

CRSP Delisting Returns

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Introduction

The Center for Research in Security Prices (CRSP) at the University of Chicago's Graduate School of Business maintains historical equity data dating back to December 1925. The CRSP data is widely considered to be the most accurate and comprehensive equity data available for the New York, American, and NASDAQ stock exchanges. Our data includes delisting returns for many of the securities that delisted from these exchanges. A delisting return is the return on a security after it has been removed from the exchange, and it is calculated by comparing the security's value after it delists with its price on the last day of trading. The value after delisting can be an off-exchange price, an off-exchange bid-ask spread (expressed as the average of the bid and ask quotes), or the sum of a series of distribution payments. Delisting information is based on the exchange of shares at the earliest possible opportunity, and the exchange can be the result of trades on a secondary market, distribution payments from the company, or outstanding tender offers. If the CRSP Research Department cannot find a value for a security after it delists, then a missing delisting return code is substituted for a delisting return. If information is not available immediately, then the information is coded as it becomes available. Therefore, issues with missing delisting return codes may eventually show a delisting return.¹

Over the past few years, the interest in delisting returns data for issues that delisted due to poor performance has increased dramatically. As a result, CRSP instituted a series of historical data research projects designed to increase the granularity of the delisting returns in our databases. The CRSP Research Department expended significant resources to capture the off-exchange prices, bid-ask spreads, and distribution payments that are needed to calculate delisting returns. Based on the number of delisting returns that are now available to CRSP data subscribers, we believe that these projects were highly successful.

The historical research projects were designed to make the CRSP data more comprehensive. However, a significant number of delisted stocks still do not have delisting returns even though several historical projects have already been completed. As Shumway (1997) suggested, a bias may exist in empirical research results *if the CRSP missing delisting returns are not treated properly*. However, CRSP does not believe that these missing returns inherently cause a bias in the CRSP data. In fact, CRSP indicates which issues have missing returns in order to avoid a delisting bias. Based on research papers published in the past few years, it seems that missing delisting returns pose a more complicated problem than once thought. Due to their complexity, CRSP does not make any specific recommendations on how to treat missing returns. Instead, we believe that anyone conducting research using the CRSP delist data must carefully consider how to properly treat missing delisting returns, given their own particular research situation, in order to avoid the type of empirical bias that Shumway discussed.

This paper describes the historical research projects, the methodologies used by the CRSP research staff to locate additional data, and the procedures used to calculate delisting returns. We discuss how liquidation announcements may affect delisting returns, and we discuss the concept of a bias in the CRSP data. We calculate average delisting returns using all available CRSP data for issues that delisted from the New York (NYSE), American (AMEX), and NASDAQ stock exchanges. (Throughout this paper, data for the NYSE

¹ For more information about CRSP's equity data, please see the CRSP Data Description Guide (2000), published on our WEB site at www.crsp.com. Subsequent sections of this paper provide more information on CRSP's delisting research, delisting returns calculations, and delisting coding schemes.

and AMEX are combined while data for the NASDAQ is separate.) The results of our calculations are compared with the results published by Shumway (1997) and Shumway and Warther (1999). We also substitute single-replacement values for missing returns and look at the effects that these single-replacement values have on CRSP's Cap-Based Portfolio calculations. Furthermore, we discuss the concept of partial-month returns and point out that they are not delisting returns.

The CRSP data used for all delisting returns calculations discussed in this paper are from the CRSP monthly file through December 2000. The CRSP daily file also includes additional delisting returns, but it has fewer returns than the monthly file for three reasons:

1. The time series is shorter. The daily file begins in 1962 while the monthly file begins in 1925.
2. The post-delist acceptance window is shorter. Daily prices and bid-ask spreads that are beyond ten trading days of the delist dates are rejected. For the monthly file, prices and bid-ask spreads that are beyond ten months of the delist dates are rejected.
3. The daily file does not include any partial-month returns. The monthly file includes numerous partial-month returns, which are stored in the delisting returns field.

Historical Data Research Projects

By the end of 1999, two major historical data research projects were completed: issues that delisted due to liquidation and issues that delisted because they were dropped by an exchange. A few related minor projects have also been completed. These research projects are very resource-intensive and fairly exhaustive. They were designed to locate all available delisting information by checking a variety of data sources.

The first project undertaken by the CRSP research staff involved issues that delisted because the firm entered into liquidation proceedings. CRSP researchers looked for evidence of pre-delist announcements as well as missing liquidation distribution payments. They also re-coded the delisting events from the general delist code (400) to the more descriptive 4** delist codes whenever possible. The second major project undertaken by CRSP researchers involved issues that delisted because they were dropped by an exchange. (In most cases, these issues were dropped due to the poor performance of the company.) These issues were divided into two large groups:

1. All issues that had a delist code of 500 were researched. (A code 500 indicates that the reason an issue was dropped from the exchange is unknown.) For each of these issues, researchers looked for information that explained why the issue was dropped from the exchange. If an explanation was found, then the delisting event was re-coded from the general delist code (500) to the more descriptive 5** delist codes.
2. All issues that had a 5** delist code (including 500's) and that had a missing delisting return were researched. The researchers looked for off-exchange prices or off-exchange bid-ask spreads. If no prices or spreads could be found, then the researchers looked for missing distribution payments.

At the beginning of the first historical research project, the status of all relevant equity issues was set to "pending further research". The primary goal of the research staff was to close as many issues to further research as possible since a delisting return cannot be calculated unless an issue's status has been set to "closed to further research". An issue is "closed to further research" if any of the following conditions apply:

1. Research has found and verified an acceptable off-exchange price or spread within ten periods of the delist date (e.g. ten months for the monthly file.) See the next section for additional information on what CRSP requires for a price or spread to be acceptable.

2. Research has found and verified that a final distribution has been paid to shareholders.
3. Research has found and verified that no distributions were paid (nor will ever be paid) to shareholders. In this case, the issue is considered worthless. Note that CRSP does not declare an issue to be worthless unless one of our sources has already declared it to be worthless. CRSP accepts evidence of worthlessness if that evidence is found within three years of the delist date.
4. Some liquidation distributions have been paid to shareholders, but no final distribution has been found and ten years have passed since the date of the most recent distribution information. (Since liquidation distributions can be paid over a period of several years, CRSP looks for liquidation distribution payments up to ten years after the delist date.)
5. No distributions have been paid to shareholders for an issue that left an exchange due to liquidation or bankruptcy and ten years have passed since the delist date.
6. No delist information can be found for an issue that was dropped by an exchange (for reasons other than liquidation or bankruptcy) and three years have passed since the delist date. (CRSP assumes that if information is available for issues that were dropped from an exchange, it can be found within three years of the delist date.)

If none of the above conditions apply to a given issue, then that issue's status remains "pending further research." CRSP researchers periodically look for post-delist information for issues that have a "pending" status because the first available information can lag behind the delist date by months or even years. Off-exchange trade prices or bid-ask spreads are often not available for several months beyond the date that an issue delisted because no trades occurred and no spreads were reported. Likewise, distributions may not be paid to shareholders for several years beyond the delist date. As a result of these data lags, information may be added to the CRSP database for up to three years after the delist date for issues that were dropped by an exchange due to poor performance. Similarly, information may be added to the database for up to ten years after the delist date for issues that delisted due to bankruptcy or liquidation. (As of December 2000, around 280 issues that delisted between January 1998 and December 2000 due to liquidation or poor performance are pending further research. Only 26 issues that delisted prior to January 1998 are pending further research.)

Delisting Return Calculations

CRSP calculates delisting returns for all issues that have acceptable off-exchange prices or bid-ask spreads². Delisting returns are also calculated for issues that do not have prices or spreads but do have distributions paid to shareholders. (In these cases, the issue has to be "closed to further research" as defined in the previous section.) The calculation of delisting returns is a rather complex issue, and CRSP obviously has to make some assumptions and decisions regarding these calculations. For example, under what circumstances should a return be calculated? Which data should be included in the calculations? Which data should not be included? What kind of price data should be accepted and what kind should be rejected? In an effort to ensure that all CRSP data users understand how CRSP calculates delisting returns, the guidelines used by our research staff for the monthly data are listed below:

1. If a closing price or spread is found within ten months of the delist date, then that price or spread is used to calculate a delisting return. Prices or spreads that are found beyond the ten-month limit are considered to be unacceptable off-exchange values. The ten-month restriction was chosen to protect

² Prices and spreads are identified in the CRSP data by the type of mathematical sign that precedes the value. A spread has a negative sign in front of the value while an actual trade price does not have any sign in front of the value.

the integrity of the data. The longer the time span between the delist date and the date of the next available information, the greater the chance of capturing incorrect data. There is a greater chance that 1) splits or reverse splits occurred, but were not reported in our sources; 2) the data may apply to a completely different company that has the same name; and 3) the equity owners of the company may have changed through some type of reorganization. CRSP firmly believes that no data is far better than bad data, so this fairly stringent restriction is enforced, and the ten-month rule applies to each of the cases listed below.

2. In some cases, where prices or spreads are found, post-delist distribution payments are also found. Delisting returns are calculated by adding the first off-exchange price or spread to the sum of all the distribution payments made to shareholders up to the date of the price. However, all distribution payments made after the date of the price or spread are ignored because CRSP assumes that the rational investor sells a delisted stock at the first opportunity. (The first opportunity is represented by the existence of an off-exchange price or an off-exchange bid-ask spread).
3. In some cases, an issue is dropped by an exchange, and sometime thereafter, the issue became involved in a tender offer or merger. The event is given a 5** delist code instead of a 2** (merger) delist code because the merger or tender offer did not begin until well after the issue delisted. A delisting return is calculated using the first available price or spread. Any tender offer distributions that occurred after the date of the first price or spread are ignored. Again, CRSP assumes that all shareholders will sell at the first opportunity after the issue delists. If no price or spread is found, then the tender offer is treated as a distribution, and it is used to calculate a delisting return.
4. For liquidations, if no prices or spreads are found within the ten-month period, but a final distribution payment is found, then a delisting return is calculated using the sum of all post-delist distribution payments. CRSP assumes that no trading occurred after the delist date (because no price or spread was found) and that shareholders received the sum of all distribution payments.
5. For liquidations, if no prices or spreads are found within the ten-month period and no final distribution payment is found, but at least one non-final payment is found, then a delisting return is calculated using the sum of all post-delist distribution payments. The issue must be closed to further research, as defined in the previous section. Since CRSP assumes that the final distribution payment would have been paid within ten years, we therefore assume that the last known payment is actually the final payment or that the final payment was not reported in any of our sources.³
6. For dropped issues, if no prices or spreads are found within the ten-month period, but at least one distribution payment is found, then a delisting return is calculated using the sum of all post-delist distribution payments. The issue must be closed to further research, as defined in the previous section.³
7. If a price or spread is found beyond the ten-month restriction, but no distribution payments are found, then the price or spread is rejected and the delisting return for the issue is set to -66. (A -66 indicates that the delisting return is missing, but a value was found beyond the ten-month restriction.)
8. If no prices, spreads, or distribution payments are found, then researchers look for evidence of worthlessness. If the issue was declared worthless within three years of the delist date, then the delisting return is set to -1.00 (i.e. a 100% loss to the shareholder.) CRSP will indicate that a stock is worthless only if one of our sources declares the stock to be worthless. If CRSP cannot verify worthlessness through one of our data sources, then we do not declare the stock to be worthless.

³ There is one exception to this rule: if one or more distributions have an unknown amount paid to shareholders, then all distributions are ignored and the delisting return is considered missing.

9. If a price, spread, distribution payment, or evidence of worthlessness cannot be found within any of the guidelines listed above, then the delisting return for the issue is set to -55. (A -55 indicates that the delisting return is missing because none of CRSP's sources provided a value after delisting.)
10. If a price, spread, or distribution payment produced more than a positive or negative fifteen percent delisting return, then the research staff attempts to verify, and if necessary, correct the value. (Note that large delisting returns are common and considered acceptable when a stock's final value is less than a dollar per share.) Issues that produce unusually large returns are also researched for stock splits and reorganizations, and all necessary adjustments are made. However, it is possible that splits and reverse splits were never reported by any of the sources used by the CRSP Research Department. Without such information, CRSP cannot properly adjust delisting returns.⁴

Once again, CRSP developed these policies in order to provide the most accurate delisting return data possible while protecting the integrity of the CRSP databases. These restrictions limit the risk of replacing missing data with bad data.

Data Sources

CRSP uses a variety of data sources to obtain off-exchange prices and bid-ask spreads, distribution payments, evidence of worthlessness, pre-delist announcements, and event explanations. Until recently, CRSP did not include off-exchange prices or bid-ask spreads from NQB's Pink Sheets because of the problematic nature of the Pink Sheets data. According to Shumway (1997),

"There is often a large spread between the bid and ask quotes for OTC stocks. ... 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 quotes supplied by NQB are not accurate. ... 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. 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."

Despite the problematic nature of the Pink Sheets data, and OTC data in general, CRSP has decided to include Pink Sheets data, as provided by our data sources, for the sole purpose of obtaining additional delisting returns⁵. We believe that for individual issues, a delisting return calculated using Pink Sheets data would be more accurate than one calculated using a single-replacement value that is substituted for all missing returns. However, researchers using CRSP data should consider Shumway's (1997) warning: "...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."

Delisting Announcements

CRSP uses several sources to search for evidence of pre-delist announcements, which indicate that an issue will be dropped from an exchange due to liquidation or poor performance. The announcement dates are important because they may have an impact on the delisting return. For example, if a firm's entry into

⁴ There are 73 issues that delisted due to poor performance or liquidation in the monthly data file (as of December 2000) that have delisting returns greater than 100%. All but 5 of these issues are "penny" stocks. Eighteen of them are pending further research.

⁵ CRSP does not receive any price data directly from the National Quotation Bureau's Pink Sheets. Our price data comes from multiple sources, some of which include Pink Sheet Prices. However, our data sources do not indicate where they obtained each individual price or quote.

liquidation proceedings was announced, then the shareholders may have been able to sell their shares prior to delisting. According to Shumway (1997), “Since any stock price reaction to the delisting news will occur around the announcement day rather than the delist day, delisting returns should be close to zero.” However, if no pre-delist announcement was made, then the delist came as a surprise to the shareholders. We assume that the delisting returns should be less (i.e. more negative) for surprise delists than for announced ones.

Pre-delist announcements are extremely rare for issues that were dropped by an exchange due to poor performance. However, the CRSP data contains a total of 412 issues that delisted due to liquidation, and 42.7 % of them have some type of pre-delist announcement of liquidation⁶. The research staff found evidence of pre-delist announcements for 41.7% of the NYSE and AMEX liquidation issues and 44.1 % of the NASDAQ liquidation issues. The average delisting returns for liquidations are listed in Table 1. All known post-delist liquidation payments were used to calculate individual delisting returns.

Table 1: Liquidation Announcement Dates and Delisting Returns

Delisting Was Announced	Delisting Returns Exist	NYSE / AMEX		NASDAQ	
		Number of Issues Found	Average Delisting Return	Number of Issues Found	Average Delisting Return
YES	YES	89	6.8 %	70	20.2 %
NO	YES	118	9.8 %	89	11.7 %
YES	NO	9	N/A	8	N/A
NO	NO	19	N/A	10	N/A

The delisting returns shown in the first two rows of Table 1 for the NYSE / AMEX data seem reasonable. The return to the investor is less if the delisting was announced prior to the delist date than if it was a surprise delist. However, the returns for the NASDAQ data are surprising. The investors did better if the delisting was announced than if it was a surprise. It is also surprising that none of the average delisting returns shown in Table 1 is close to zero – especially for announced liquidations.

Partial-Month Returns

Since the data used in the calculations discussed in this paper are from the CRSP monthly file, a few comments about partial-month returns may be appropriate. For monthly data, if no post-delist value (e.g. price, bid-ask spread, or distribution payment) can be found, then a delisting return cannot be calculated. Instead, CRSP attempts to calculate a partial-month return using the last daily trade price or bid-ask spread for the month in which the security delisted.

Partial-month returns are calculated only if all of the following conditions are met:

1. CRSP researchers could not find any value after the delist date.
2. The security did not delist on the last trading day of the delisting month.
3. Daily prices exist between the previous month's last trading date and the delist date.

⁶ The dates of these announcements are located in the Date of Next Available Information (NEXTDT field) of the DELIST structure, but this field holds announcement dates only for issues that delisted due to liquidation. In the past, if liquidation proceedings were announced, then the NEXTDT was set equal to the Delisting Date (DLSTDT field). This policy no longer holds true for issues that delisted due to liquidation (i.e. issues with a 4** delist code.)

Partial-month returns are stored in the *Delisting Return* field even though they are not actual delisting returns. CRSP identifies partial-month returns by making the value in the *Delisting Payment Date* field less than or equal to the value in the *Delisting Date* field⁷. The prices used to calculate partial-month returns are not off-exchange prices; they are the last daily trade prices or bid-ask spreads available during the delisting month⁸. When a post-delist value is available, a partial-month return provides the gain or loss accumulated between the date of the last daily trade and the delist date. These returns are necessary to maintain consistency with the corresponding daily returns data. When post-delist values are not available, CRSP believes that calculating a partial-month return using a price after the last month-end price allows the researcher to make a more accurate estimate of an actual delisting return. However, if a daily trade price or bid-ask spread cannot be found for the delisting month, as described in condition three above, then no partial-month return is calculated. Instead, the delisting return is considered missing, and it is set to -55.

Researchers may choose to adjust the partial-month returns. For example, if researchers assume that issues with missing delisting returns should be replaced by an average loss, then the same average loss should be compounded into the partial-month returns. In this manner, researchers can calculate *replacement delisting returns* that incorporate gains or losses from partial-month returns. Of course, researchers can simply assume that partial-month returns are a valid proxy for delisting returns and thus make no adjustments. The important point is that researchers using the CRSP monthly data must determine how best to handle partial-month returns as well as missing delisting returns given their particular research situation. (In the daily file, no partial-month returns are possible, and no proxies or estimates for missing returns are available.)

Average Delisting Returns

Now that CRSP has captured a large number of previously missing delisting returns, we are able to calculate average returns for each of the major types of delisting events. The average delisting returns for monthly data (from 1925 through December 2000) are provided in Table 2 for the NYSE, AMEX, and NASDAQ exchanges. The “Number of Issues Found” columns indicate the number of issues that have delisting returns. Depending on the type of delisting event, anywhere from 70 to nearly 100 percent of all delisted issues have delisting returns.

Table 2: Average Delisting Returns – All Delisting Events

Reason for Delisting	NYSE / AMEX		NASDAQ	
	Number of Issues Found	Average Delisting Return	Number of Issues Found	Average Delisting Return
Merger	3659 (99.4 %)	+3.1 %	4262 (99.2 %)	+3.9 %
Exchange of Stock	468 (99.6 %)	0.0 %	304 (99.0 %)	+2.6 %
Liquidation	202 (86.7 %)	+8.7 %	149 (85.1 %)	+16.3 %
Poor Performance ⁹	1019 (73.2 %)	-41.7 %	3868 (76.5 %)	-16.3 %

Researchers are particularly interested in the delisting returns associated with issues that were dropped from an exchange due to poor performance (i.e. most of the issues that are given 5** delist codes.) In Table 3, we compare the average returns calculated by CRSP researchers to the average returns published by Shumway (1997) and Shumway and Warther (1999).

⁷ Partial-month returns are stored in the *Delisting Return* field, but they do NOT increase the number of actual delisting returns.

⁸ The prices used to calculate partial-month returns are stored in the *Amount After Delisting* field, but again they are NOT off-exchange prices.

⁹ These figures are for code 5** poor performance issues only.

Table 3: Comparison of Average Delisting Returns – Poor Performance Delists

	NYSE / AMEX		NASDAQ	
	CRSP	Shumway	CRSP	Shumway & Warther
Number of Returns Calculated	1019	734	3868	2107
Percent of Returns Calculated	73 %	71 %	77 %	63 %
Average Delisting Return	-41.7 %	-30.0 %	-16.3 %	-26.3 %

The following observations may explain the differences between CRSP's average returns and Shumway's average returns as listed in Table 3.

1. The CRSP NYSE and AMEX data begins in 1926 while the CRSP NASDAQ data begins in 1972. We used all **monthly** data through December 2000. Shumway used subsets of the CRSP **daily** data: 1962 – 1993 for NYSE and AMEX issues and 1977 – 1994 for the NASDAQ issues.
2. A significant number of issues have been re-coded as a result of CRSP's historical research projects. The re-coding will affect the average delisting returns when calculated on a per-delist code basis. For example, all issues that had a delist code of 700 (delisted by Securities Exchange Commission) have been recoded. They now have a delist code of 591 (delisted by current exchange – delisting required by Securities Exchange Commission).
3. Issues that have a delist code between 501 and 519 (issue moved to a different exchange) were not included in the CRSP calculations since these are not necessarily performance-based delists. Also, issues with delist codes of 573 (going private), 588 (conversions of closed-end investment company to opened-end investment company), and 590 (underlying assets have merged with another company) were not included in the CRSP calculations for the same reason. CRSP included in the calculations all issues with a delist code of 551 (insufficient number of shareholders). However, not all of these issues delisted due to poor performance; some of them are associated with tender offers and actually have positive returns.¹⁰
4. CRSP accepts off-exchange prices or bid-ask spreads only if they occur within ten months (300 calendar days specifically) of the delist date for NYSE, AMEX and NASDAQ issues. Shumway accepted off-exchange prices or bid-ask spreads if they occurred within three months (100 days specifically) of the delist date for NYSE and AMEX issues. Shumway and Warther accepted off-exchange prices or bid-ask spreads if they occurred within 24 months of the delist date for NASDAQ issues.
5. CRSP assigns a -1.00 delisting return for an issue that was worthless if the evidence of worthlessness occurs within three years of the delist date. This holds true for delistings from the NYSE, AMEX, or NASDAQ exchanges. Shumway accepts evidence of worthlessness if it occurs within five years for NASDAQ delists, but he does not indicate any restrictions regarding evidence of worthlessness for NYSE and AMEX delistings. Additional worthless issues, with a -1.00 delisting return, will have an impact on average delisting returns.
6. CRSP accepts the first off-exchange closing price or bid-ask spread. Shumway accepted the first off-exchange prices or spreads, but he does not indicate if they were the closing values. If more than one set of quotes was reported, he took the average of the highest bid, lowest bid, highest

¹⁰ Other 5** delist codes that are included in the CRSP calculations indicate that a company failed to meet certain requirements. However, such failures may not necessarily indicate poor financial performance. In some of these cases, the delisting returns are actually positive.

ask, and lowest ask. These are subtle differences in price collection methodologies, but the differences may result in the use of different prices or spreads to calculate individual delisting returns.

As shown in Tables 2 and 3, CRSP has calculated delisting returns for 73 percent of the NYSE and AMEX issues and 77 percent of the NASDAQ issues that delisted due to poor performance. However, 373 NYSE and AMEX issues and 1189 NASDAQ issues still have missing delisting returns. (Of these, partial-month returns are provided for 300 NYSE and AMEX issues and 1084 NASDAQ issues.) The returns are missing because CRSP researchers were unable to find the information required to calculate delisting returns in any of our data sources. CRSP, as a data provider, does not make any specific recommendations on how to treat these missing returns. Nor do we accept or reject recommendations for handling missing delisting returns made by anyone using the CRSP data. We agree with Shumway that researchers can create delisting biases in their empirical research results if missing delisting returns are not properly handled. However, we reject the notion that the CRSP equity data is somehow biased simply because delisting returns are missing. Issues with missing delisting returns are purposefully given special codes that indicate why a return is missing in order to avoid creating a bias in the CRSP data.

In order to avoid a delisting bias in his research work, Shumway (1997) published a possible single-replacement value that could be substituted for all NYSE and AMEX missing delisting returns. Also, Shumway and Warther (1999) published another possible single-replacement value that could be substituted for all NASDAQ missing delisting returns. Although these suggested values are derived in part from existing delisting returns data, they also are based on a series of assumptions. Other researchers may choose to make different assumptions and thus choose different single-replacement values that could be substituted for missing delisting returns.

While CRSP cannot provide specific recommendations regarding missing delisting returns, we do recommend that, in general, all researchers carefully consider how missing delisting returns should be handled in their particular situation. For example, CRSP believes that researchers should question whether or not using one replacement value for all missing delisting returns associated with poor performance delists is the most appropriate solution for all types of portfolios. Researchers should also question whether or not treating partial-month returns as if they were delisting returns (i.e. without some type of adjustment) is an appropriate solution.

In order to test the impact of using single-replacement values for all missing delisting returns for performance delists, we needed to calculate average delisting returns for each individual CRSP delist code. We assume that significant variation in the average delisting returns for individual delist codes is an argument against using single-replacement values. Table 4 provides the average delisting returns for NYSE and AMEX individual performance delist codes that had a statistically significant number of returns¹¹. The amount of variation in the returns for individual delist codes is significant. Since Shumway (1997) did not provide average delisting returns per delist code for NYSE and AMEX data, we cannot compare our values to his. Table A4 (in the Appendix) lists NYSE and AMEX average delisting returns for all poor-performance delist codes. Also, Figures A1 through A4 (in the Appendix) show the NYSE / AMEX delisting return data graphically.

¹¹ We consider a delist code to have a statistically significant number of returns if at least 100 returns have been captured. For delist codes with low counts (under 40 issues), differences in the average delisting returns vary from slight to huge. CRSP believes that the low counts make these averages statistically irrelevant.

Table 4: NYSE and AMEX Average Delisting Returns – Poor Performance Delists

CRSP Delist Code	Number of Issues Found	Average Delisting Return
500	309	-26.3 %
574	240	-61.7 %
584	316	-43.4 %

The average delisting returns for the NASDAQ individual performance delist codes that had a statistically significant number of returns are shown in Table 5. Since Shumway and Warther (1999) provided their average delisting returns for individual delist codes, we have included them for comparison. The variation in CRSP’s average delisting returns is noticeable, but the variation in Shumway and Warther’s returns is significant. Table A5 (in the Appendix) lists NASDAQ average delisting returns for all poor-performance delist codes while Figures A5 through A7 (in the Appendix) show the NASDAQ delisting return data graphically.

Table 5: Comparison of NASDAQ Average Delisting Returns – Poor Performance Delists

CRSP Delist Code	CRSP		Shumway and Warther	
	Number of Issues Found	Average Delisting Return	Number of Issues Found	Average Delisting Return
500	566	-18.6 %	391	-20.8 %
550	247	-19.7 %	255	-30.3 %
552	438	-12.4 %	83	-0.2 %
560	874	-11.5 %	606	-28.9 %
561	493	-16.4 %	134	-26.5 %
570	133	-16.7 %	82	-20.8 %
580	578	-19.2 %	344	-32.5 %
582	115	-18.9 %	16	-37.1 %

For many of the cases in Table 5, the CRSP average delisting returns are significantly different from those reported by Shumway, possibly due to reasons noted earlier in this section of the paper.

Missing Delisting Returns - Effects on Cap-Based Portfolio Calculations

Given the variation in average delisting returns associated with the individual delist codes shown in Tables 4 and 5, CRSP wanted to further test the effects of single-replacement values. Therefore, we calculated a series of Cap-Based portfolios using the CRSP monthly data (through December 2000) to measure the effect that single-replacement values have on annualized portfolio returns. CRSP researchers calculated our standard Cap-Based portfolios¹² using two different methodologies for handling missing delisting returns. In the first method (called “Partial” in the following tables,) we replaced missing delisting returns with the gain

¹² The standard CRSP Cap-Based Portfolio includes data from the NYSE, AMEX, and NASDAQ National Market; NASDAQ Small Cap stocks are NOT included. The portfolio’s break points are based on the NYSE data. Note: the CRSP Cap-Based Portfolios are available as a stand-alone product.

or loss that would have resulted if an issue had been sold on the last daily trading date (i.e. a partial-month return.) If a trade price could not be found within the month an issue delisted, then no return is calculated for that issue. Also, no adjustments are made to the partial-month returns. In the second method, we replaced missing returns with one of three different single-replacement values. If a partial-month return exists, then the single-replacement values were compounded off the partial-month return. If no partial-month return is available, then the single-replacement values are simply substituted for the missing delisting return. The three single-replacement values respectively assume that all issues with missing delisting returns (including those issues with partial-month returns) lost an additional 30, 55, or 100 percent of their pre-delist value after leaving the exchange¹³. A 100 percent loss is obviously the lower limit of single-replacement values.

Table 6 shows the annualized returns in percentages (from 1925 through December 2000) for portfolios one through ten. The annualized returns change very little in portfolios one through nine regardless of methodology. For portfolio ten, which includes the smallest capitalization stocks from the NYSE, AMEX, and NASDAQ NMS, the difference between methods is noticeable but not large (less than two tenths of one percent.)¹⁴ The slight differences are not surprising since the NASDAQ Small-Cap stocks are not included in these portfolio calculations. The single-replacement value does not appear to have much impact on the portfolios' annualized returns, and treating partial-month returns as if they were delisting returns appears to be an acceptable solution. Therefore, we conclude that for larger capitalization stocks, the choice of single-replacement values does not appear to significantly alter the relative performance of the Cap-Based portfolios.

Table 6: Annualized Returns for NYSE / AMEX / NASDAQ National Market Data

Portfolio	Annualized Returns			
	Partial	-30%	-55%	-100%
1	10.31	10.31	10.31	10.31
2	11.27	11.27	11.27	11.27
3	11.58	11.58	11.58	11.57
4	11.53	11.53	11.53	11.53
5	11.81	11.81	11.81	11.81
6	11.84	11.83	11.83	11.82
7	11.57	11.57	11.56	11.55
8	11.66	11.65	11.64	11.63
9	11.75	11.74	11.74	11.72
10	13.11	13.05	13.00	12.92

Since the NASDAQ Small-Cap stocks are not included in CRSP's standard Cap-Based Portfolios, we decided to create new Cap-Based portfolios (using monthly data from 1972 through December 2000) that include all NASDAQ National Market and NASDAQ Small-Cap stocks, but do not include issues that traded on the NYSE or AMEX.¹⁵ We calculated the annualized returns on the new portfolios using the same methodologies and the same single-replacement values that we used for the standard Cap-Based Portfolios

¹³ Shumway (1997) proposed the replacement value of -30 % for NYSE and AMEX issues with missing delisting returns. Shumway and Warther (1999) proposed the replacement value of -55 % for NASDAQ issues with missing delisting returns.

¹⁴ The break point for portfolio ten of CRSP's standard Cap-Based portfolio is \$86,810,100. The break point is the largest capitalization included in a given portfolio.

¹⁵ These portfolios are not available as a CRSP product.

discussed above. However, the break points were based on the NASDAQ data (National Market and Small-Cap) instead of the NYSE data. Therefore, the absolute size of companies in this index is not comparable to those in CRSP's standard Cap-Based Portfolios.

The annualized returns in percentages (from 1972 through December 2000) for portfolios one through ten are shown in table 7. The annualized returns change very little in portfolios one through six regardless of the methodology. For portfolios seven through nine, the differences between methods are noticeable but not large (the largest is slightly more than two tenths of one percent.) Portfolio ten, which contains the smallest capitalization issues, has the largest difference in annualized returns.¹⁶ The largest difference between single-replacement values is less than four tenths of one percent while the maximum difference between the “partial” method and the single-replacement value method is slightly more than one half of one percent.

Table 7: Annualized Returns for NASDAQ National Market / NASDAQ Small-Cap Data

Portfolio	Annualized Returns			
	Partial	-30 %	-55 %	-100 %
1	14.76	14.75	14.75	14.75
2	11.22	11.21	11.21	11.21
3	9.01	9.02	9.02	9.02
4	5.86	5.83	5.81	5.77
5	5.44	5.44	5.43	5.39
6	4.54	4.54	4.53	4.51
7	2.06	2.00	1.96	1.87
8	2.18	2.12	2.08	2.04
9	4.52	4.47	4.41	4.31
10	16.67	16.48	16.35	16.13

The “partial” method produces returns that are slightly higher than the returns provided by the single-replacement value method for most of the portfolios. However, if the “partial” method is used, then the differences in returns as compared to the single-replacement value method are still not very large for any of the portfolios¹⁷. Therefore, with regard to cap-based portfolios and annualized returns, we conclude that treating partial-month returns as if they were delisting returns appears to be an acceptable solution for all but the smallest capitalization stocks. Also, the choice of single-replacement values does not seem to have much of an impact on the annualized returns for the NASDAQ National Market and Small-Cap data. The small differences in the NASDAQ Cap-Based portfolios are surprising since the NASDAQ Small-Cap stocks are included in these portfolio calculations. It appears that the choice of single-replacement values has a more pronounced impact when research is concentrated on just the smallest capitalization stocks.

¹⁶ The break point for portfolio ten of CRSP's NASDAQ Small Cap and NMS Cap-Based portfolio is \$11,180,813. The break point is the largest capitalization included in a given portfolio.

¹⁷ Reminder: the “Partial” method does not apply to delisting returns calculated with CRSP daily data. However, the use of single-replacement values applies to delisting returns calculated with either CRSP monthly data or with CRSP daily data.

Conclusions

CRSP developed a series of historical projects to improve the granularity of our delisting returns database and thereby further increase the accuracy, integrity, and completeness of the CRSP equity data. Two major projects, which addressed missing delisting returns for liquidations and issues dropped by an exchange, have been completed. As a result of these two projects, a large number of previously missing delisting returns have been replaced with actual returns based on off-exchange prices, off-exchange bid-ask spreads, or post-delist distribution payments. However, a significant number of poor performance issues are still missing delisting returns. In most of these cases, partial-month returns are calculated and stored in the same data field that holds the delisting returns.

Those issues that still have missing returns do not in and of themselves introduce a bias into the CRSP data. Indeed, we have coded these issues as missing to prevent the introduction of a bias. However, empirical research results may be biased if researchers do not properly account for the missing returns. One of the main purposes of this paper has been to provide researchers with a perspective on the treatment of missing delisting returns, as well as some of the possible effects that various assumptions associated with them can have on empirical results. As strictly a data provider, CRSP does not make any recommendations on how to account for missing delisting returns. Suggested single-replacement values have been published by other researchers, but CRSP neither accepts nor rejects these values. Of course, CRSP recognizes that different approaches regarding the treatment of missing delisting returns may be appropriate for different situations. Again, we urge every researcher who uses the CRSP data to carefully consider which approach is most appropriate for their particular study.

Based on the variation of average delisting returns for individual delist codes, we believe that anyone using the CRSP data should question whether one value can be used to replace all missing returns. However, for portfolios that include larger capitalization issues (e.g. NYSE, AMEX, or NASDAQ National Market issues), the choice of single-replacement values does not appear to have much of an impact on the portfolios' annualized returns. We assume that by choosing multiple single-replacement values based on the combination of delisting stock exchange and individual delist codes, the portfolios' annualized returns may be more accurate. However, the returns may not be much different from returns calculated with just one single-replacement value for all missing delisting returns.

CRSP also reminds researchers that partial-month returns are not delisting returns. Currently, researchers can treat them *as if* they were delisting returns or adjust them to create delisting returns. Regardless of the method used, CRSP believes that each researcher should carefully consider how to treat partial-month returns in each specific analysis to be performed.

Based on the announcement data available to CRSP for issues that delisted due to liquidation, pre-delist announcements appear to have a significant effect on delisting returns for issues that delisted from the NYSE, AMEX, or NASDAQ. However, we find the impact of these announcements on delisting returns for issues that delisted from the NASDAQ somewhat surprising.

In this paper, we wanted to highlight recent research that CRSP has undertaken to improve our delisting database and to note a few of the differences between the monthly and daily CRSP stock files. We also wanted to take this opportunity to explain the standards and methodologies we use to collect, research, and code our data. We place substantial importance on these standards and methodologies in order to provide the most accurate historical equity data available.

References

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Shumway, Tyler, 1997, The Delisting Bias in CRSP Data, *The Journal of Finance*, 52, 327 – 340.

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Appendix

Table A4: Average Delisting Returns – NYSE / AMEX Poor Performance Delists

CRSP Delist Code	CRSP	
	Number of Issues Found	Average Delisting Return
500	309	-26.3 %
520	18	-41.5 %
551	36	-16.8%
552	20	-72.5 %
560	13	-19.5 %
561	27	-21.3 %
570	11	-29.3 %
572	5	-75.9 %
574	240	-61.7 %
580	10	-71.1 %
582	2	-31.1 %
584	316	-43.4 %
585	2	-51.0 %
589	4	-41.0 %
591	6	-85.6%

Table A5: Comparison of Average Delisting Returns – NASDAQ Poor Performance Delists

CRSP Delist Code	CRSP		Shumway & Warther	
	Number of Issues Found	Average Delisting Return	Number of Issues Found	Average Delisting Return
500	566	-18.6 %	391	-20.8 %
520	36	-20.4 %	47	-35.6 %
550	247	-19.7 %	255	-30.3 %
551	73	-1.0 %	53	-2.6 %
552	438	-12.4 %	83	-0.2 %
560	874	-11.5 %	606	-28.9 %
561	493	-16.4 %	134	-26.5 %
570	133	-16.7 %	82	-20.8 %
572	10	+4.5 %	4	-23.5 %
574	91	-31.8 %	13	-39.8 %
575	3	-2.6 %	2	+4.1 %
580	578	-19.2 %	344	-32.5 %
581	60	-3.5 %	30	-9.1 %
582	115	-18.9 %	16	-37.1 %
583	6	-12.2 %	5	-60.9 %
584	75	-34.5 %	3	-66.1 %
585	55	-27.1 %	N/A	N/A
587	6	-11.6 %	N/A	N/A
591	9	-44.1 %	N/A	N/A

Figure A1 - NYSE and AMEX Performance Delisting Events

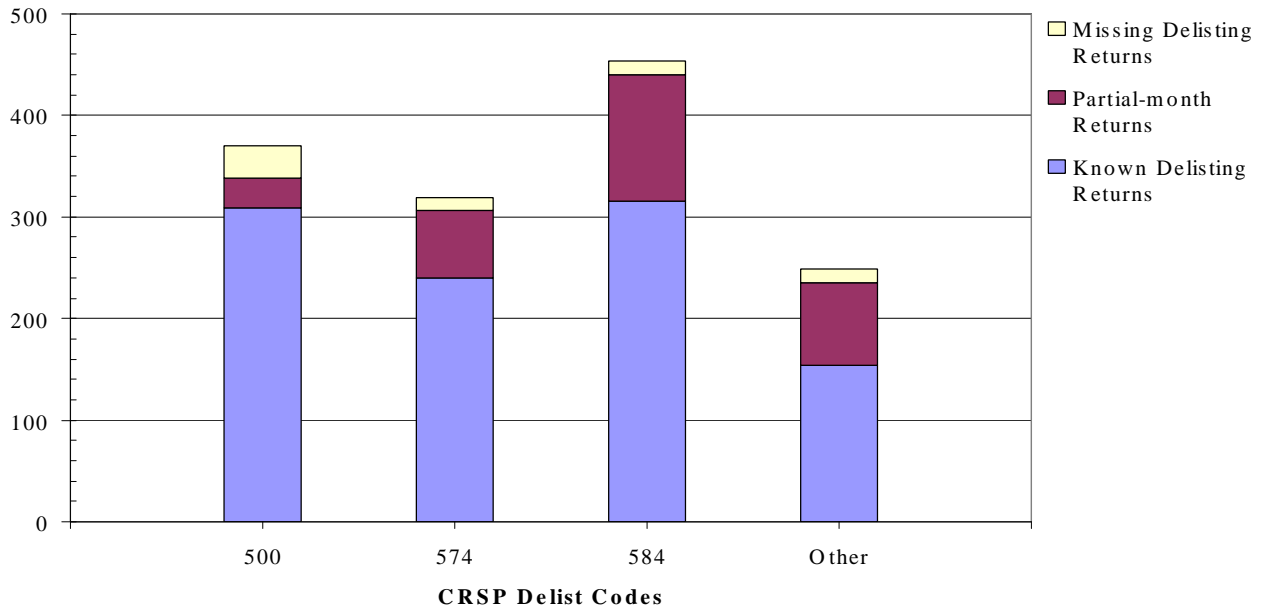


Figure A1 – This figure indicates that very few NYSE or AMEX performance (code 5**) issues still have missing delisting returns. However, a partial-month return is only a proxy for a delisting return and is provided in the monthly file because a delisting return could not be calculated.

Figure A2- NYSE and AMEX Performance Delisting Returns

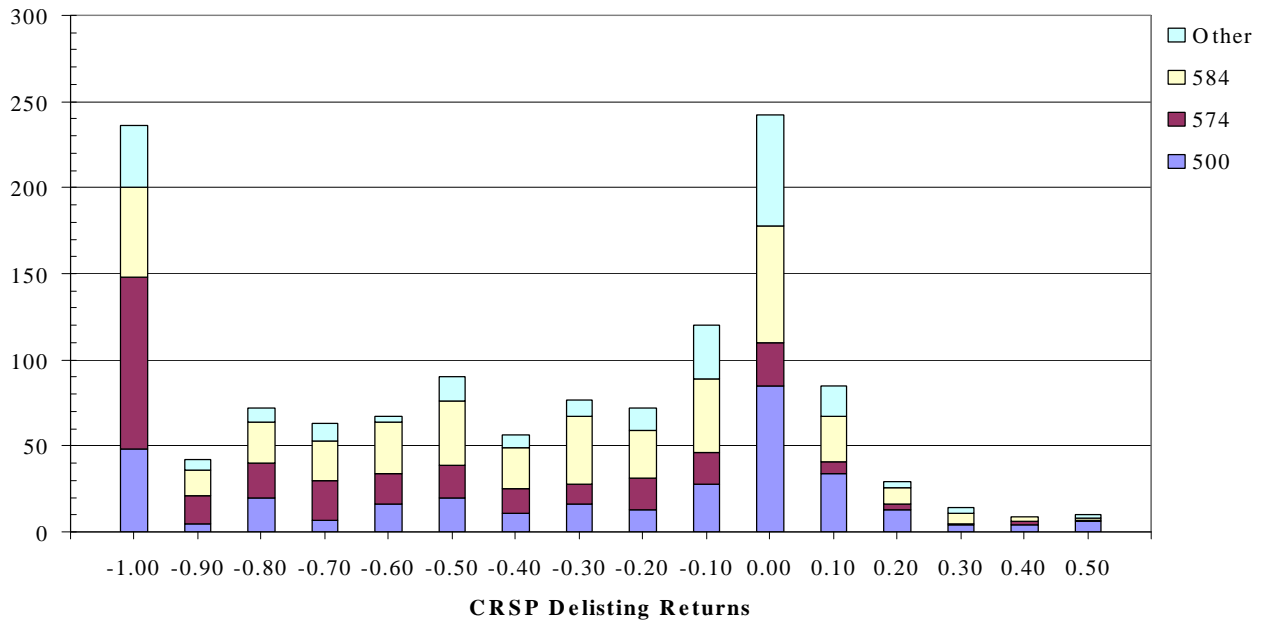


Figure A2 – The bar centered at -1.00 primarily represents the worthless code 5** issues, although it may represent some issues between -0.95 and -1.00. The few data points that had delisting returns greater than +0.55 are not included in this graph for display purposes.

Figure A3 - NYSE and AMEX Performance Delisting Returns

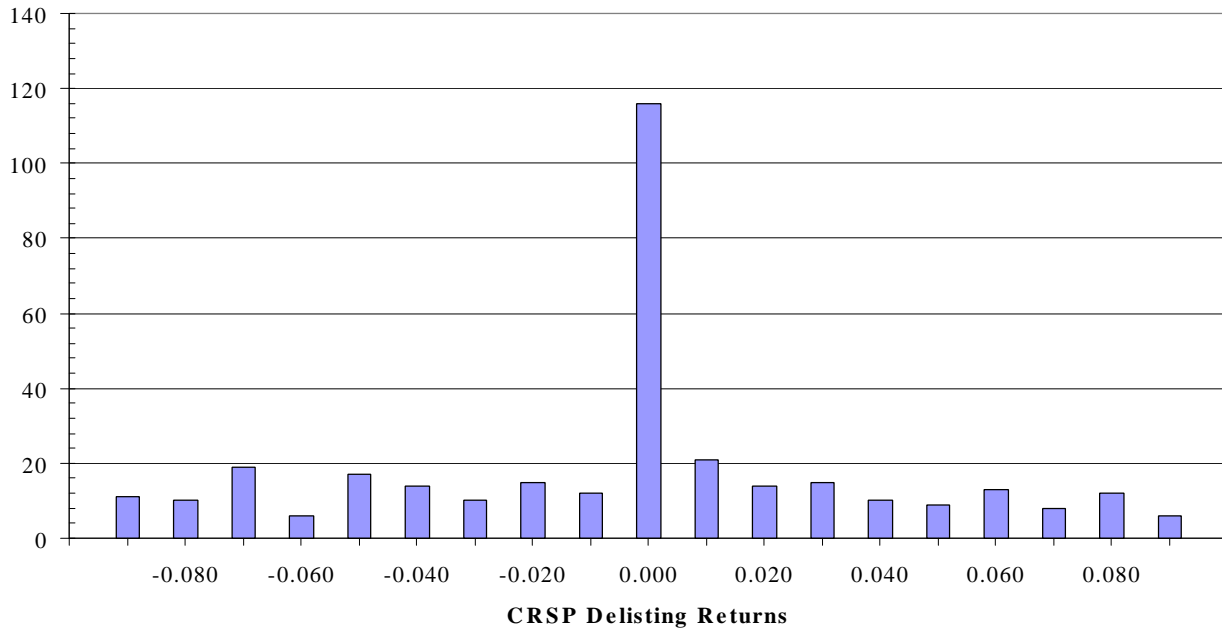


Figure A3 – This graph is a “blow up” around zero of the graph in Figure A2. The bars represent NYSE and AMEX delisting returns between -0.095 and $+0.095$ for all performance delist codes. The bar centered at 0.000 represents issues with delisting returns between -0.005 and $+0.005$.

Figure A4 - NYSE and AMEX Performance Delisting Returns

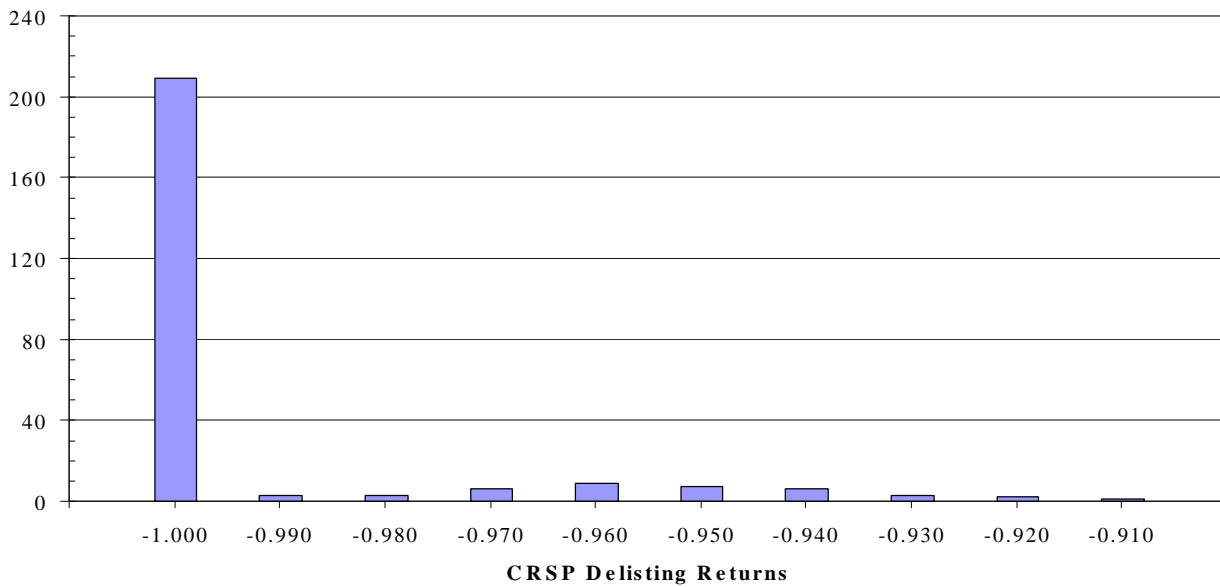


Figure A4 – This graph is a “blow up” around -1.000 of the graph in Figure A2. The bars represent delisting returns between -1.000 and -0.905 for all performance delist codes. All but one of the issues represented by the bar centered at -1.000 have delisting returns equal to -1.000 , the lowest possible value.

Figure A5 - NASDAQ Performance Delisting Events

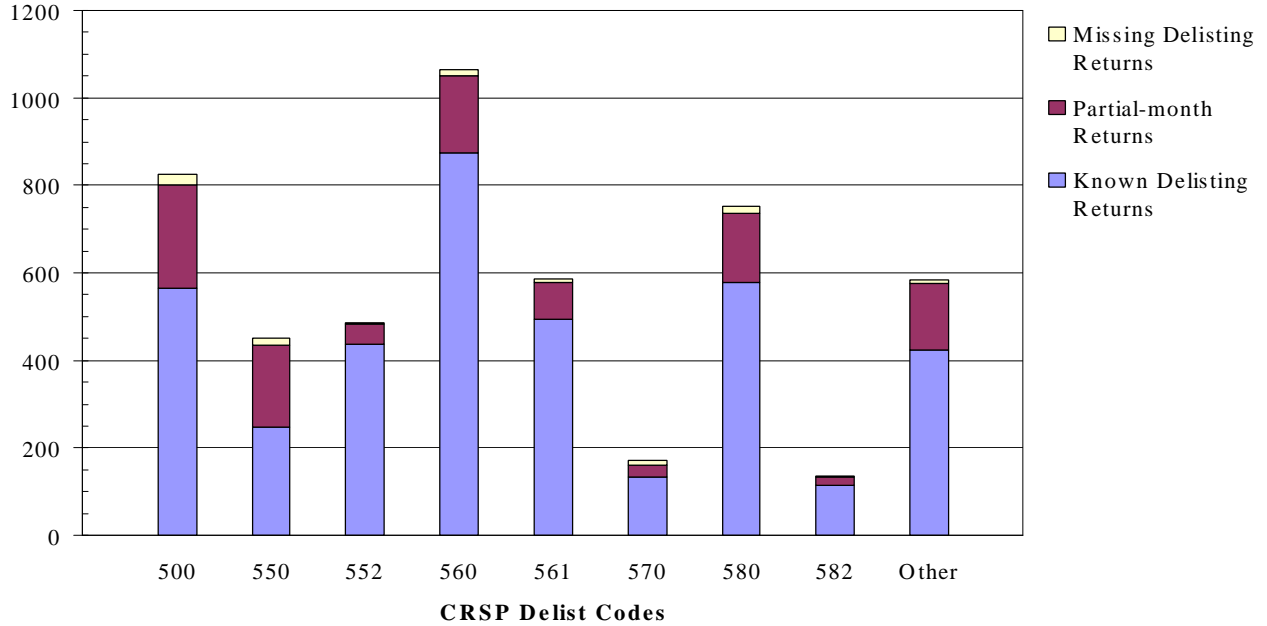


Figure A5 – This figure indicates that very few NASDAQ performance (code 5**) issues still have missing delisting returns. Again, partial-month returns are provided when delisting returns could not be calculated.

Figure A6 - NASDAQ Performance Delisting Returns

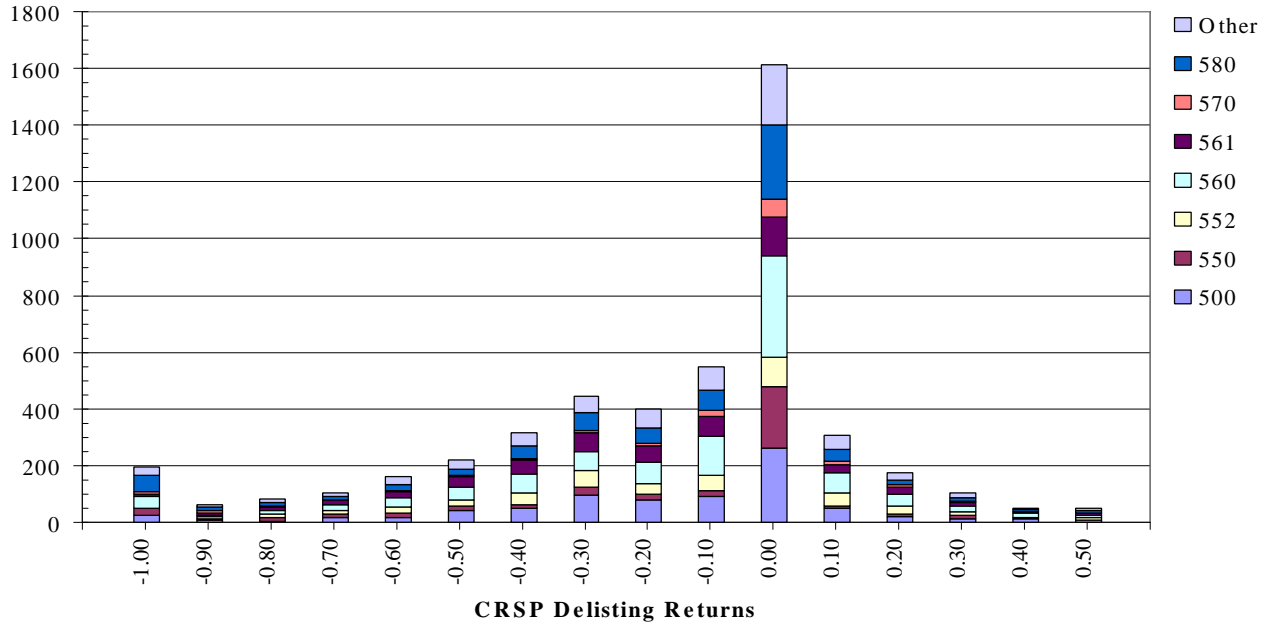


Figure A6 – The bar centered at 0.00 primarily represents performance (code 5**) issues with delisting returns equal to zero, although it may represent some non-zero issues with returns between -0.05 and $+0.05$. The few data points that had delisting returns greater than $+0.55$ are not included in this graph for display purposes.

Figure A7 - NASDAQ Performance Delisting Returns

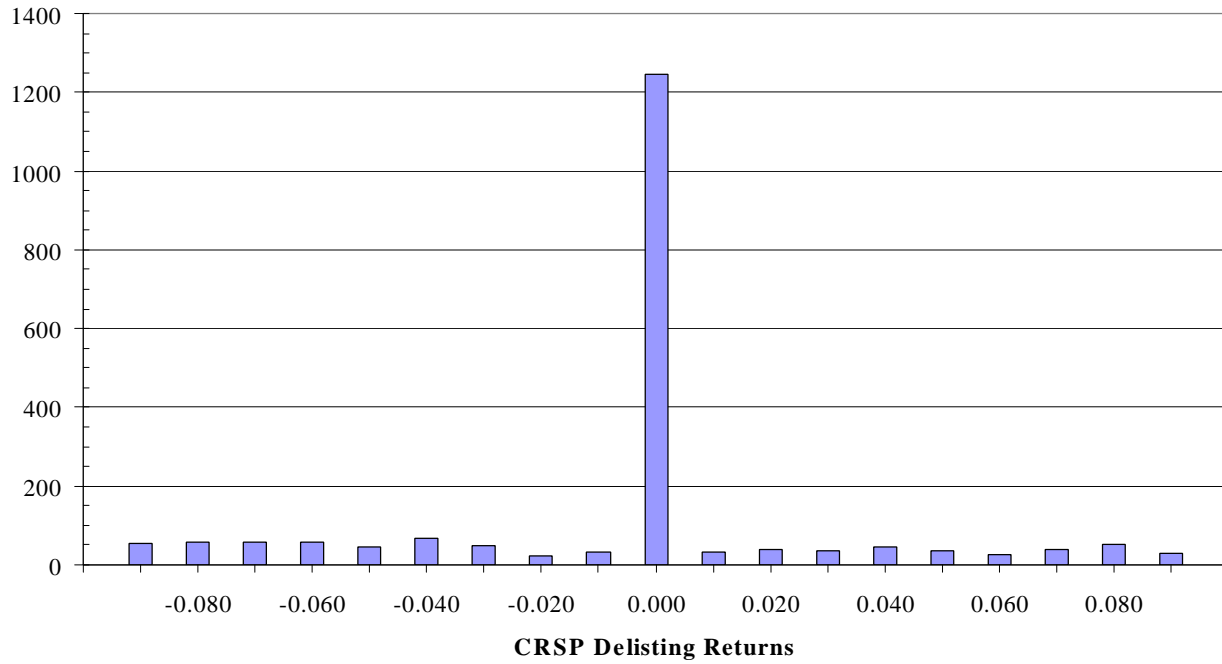


Figure A7 – This graph is a “blow up” around zero of the graph in Figure A6. The bars represent NASDAQ issues with delisting returns between -0.095 and $+0.095$ for all performance delist codes. The bar centered at 0.000 represents issues with delisting returns between -0.005 and $+0.005$.