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The Delisting Bias in CRSP Data

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ABSTRACT

I document a delisting bias in the stock return data base maintained by the Center for Research in Security Prices (CRSP). I find that delists for bankruptcy and other negative reasons are generally surprises and that correct delisting returns are not available for most of the stocks that have been delisted for negative reasons since 1962. Using over-the-counter price data, I show that the omitted delisting returns are large. Implications of the bias are discussed.

ACADEMIC RESEARCHERS, INVESTMENT PROFESSIONALS, and government analysts all use the stock return data base maintained by the Center for Research in Security Prices (CRSP). Their studies typically form portfolios based on publicly available information and then use CRSP data to calculate portfolio returns. The accuracy of the CRSP data and the feasibility of the portfolio strategies that they investigate are critical to the validity of these studies.

Exchanges sometimes delist, or cease trading, stocks before investors are able to sell them.¹ To correct for surprise delists, CRSP calculates delisting returns. The *CRSP Stock File Guide* (1994) explains:

(The delisting return) is the return of the security after it is delisted. It is calculated by comparing a value after delisting against the price on the security's last trading date. The value after delisting can include a delisting price or the amount from a final distribution.

It is commonly believed that CRSP collects delisting returns whenever they are unanticipated. But the CRSP files are missing thousands of delisting returns.² Despite the fact that most delists for bankruptcy, insufficient capital, and other performance-related reasons are unannounced, no delisting return

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¹ Major stock exchanges (NYSE, AMEX, and Nasdaq) delist securities regularly for a variety of reasons. The NYSE's constitution (Commerce Clearing House, 1978) contains a list of conditions that prompt the review of a stock's continued listing status and a detailed procedure for delisting. Exchanges drop securities when firms merge, when exchange offers make securities obsolete, when firms liquidate or move to another exchange, and when firms' performances fall below the exchange's listing criteria.

² Because CRSP only assigns monthly returns to stocks that trade for an entire month, CRSP's monthly files are also missing returns for most stocks' first and last trading months. The CRSP

is calculated for most stocks delisted for these reasons from 1962 to 1993.³ Omitted delisting returns introduce a bias into studies that use the CRSP data. Without delisting returns, it is not possible to accurately calculate the returns to a feasible portfolio. To obtain the returns of portfolios formed without them, investors would have to sell delisting stocks on their last trading day. Since investors do not generally know when stocks will be delisted, portfolio returns calculated without delisting returns are not possible *ex ante*.

To illustrate the bias, consider the case of Magnet Bank FSB of Charleston, West Virginia (CRSP permno = 68531). Magnet was delisted from The American Stock Exchange (AMEX) on February 10, 1988. CRSP gives Magnet's stock a delisting code of 500 (issue stopped trading on exchange, reason unavailable) and a missing delisting return code of -99.0 (security trades on a new exchange after delisting, but CRSP currently has no sources to gather price information). But on February 10, the Federal Savings and Loan Insurance Corp. (FSLIC) announced that it was helping Atlantic Financial, a bank holding company, to acquire Magnet Bank's assets. Describing Magnet's delisting, United Press International (UPI) wrote "The announcement came at 3:55 p.m., five minutes before the American Stock Exchange shut down for the day. The stock closed at \$1.50, suggesting investors had no time to react." A spokesman for the FSLIC was quoted by UPI as saying "The people that hold stock in Magnet are holding stock in an institution that was failing financially. The stock is not going to be worth a whole lot." Magnet's stock had closed at \$1.50 on each of the four previous days. Pricing quotations for Magnet's stock never appeared in the *Pink Sheets*, a publication that tracks over-the-counter trading. The Financial Stock Guide Service's (1993) *Directory of Obsolete Securities* lists the stock as worthless, claiming the firm had "no stockholder's equity" after Atlantic's takeover.

Although Magnet's stock should have a delisting return of -1, its delisting return is missing. Since it was not possible for an investor to know that Magnet's stock would become worthless on February 10, a researcher using CRSP data will assign a portfolio containing Magnet's stock an artificially high return. Many distressed firms' stocks, like Magnet Bank's, are missing delisting returns in the CRSP files. These missing returns are the source of the bias documented in this article.

This article attempts to measure the size and effect of the delisting bias in CRSP stock return data. Section I reports the number of missing delisting returns in the CRSP data. It also contains an analysis of how many delists are surprises to investors and the abnormal return to a stock when delisting is announced. Section II characterizes the omitted delisting returns using over-the-counter price data for delisted stocks. Section III examines the effect of the bias on three recent studies. Section IV concludes.

files contain the information necessary to correct for this convention, so the potential bias that these missing data create is not explored in this article.

³ For stocks delisted prior to 1962, 229 of 245, or 93.5 percent of the stocks delisted for performance reasons have delisting returns.

Table I
Delisting Returns in the CRSP Data

Most of the performance-related delisting returns are missing in both the New York Stock Exchange/American Stock Exchange (NYSE/AMEX) and Nasdaq Center for Research in Security Prices (CRSP) files. Data are from the 1993 daily version of the CRSP stock return files. Delisting returns (DRET) are either the value found in CRSP's delisting return field or, where implied by CRSP's conventions, they are equal to -1 .

Reason	CRSP Codes	Firms	w/DRET	% w/DRET	Ave DRET	<i>t</i> -Stat
Panel A: NYSE and AMEX CRSP File, 1962–1993						
Merger	200–240	2171	2147	98.9	1.94%	7.85
Exchange	300–390	332	326	98.2	–0.74%	–0.93
Liquidation	400	134	42	31.3	1.00%	0.79
Δ Exchange	501–519	84	69	82.1	–2.09%	–1.44
Performance ^a	500, 520–584	1029	120	11.7	–41.56%	–8.56
Any reason		3750	2704	72.1	–0.43%	–1.22
Panel B: Nasdaq CRSP File						
Merger	200–240	2020	1934	95.7	2.31%	11.87
Exchange	300–390	327	284	86.8	2.29%	4.63
Liquidation	400	137	37	27.0	–11.10%	–2.59
Δ Exchange	501–519	1388	1334	96.1	1.36%	1.61
Performance	500, 520–584	3750	0	0.0	N/A	N/A
Any reason		7622	3589	47.1	1.82%	5.39

^a Includes stocks delisted with a CRSP code of 500 (reason unavailable, 790 stocks), 520 (went to OTC, 29 stocks), 551–573 and 580 (various reasons, 22 stocks), 574 (bankruptcy, 160 stocks), and 584 (does not meet exchange financial guidelines, 28 stocks).

I. The Delisting Problem

This section documents that most performance delisting returns are missing in the CRSP files, that most performance delists are surprises to investors, and that firm value is adversely affected by delisting.

A. Missing Delisting Returns

Table I reports the number of delists in the New York Stock Exchange (NYSE)/AMEX and Nasdaq⁴ CRSP files broken down by the reason for delisting. The reasons for delisting correspond to delisting codes assigned by CRSP. The performance category (CRSP delisting codes 500 and 520–584) includes securities delisted for a variety of negative reasons. Before introducing three digit delisting codes in 1987, CRSP assigned a code of 5 to firms that went

⁴ Because the structure of Nasdaq is quite different from that of the other exchanges, delisting from Nasdaq and delisting from NYSE are quite different events. NYSE delisted stocks undergo a formal process, including hearings and the possibility of appeals; Nasdaq delisted stocks may be delisted simply because market makers are no longer interested in trading them. Seguin and Smoller (1996) discuss delistings from Nasdaq.

bankrupt, had insufficient capital, changed exchange, or were not easily classified. With the advent of three digit codes, all stocks previously given a code of 5 were given a code of 500. Thus, most securities in the performance category were delisted for poor performance, but some just changed exchange.

In versions of CRSP's files prior to 1993, there were 48 delisting returns of -1 in the NYSE/AMEX file after 1961, but there are no returns of -1 in CRSP's delisting return field now.⁵ Because of concerns about the quality of delisting data, CRSP dropped all delisting returns of -1 in the 1993 and subsequent files. Securities that previously had a delisting return of -1 are coded in a special way, but their delisting returns are missing.⁶ CRSP does not record any implied delisting returns of -1 for delists after 1978, and the Nasdaq file contains no implied delisting returns of -1 . Delisting returns of -1 are included in the calculations reported in Table I because studies done before the 1993 files were released use these returns and future studies should use them.⁷

Only 11.7 percent of the NYSE/AMEX stocks delisted for performance reasons have delisting returns, and none of the 3750 performance delisted stocks in the Nasdaq file has a delisting return. Delisting returns are almost always collected for other types of delistings. Although many of the stocks delisted for liquidation do not have delisting returns, almost all of the liquidations without returns were apparently announced before delisting.⁸

B. Announced Delists

Exchanges sometimes announce that a security will be delisted before the security's last trading day. Since any stock price reaction to the delisting news will occur around the announcement day rather than the actual delist day, delisting returns for preannounced delists should be close to zero. Furthermore, since investors can sell securities that continue to trade on an exchange after a delisting announcement, portfolio returns calculated without delisting returns are feasible for investors when delists are preannounced.

B.1. Announcements in Nexis

I search for performance-related delists from 1984 through 1993 using the electronic news retrieval service *Nexis*. Because *Nexis* is less complete in

⁵ CRSP's delisting returns reported throughout the paper are either from CRSP's RDELIS(DLRET,1) field or, where implied by CRSP's conventions, they are returns of -1 . A few more delisting returns can be calculated with CRSP's RDELIS(DLPRC,1) variable. These potential delisting returns are not included because their quality is suspect.

⁶ Securities that previously had delisting returns of -1 are now given a value of DELIST(NEXTDT,1) equal to the value of DELIST(DLSTDT,1) plus one trading day and they are given a value of RDELIS(DLPRC,1) equal to zero.

⁷ CRSP added many implied delisting returns of -1 to the 1994 NYSE/AMEX file after reading an early version of this article.

⁸ CRSP sets a security's delisting price date equal to its last trading date, "[i]f a liquidation was announced in advance" of delisting (CRSP, 1994). Performance-related delists that CRSP classifies as announced liquidations are discussed in section I.B.2.

Table II
Delist Announcements

Table II estimates how frequently performance-related delists are announced before the security's last day of trading. Column two reports the number of New York Stock Exchange (NYSE) and American Stock Exchange (AMEX) delists due to poor performance by year. Column three reports the number of firms for which some news of the delisting appeared in *Nexis* or the *Wall Street Journal Index*. Column four reports the number of firms with announcements prior to the end of trading. Column five contains the ratio of column 4 to column 3.

Year	Delists ^a	in Nexis or WSJ	Preannounced	Col 4/Col 3
1984	17	11	1	0.09
1985	22	13	2	0.15
1986	30	15	3	0.20
1987	16	11	5	0.45
1988	14	12	1	0.08
1989	18	16	4	0.25
1990	37	32	9	0.28
1991	57	49	24	0.49
1992	47	44	13	0.30
1993	26	23	6	0.26
Total	284	226	68	0.30

^a Delists with CRSP codes of 500 or 550–584.

earlier years, I also check the *Wall Street Journal Index* before 1989. Based on the news articles describing the events leading to each delisting, I determine which delists were announced prior to delisting.

Table II shows that about two-thirds of performance delists are surprises. The ratio of preannounced delists to delists found averages 0.3. Therefore, portfolio returns calculated without delisting returns are not feasible.

The *Nexis* articles reveal a qualitative difference between preannounced delists and surprise delists. Most preannounced delists result from a company's failure to meet its exchange's listing requirements. While many of these companies are in financial distress, most of them continue to trade elsewhere after delisting. Companies that experience surprise delists are often worthless when they delist. The articles confirm that many of the surprise delists correspond to bankruptcy filings or the filing or approval of a reorganization plan that makes the firm's equity worthless. Firms that can announce that they are going to be dropped generally fare better than those that delist suddenly.

The *Nexis* articles also provide evidence that many surprise delistings involve trading halts or suspensions. Careercom (permno = 56303), a company that maintained 46 trade schools before going bankrupt on December 16, 1992, is a good example of how halts often occur around delisting. *Nexis* contains a December 16 Reuters wire stating that trading was halted in Careercom's stock because of "news pending." Another Reuters article explains that Careercom announced its Chapter 11 bankruptcy filing and its intention to close or sell all of its schools. A third December 16 Reuters article declares that the

Table III
CRSP's "Announced" Delists

According to Center for Research in Security Prices (CRSP), 256 of the 1029 performance delists in the 1993 New York Stock Exchange/American Stock Exchange (NYSE/AMEX) file announced their delisting prior to their last trading day. Panel A compares delisting announcements found in *Nexis* and the *Wall Street Journal Index* to the announcements recorded by CRSP. Column two reports the number of performance-related delists by year. Column three reports how many of each year's delists are coded as announced in CRSP. Column four shows how many of CRSP's announced delists have an announcement in either *Nexis* or the *Wall Street Journal Index*. Panel B displays an analysis of delisting returns constructed with over-the-counter prices for 160 of these firms.

Panel A: CRSP Announced Vs. Nexis Announced			
Year	Delists	Ann in CRSP	Ann in Nexis or WSJ
1984	19	10	1
1985	27	6	2
1986	36	6	1
1987	18	11	5
1988	19	8	1
Total	119	41	10

Panel B: New Delisting Returns from OTC Data		
Observations	Ave DRET	t-Stat
160	-9.66%	-3.93

NYSE suspended trading in Careercom's stock immediately, and that "following suspension, application will be made to the Securities and Exchange Commission to delist the issue." This article cites Careercom's Chapter 11 filing and its failure to meet the NYSE's guidelines as reasons for the delisting. On December 23 Careercom announced that it did not foresee any distribution for its shareholders. Careercom's returns series in CRSP confirms that trading was halted before investors were able to fully react to the news. Careercom's stock had a return of -6 percent on its last trading day; its price went from \$0.25 to \$0.234. Its penultimate return was 14 percent.

The articles include many similar cases. When a news release about a particular stock is expected, exchanges frequently halt trading in the stock until the news is made public. If the news prompts delisting, trading may be suspended indefinitely. Official delisting generally occurs many days after a stock's last trading day.

B.2. Announcements in CRSP

There are 256 NYSE/AMEX performance delists that CRSP classifies as preannounced delists. The 1994 CRSP documentation explains "If a liquidation was announced in advance and trading continued on the exchange after the announcement of the liquidation," the delisting price date is set equal to

Table IV
The Effect of Announcements

Table IV displays event study results for stocks that experience a delisting announcement prior to their last day of trading. Abnormal returns (AR) are calculated as $AR_{it} = R_{it} - \alpha_i - \beta_i R_{mt}$, where R_{it} is the return on stock i on day t and R_{mt} is the value weighted New York Stock Exchange/American Stock Exchange (NYSE/AMEX) market return on day t . The parameters α_i and β_i are estimated from a regression of R_{it} on R_{mt} using the returns data from the 200 days prior to the event date. The announcement day is from news reports in *Nexis*.

Event Time	Ave Cumulative AR	Firms	<i>t</i> -Stat
Announcement day	-8.7%	59	-2.39
One day after	-14.0%	58	-2.36
Two days after	-14.9%	54	-2.72

the last trading date and the delisting price is set equal to the stock's last trading price. Delists that CRSP codes as announced have missing delisting returns, but the delisting returns implied by their delisting prices are zero. Implied delisting returns of zero are considered missing in Table I (see footnote 5). Table III compares CRSP's announcement information to the information found in *Nexis* and the *Wall Street Journal Index*. CRSP does not report any announcements after 1988, so the table only covers the period 1984-1988.

Table III indicates that CRSP's announcement data are not accurate. Panel A shows that there is evidence of an announcement in about one-fourth of the cases that CRSP classifies as preannounced delists. Panel B shows that delisting returns calculated with over-the-counter prices average a statistically significant -9.7 percent for 160 of the 256 delists that CRSP classifies as preannounced. CRSP's announcement data is suspect. Even if CRSP's number of announcements is correct, the total number of announced delists calculated by adding CRSP's 256 to the 56 announcements that I found from 1989 forward is still just 30.3 percent of the total number of NYSE/AMEX performance delists documented in Table I.

C. Delisting and Firm Value

Table IV presents the findings of a simple event study around delisting announcement dates using a sample of 59 firms for which an announcement date could be identified. Because it is difficult to determine whether announcements were made before or after the end of trading on any given date, the cumulative abnormal return one day after the announcement is probably the best indicator of the full stock price reaction. Table IV shows that firms that announce a performance-related delisting lose on average 14 percent of their value immediately after the announcement. This is a larger effect than the effect found by Sanger and Peterson (1990). Given the difference between announced and surprise delists, 14 percent probably understates the effect of delisting on firm value.

Figure 1 shows that trading volume is unusually high around delisting announcements. The figure plots the average, across delisting firms, of the number of shares traded divided by the total number of shares outstanding. The plot shows that volume jumps by a factor of about three when delisting is preannounced. Delisting announcements precipitate both a significant loss of firm value and a flurry of trading.

Over 4,500 performance delisting returns are missing in the CRSP files. These returns correspond to delists that clearly affect firm value and that are not announced in advance.

II. New Delisting Data

This section describes the over-the-counter (OTC) price data used to construct delisting returns. It also shows that CRSP's omitted delisting returns are large.

A. The Source of the New Data

I collected OTC prices for NYSE and AMEX firms delisted since 1962 from the publishers of the *Pink Sheets*, the National Quotations Bureau (NQB). The data consist of four numbers: a high bid price, a low bid price, a high ask price, and a low ask price. I average these four numbers to estimate market prices below. The dates of NQB's price quotes varied substantially from the delisting dates.⁹ Most quotes were for dates within a month or two of the last exchange trading date, but some were for dates several years later. For the analysis below, I eliminate quotes for dates more than 100 calendar days after delisting.

I search for firms with missing or incomplete OTC data in the *Directory of Obsolete Securities* and *Nexis*. Firms that became worthless according to one of these references are given a delisting return of -1 . Of the 1029 firms that delisted due to performance considerations, 84 firms appear to have become worthless. CRSP has coded these firms as implied delisting returns of -1 in the 1994 file. Stocks that still have missing returns after this process are those for which NQB could not find prices within 100 days of delisting and that did not become obviously worthless after delisting.

OTC price data is somewhat problematic. There is often a large spread between the bid and ask quotes for OTC stocks. For example, on January 18, 1993, about a month after Careercom's stock was delisted (see Section I.B.1.), the *Pink Sheets* records that brokers bid \$0.01 for the stock and offered it for \$0.10 a share. Careercom's large bid-ask spread indicates a lack of liquidity. It is unlikely that investors are able to sell large amounts of stock for the prices quoted by NQB.

The NQB data have other problems. First, NQB quotes don't identify actual trades. Since dealers are not obligated to honor the price quotes they supply to NQB, some quotes may be exaggerated to attract customers. Second, some

⁹ For stocks delisted before 1981, the NQB supplied the nearest month-end prices after delisting. For subsequent delists, they provided the next available quote date.

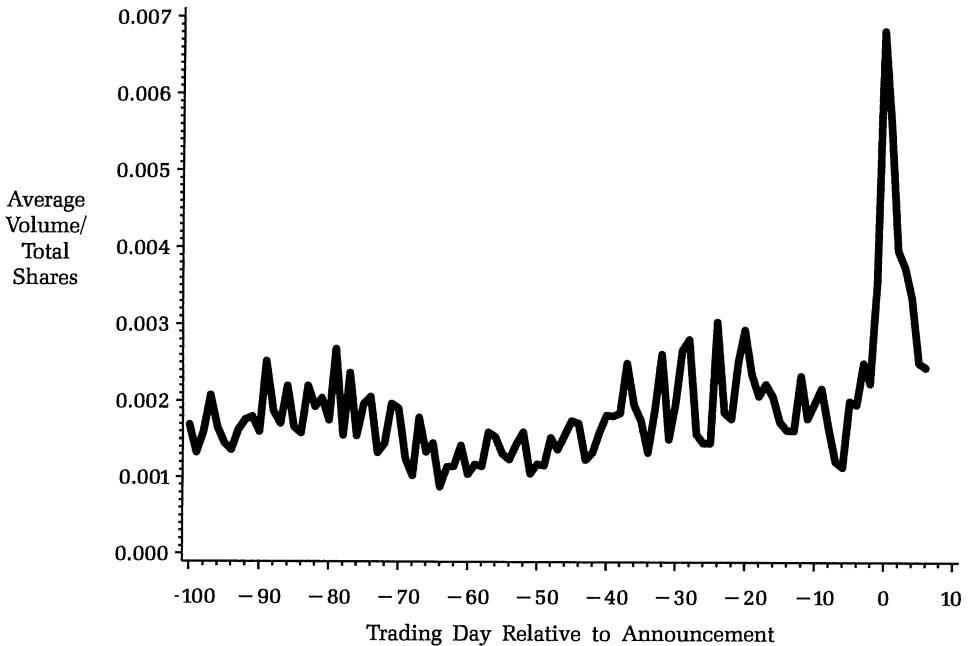


Figure 1. Average trading volume around delist announcements. This figure illustrates what happens to a stock's trading volume when its delisting is announced before its last trading day. Using 59 firms for which a delisting announcement date could be identified in *Nexis*, the figure plots average daily volume per share across firms. Day 0 is the announcement date.

quotes supplied by NQB are not accurate. I dropped the delisting returns of two firms because they were obviously too large, but there may be other mistakes in the NQB data that I did not detect.¹⁰ Third, since NQB quotes do not identify actual trades, it is almost certain that some of the stocks that have delisting returns greater than -1 actually became worthless.¹¹ Finally, NQB does not record every price quoted. When companies become worthless, it is often hard to be certain that stockholders have no opportunity to sell their securities between the stock's delisting date and the date on which it becomes worthless.

While the NQB is the best source for prices of delisted stocks, data taken from the *Pink Sheets* are far from perfect. It is not possible to obtain more than an estimate of performance delisting returns with these data. CRSP has been

¹⁰ I dropped the delisting returns of New Valley Corp (permno = 15325, DRET = 967 percent) because it was bankrupt and precision aerotech (permno = 70981, DRET = 400 percent) because its delist was announced.

¹¹ Western Savings and Loan Association of Phoenix, Arizona (permno = 49840) illustrates this problem. On June 16, 1989, Western was placed in FSLIC receivership and delisted from NYSE. The *Directory of Obsolete Securities* lists Western stock as worthless as of June 14th because of the FSLIC takeover, but the NQB data list a bid quote of $1/16$ and an ask quote of $1/8$ on June 22nd. The NQB data assign a delisting return of -75 percent to this stock while the *Directory of Obsolete Securities* information indicates a return of -1 .

Table V
New Delisting Returns from OTC Prices

Table V presents summary statistics for Center for Research in Security Prices (CRSP) omitted delisting returns. Line 1 describes the data available in the 1993 CRSP files for New York Stock Exchange (NYSE) and American Stock Exchange (AMEX) performance delists since 1962. Lines 2 through 5 describe delisting returns calculated with over-the-counter (OTC) price data purchased from the National Quotations Bureau (NQB), publishers of the *Pink Sheets*. Line 2 describes returns when the delisting price is calculated as the average of the high bid, low bid, high ask, and low ask quotes provided by NQB. Line 3 indicates that 84 firms were identified as worthless after delisting. Line 4 contains the results of adding the returns of -1 to line 2. Line 5 describes the results of combining the new data from NQB in line 4 with the CRSP data from line 1. When both returns are available, Line 5 uses the new OTC data.

Line Description	N	% w/DRET	Ave	Std	Min	Med	Max
1: Original CRSP	120	11.7	-41.6	53.2	-100.0	-33.3	77.8
2: New OTC returns	577	56.1	-23.0	45.4	-98.4	-26.0	315.9
3: Worthless firms	84	8.2	-100.0	0.0	-100.0	-100.0	-100.0
4: New data (lines 2 + 3)	661	64.2	-32.7	49.6	-100.0	-36.0	315.9
5: Total (lines 1 + 4)	734	71.3	-29.9	48.9	-100.0	-31.3	315.9

reluctant to collect OTC data because of these problems. CRSP will eventually release the NQB data as delisting prices (with delisting price dates), but it will probably not calculate delisting returns with NQB prices.

B. Average Delisting Returns in the New Data

Summary statistics for delisting returns are presented in Table V. Line 1 contains information about original CRSP data. Lines 2 through 5 describe the new data from NQB. There were 577 firms for which NQB supplied both bid and ask information.¹² Line 2 shows that the average return for these firms was -23 percent. Line 3 indicates that of the 452 firms that do not have complete NQB information, 84 became worthless after delisting. Adding the worthless stocks to the stocks with OTC data gives an average delisting return of -33 percent. In line 5, the original CRSP data are combined with the new OTC data to estimate the over-all delisting return average. With 71 percent of the delisting returns accounted for, the average return is -30 percent. Table V clearly shows that delisting returns are quite different from zero.

III. The Bias in Previous Studies

When is the delisting bias likely to matter? It should make a difference in portfolios with a concentration of firms that are likely to delist for negative reasons. According to Queen and Roll (1987), portfolios dominated by small

¹² There are 103 firms that only have bid information from NQB and there are 13 firms with only ask data. To check whether firms with missing information are similar to firms with complete information, I analyzed delisting returns calculated with just the bid price and just the ask price. It is not clear that firms that are missing data are similar to those with complete data.

Table VI
Delisting Returns in Overreaction Studies

Table VI examines the effect of the delisting bias on tests of De Bondt and Thaler's (1985) overreaction hypothesis. In each of the 21 periods, 1926–1928, 1929–1931, . . . , 1986–1989, the 35 New York Stock Exchange (NYSE) firms with the highest three year cumulative returns are classified as winners and the 35 firms with the lowest returns are classified as losers. The differences between the subsequent cumulative returns of the winners and losers are reported. Returns are cumulated by both the cumulative abnormal returns (CAR) method and the buy-and-hold method of Conrad and Kaul (1993). Three different sets of delisting returns (DRET) are used in the calculations: original Center for Research in Security Prices (CRSP) delisting returns, the new delisting returns calculated with over-the-counter (OTC) data, and delisting returns of -1 for each performance delist.

Months:	1	6	12	18	24	30	36
DRET	Cumulative Losers-Winners Returns (<i>t</i> -Stats)						
Panel A: CAR Method							
CRSP	9.1 (2.78)	3.7 (0.85)	2.6 (0.41)	17.7 (1.74)	16.7 (1.45)	28.8 (2.01)	30.9 (2.13)
OTC	9.1 (2.78)	3.7 (0.83)	2.5 (0.39)	17.3 (1.70)	15.9 (1.38)	28.0 (1.96)	29.9 (2.07)
−1	9.1 (2.78)	3.1 (0.71)	0.3 (0.06)	14.3 (1.55)	12.8 (1.21)	24.7 (1.83)	26.2 (1.94)
Panel B: Buy-and-Hold Method							
CRSP	9.1 (2.78)	1.5 (0.38)	−2.2 (−0.4)	6.2 (0.82)	5.4 (0.66)	16.1 (1.32)	16.8 (1.32)
OTC	9.1 (2.78)	1.5 (0.37)	−2.3 (−0.4)	6.0 (0.79)	5.1 (0.62)	15.9 (1.29)	16.5 (1.29)
−1	9.1 (2.78)	0.4 (0.10)	−4.4 (−0.8)	3.8 (0.49)	3.0 (0.37)	13.6 (1.12)	13.8 (1.10)

stocks, stocks with low past returns, or stocks with a low price should be the most sensitive to the bias. The bias should be larger for equally-weighted portfolios than for value-weighted portfolios. Portfolio returns calculated by a buy-and-hold method should not be as sensitive to the bias as portfolio returns calculated by compounding average stock returns, like cumulative abnormal returns (CAR). Some studies are more susceptible to the bias than others; its effect depends on both how stocks are sorted and how returns are calculated.

To examine the effect of the bias, I replicate three studies using both CRSP returns and the new OTC delisting returns. Because the new data from NQB is somewhat problematic, I also replicate the studies with a delisting return of -1 assigned to each performance delist. Results obtained with delisting returns of -1 reveal the maximum possible extent of the bias.

A. Overreaction

The first study I replicate is the initial overreaction article by De Bondt and Thaler (1985). Because losers delist for performance reasons more frequently than other stocks, the returns of a portfolio of firms with low past returns

ought to be sensitive to the delisting bias. Table VI presents the results of replicating De Bondt and Thaler's overreaction study with both the Cumulative Abnormal Return approach and the buy-and-hold approach advocated by Conrad and Kaul (1993). The CAR method additively cumulates the portfolio's average return,

$$\text{CAR}_t = \sum_{\tau=0}^t \left[\sum_{i=1}^{n_r^l} \left(\frac{1}{n_r^l} \right) r_{\tau}^{li} - \sum_{j=1}^{n_r^w} \left(\frac{1}{n_r^w} \right) r_{\tau}^{wj} \right] \quad (1)$$

where r_{τ}^{wj} denotes the raw return of the j th winner stock in period τ and n_r^w is the number of stocks left in the winner portfolio in period τ . The CAR calculation implies a monthly portfolio rebalancing. The buy-and-hold method averages the compounded returns of each stock in the portfolio,

$$\text{Buy \& Hold}_t = \left(\frac{1}{35} \right) \sum_{i=1}^{35} \left[\prod_{\tau=1}^t (1 + r_{\tau}^{li}) - 1 \right] - \left(\frac{1}{35} \right) \sum_{j=1}^{35} \left[\prod_{\tau=1}^t (1 + r_{\tau}^{wj}) - 1 \right]. \quad (2)$$

The buy-and-hold calculation implies no rebalancing. Delisted stocks are given a return of 0 after delisting in the buy-and-hold calculation.

Using the CAR method, the new delisting returns from OTC data reduce the disparity between the losers' and the winners' performance by 1 percent. Using returns of -1 for all performance delists reduces the difference by 4.7 percent. Statistical significance is also somewhat reduced. Delisting returns of -1 change overreaction's t -statistic from a marginally significant 2.13 to a marginally insignificant 1.94. Since 11 of the 21 portfolio evaluation periods used in Table VI occur before 1962, when delisting returns are fairly complete, the delisting bias is not large.

Consistent with Conrad and Kaul's evidence, using the buy-and-hold method to calculate the returns of winners and losers produces a small and statistically insignificant overreaction effect. The difference made by including delisting returns is also small. Including delisting returns of -1 in the buy-and-hold calculations reduces the performance of losers compared to winners by 3 percent. This finding verifies that buy-and-hold calculations are less susceptible to the delisting bias than are CAR calculations.

B. IPO Performance

The second study I replicate is Ritter's (1991) study of initial public offering (IPO) performance. Like Ritter, I match small NYSE/AMEX stocks to IPOs to determine the average excess return of IPOs for their first three years. Since the stocks that Ritter matches to IPOs are some of the smallest stocks in the NYSE/AMEX file, the matching procedure may be sensitive to the delisting bias. The difference made by including the new NQB delisting returns is very small (less than 1 percent a year) compared to the underperformance of the

Table VII

Delisting Returns in Size and Book-to-Market Portfolios

Returns reported in Table VII are calculated by sorting all New York Stock Exchange (NYSE), American Stock Exchange (AMEX), and Nasdaq stocks in the Center for Research in Security Prices (CRSP) files into 100 portfolios based on market capitalization and the ratio of book equity (measured at the firm's fiscal year-end) to market equity (measured at the end of December) for each year from 1962 to 1992. The ten market size portfolios are formed by sorting stocks into size categories based on the yearly NYSE size decile limits. Each size portfolio is sorted into ten more portfolios based on book-to-market equity. Then the average monthly return for each of the 100 resulting portfolios in the calendar year after the sort year is calculated and annualized. All portfolio returns reported are equally-weighted returns. Three different sets of delisting returns (DRET) are used in the calculations: original CRSP returns, the new delisting returns calculated with over-the-counter (OTC) data, and delisting returns of -1 for each performance-related delist. Stocks that underwent a performance delist but are missing a new delisting return from National Quotations Bureau (NQB) are given a delisting return of -0.3 in the OTC return column.

Book-to-Market Portfolios (DRET)				Size Portfolios (DRET)			
Port.	CRSP	OTC	-1	Port.	CRSP	OTC	-1
High	20.62	20.40	19.62	Small	21.28	19.83	16.07
9	18.84	18.72	18.32	2	14.82	14.68	14.27
8	17.54	17.42	17.11	3	15.29	15.25	15.07
7	16.39	16.26	15.81	4	16.34	16.30	16.18
6	14.62	14.53	14.23	5	16.12	16.10	15.99
5	14.74	14.61	14.32	6	14.31	14.30	14.19
4	13.95	13.83	13.49	7	14.10	14.10	14.08
3	12.41	12.22	11.76	8	14.67	14.67	14.67
2	12.41	12.19	11.65	9	12.45	12.45	12.40
Low	9.72	9.42	8.65	Large	11.71	11.71	11.71

IPOs in his sample. This is partially due to Ritter's use of buy-and-hold returns. The results are not reported in a table.

C. Size and Book-to-Market Portfolios

The third study that I replicate is the study of size and book-to-market equity effects in stock returns by Fama and French (1992). The results appear in Table VII. My method is slightly different from that of Fama and French, but the qualitative results are very similar. For the smallest size decile, introducing delisting returns of -1 decreases the annualized average monthly return by 5.21 percent. The delisting returns from NQB reduce the return by 1.45 percent. All returns reported in Table VII are equal-weighted portfolio returns. Value-weighted portfolio returns show less sensitivity to the bias.

An interesting fact demonstrated in Table VII is that the influence of delisting returns seems to be highly correlated with size but not correlated with book-to-market equity. Including delisting returns of -1 reduces the performance of small stocks substantially, but it does not affect large stocks' returns. It reduces the returns to high book-to-market stocks by 1 percent, and it reduces the returns to low book-to-market stocks by 1.07 percent.

IV. Conclusion

This article documents a delisting bias in the stock return data base maintained by CRSP. It finds evidence of omitted delisting returns that average about -30 percent, and it shows that most of CRSP's missing delisting returns correspond to surprise delists. The omitted delisting returns can have important consequences for research applications.

In view of the delisting bias, researchers should be explicit about how they handle delisting returns. Portfolio strategies that are susceptible to the bias can be evaluated with the new OTC delisting returns described here. They can also be tested with returns of -0.3 replacing the missing performance delisting returns in CRSP. An upper bound for the bias can be computed by assuming a delisting return of -1 for every performance-related delist.

The delisting bias is more severe in the Nasdaq data than in the NYSE/AMEX files. Despite the fact that nearly half of all Nasdaq delists are for poor performance, no performance delisted Nasdaq stock has a delisting return in the CRSP data. Given the differences between Nasdaq and other exchanges, precisely what the bias means for these stocks is unclear. Quantifying the delisting returns of Nasdaq stocks is a topic that merits future study. Until more is known about those returns, studies that rely heavily on the Nasdaq data will be difficult to interpret.

Given the overall quality of the data maintained by CRSP, the delisting bias is surprising. If the thousands of researchers that use CRSP data have overlooked the delisting bias, there may be other unknown data biases confounding empirical results.

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