIMORE & OHIO RR CO	3.5	4	PAN AMERICAN PETROL	3.5	4
BETHLEHEM STEEL CORP	3.5	4	PENNSYLVANIA RR	0	0
BROOKLYN MANHATTAN TRAN	3.5	4	READING COMPANY	3.5	4
CHESAPEAKE & OHIO RY	3.5	4	SAVAGE ARMS CORP		−26
CHICAGO & EASTN ILL RY		−67	SIMMONS COMPANY		0
CHICAGO MILW & ST PAUL	3.5	4	SOUTHERN PACIFIC CO	3.5	4
CHICAGO ROCK IS & PAC	3.5	4	SOUTHERN RAILWAY CO	3.5	4
CHRYSLER CORP	4.5	5	STANDARD OIL CO CALIF		0
COCA COLA CO	3.5	4	STUDEBAKER CORP NJ	4.5	5
CONTINENTAL CAN INC	3.5	4	UNION PACIFIC RR	3.5	4
CRUCIBLE STL CO AMER	0	2	UNITED DRUG CO		0
CUBA CANE SUGAR CORP		0	UNITED FRUIT CO	0	0
CUYAMEL FRUIT CO		0	UNITED STATES STEEL	4.5	5
DAVISON CHEM CO	4.5	5	U S INDL ALCOHOL	3.5	4
DELAWARE & HUDSON CO	0	0	UNITED STS RUBR CO	4.5	5
DEVOE & RAYNOLDS CO		0	VIRGINIA CAROLINA		−14
ERIE RR CO	3.5	4	WEBER & HEILBRONER	0	0
FAMOUS PLAYERS LASKY	3.5	4	WESTERN UN TELEG CO	0	0
FOUNDATION CO		0			

data. Most stocks have a loan rate of 3.5% or 4.5%, while a handful have rates of zero. For comparison, the call-money rate at this time was 5%, so most stocks are being lent slightly below the call-money rate.[2] The data for January shows no stocks trading at a premium (a negative rebate) and a large mass of stocks at a rate of exactly zero, an unlikely event if rates were continuously distributed in response to supply and demand.

This centralized market for borrowing NYSE stocks no longer exists. Instead, circa 2000 stock lending is done via individual deals struck between institutions and brokers. This lack of a central market is why existing studies of the cost of shorting have only limited historical data from proprietary sources. In this sense, the shorting market has regressed since our sample period, since rebate rates are no longer centrally determined and publicly observable.

On balance, however, except for regulation, the fact that the stock lending market is no longer centralized does not necessarily mean that shorting is more difficult or expensive today than in the 1920s. Most NYSE stocks did not trade in the loan crowd. Table 1 lists 59 stocks for February 1926, while CRSP lists 518 NYSE stocks for the same date, so only 11% of existing stocks got into our sample in that month. Further, of these 59 stocks probably most borrowing never went through the loan crowd but rather occurred internally within brokers.

3.3. The sources of cross-sectional variation in rebate rates

Rebate rates reflect supply and demand of shares to lend. Stocks go on special when shorting demand is large relative to the supply of shares available for lending. Thus, specific stocks can be costly to short either because there is a large demand or a small supply. No matter what the reason for the high shorting costs, however, the consequences of the costs are clear. Stocks that are expensive to short can be overpriced since it is expensive to correct the overpricing. Thus, we do not need to identify the reason for the low rebate rate in order to test whether it results in overpricing.

Demand for borrowing stock can be high, most obviously, because the stock is overpriced. This speculative demand for shorting is the motivation for studies that try to predict stock returns with short interest. In addition, investors also short for hedging needs. Accounts from our sample period describe the familiar arbitrage activity of buying one security and shorting another, with trades involving preferred stock, convertible bonds, rights issues, and so on. Unlike modern sample periods with exchange-traded derivatives, shorting individual stocks appears to have been the main way for investors to hedge market risk. In our sample, shorting was also an important tool for technical purposes such as hedging dealer inventories, the

[2] Both call-money and loan rates are closing prices as of the last day of the month. However, there is a slight mismatch in our observations of call loan rates since they are only available on weekdays. In contrast, the NYSE was open on Saturday during this period. The January 1926 observations on loan rates (as well as CRSP prices) come from Saturday, January 30, 1926, whereas the call-money rate comes from Friday, January 29.

operations of odd-lot traders and specialists, and selling shares of owners whose share certificates were physically distant from the NYSE.

Stocks can also be costly to short if their lendable supply is low. In general, small and illiquid stocks are difficult to short for the same reason that they are difficult to buy: it is hard to find trading partners. More specifically, both circa 2000 and in our sample period, loanable supply consists of shares owned by financial institutions (such as mutual funds) and shares held by retail investors in margin accounts at stockbrokers. Accounts of the process circa 2000 stress institutional ownership as the determining factor (D'Avolio, 2001). Accounts in our sample stress the importance of stocks held by brokers and individuals buying on margin. Supply varied across stocks and across time for the same stocks as the amount held in margin accounts varied.

In understanding the determinants of the rebate, it is useful to examine an extreme outlier in our sample. Wheeling & Lake Erie Railroad on the last trading day of January 1927 had a rebate rate of −290%, representing a daily fee of fifty cents per share for maintaining a short position on a stock trading at $62.125. At this time most stocks were lent at (and the call-money rate was) 4%, so to borrow this stock one had to sacrifice a 294% annualized return. At one point during February 1927 this daily fee rose to an amazing $7 per day.

The premium arose in January and February 1927 because of a confluence of factors described in Meeker (1932). First, in January there was substantial speculation that Wheeling would be acquired. As it turns out, this speculation was correct. Three other firms together bought shares and acquired a 50% stake in Wheeling, and the price rose in January from $27 to $60. As these firms bought common shares, the amount of Wheeling common stock available for lending fell. In addition, Wheeling had preferred shares convertible into common stock. Unfortunately, Wheeling had failed to obtain the necessary regulatory authorization from the NYSE and the Interstate Commerce Commission to issue additional common stock. Thus when holders of preferred shares attempted to convert their shares, their attempt was refused. Had these preferred shares been converted, the supply of common would have risen.

In addition to low lendable supply, shorting demand for Wheeling during this period was probably high. There was both takeover speculation and arbitrageurs who were long Wheeling convertible preferred and short the common. During the period January 27 to February 9, Wheeling common stock had extremely volatile prices, low volume, and high shorting costs, all driven by extensive shorting demand intersected with the very low supply of lendable shares. On February 9th, for example, the common stock price ranged from 105 to 66.75. Thus, it is plausible that arbitrageurs would be willing to pay high holding costs to guard themselves against the extreme volatility in Wheeling. Last, it is worth noting that the extraordinary cost of shorting only lasted two weeks.

3.4. Additions to the list as a indicator of shorting demand

We show later that new entrants tend to enter at high shorting cost, but Table 1 demonstrates the general pattern. Table 1 shows that in February 1926, the list grows substantially as more stocks are added. Unlike the old stocks, which continue to have loan rates in much the same pattern as January, these 17 new stocks all have loan rates that are zero or negative (we do not classify United Drug as new since it had been in the loan rate list prior to January). The rates are expressed in annual percent terms. Some of the premium rates are extremely high. For example, Chicago and Eastern Illinois Railway loaned at a premium of one-sixteenth, which means that a borrower would pay the lender one-sixteenth of a dollar per share per day (an annual rate of −67%).

Why did Chicago and Eastern Illinois get added to the list, and why does it have such an outlandish cost of shorting? It must be that (compared to January), in February either the supply of lendable shares fell or the demand for lendable shares rose. According to the WSJ on March 1, 1926: “Ask any broker who makes it a practice to lend stocks to the shorts and he will tell you the demand is heavier than it has been in months.” It appears that for some reason, shorting demand for Chicago and Eastern Illinois, along with the other 16 stocks, increased in February. This increase in shorting demand drove the stocks into the loan crowd.

Ultimately, however, it does not matter whether a stock is added to the list because of changes in supply or demand. In either case, the inclusion on the list indicates that there exists substantial demand for borrowing the stock to short it. Contemporary accounts indicate that brokers preferred not to go to the loan crowd if possible. Leffler (1951) describes (p. 283) the algorithm for borrowing stock. First the broker himself might own it. If not, his customers might own it in a margin account. If not, other friendly brokers might own it and he would contact them directly. Only after these avenues are exhausted would a broker go to the loan crowd. Meeker (1932, p. 94) says that brokers prefer to settle in house if possible since it saves bookkeeping work and because the broker retains the benefits of lending without sharing it with another broker.

In our empirical work, we focus on new entrants to the loan rate list like the 17 stocks added at the end of February 1926. Most loan crowd entrants loan below the general collateral rate. Other stocks loan below the general collateral rate in our sample. However, the fact that a stock has a high shorting cost may not indicate high shorting demand. Dice (1926) comments on three of the stocks in Table 1: “That a stock is quoted flat may or may not mean that there is a large short interest in the stock. Delaware & Hudson, United Fruit, and Western Union have lent flat for some years. They are not regularly loaned at any other rate than on a flat basis, that is, the lender refuses to pay interest to the borrower for the money deposited.” Unfortunately, Dice offers no clues as to why these three stocks lend flat for long periods of time.

Thus, a stock’s first appearance on the loan list is perhaps the best indication that shorting demand is high, so high relative to supply that it cannot be met by internal bookkeeping by brokers. This measure of shorting demand is superior to short interest because high short interest can indicate high demand or high supply. For example, U.S. Steel always had relatively high short interest in this period, but this was because it was easy to short and consequently was typically used for hedging purposes (in the way modern investors would use S&P futures).

4. The sample

We start by collecting loan rates by hand from the WSJ from December 1919 to October 1933. The Journal publishes loan rates on a daily basis; however, since CRSP only has monthly data for this period, we collect only loan rates for the last trading day of the month. CRSP returns begin in January 1926. Thus although we have loan rate data for the pre-CRSP period of 1919–1925, we do not use this data in our analysis because we do not have prices and returns for this period. For the period 1926–1933, we obtain stock prices, returns, dividends, and market equity from CRSP. We also obtain book values from an updated version of the Davis et al. (2000) database.[3]

4.1. Developments in the shorting market in the 1920s and 1930s

Our sample period of 1926–1933 was an eventful time for the U.S. stock market, as the nominal level of stock prices first doubled and then dropped to one-third of the original level. During our sample a major regime shift in the stock loan market occurred in October 1930. Fig. 1 demonstrates this regime shift, showing that except for March 1933, no stock had a positive rebate after October 1930. The figure shows

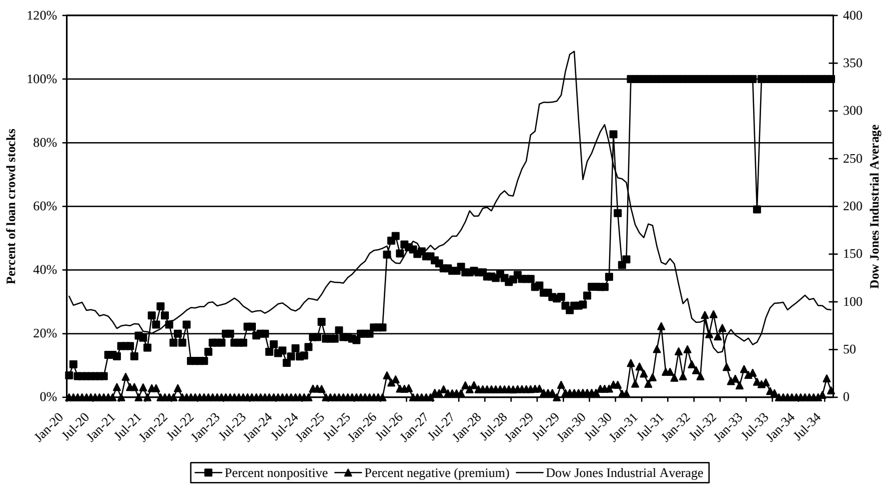

Fig. 1. Stock prices and the distribution of loan rates, 1920–1934. The fraction of loan crowd stocks that have nonpositive or premium loan rates and the level of the Dow Jones Industrial Average. The loan rate variables are end of month; the Dow variable is the monthly average of daily levels.

[3] Book values for stocks with fiscal years ending in year N are assigned to year $N+1$ (we also drop negative book values). Thus book value is at least one month stale; book value for year N is first reflected in market-book in January of year $N+1$.

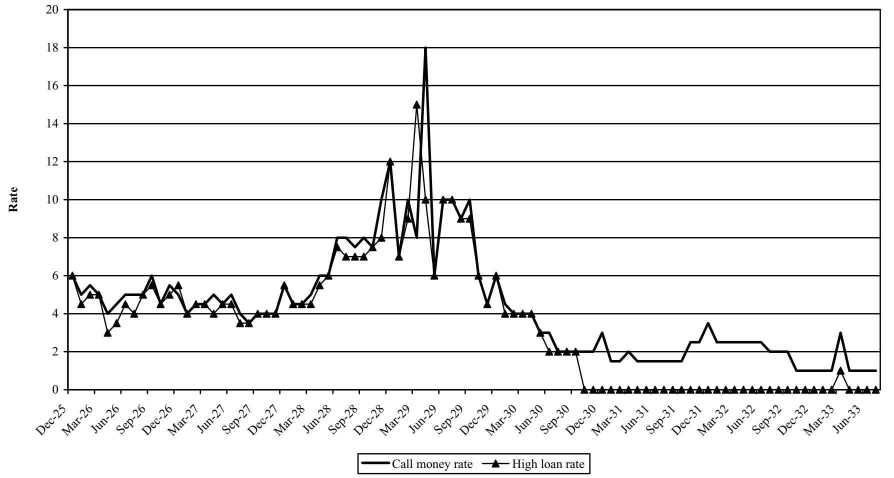

Fig. 2. Call-money rates and loan rates, 1925–1933. Call-money rate and loan rates in percent as of the last trading day of the month. The stock loan rate is the highest loan rate observed.

the fraction of stocks with nonpositive (zero or premium) rates and the fraction with premium rates. For comparison we show the level of the Dow Jones Industrial Average (DJIA).

Fig. 2 shows month-end call-money rates, the highest stock loan rate in the cross-section for a given month, and the DJIA. Call-money and loan rates track each other closely until the regime shift in October 1930, after which loan rates permanently drop well below call-money rates. Fig. 3 shows the growth in our sample over time,

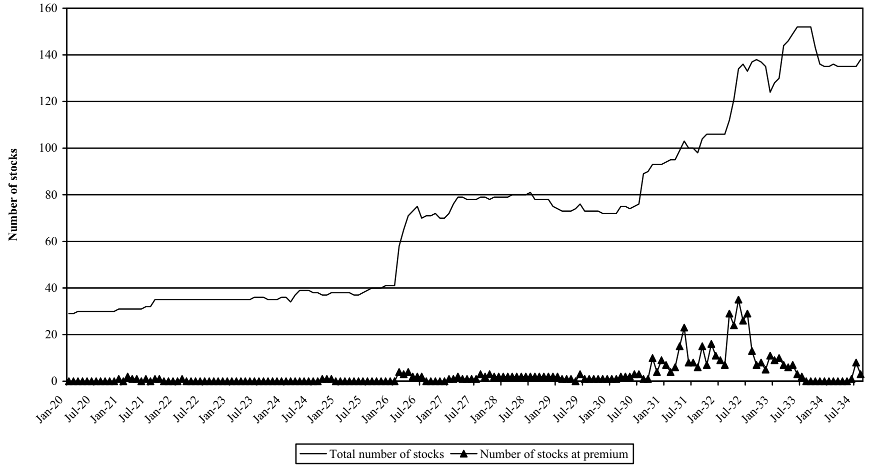

Fig. 3. Number of loan crowd stocks and number of premium stocks, 1920–1934. Total number of stocks is the number of stocks listed in the month-end list of loan rates in the WSJ. Number of premium stocks is the number of loan rates that are below zero.

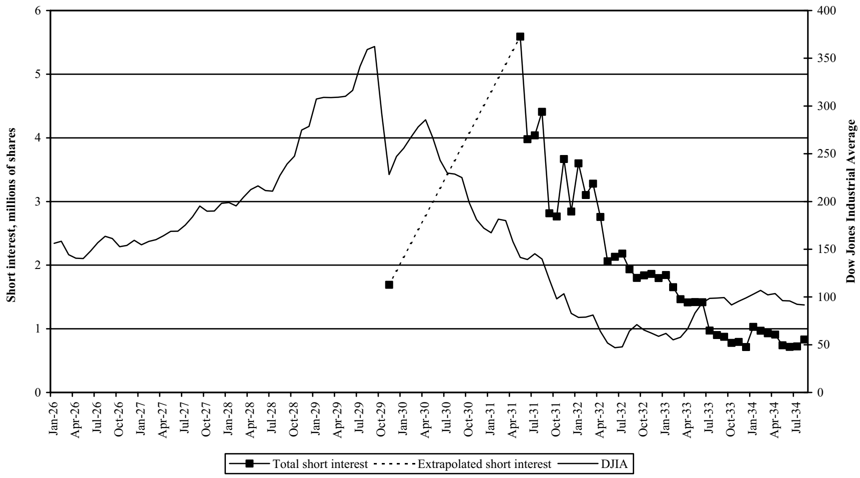

Fig. 4. Aggregate short interest and stock prices, 1926–1934. Stock prices are measures by the monthly average of daily levels of the Dow Jones Industrial Average. Total short interest is measured in millions of shares, and is shown for November 12, 1929, and then monthly starting in May 1931.

and again shows the increased incidence of negative loan rates after 1930. Fig. 4 shows the DJIA and aggregate short interest measured in millions of shares. The NYSE collected short interest for the one day of November 12, 1929, and then collected data regularly starting in May 1931. Opponents of short-selling during this period often pointed to the evidence in Fig. 4 to claim that short-selling caused the market to decline, or at least did not appear to cushion market fluctuations.

Fig. 5 shows the value-weighted cost of shorting the portfolio of all loan crowd stocks, and compares it to short interest for loan crowd stocks, obtained from Macaulay and Durand (1951) and Meeker (1932). Here, short interest is measured as total short interest for the group divided by the total shares outstanding for the group. The variable COST, used in our empirical work examining monthly returns, is the percent monthly holding cost of shorting the stock or alternatively the monthly benefit of owning the stock and lending it out. It is calculated by subtracting the end-of-month rebate rate from the call-money rate and dividing by twelve, and assumes that this rate difference remains constant over the next month. Thus if R is the traditionally calculated monthly return using prices and dividends, R + COST is the return from owning and lending, and $-R-$ COST is the return from shorting.

The evidence in Fig. 5 reflects movements in both supply of and demand for borrowed shares. The major movements are consistent with shifts in demand. Shorting quantity and cost are both low in 1929, both high in 1931–1932, and both low again thereafter. This pattern looks like it is tracing out the supply curve for borrowed stock. However, an identifiable temporary supply shock took place in March 1932. In February 1932 the NYSE announced that as of April 1, 1932 brokers would require written permission from customers before lending stocks on margin (Hoffman, 1935). The effects of this regulation can be seen in Fig. 5 with the huge

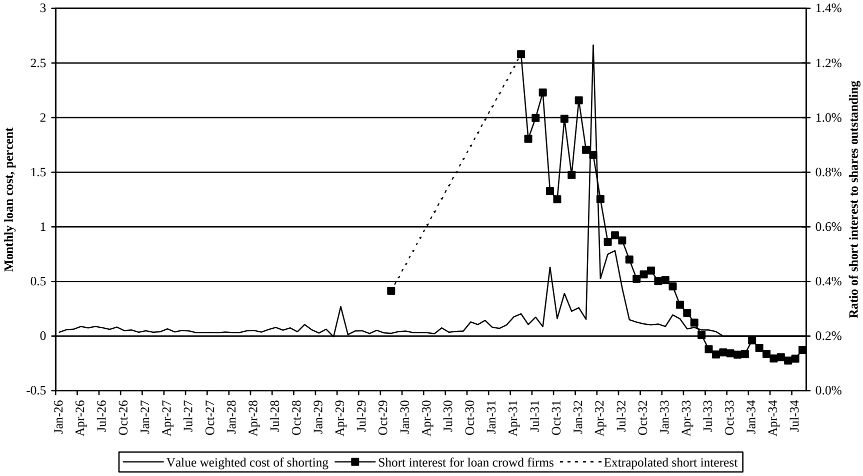

Fig. 5. Short interest and loan costs for loan-crowd stocks, 1926–1934. Short interest for (a subset of) loan crowd stocks is measured as total short interest for the group divided by the total shares outstanding for the group. It is shown for November 12, 1929, and then monthly starting in May 1931. Cost is the percent monthly holding cost of shorting the stock, and is value-weighted over the portfolio of all loan crowd stocks.

spike in loan rates as of the last trading day of March 1932 and the subsequent decline in short interest.

Figs. 1–5 do not support the notion that high shorting costs allowed the overall market to become overpriced prior to the crash of 1929. To the contrary, the fraction of stocks loaning at nonpositive rates steadily declined between 1926 and 1929. Instead, unwillingness to short (as opposed to the cost of shorting) could have played a role. Unfortunately, although we have better price data on stock lending in our sample than in modern samples, we have worse quantity data prior to May 1931. Anecdotal evidence indicates that the volume and amount outstanding of short-selling declined during the 1920s. In a description similar to Shleifer and Vishny (1997), Meeker (1932) reports that short sellers had lost money as prices rose in 1928 and 1929, so that prior to the crash "few had the hardihood to sell short" and so "the panic of 1929 descended on an inadequate short interest."

4.2. *The regime shift in october 1930 and the end of the loan list*

The regime shift in October 1930 was dramatic. Suddenly, *no* stock lent at a positive rate. Barron's (10/20/30) described the "virtually unprecedented spectacle" when U.S. Steel loaned at a premium "for the first time in the recollection of the present generation" in October 1930 as "one of the most excited sessions ever witnessed" at the loan crowd. As can be seen in Fig. 2, this regime shift was not caused by a decline in call-money rates, which had been constant at 2% for the previous three months. Hoffman (1935) blames the regime shift on increased demand for shorting and decreased supply of loanable stocks because "the floating supply of stock had also declined, due to the large amount of outright buying" (i.e., fewer shares were owned in margin accounts).

The shift may have been a response to anti-shorting pressure from the U.S. government and from popular opinion. Governments often restrict short-selling in an attempt to maintain high security prices. Meeker (1932) reviews the attempts by a colorful cast of characters (from Napoleon to the New York state legislature) to ban short-selling. Short-selling restrictions historically follow major price declines as short sellers are blamed.

Consistent with the historical pattern, the stock loan market after 1929 was affected by political events. Short sellers were extremely unpopular in 1930, and many politicians, journalists, and investors blamed them for the stock market crash. Press accounts in October 1930 report on rumors that officials of the NYSE were quietly discouraging stock lending "in order to discourage excessive short-selling," (*Commercial and Financial Chronicle*, 10/18/30) and that the lenders themselves (such as investment trusts) "do not wish to do anything which would encourage short-selling" (*Barron's*, 10/20/30). This unwillingness to lend (which seems irrational in competitive markets) could be justified by fears of legal persecution in a hysterical political environment.

It is clear that the anti-shorting climate was hysterical in October 1930. President Herbert Hoover met with the president of the NYSE to discuss the situation and curtailing possible bear raids implemented via short-selling. The FBI's J. Edgar Hoover was quoted as saying he would investigate the conspiracy to keep stock prices low. Scroggs (1930) reports in October 1930 that the Secretary of Agriculture denounced the short-selling of wheat futures by agents of the Soviet government (the Soviets were engaged in uncharacteristically sensible hedging operations). Numerous anti-shorting regulations stem from this period, such as the uptick rule and the Investment Company Act of 1940 which placed severe restrictions on the ability of mutual funds to short (see Macey et al. 1989).

We end our sample in July 1933 since there is little cross-sectional variation in loaning rates after that date. In August 1933, the loan rate list is all zeros. Fig. 1 shows this uniformity continued for many months (until June 1934) and Fig. 2 shows the number of stocks listed started to decrease. The Journal stopped printing the loan rate list in October 1934.

Perhaps due to anti-shorting pressure or a general decrease in speculative activity, shorting activity declined over time. As can be seen in Figs. 4 and 5, short interest was extremely low in 1933 and thereafter. Hoffman (1935) provides as explanations the Senate investigations of April 1932, closer supervision by the exchange, higher premiums, and a "dwindling supply of loanable stocks." The loanable supply would dwindle if buy-and-hold investors replaced leveraged margin investors, which undoubtedly occurred in the aftermath of the 1929 crash.

The apparent withering of the ability to short during this period is important because it helps answer the question posed by Shleifer (2000): "Why do the mechanisms of borrowing securities and selling them short appear so under-developed?" (p. 195). Political and legal anti-shorting pressure, which arises periodically after major market declines, seems essential to understanding the nature of the market for shorting.

4.3. Properties of loan rates

Table 2 shows the distribution of loan rate status in the sample and the characteristics of stocks by loan status. We have a total of 8,310 monthly observations during the 92 month period from December 1925 to July 1933. We have 211 stocks, of which 167 were added to the list after December 1925. Each month we rank all stocks by shorting cost, and create COSTRANK, a variable from zero to one reflecting the percentile rank of COST within loan crowd stocks that month. Table 2 shows the characteristics for the top and bottom-half sorted by COST, and also for premium stocks, stocks with loan rates of exactly zero, and stocks with positive loan rates.[4]

For the whole sample of 1926–1933, premium stocks are rare, comprising 6% of the sample. Stocks with a nonpositive loan rate are 68% of the sample, rising over time as reflected in Fig. 1. Compared with modern data, it appears that nonpositive loan rates are more common in the 1920s. For example, Reed (2001) finds only about 6% of stock loans are on "special" or have loan rates below the general collateral rate during 1998–1999, and only a few of these have zero or negative rebates.

Although premiums are rare, when they do occur they can be very large. We have 487 observations of premiums for 109 different stocks. Of these, the median annualized rate is −12%, the mean is −30%, and the minimum is −782%. These extreme premiums are somewhat higher than observed in modern data. D'Avolio (2001) reports a maximum difference between the rebate and general collateral rate of 82% per year, and Reed (2001) reports 45%.

The average shorting cost in our sample is 35 basis points per month. This average cost is much higher than that reported in modern data, which D'Avolio (2001) reports is 41 basis points *per year* (equal-weighted for all stocks in his database). Even restricting the sample to positive loan rate stocks (which drops all but one month of the 1930–1933 sample), the average cost is 12 basis points monthly or 144 basis points annually.

4.4. Loan status and other characteristics

Table 2 also shows the log market equity, log market-book ratios, dividend yields, and past returns by loan rate status. First, it shows that loan crowd stocks are more than twice as big as other stocks. Looking within loan crowd stocks, Table 2 shows that high cost stocks are much smaller than low cost stocks and also tend to have lower market-book ratios (a fact that is not surprising given that market-book and market value of equity are positively correlated).

[4] The reason that the fraction of stocks in the top and bottom halves is not exactly 50 is the frequency of ties. In the 1930–1933 sample, the maximum loan rate is a rate of exactly zero, so that 89% of the sample with a zero loan rate is the bottom-half of the cost distribution (except for one month).

Table 2

Stock loan rates, 1925–1933

Properties of loan rates for 8,310 monthly observations. COST is the monthly percent cost of shorting, defined as the call-money rate minus the loan rate, divided by 12. ME is market value of equity. M/B is market-to-book. D/P is the dividend yield, defined as total dividend per share payments over the last 12 months divided by the current price (adjusted for splits). $R_{t-1,t-12}$ is total stock return from month t-12 to month t–1, in percent. The sample runs from December 1925 to July 1933. The 1925–1930 sample is December 1925 to September 1930. The 1930–1933 sample is October 1930 to July 1933. COSTRANK is the percentile of the cost among loan crowd stocks in that month. SIZERANK is the percentile of market equity among all CRSP stocks in that month. MBRANK is the percentile of M/B among all CRSP stocks in that month. RETURNRANK is the percentile of $R_{t-1,t-12}$ among all CRSP stocks in that month.

Panel A. Summary statistics

	1925–1930	1930–1933	1925–1933					
	Fraction	Fraction	Fraction	COST	ln(ME)	Ln(M/B)	D/P	$R_{t-1,t-12}$
All loan crowd stocks				0.35	10.89	−0.31	5.57	0.77
Top-half ranked on cost	0.47	0.12	0.30	0.87	10.33	−0.19	4.41	2.26
Bottom-half ranked on cost	0.53	0.88	0.70	0.12	11.13	−0.36	6.02	0.21
By loaning rate								
Positive	0.61	0.01	0.32	0.12	11.87	0.15	4.23	19.10
Zero (flat)	0.37	0.89	0.62	0.24	10.38	−0.55	5.99	−5.82
Negative (premium)	0.02	0.10	0.06	2.69	10.89	−0.52	7.76	−18.22
Stocks not in loan crowd					9.10	−0.48	4.89	−0.44
Only months in which stocks are added to loan crowd list:								
Stocks appearing for the first time				1.91	10.56	0.01	6.88	−8.58
All other loan crowd stocks				0.35	10.75	−0.53	6.26	−14.17

Panel B. Correlations with COSTRANK

	SIZERANK	MBRANK	RETURNRANK
1925–1933	−0.37	−0.06	−0.04
1925–1930	−0.55	−0.14	−0.12
1930–1933	0.08	0.05	0.09

The patterns in Panel A of Table 2 confirm some pieces and contradict other pieces of evidence from modern studies using very short sample periods from one data provider. Geczy et al. (2001) and D'Avolio (2001) find that stocks with high shorting costs have higher market-book, contradicting Panel A of Table 2. Geczy et al. also find that stocks with high shorting costs are not smaller than other stocks, although D'Avolio finds the opposite. D'Avolio finds that stocks with high shorting costs have low past returns, unlike Panel A of Table 2.

Panel B offers an explanation for these contradictions, showing that the correlations of shorting cost and other characteristics are not constant over time. Every correlation switches sign between 1926–1930 and 1930–1933. Most strikingly, the strong negative correlation between size and shorting cost that is apparent in the earlier part of the sample disappears later on. These differences highlight the limitations of existing evidence on shorting costs. The characteristics related to shorting costs change over time, so short samples have limited applicability. However, it may be that the 1930–1933 period is relatively unusual in U.S. financial history, in that bigger stocks were actually more expensive to short. And of course, like Geczy et al. (2001) and D'Avolio (2001), our sample does not include stocks for which there is simply no shorting.

4.5. How do stocks get on the list and why do they stay on?

We have no definitive evidence on why stocks are added or removed from the list. Table 3 shows transition probabilities. Loan status is highly persistent. In the 1926–1930 period when positive loan rates were plentiful, stocks with a positive loan rate this month had a 95% chance of having a positive rate next month. Especially persistent is having an exactly zero loan rate: over the two different regimes, a stock that had always been at zero had a 94–96% chance of having another zero loan rate in the next month. Stocks are rarely removed from the list. Premium stocks are more likely to be removed (at 5% likelihood over the whole sample), but in general the probability of removal is 1%.

Table 1 shows that new stocks enter at zero or a premium in February 1926. Table 3 shows that this pattern is systematic. Between 1925:12 and 1933:7, 167 stocks enter our list for the first time. We classify a stock as entering the list if it had not previously been listed anytime since December 1919 (using month end observations). Of these new entrants, 33% are at a premium compared with 6% for the whole sample. Table 2 shows the characteristics of these new entrants in their first month on the loan list and compares their characteristics to incumbent stocks on the same date. New entrants are significantly different from incumbent stocks; they are slightly smaller, have market-book ratios that are much higher, and have returns that are more than 5% higher in the past year. Looking at shorting costs, new entrants have costs that are more than five times higher per month. New entrants do not tend to be recent IPOs, instead they have been in CRSP an average of 45 months before appearing in the loan rate list.

Additions come in four waves, usually occurring on a single day. As seen in Fig. 3, all these waves come after the CRSP era starting in December 1925, so fortunately

Table 3

Loan rate status transition probabilities

For stocks that have reported loaning rates in either month $t-1$ or month t. The "Ever positive" and "always zero" columns are for stocks with at least six previous observations and use data going back to 1919:12. The sample runs from December 1925 to July 1933. The 1925–1930 sample is December 1925 to September 1930. The 1930–1933 sample is October 1930 to July 1933.

	Loan rate in previous month				In all previous months	
	Positive	Zero	Premium	Not in loan crowd	Ever positive	Always zero
1925–1933						
N	2,678	5,145	487	167	5,352	1,089
Positive	0.93	0.02	0.00	0.22	0.46	0.03
Zero	0.06	0.94	0.38	0.46	0.49	0.95
Premium	0.00	0.03	0.57	0.33	0.04	0.01
Not in loan crowd	0.01	0.01	0.05	0.00	0.01	0.02
1925–1930						
N	2,619	1,595	91	85	2,910	652
Positive	0.95	0.03	0.00	0.42	0.83	0.04
Zero	0.04	0.94	0.13	0.44	0.15	0.94
Premium	0.00	0.01	0.81	0.14	0.01	0.00
Not in loan crowd	0.01	0.02	0.05	0.00	0.01	0.02
1930–1933						
N	59	3,550	396	82	2,442	437
Positive	0.00	0.02	0.00	0.00	0.01	0.02
Zero	1.00	0.94	0.44	0.48	0.90	0.96
Premium	0.00	0.04	0.51	0.52	0.08	0.01
Not in loan crowd	0.00	0.01	0.05	0.00	0.01	0.01

there is no need to gather pre-CRSP data to study new entrants. The first wave, already discussed, is in February 1926, when 17 stocks appear for the first time in the March 1, 1926 WSJ. Sixteen more stocks enter the loan rate list over the next four months. The second wave occurs in August 1930 with 33 new stocks appearing for the first time in the August 25 1930 WSJ. The third wave comes in between March and May 1932 with 27 stocks entering on various days. The fourth wave occurs in March 1933 with 12 stocks first appearing in the March 20 WSJ.

The fact that many stocks enter on a single date suggests that factors idiosyncratic to the stock are not responsible. We do not know if these factors involve rising demand for borrowed stock or falling supply. What is clear, however, is that there was particularly high shorting demand for these specific stocks relative to other stocks, since these specific stocks were the ones added to the loan rate list.

One regularity is that stocks are seldom removed from the list, even when it appears there is little shorting activity in the stock. An example is a firm called Real Silk Hosiery. It entered the list along with four other stocks in February 1927. It enters at a zero rate, and remains at a zero rate until it leaves the list in December

1932. In June and July of 1931, the NYSE reported zero short interest outstanding for Real Silk Hosiery, yet its rate stayed constant at zero. Our suspicion is that zero rate stocks just stay on the list at a zero rate if there are no transactions.

5. Scaled prices and subsequent returns

In this section we examine both scaled prices and subsequent returns. We start by examining scaled prices to see if they rise before a stock becomes expensive to short or enters the loan list, and fall thereafter, consistent with the overpricing hypothesis. We then examine return predictability based on loan rate status. As predicted by the hypothesis that expensive to short are more likely to be overpriced, subsequent returns are lower for stocks with lower loan rates. Subsequent returns are especially low for new entrants to the loan rate list.

5.1. Pattern of market-book ratios

Table 4 examines monthly market-book ratios for loan crowd stocks. Column (1) regresses the log market-book ratio on COSTRANK, the percentile ranking of shorting COST. COSTRANK is zero for the cheapest-to-borrow stocks and one for the costliest-to-borrow stocks. Here as elsewhere in this paper, the regressions include date dummies (a different intercept term for each calendar date) and the standard errors have been adjusted for the clustering of observations by date.

Table 4's column (1) shows that contrary to the overpricing hypothesis, expensive-to-short stocks do not look overpriced. The lowest cost stock has a log market-book ratio that is 35% lower than the highest cost stock. However, as shown in Table 2, size is a potentially confounding factor in these regressions, since smaller stocks are harder to short and also tend to have lower market-book. Column (2) adds NEWQ1, a dummy variable equal to one in the first quarter of a stock's appearance on the loan list (that is, NEWQ1 is one in month t if the firm's first month on the list is month $t-2$ to month t). Consistent with the hypothesis that new entrants are overpriced and have high shorting demand, new entrants have log market-book ratios that are 56% higher than incumbents, controlling for shorting cost.

Table 4's column (3) accounts for size by putting log market equity on the right-hand side of the regression. Controlling for size, the highest cost stock has a log market-book ratio that is 32% higher than the lowest cost stock, consistent with the overpricing hypothesis. This result highlights the importance of controlling for size in drawing conclusions about overpricing. Unaffected by size corrections, however, is the strong effect for newly lent stocks. Again, new entrants have particularly high valuations.

Columns (4)–(6) of Table 4 are the most direct test of the overpricing hypothesis. They control for fixed effects by including an individual intercept for each stock (as well as date dummies). Thus they test whether the same stock has a higher market-book ratio when it is expensive to short or newly appearing on the loan list, compared to when it is cheaper to short or not on the loan list. The sample for

Table 4
Market-book ratios and loan rate status 1926–1933
OLS regressions where ln(M/B) is the dependent variable. The sample for columns (1)–(3) is all loan crowd stocks. The sample for columns (4)–(6) includes stocks that are not in the loan crowd in month t but have been or will be in other months. NEWQ1 is a dummy variable equal to one if the stock first appeared on the loan crowd list this quarter, i.e., in months $t-2$ to t. NEWQ(−2) to NEWQ4 are defined similarly. AFTERQ4 is for stocks that were on the loan crowd list before month $t-12$. COSTRANK is the percentile of the cost among loan crowd stocks in that month, unless the stock is not loaned in the loan crowd in which case it is zero. The sample is restricted to stocks with share price greater than $5. All regressions include calendar date dummies, with standard errors (in parentheses) that take into account clustering by date. The sample runs from December 1925 to July 1933.

	(1)	(2)	(3)	(4)	(5)	(6)
Sample	Loan crowd currently			Loan crowd ever		
Period	1926–1933	1926–1933	1926–1933	1926–1933	1926–1930	1930–1933
Ln(ME)			0.31			
			(0.01)			
COSTRANK	−0.35	−0.41	0.32	0.19	0.15	0.26
	(0.07)	(0.06)	(0.05)	(0.03)	(0.06)	(0.04)
NEWQ(−2)				0.21	0.19	0.12
				(0.03)	(0.03)	(0.03)
NEWQ(−1)				0.26	0.29	0.15
				(0.03)	(0.04)	(0.03)
NEWQ0				0.30	0.33	0.19
				(0.03)	(0.03)	(0.03)
NEWQ1		0.56	0.62	0.21	0.25	0.09
		(0.06)	(0.05)	(0.04)	(0.05)	(0.03)
NEWQ2				0.12	0.21	−0.02
				(0.04)	(0.04)	(0.04)
NEWQ3				0.05	0.09	−0.05
				(0.03)	(0.04)	(0.04)
NEWQ4				−0.02	0.01	−0.11
				(0.03)	(0.04)	(0.04)
AFTERQ4				−0.06	−0.04	−0.18
				(0.02)	(0.02)	(0.04)
N	6,970	6,970	6,970	14,774	9,259	5,515
R^2	0.15	0.17	0.38	0.85	0.87	0.90
Stock specific dummies	N	N	N	Y	Y	Y

columns (4)–(6) are all observations for stocks that are ever loaned in the loan crowd, including stocks that will be in the future (in contrast to columns (1)–(3) which only use stocks in the months that they are on the loan list). In addition to NEWQ1, we add dummies for the three quarters prior to the stock's entry onto the loan rate list (NEWQ(−2) through NEWQ0) and the three quarters after inclusion (NEWQ2 through NEWQ4) or thereafter (AFTERQ4). The dummy variables compare valuation in these periods to valuation when the stock was not on the loan list; we set the COSTRANK variable equal to zero in nonloan-crowd months.

In terms of the coefficient on COSTRANK, columns (4)–(6) of Table 4 are similar to column (3) and show that stocks have higher valuations when they are more costly to short. Looking at column (4), again the valuations are significantly related to the cost of shorting; the same stock when cheapest to short has a market-book ratio that is 19% lower than when most expensive to short.

Looking at the coefficients on the inclusion dummies in column (4), the time pattern of market-book is exactly what is predicted by the overpricing hypothesis. In the period prior to entering the loan rate list, log market-book ratios rise, peaking at 30% above average in the quarter just before appearance on the loan list. After appearing on the loan list, market-book ratios fall, going down to just 5% above average three quarters later. As shown in columns (5) and (6), this pattern is repeated in each of the subsamples.

This pattern suggests that stocks become overpriced over the course of several months, they are identified as overpriced by short sellers, and the demand for short-selling rises. Stocks appear on the loan list due to this demand, and subsequently fall as the mispricing is corrected. The results are consistent with Dechow et al. (2001), who find that short interest rises and falls with market-book, and with Geczy et al. (2001) who find higher short-selling costs for growth stocks.

In summary, the scaled prices are consistent with the idea that stocks can be overpriced when it is difficult to correct the overpricing. Of course, a major caution is that these conclusions are based on only eight years of data, and based on an arbitrary measure of valuation that does not control for risk or growth rates. We next turn to subsequent returns to address these issues.

5.2. Subsequent returns

Table 5 shows the relation between loan rate status and the next month's return. We start by simply regressing month $t+1$ total return, in percent, on COSTRANK in month t. Column (1) shows that the most expensive to short stocks have returns that are 1.61% lower per month than the cheapest to short stocks. The t-statistic is 1.85. Since we have a one-sided hypothesis (that higher cost stocks have lower subsequent returns), it is appropriate to look at one-sided p-values (for the hypothesis that the coefficient is negative), and we can easily reject the one-sided hypothesis.

Column (2) of Table 5 adds a dummy variable, NEWQ1, for the first quarter of inclusion in the loan rates list. These new entrants have average returns that are 1.94% lower per month than other loan crowd stocks, controlling for shorting cost, and this effect is statistically strong. The shorting cost variable falls to 1.40%, economically large and (marginally) significant for the one-sided hypothesis. Column (3) shows the effect of size-adjusting. We size adjust the dependent variable by subtracting from raw returns the value-weighted returns on the portfolio of all nonloan-crowd stocks in the same size decile, sorting in month t. We use only stocks with a price greater than \$5 a share, and require that there be more than 20 such stocks in the decile portfolio (many small stocks had prices of less than \$5 a share in the early 1930s). We should note, however, that size and loan rates are not

Table 5
The relation between loan rate status and returns
OLS regression of returns in month $t+1$ on loan status in month t. The sample for columns (1)–(4) is all loan crowd stocks. The sample for column (5) includes stocks that are not loan crowd in month t but have been or will be in other months. In columns (1) and (2) the dependent variable is raw returns, R. In columns (3)–(5) the dependent variable is size-adjusted returns, R −RSIZE, where RSIZE is the value-weighted return on the portfolio of all CRSP stocks (not in loan crowd) in the same market-capitalization decile as the loan crowd stock in month t. NEWQ1 is a dummy variable equal to one if the stock is on the loan list and first appeared this quarter, i.e., in months $t-2$ to t. NEWQ(−2) to NEWQ4 are defined similarly. AFTERQ4 is one for stocks that were on the loan crowd list before month $t-12$. COSTRANK is the percentile of the cost among loan crowd stocks in that month, unless the stock is not loaned in the loan crowd in which case it is zero. The sample is restricted to stocks with share price greater than $5 in month t and when size-adjusting returns we require the portfolio to contain more than 20 stocks. All regressions include calendar date dummies, with standard errors (in parentheses) that take into account clustering by date. The loan rate sample runs from December 1925 to July 1933.

	(1)	(2)	(3)	(4)	(5)
LHS Var.	R		*R*−RSIZE		
Sample	Loan crowd currently				Loan crowd ever
COSTRANK	−1.61	1.40	−0.45		−0.30
	(0.87)	(0.85)	(0.79)		(0.76)
NEWQ(−2)					0.18
					(1.30)
NEWQ(−1)					1.12
					(0.84)
NEWQ0					0.73
					(0.82)
NEWQ1		−1.94	−2.52	−2.57	−3.21
		(0.79)	(0.95)	(0.96)	(0.90)
NEWQ2					−1.64
					(1.17)
NEWQ3					−1.73
					(0.87)
NEWQ4					−0.66
					(0.92)
AFTERQ4					−0.55
					(0.56)
R^2	0.58	0.58	0.10	0.10	0.04
N	7,828	7,828	7,398	7,398	16,564

necessarily mutually exclusive. For example, it could be that small stocks were overpriced in the period 1926–1933, and had both low subsequent returns and high shorting costs. In this scenario, whether size subsumes shorting costs is not necessarily a useful question.

Size-adjusting substantially reduces the magnitude of the cost rank variable and it becomes far from significant. But new entrants continue to have very low returns in the following month. Column (3) of Table 5 is our baseline specification and shows the major finding of this paper. New entrants, which are expensive to short, have low subsequent returns. Since the loan list is public information, this result is inconsistent with rational models such as Diamond and Verrecchia (1987). In their simple rational model, once short interest is announced stock prices should immediately adjust to take into account the negative information. For example, Aitken et al. (1998) find that stock prices fall immediately in response to announced increases in short interest. Here, however, one is able to predict returns one month ahead using public information on shorting costs.

Looking at the coefficient in column (4) of Table 5, the results are driven by the 450 monthly observations that occur in the first quarter for new entrants. The mean difference in size-adjusted returns between the first quarter and other quarters is −2.57%. The mean size-adjusted returns for the 450 observations alone is −2.05%, while the median is −1.74% and 59% of the monthly size-adjusted returns are negative.

Column (5) of Table 5 shows the dummy variables tracking the entry of the stock onto the loan list. As in Table 4, the time pattern of returns matches the overpricing hypothesis. In the three quarters prior to entering the list, returns are positive (economically large but statistically insignificant). In the quarter after the stock enters the list, returns are a significantly negative 3.21% per month. In the next three quarters, returns continue to be negative (as before large but insignificant). Again in column (5) the sample is all stocks that were ever in the loan crowd at any time (column (5) does not include stock fixed effects but adding them makes no difference to the coefficient on NEWQ1).

Table 6 examines the robustness of the main results on return predictability. First, columns (1) and (2) show that the baseline results hold in the two different subsamples. The coefficient on NEWQ1 is also robust to a variety of different modifications.[5]

One implication of frictions is that stock returns can be predictable within arbitrage bounds. Column (3) of Table 6 examines the predictability of stock returns using market-book ratios. Consistent with the well-known value effect, the coefficient on market-book is negative, indicating that stocks with high scaled prices have low future returns. Column (3) tests whether this relation is particularly strong for the new entrants, by interacting the NEWQ1 variable with log market-book. Expensive-to-short stocks can be especially overpriced so their returns should be especially predictable, and as shown previously entrants have especially high valuations. The results show that as predicted, the coefficient is higher for these new entrants, but this difference is not statistically significant.

Columns (4)–(6) of Table 6 adjust the left-hand side returns for other variables in addition to size. In each case we subtract (from the raw return on a loan crowd

[5] The following additional robustness checks to Table 5 do not substantially change the NEWQ1 coefficient in column (3): splitting the sample into before or after the crash of October 1929, splitting the sample into months in which market returns were positive or nonpositive, or discarding size-adjusted returns with absolute value greater than 50. For column (5), adding fixed stock effects does not change the results.

Table 6
Robustness checks on the relation between loan rate status and returns

OLS regression of percent returns in month $t+1$ on variables in month t. The sample is all loan crowd stocks. In columns (1)–(3) the dependent variable is returns adjusted for size ($R-$RSIZE) and in column (4)–(5) the dependent variable is returns adjusted for additional characteristics ($R-$RMATCH). R is raw returns in percent. RSIZE is the value-weighted return on the portfolio of all CRSP stocks (not in loan crowd) in the same market-capitalization decile in month t. RMATCH is a value-weighted return on a portfolio constructed using all CRSP stocks (not in loan crowd) and is designed to match the characteristics of the individual loan crowd stock in month t. In column (4), RMATCH consists of stocks matched by market-capitalization quintile and market-book (M/B) quintile in month t. In column (5), RMATCH consists of stocks matched by market-capitalization quintile, market-book quintile, and prior one-year return quintile. In column (6), RMATCH consists of stocks matched by two-digit industry code and size decile. NEWQ1 is a dummy variable equal to one if the stock is on the loan list and first appeared this quarter, i.e., in months $t-2$ to t. COSTRANK is the percentile of the cost among loan crowd stocks in that month. The sample is restricted to stocks with share price greater than \$5 in month t. In columns (1)–(3) we require the matching portfolio to contain more than 20 stocks, in columns (4)–(6) we require at least one matching stock. All regressions include calendar date dummies, with standard errors (in parentheses) that take into account clustering by date. The loan rate sample runs from December 1925 to July 1933. The 1926–1930 sample is December 1925–September 1930. The 1930–1933 sample is October 1930 to July 1933.

Matched by	(1) Size deciles	(2) Size deciles	(3) Size deciles	(4) Size and M/B quintiles	(5) Size, M/B, and prior return quintiles	(6) Size deciles and two-digit Industry Code
Sample	1926–1930	1930–1933	1926–1933	1926–1933	1926–1933	1926–1933
COSTRANK	–0.49	–0.38	–0.58	–0.59	0.69	–0.54
	(0.70)	(2.94)	(0.91)	(0.77)	(0.91)	(0.90)
NEWQ1	–1.81	–3.10	–2.21	–1.47	–1.26	–2.05
	(0.95)	(1.50)	(0.92)	(0.72)	(0.92)	(0.77)
ln(M/B)			–0.56			
			(0.55)			
NEWQ1*ln(M/B)			–0.53			
			(1.02)			
R^2	0.03	0.13	0.11	0.05	0.03	0.05
N	4,240	3,158	6,583	6,909	5,597	6,201

stock) the return from a value-weighted portfolio consisting of matched firms from the universe of nonloan-crowd CRSP stocks. Since finding enough matching firms is a problem, in these columns we require the matching portfolio to contain at least one stock (instead of more than 20 stocks as previously). Column (4) adjusts for both size and market-book. We sort all nonloan-crowd stocks into size and market-book quintiles and from the intersection of these sorts form 25 matching portfolios. With this adjustment, the NEWQ1 coefficient shrinks from -2.57 in the baseline regression to –1.47, although it is still significant.

Following Daniel et al. (1997), column (5) of Table 6 adjusts for size, value, and momentum by matching on market equity, market-book, and prior one-year return quintiles (resulting in 125 matching portfolios). The addition of momentum has only a slight effect on the point estimate compared to column (4) (the standard errors rise since we lose about one-third of the new entrants by discarding stocks without a year of previous return data, chiefly because CRSP data starts in 1926). Column (6) matches by size and industry using size deciles and by two-digit Standard Industrial Classification codes. The coefficient on NEWQ1 is only slightly changed compared to the baseline result.

In summary, the new entrant effect is not subsumed by size, value, momentum, or industry. This result suggests that short sellers are able to identify stocks that are overpriced relative to similar stocks. Comparing columns (3) and (4) of Table 6, we conclude that although the two different ways of controlling for market-book have different quantitative effects, in both cases new entrants have returns that are lower than predicted by their high valuations alone. We later show Fama-French (1993) three-factor regressions, and show that this third way of controlling for market-book does not change this conclusion.

5.3. *Do returns vary one-for-one with shorting costs?*

Table 7 examines whether shorting entrant stocks would be profitable after accounting for the costs of shorting. We test for the profitability of shorting new entrants by adding cost to the left-hand side returns. Thus the left-hand side is $R-$RSIZE + COST, where R is the simple stock return in month $t+1$, RSIZE is the contemporaneous return from the stock's size decile, and COST is the monthly cost of shorting observed at the end of month t. The left-hand side variable can be interpreted either as the return one gets from owning the stock and lending it out, or the negative of the return one gets from shorting the security and paying the shorting costs in the loaning market. Since the returns on the left-hand side are size-adjusted (and we do not observe shorting costs or even ability to short for RSIZE), the assumption is that one can short the size decile portfolio at no cost.

Column (1) of Table 7 shows that cost-adjusted returns for loan crowd entrant stocks are still large and negative at 1.85%, and one can reject the one-sided hypothesis that the returns are not negative (the t-statistic is 1.83). Since this monthly return differential is measured over the three-month period after loan crowd entry, the total return differential is almost 6%, which is quite large relative to likely transaction costs. For example, Jones (2001) finds that the 1926–1933 average

Table 7
Returns after costs
OLS regression of percent returns in month $t+1$ on loan status in month t. The sample is all loan crowd stocks. R is raw returns in percent. In columns (1)–(3) the dependent variable is size-adjusted returns plus the cost of shorting ($R-$RSIZE$+$COST). In columns (4)–(5) the dependent variable is size-adjusted returns ($R-$RSIZE). RSIZE is the value-weighted return on the portfolio of all CRSP stocks (not in loan crowd) in the same market-capitalization decile in month t. COST is the monthly percent cost of shorting, defined as the call-money rate minus the loan rate, divided by 12. NEWQ1 is a dummy variable equal to one if the stock is on the loan list and first appeared this quarter, i.e., in months $t-2$ to t. PREMIUM is a dummy variable equal to one for stocks lending at a premium. The sample is restricted to stocks with share price greater than $5 in month t and when adjusting by size we require the matching portfolio to contain more than 20 stocks. All regressions include calendar date dummies, with standard errors (in parentheses) that take into account clustering by date. The loan rate sample runs from December 1925–July 1933. The 1926–1930 sample is December 1925 to September 1930. The 1930–1933 sample is October 1930 to July 1933.

	(1)	(2)	(3)	(4)	(5)
LHS variable		$R-$RSIZE$+$COST		$R-$RSIZE	
Sample	1926–1933	1926–1930	1930–1933	1926–1933	1926–1933
NEWQ1	−1.85	−1.10	−2.46	−2.40	−2.39
	(1.01)	(0.96)	(1.67)	(0.91)	(0.89)
COST				−0.24	−0.40
				(0.22)	(1.04)
COST∗PREMIUM					0.17
					(1.07)
PREMIUM					−0.10
					(1.22)
R^2	0.10	0.03	0.13	0.10	0.10
N	7,398	4,240	3,158	7,398	7,398

proportional bid–ask spreads for stocks in the Dow Jones industrial and rail averages are only 0.80%, and commissions for NYSE non-members average 0.37% over the same interval. Thus, shorting loan crowd entrants is profitable even for exchange outsiders paying commissions and bid–ask spreads.

Columns (2) and (3) of Table 7 show the effect is spread out more or less evenly over the two subsamples. The larger effect in the second half of the sample is consistent with the idea that the unmeasured costs of shorting (such as increased regulation, legal harassment, and social stigma) are also larger in the second half of the sample.

Column (4) of Table 7 puts in shorting costs on the right-hand side rather than including them in the dependent variable. The hypothesis of interest is that the coefficient is –1. One interpretation of this hypothesis is that, if arbitrageurs short overpriced stocks until the cost of doing so is equal to the benefit, subsequent returns should fall one-for-one with the cost of shorting. An equivalent interpretation is that holders of the stock are willing to accept a lower rate of return for owning the stock, in return for the income they reap by lending the stock out to short sellers. Once again, if they buy the stock until the marginal benefit equals the marginal cost, the coefficient should be negative one. In column (4) the coefficient is significantly different from −1 but not different from zero. Column (5) allows the coefficient on cost to differ for premium stocks, and shows that the low coefficient on cost is partly driven by premium stocks (the coefficient rises to −0.4 for stocks with nonnegative loan rates).

Thus the major result from Table 7 is that new entrants have very low returns, even after taking account the benefit of owning and lending or the cost of shorting. In other words, frictions cannot explain why anyone is willing to own these stocks, nor why short sellers do not continue to pay the shorting costs, sell and drive the price down further. This result is important because it shows that direct financial shorting costs cannot fully explain the overpricing. Unwillingness to short or other costs that are not captured in the loan rate must play a role; otherwise it is hard to see why one should be able to earn excess returns of 1–2% a month using publicly available information. Some type of generic short sale constraint is preventing arbitrageurs from driving down prices enough.

5.4. Monthly portfolio returns

In Table 8 we examine monthly portfolio returns from implementing the new entrant strategy. We form portfolios that buy stocks that have been added to the loan rate list in the past 12 months and short these stocks' corresponding size portfolios. Since new entrants come in waves, there are numerous months with no new additions. We discard months in which there were fewer than five such stocks available, and so we use 61 months out of the 92 months in our sample.

Column (1) of Panel A of Table 8 shows results from an equal-weighted portfolio of new entrants. The mean monthly return is large and significant at −1.28 (about what one would expect from Table 5). The median equal-weighted monthly return is −1.23, while the average of the within-month median is –1.28, showing outliers are not an issue. Next we add the three factors of Fama and French (1993): RMRF (the value-weighted market return minus *t*-bill returns), SMB (small minus big, returns on small stocks minus returns on big stocks), and HML (high minus low, returns on high book-market stocks minus returns on low book-market stocks), all available starting in July 1926 from Davis et al. (2000). Risk-adjusting in this way has little effect on the mean return, and the intercept term is still large and significant. Thus it appears that the loan crowd entrant effect is statistically distinct from the size and value effects.

Column (3) of Table 8 constructs the left-hand-side variable using returns in excess of *t*-bill returns (instead of returns in excess of size decile returns). The intercept term is basically unaffected (naturally the market factor loading and R-squared rise dramatically). Columns (4) and (5) use value-weighted portfolio returns (now using size-adjusted returns as in columns (1) and (2)). Although here again the three-factor model has little effect, compared to equal-weighted the average returns are about half as big. Evidently the effect is concentrated in smaller loan crowd stocks. One

Table 8
Monthly portfolio returns
Monthly portfolio regression results for returns from January 1926 to August 1933. Panel A shows mean returns and three-factor results for a portfolio of new entrants to the loan crowd. NEW_{EW} is the equal-weighted size-adjusted return for all stocks newly appearing on the loan list in the past 12 months, provided five such stocks exist in month t. NEW_{VW} is similarly defined but value-weighted. $NEWRF_{EW}$ is similarly defined but instead of using size-adjusted returns it uses equal-weighted excess returns, defined as returns minus t-bill returns. RMRF, SMB, and HML are market, size, and value factors constructed by Davis, et al. (2000) and available starting July 1926. Panel B shows mean returns for new entrants after adjusting for shorting costs, and shows mean return for value portfolios with and without adjusting for shorting costs. HC − LC is a proxy for HML for loan crowd stocks, constructed using HC and LC. HC is high book-market and loan crowd, the equal-weighted return on a portfolio of loan crowd stocks in the bottom 50% of market-book in the CRSP universe. LC is low book-market and loan crowd, the equal-weighted return on a portfolio of loan crowd stocks in the top 50% of market-book in the CRSP universe. $COST_i$ is the monthly percent cost of shorting portfolio i.

Panel A. Three-factor regressions

LHS variable	(1) NEW_{EW}	(2) NEW_{EW}	(3) $NEWRF_{EW}$	(4) NEW_{VW}	(5) NEW_{VW}
Constant	−1.28	−1.02	−0.99	−0.63	−0.44
	(0.47)	(0.47)	(0.48)	(0.42)	(0.43)
RMRF		0.12	1.07		0.11
		(0.06)	(0.06)		(0.05)
SMB		−0.19	0.02		−0.10
		(0.08)	(0.08)		(0.07)
HML		−0.03	0.00		−0.15
		(0.09)	(0.09)		(0.08)
R^2	0.00	0.16	0.93	0.00	0.11
Number of months	61	57	57	61	57

Panel B. Mean returns

	(1) Plus lending benefit	(2) Traditional returns	(3)	(4) Minus shorting cost	(5) Minus shorting cost plus lending benefit
Variable:	$NEW_{EW}+COST_{NEW}$	HML	HC−LC	$HC-LC-COST_{LC}$	$HC+COST_{HC}-LC-COST_{LC}$
Mean	−0.69	0.45	0.42	0.11	0.46
	(0.48)	(0.72)	(0.77)	(0.77)	(0.77)
Number of months	61	86	86	86	86

possible explanation is that the other risks and costs of short-selling are concentrated in smaller stocks that can be more difficult to short.

Panel B addresses the question of whether the low returns are fully accounted for by the short-selling costs. As before, the answer is no. In column (1) of Table 8, again we cost-adjust the returns by adding the cost of shorting to the portfolio return, and again this variable can be interpreted as the benefit of owning the stock and lending it to short sellers. Comparing the first columns of Panels A and B, less than half of the negative returns can be explained by short-selling costs. Cost-adjusted returns are large at −0.69% per month, although the *t*-statistic on this coefficient is only 1.43. However, this method of adjusting for shorting costs does not adjust the long and short positions equally, and thus over-adjusts for shorting costs. As we show below, this asymmetric treatment can be misleading.

The rest of Panel B examines the value effect. In column (2) of Table 8 we show the mean return on the value factor during our sample, from Davis et al. (2000). The fact that (controlling for size) higher market-book stocks are more expensive to short has potentially important implications for the value effect. We address this issue in our sample of stocks by calculating a proxy for HML using only loan crowd stocks. We form an equal-weighted portfolio of loan crowd stocks in the top-half of all CRSP stocks sorted on book-market, and we subtract returns from the loan crowd stocks in the bottom-half. This proxy, which we call HC −LC (for high book-market and loan crowd minus low book-market and loan crowd), is quite successful at matching the properties of HML given the limitations of the sample. It has a monthly correlation of 0.89 with HML, and as shown in columns (2) and (3) it closely reproduces the mean return on HML in this period (which happens to be about the same as the average HML of 0.46 reported by Davis et al. (2000) for the entire period 1929–1997). Although our sample does not include many stocks (such as small stocks) that could be impossible or very costly to short, it is notable that the value effect is still present in stocks that we know are shortable. Thus inability to short cannot be responsible for the value effect in our sample.

HML and HC−LC can be interpreted as the return one would get from owning value stocks and shorting growth stocks. As is traditional, the returns in columns (2) and (3) of Table 8 are calculated only using prices and dividends and ignoring the costs of shorting or the benefit of lending. Column (4) shows the effect of subtracting shorting costs from the returns earned by the short end of the strategy, namely shorting growth stocks. It shows that accounting for the costs of shorting during this period, the average profits on the value strategy are completely obliterated. However, this calculation is incomplete since it does not include the benefit of lending value stocks. The effects of symmetrically adding the cost of shorting to the long side of the strategy, as well as subtracting from the short side, are shown in column (5). Column (5) shows that differences in shorting costs completely fail to explain the value effect, as the added component of returns is about the same for both the long and short portfolios. Thus like Geczy et al. (2001), we find it does not appear that shorting costs could plausibly explain the value effect in our sample.

6. Conclusion

In this paper, we assemble a data set on stock loan rates for a number of NYSE stocks over an eight-year period. These loan rates represent the direct monetary costs of shorting a particular stock. They also reveal which stocks are in demand by short sellers. While we do not know the precise algorithm that determines when demand is high enough to warrant trading the stock in the loan crowd or why these additions tend to all occur on a single day, the valuable information lies in which stocks out of the universe of potential additions are selected.

We find that stocks that are expensive to short have high market-book ratios, compared to times when these stocks are cheaper to short. However, we find that the value effect does not appear to be easily explainable using shorting costs. Stocks that are expensive to short have low subsequent returns, consistent with the hypothesis that they are overpriced. These expensive to short stocks tend also to be small, and after accounting for size the evidence for this return effect is statistically weak (at least in our short sample).

Stocks that have high shorting demand (as indicated by their addition to the stock loan list) have low subsequent returns, and this effect is statistically strong and robust. The economic magnitude of the effect is large. In the period 1926–1933, loan crowd entrants have average returns that are 1–2% per month lower than other stocks of similar size. These stocks appear overpriced. Looking at the time pattern of market-book ratios and returns, stocks have positive returns and rising valuations prior to being added to the list. Their market-book ratios peak when they are added to the list, and the excess returns thereafter are negative. These low returns exceed the costs of shorting, so that it appears possible for arbitrageurs to earn high returns after costs from shorting these overpriced stocks. Put another way, a rational investor would not be willing to buy these stocks since they would not generate sufficiently high income from lending the stock out. Thus, in addition to the shorting costs that we observe, there must be some other short sale constraint which allows these stocks to become overpriced.

Even if the magnitude of the returns was quantitatively equal to the shorting costs, in equilibrium all shares must be held by some investor who is not lending them out. Thus some investors were voluntarily buying stocks with extremely low subsequent returns, despite the fact that the high shorting costs were publicly observable in the WSJ, and high shorting demand might be inferred by the first appearance of these stocks in the WSJ's list. Why these investors were willing to buy these overpriced stocks is a mystery. It could be that these investors had some special reason to buy these stocks, a reason not shared by other investors. This reason might be some tax implication, institutional constraint, hedging demand, cognitive error, difference of opinion, or unusual preference.

Overall, the evidence is consistent with stories like Pontiff (1996) and Shleifer and Vishny (1997) in which there are limits to arbitrage. Specifically, some stocks become overpriced. A subset of investors recognizes and shorts these overpriced stocks. Because the shorting market is imperfect, this subset of investors affects costs in the shorting market, making these stocks expensive to short and driving them onto the loan crowd.

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