

The Life Cycle of an Arbitrage Opportunity: Reconstitutions of the Russell 2000

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ABSTRACT

The effects of Russell 2000 rebalancing on stock prices are large and statistically significant. We see large increases in the prices of stocks added to the index, and even larger price declines in stocks removed from the index. Additionally, we find that the deletions with the smallest market capitalizations have the largest price decreases. However, our most interesting findings have to do with traders taking advantage of Russell rebalancing. We have data on short positions and volume that help to explain unusual effects seen in stock prices from 1996 through 1999, and we find that the perfectly predictable component of reconstitution price effects has disappeared.

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The Life Cycle of an Arbitrage Opportunity: Reconstitutions of the Russell 2000

The Russell 2000 is an index of small U.S. stocks. The inclusion or exclusion of stocks is based primarily on market capitalization, and the index is rebalanced, or reconstituted, every June. Because market capitalizations-and therefore membership criteria-are publicly available, the inclusion or exclusion of a particular stock is predictable.

The Frank Russell Company estimates that \$12.9 billion is passively invested in the Russell 2000, or approximately 1% of its value. One fund, the Vanguard Small-Cap Index Fund accounted for \$3.544 billion of that total, and its growth has been enormous; since 1990, the Vanguard Small-Cap Index Fund has grown 7604% (See Figure 1). Currently, index funds are estimated to hold approximately 1% of the total market capitalization of the Russell 2000. The proportion of shares held by index funds is larger for the S&P 500¹, but the price effects of large trades in the Russell 2000 are magnified by the illiquid nature of small stocks.

Like the “S&P Game” described in Beneish and Whaley (1996), there is an opportunity to take advantage of Russell 2000 Reconstitutions by buying stocks being added to the Russell 2000 before the date of reconstitution and selling them after index funds’ demands have been satisfied. Stocks are also dropped from the Russell 2000, short-selling can be used to profit from the negative price pressure of index funds selling shares. The purpose of this study is to document the life cycle of this arbitrage opportunity.

We see that as fund indexing and index arbitrage grow, the price effects on Russell 2000 stocks become larger. In 1990, we see a 1.5% increase for additions and a cor-

¹Beneish and Whaley (1996) suggest about ten percent of the S&P 500’s value is held by public and private index funds

responding decrease in deletions of 1.3%. In 1999, we see 7.1% (3.8%). Interestingly, almost all of the price effects from 1990-1992 can be seen on the day of reconstitution and the preceding day. However, from 1996-1999, price decline in deletions happens before reconstitution. In fact, in 1999, we see little price decline for deletions on or after the announcement date.

We find asymmetry in the price effects for additions and deletions from the Russell 2000. In particular, we see little run-up in prices before reconstitution for additions while there is significant price movement for deletions before reconstitution. The most striking asymmetry comes in the last years of our sample where we see little price increase in additions before reconstitution, whereas all of the price decline for deletions happens before reconstitution. Moreover, the price decline in deletions, approximately 7% in 1999, is more dramatic than the associated increase for additions, approximately 4%. Block trading is one potential explanation of this asymmetry (see Keim and Madhavan (1996) and Holthausen, Leftwich, and Mayers (1990)). Although other studies have found asymmetries between additions and deletions for the S&P 500 (Lynch and Mendenhall (1997)), our large sample of deletions allows us to examine price effects in more detail.

We also find substantial differences in price effects among deletions of different sizes. We find that prices for deletions with the smallest market capitalization decline by over 7% from 1990 through 1999 while the deletions with the largest market capitalizations actually increase in price by 1% over a window including announcement and reconstitution dates. We find no such pattern in additions.

I. Guessing the Russell 2000 List

The Frank Russell Company constructs the Russell 2000 by selecting the 3000 largest stocks with prices above \$1.00. From these 3000 stocks, the 2000 smallest stocks are

combined into a value-weighted portfolio to form the Russell 2000. Market capitalizations are measured at the end of May, and the new composition of the Russell 2000 is announced on the second Friday in June. The index is then reconstituted on June 30th with the new list of stocks. Unlike the S&P 500, market capitalization is based on the number of shares outstanding minus any shares held by individuals or institutions holding 10% or more of the shares outstanding.

Using available shares, or float, as a basis for market capitalization makes the Russell reconstitution difficult to predict for the average investor, but that doesn't stop the big boys. In 1999, Merrill Lynch began a reconstitution guess list. This list was updated until the announcement date, and there was a guess list available using May 31st data before Russell announced its reconstitution. The guess list predicted that most of the liquidity need would be for deletions from the Russell, and smaller deletions would be hardest hit. Merrill's report even recommended that short-sellers unwind their positions one day before the reconstitution to side step a short-squeeze.

Not surprisingly, in 1999, we see large price movements for deletions leading up to the announcement and after the reconstitution, but relatively flat prices between announcement and reconstitution. Furthermore, trading volume is extremely heavy in 1999 for additions and deletions (an average of approximately 300000 shares daily from 20 days before the announcement to 20 days after the reconstitution) whereas stocks kept in the Russell see an average of only 150000 shares traded daily for the same period. The average stock being deleted from the Russell 2000 traded 628000 shares on the day of reconstitution while the average stock that remained in the Russell traded only 218000 shares. Not only was volume higher in 1999, but it is also the case that the increase in volume has been larger for additions and deletions than for retained stocks; there has been an increase of approximately 700% in trading volume for additions and deletions from 1992 through 1999 whereas retention volume has increased by 360% over the same period. (See Figure 5).

II. Sample and Methodology

The Frank Russell company provided us with Russell 2000 constitution lists since 1979. The Russell 2000 was rebalanced quarterly from January 1979 through December 1986, then Semi-annually until June 1989 and annually after that. Currently, we study the 1990-1999 period.

Stock Data:

We matched included stocks to price, return and capitalization data from the Center for Research in Security Prices (CRSP) from 1979 through 1998. We constructed daily stock price, volume and return data from January through October of 1999 using the New York Stock Exchange's Trade and Quote (TAQ) Database. We used TAQ's monthly shares outstanding variable in 1999.

Short Loans:

This paper uses a unique short selling database from their securities lending business. The database contains sizes and rebate/premium rates for short positions on a loan-by-loan basis. The database was provided by the one of the largest lenders of U.S. stocks, providing approximately 30% of hypothecated shares. Since many shares on loan for small short positions are provided "in-house" at brokerage firms, the loan database tends to provide shares for large short positions or for positions in stocks that are not widely traded. Although large loans and loans in illiquid stocks are what we are looking for in Russell reconstitution arbitrage positions, our lender is still one of several large securities lenders. Our short selling database is only used as a proxy for the number of shares on loan.

Methodology:

Since 1990, the Frank Russell Company has announced the new Russell 2000 list on the second Friday of June, and the index has been reconstituted on June 30th². We take these two dates as the announcement date and reconstitution date, respectively. Even though our sample is large, there is correlation between returns across stocks because announcement and reconstitution dates are shared. We deal with the correlation by using a portfolio approach to test for significance of reconstitution and announcement effects (see Campbell, Lo, and MacKinlay (1997) and Carhart, Kaniel, Musto, and Reed (1999)).

Since the Russell 2000 is an index of small stocks, it would be inappropriate to simply subtract the return of the market portfolio as is standard practice in S&P studies (see Dhillon and Johnson (1991) and Lynch and Mendenhall (1997) for examples). Furthermore, estimation of a factor model is difficult in our setting. Since many additions are ipos, an estimation window for additions would be best placed after reconstitution, but many of the deletions have missing data or are very thinly traded after reconstitution. To avoid any potential bias from mismatched estimation windows and to correctly adjust for movements in stocks with capitalizations matching the Russell 2000, we adjust returns with an equally-weighted portfolio of stocks in CRSP deciles 4 through 9.

III. Results

Price Effects from Indexing:

Previous work on S&P 500 reconstitution has attempted to explain price effects with several competing hypotheses: temporary price pressure, downward-sloping demand (see Shleifer (1986)), information and liquidity. With the small stocks in the Russell 2000, we would expect liquidity and price pressure to play a larger role than in the S&P 500.

²In 1990, 1991 and 1996, June 30th was a weekend day, and the effective date of the reconstitution was the next trading day after June 30th.

In an attempt to shed light on the relative effects of these competing explanations, we split our sample into the following windows:

1) Pre-Announcement window (*PREANNNDAYS in Table II*) runs from 10 trading days before announcement to the day before the announcement.

2) Announcement window (*ANNNDAYS in Table II*) includes the announcement date and the following day in case the information is made available after markets close.

3) Middle window (*MIDDAYS in Table II*) starts two trading days after the announcement date and ends two days before the reconstitution date.

4) Reconstitution window (*REDAYS in Table II*) the reconstitution date and the preceding trading day. There is no problem with the timing of information release because the announcement was made at least 10 days earlier, but index funds may buy the new index at the close of trading the day before the index is rebalanced.

5) Post-Reconstitution window (*POSTREDDAYS in Table II*) starts the day after the reconstitution and ends 10 trading days after the reconstitution date.

The temporary price pressure hypothesis from index trading is consistent with short intervals of increased (decreased) prices for additions (deletions). In the first sub-period (1990-1992), we do see strong evidence in favor of the price-pressure hypothesis. We see an abnormal return of 0.62% (-1.66%) per day on the two days in the reconstitution period for additions (deletions). The estimates are statistically different from zero. As an added check, we see no such effect in the stocks remaining in the reconstitution. We also see some price reversal in the first sub-period, but it is not statistically significant.

Overall, the pattern in returns from 1990 through 1992 is consistent with the temporary price-pressure hypothesis.

From 1993 through 1995, the evidence is a bit muddy. Consistent with the price pressure hypothesis, additions show statistically significant price increases at reconstitution (.35% per day), but there is no subsequent short-term reversal. We also begin to see deletions having statistically significant price decreases between the announcement and reconstitution (-0.23% per day). Moreover, this period is longer than either the announcement period or the reconstitution period³ translating into a larger overall price decline. This pattern is consistent with index funds advancing the timing of sales of known deletions in expectation of the large price movements seen in on the reconstitution dates in the previous years. It is also consistent with arbitrageurs taking advantage of the anticipated price decline on reconstitution for known deletions. Furthermore, deletions begin to show a non-intuitive increase in price on and after announcement. This could be attributed to buying pressure from the unwinding of short positions on the day of reconstitution. Although the price pressure hypothesis may still be valid, from 1993 through 1995, we suspect price pressure from both arbitrageurs and index funds with no obvious predictions about when the prices should change.

From 1996 through 1999, the additions show a pattern consistent with temporary price pressure. (1.25% daily reconstitution increase and 0.42% daily reversal-both are statistically significant) However, it seems like the arbitrageurs, or savvy index funds, have anticipated the announcement of deletions. We see a decline of 0.22% per day in the pre-announcement period for deletions. We still see price declines in the period after announcement, consistent with selling deleted stocks after the deletion announcement from 1996-1999. However, the 1999 deletions have nearly flat prices from announcement through reconstitution leading us to believe that *everybody* anticipated the announcement. (See Figure 4.) As in the previous period, we see a large increase in the price of

³There are 11 trading days between announcement and reconstitution in 1991, 1996 and 1997, 12 days in 1992 and 1998, 13 days in 1993 and 1999, 14 days in 1994, 15 days in 1995 and 16 days in 1990.

deleted stocks on the reconstitution date. Particularly dramatic is the 1998 reconstitution where there is a one day positive return of 3% on the reconstitution date.

If the unwinding of short positions was the cause of reconstitution-date price increases, then the arbitrageurs, or savvy index funds, compensated in 1999. The reconstitution date return is negative (as we would have expected in earlier years), but the day before the reconstitution and the day after show positive returns. This is indicative of the unwinding of short positions a day early or a day late to avoid the reconstitution-day increase seen in 1998.

The strategic trading suspected in 1999 is also borne out in our short selling data. We see large short positions in stocks soon to be deleted up to a month before the announcement is made. Furthermore, we see a substantial (but temporary) decrease in short positions two days after the reconstitution date. There is further evidence of strategic trading in the significant and permanent decrease in short positions well after reconstitution.

Volume:

The most interesting aspect of volume is its magnitude for additions and deletions. We see in figure 5 that there is a noticeable “pop” on the reconstitution date for later years, but we also see that there are a lot more shares traded on average for additions and deletions than there are for retentions. In 1999, we see 304983 shares traded a day on average for additions and 333931 shares a day for deletions but only 166512 shares a day for retentions. We also see that even though deletions are the smallest stocks on average (See Table I), they clearly see the most daily trading volume around the time of index reconstitution. This is consistent with our previous intuition about strategic trading being focused on deletions. In 1999, we see another (smaller) “pop” in additions and deletions two days after reconstitution coinciding with the decrease in short positions seen in figure 7.

Table III presents results from a time-series regression on equally-weighted portfolio volume. We see that there is no significant increase in volume in any of our five effect windows except for the reconstitution window in 1999. In 1999, not only is the volume of additions and deletions very high, but the “pop” on the reconstitution date is significantly positive. We see 123639 more shares traded per day on the reconstitution date and the preceding day for additions, and an increase of 170003 shares per day for deletions on the reconstitution days. No other year has statistically significant event windows.

Size Effects:

Table IV presents results from cross sectional regressions of cumulative returns on controls for size and other potential explanatory factors. The dependent variable is the cumulative return on stocks from 10 days before announcement to 10 days after reconstitution adjusted by our small-stock index. To avoid contamination with strategic trading and associated price pressure, we measure volume and market capitalization at the end of April in the year of reconstitution. The most striking pattern picked up in the cross-sectional regression is the tendency for the smallest deletions to have the largest price decrease. The natural log of market capitalization is a significantly positive factor in the reconstitution return for deletions in all periods while it does not help to explain the price shifts in additions.

Figure 6 shows the average return across 10 size groupings for the additions, deletions and retentions. The size effect is non-linear. We see that the decline for deletions is more or less constant from the second group through the seventh group, but the first group (the smallest deletions) decline by over 2% more than the second group on average. Although there are more severe liquidity problems with smaller stocks, the Russell is a value-weighted index, so the effect would be a surprising result of naive index rebalancing. We find that trading volume does not seem to affect the reconstitution price shifts. The number of days in the period over which cumulative returns are measured almost

always matters with higher returns for years with more trading days in the measurement window. An insignificant dummy variable for stocks traded on the NASDAQ indicates that the price effect is probably not exchange-specific.

IV. Conclusion and Ideas for the Next Draft

We have documented a large and statistically significant pattern in stock prices stemming from the reconstitution of the Russell 2000. We see large increases in the prices of stocks added to the index and even larger price declines in stocks removed from the index. We find that the deletions with the smallest market capitalizations have the largest price decreases.

Our most interesting findings have to do with strategic traders taking advantage of Russell rebalancing. We see deletions having large, statistically significant price increases during the reconstitution in later years, potentially from traders unwinding short positions. Furthermore, in 1999, we see virtually all of the price decrease in deletions anticipating the Russell 2000 constitution announcement. Short selling and volume data support the idea that savvy index funds or strategic traders have taken advantage of the Russell 2000 rebalancing effect and eliminated any profitable trading strategies that are perfectly predictable.

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Figure 1. Vanguard Small-Cap Index Fund

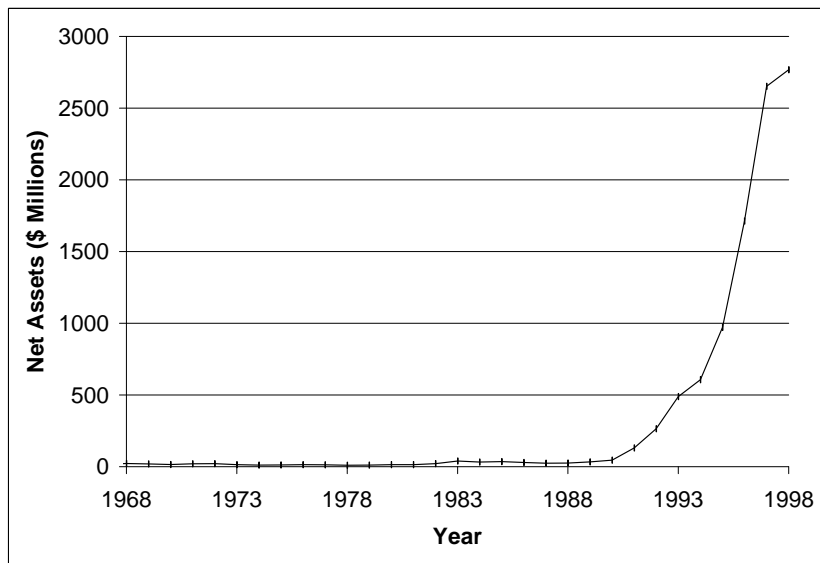


Figure 2. Vanguard Small-Cap Index Fund Tracking Error

The average difference between the Vanguard Small Cap Index Fund and the Russell 2000 Index from 1990 through 1999.

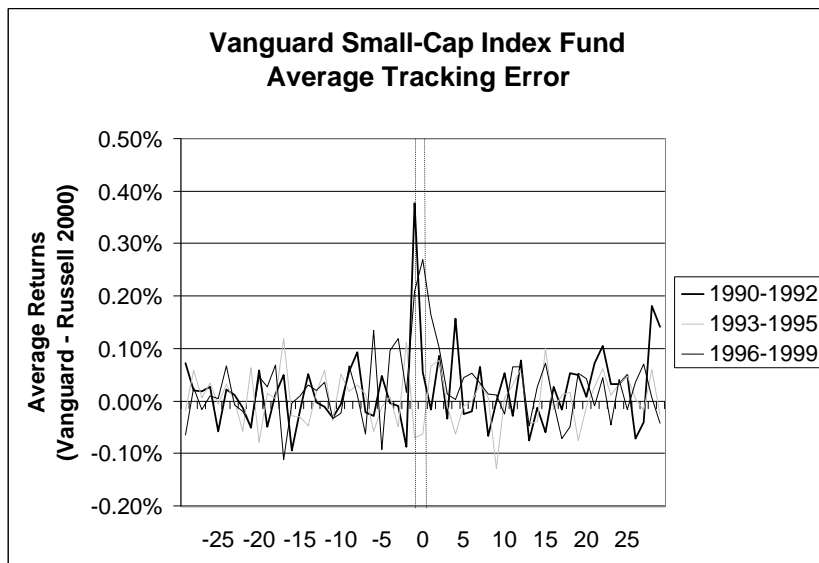


Figure 3. Cumulative Returns for Russell 2000 Changes

Equally-weighted portfolios of stocks added to (*Diamond*) kept in (*Triangle*) and dropped from (*Square*) from the Russell 2000 from 1990 through 1999. Returns are adjusted for market movements by subtracting the return on an equally-weighted portfolio of stocks in CRSP deciles 4 through 9. The results are presented with 11 trading days between the announcement date and the reconstitution date. For years with more than 11 trading days between announcement and reconstitution, returns are compounded into the fifth event day after the announcement date so that there are 11 days of returns.

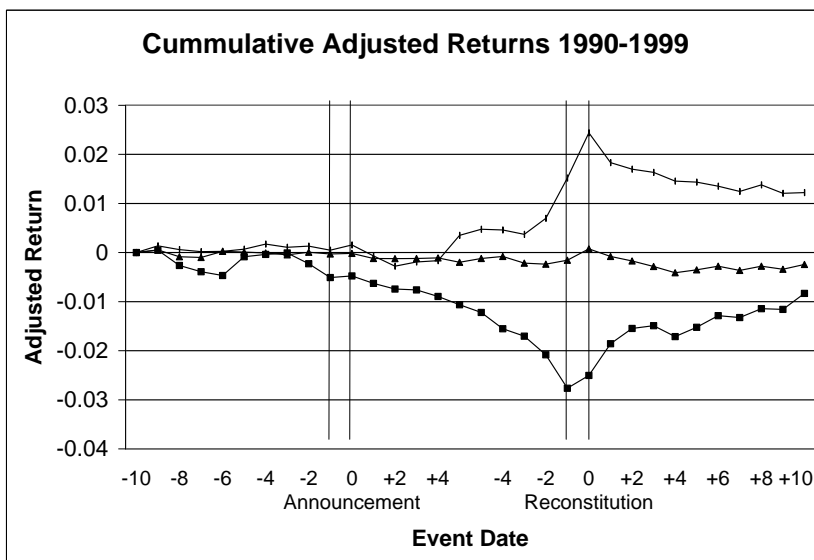


Figure 4. Cumulative Returns of Stocks Dropped from the Russell 2000
 Equally-weighted portfolios of stocks dropped from the Russell 2000. Returns are market adjusted and synchronized in event time using the methodology described in the header of Figure 3.

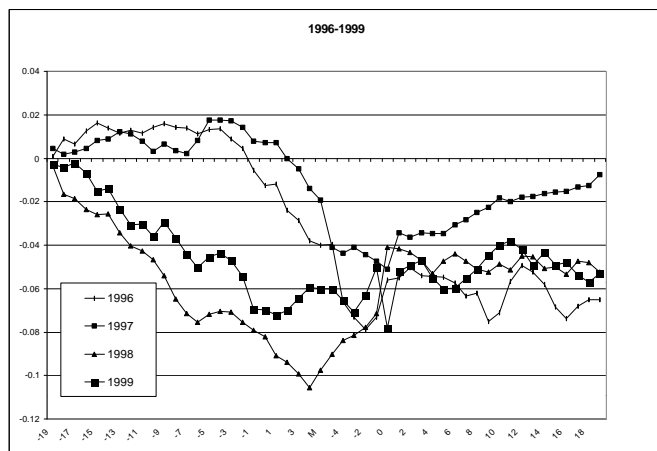
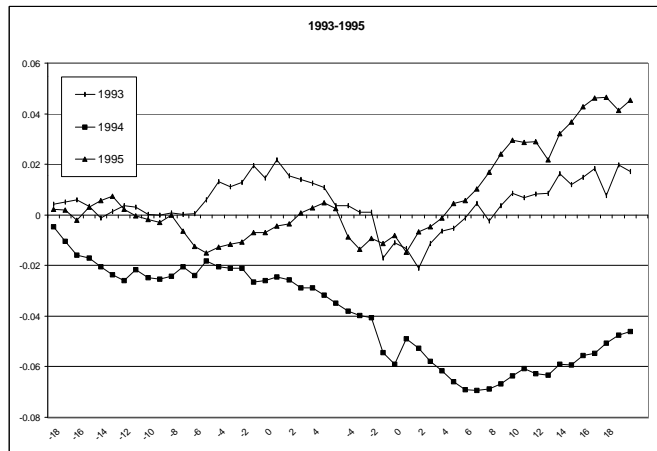
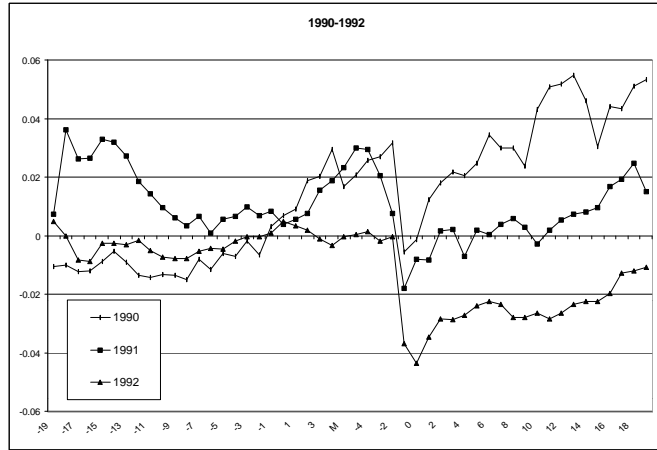


Figure 5. Stock Trading Volume

Average daily trade volume for stocks added to (*Additions*), dropped from (*Deletions*) or kept in (*Retentions*) the Russell 2000 from 1990 through 1999. Average volume is calculated over the middle of the date range between announcement and reconstitution dates so that each of the years has 11 trading days between announcement and reconstitution.

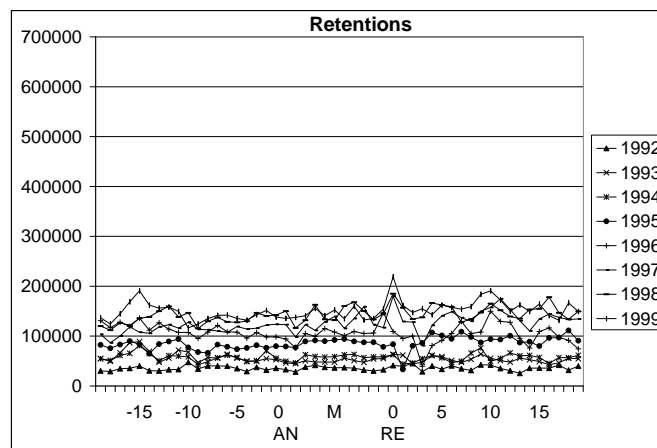
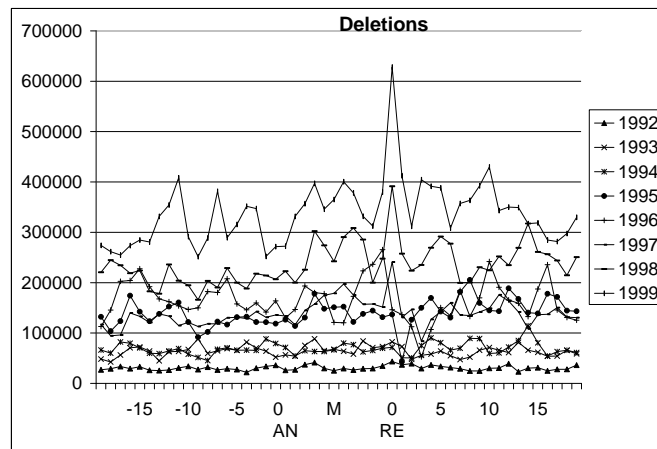
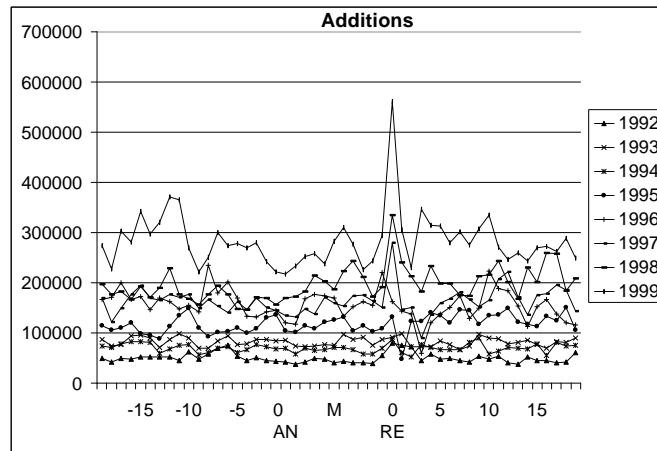


Figure 6. Size Effects in Reconstitution Returns

Average market-adjusted cumulative returns on stocks added to (*Diamond*), kept in (*Triangle*), and dropped from (*Square*) from the Russell 2000 from 1990 through 1999. Returns are adjusted for market movements by subtracting the return on an equally-weighted portfolio of stocks in CRSP deciles 4 through 9. Returns are measured from 10 days before the announcement to 10 days after the reconstitution. To measure size effects across groups with different size characteristics, we sort all stocks in a category for a given year (e.g. 1999 drops) into 10 equal groups by May 31st market capitalization; size groups are not CRSP deciles.

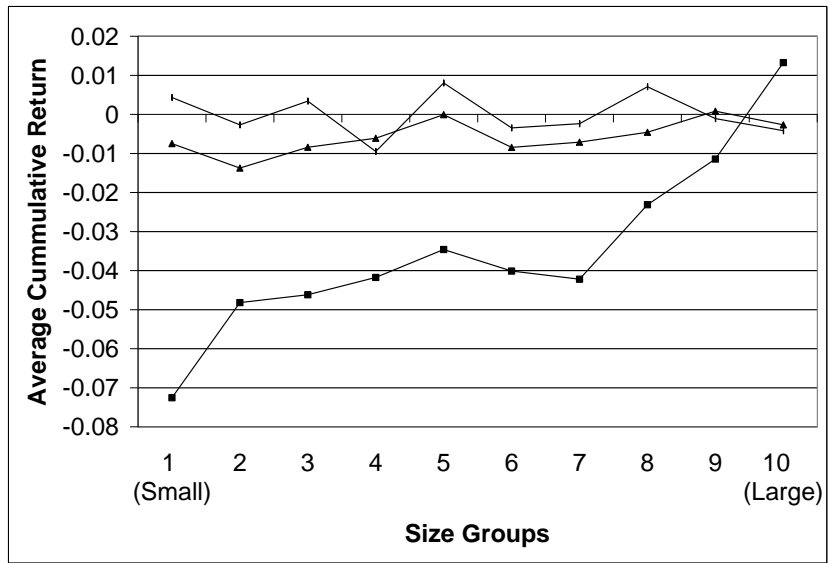


Figure 7. 1999 Shares on Short Loan at One Securities Lending Firm

Average percentage of shares on short loan from one securities lender for stocks added to (*Additions*), dropped from (*Deletions*), or kept in (*Retentions*) the Russell 2000 in 1999. Since daily shares outstanding are not yet available in 1999, we use monthly shares outstanding from the TAQ database. We hope this does not bias any results.

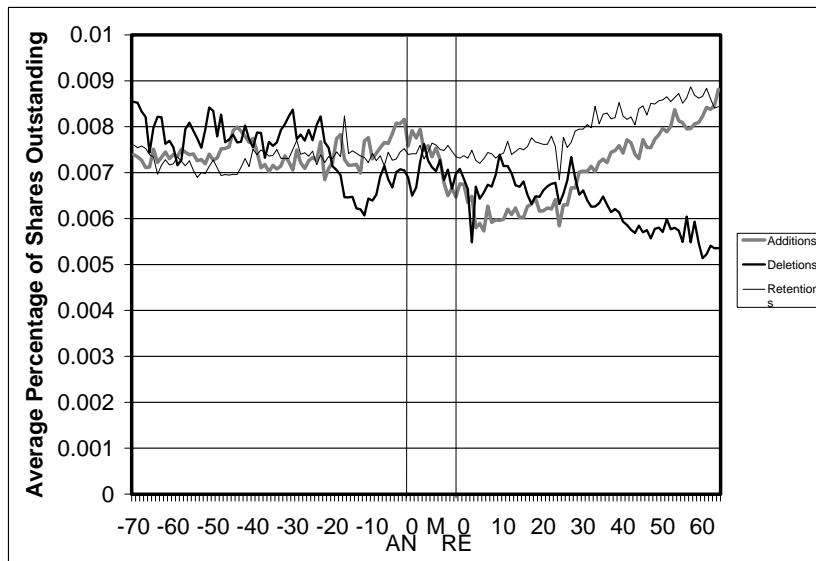


Table I
Sample Summary Statistics

The first panel presents the number of additions to the Russell 2000 from 1990-1999. The second panel describes the distribution of market capitalization for additions, deletions and retentions to the Russell 2000 from 1990 through 1999.

Panel A: Turnover

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Number Additions	396	511	553	473	589	464	559	573	588	569

Panel B: Market Capitalization (in Millions)

	Mean	25% Quartile	Median	75% Quartile
Additions	306.504	115.851	220.515	384.35
Deletions	324.591	41.204	98.705	335.76
Retentions	315.149	123.243	244.405	426.17

Table II
Announcement and Reconstitution Effects Returns Regression

$$(R_{i,t} - R_{s,t}) = a_i + b_i PREANNDAYS_{i,t} + c_i ANNDAYS_{i,t} + d_i MIDDAYS_{i,t} + e_i REDAYS_{i,t} + f_i POSTREDAYS_{i,t} + \epsilon_{i,t}.$$

Time-series regressions of portfolio returns on dummy variables indicating days before announcement (*PREANNDAYS*), announcement day and following day (*ANNDAYS*), days between announcement and reconstitution (*MIDDAYS*), reconstitution day and preceding day (*REDAYS*), and the days after reconstitution (*POSTREDAYS*). Portfolios are constructed by equally-weighting daily returns on stocks that are added to (*Additions*), dropped from (*Deletions*) or kept in (*Retentions*) the Russell 2000 during the calendar year. The benchmark R_s is an equally-weighted portfolio of stocks in CRSP deciles 4 through 9. Parameter estimates are in percentage points. Two-sided p-values for the null hypothesis of zero coefficient value are in parentheses.

Portfolio	Sub-Period	a	b	c	d	e	f
Additions	1990-1992	0.06 (0.00)	-0.03 (0.66)	-0.08 (0.65)	-0.04 (0.57)	0.62 (0.00)	-0.15 (0.05)
	1993-1995	0.05 (0.00)	-0.01 (0.86)	0.16 (0.28)	-0.00 (0.99)	0.35 (0.02)	0.12 (0.07)
	1996-1999	0.07 (0.00)	-0.05 (0.63)	-0.38 (0.09)	0.09 (0.42)	1.25 (0.00)	-0.43 (0.00)
Deletions	1990-1992	0.14 (0.00)	-0.08 (0.53)	-0.03 (0.91)	-0.08 (0.53)	-1.66 (0.00)	0.09 (0.47)
	1993-1995	0.01 (0.36)	0.01 (0.89)	0.10 (0.56)	-0.23 (0.00)	0.12 (0.48)	0.15 (0.04)
	1996-1999	-0.02 (0.28)	-0.23 (0.01)	-0.26 (0.18)	-0.26 (0.01)	0.53 (0.01)	0.15 (0.10)
Retentions	1990-1992	0.05 (0.00)	-0.01 (0.82)	-0.17 (0.13)	-0.07 (0.19)	-0.13 (0.28)	-0.09 (0.10)
	1993-1995	0.02 (0.00)	0.01 (0.80)	0.08 (0.31)	-0.07 (0.06)	0.25 (0.00)	0.03 (0.44)
	1996-1999	0.01 (0.22)	-0.06 (0.24)	-0.12 (0.25)	0.01 (0.79)	0.23 (0.03)	-0.10 (0.03)
Additions	1990-1999	0.06 (0.00)	-0.03 (0.52)	-0.13 (0.25)	0.02 (0.74)	0.79 (0.00)	-0.18 (0.00)
Deletions	1990-1999	0.04 (0.00)	-0.11 (0.05)	-0.09 (0.49)	-0.19 (0.00)	-0.25 (0.04)	0.13 (0.02)
Retentions	1990-1999	0.03 (0.00)	-0.02 (0.38)	-0.08 (0.20)	-0.04 (0.16)	0.13 (0.03)	-0.06 (0.03)

Table III
Announcement and Reconstitution Effects Volume Regression

$$VOL_{i,t} = a_i + b_i PREANNDAYS_{i,t} + c_i ANNDAYS_{i,t} + d_i MIDDAYS_{i,t} + e_i REDAYS_{i,t} + f_i POSTREDDAYS_{i,t} + \epsilon_{i,t}.$$

Time-series regressions of average daily volume on dummy variables indicating days before announcement (*PREANNDAYS*), announcement day and following day (*ANNDAYS*), days between announcement and reconstitution (*MIDDAYS*), reconstitution day and preceding day (*REDDAYS*), and the days after reconstitution (*POSTREDDAYS*). The dependent variable is the average daily trading volume of stocks that are added to (*Additions*), dropped from (*Deletions*), or retained in (*Retentions*) the Russell 2000 during the calendar year. Parameter estimates are in number of shares. Two-sided p-values for the null hypothesis of zero coefficient value are in parentheses. Each regression is run over all trading days in the given year, except for 1999 where data from January through October data are used.

Portfolio	Year	a	b	c	d	e	f
Additions	1990-1999	130429 (0.00)	-15288 (0.37)	-29768 (0.43)	-16265 (0.35)	23852 (0.52)	-10397 (0.54)
	1996-1999	214044 (0.00)	-27373 (0.43)	-51781 (0.50)	-12530 (0.74)	60218 (0.43)	-14097 (0.68)
	1999 Only	303983 (0.00)	-43312 (0.05)	-78199 (0.10)	-38803 (0.08)	123639 (0.01)	-3082 (0.89)
Deletions	1990-1999	128255 (0.00)	-10830 (0.48)	-16381 (0.63)	6718 (0.67)	35745 (0.29)	-97 (0.99)
	1996-1999	216905 (0.00)	-17941 (0.54)	-22625 (0.72)	33403 (0.28)	89540 (0.16)	6749 (0.82)
	1999 Only	333931 (0.00)	-29890 (0.13)	-31843 (0.46)	27944 (0.16)	170003 (0.00)	42050 (0.03)
Retentions	1990-1999	91344 (0.00)	-13187 (0.26)	-18877 (0.46)	-11383 (0.34)	1214 (0.96)	-7538 (0.52)
	1996-1999	145885 (0.00)	-22891 (0.33)	-29452 (0.57)	-13130 (0.60)	11113 (0.83)	-10037 (0.67)
	1999 Only	166512 (0.00)	-30559 (0.00)	-29931 (0.07)	-20818 (0.01)	20155 (0.22)	-5095 (0.50)

Table IV
Cross-Sectional Regression on Size and Other Controls

$$R_{i,t} = a + bLOGSIZE_{i,t} + cVOLUME_{i,t} + dNUMDAYSt + eNASDAQ_{i,t} + \epsilon_{i,t}.$$

Cross-sectional regressions of cumulative returns on size, volume, number of trading days and a dummy variable indicating that a stock trades on the NASDAQ exchange. The dependent variable is cumulative benchmark-adjusted returns on stocks that are added to (*Additions*), dropped from (*Deletions*) or kept in (*Retentions*) the Russell 2000 from 10 days before the announcement through 10 days after the reconstitution. $LOGSIZE_i$ is the natural log of market capitalization for stock i taken from the last trading day in April of the year of reconstitution. Similarly, $VOLUME_i$ is the daily trading volume for stock i taken from the last trading day in April of the year of reconstitution. $NUMDAYSt$ is the number of trading days in the period over which returns are measured. $NASDAQ_{i,t}$ is a dummy variable that equals 1 if stock i trades on the NASDAQ exchange on the last trading day of May in the year of reconstitution. The benchmark is an equally-weighted portfolio of stocks in CRSP deciles 4 through 9. Parameter estimates are in percentage points. Two-sided p-values for the null hypothesis of zero coefficient value are in parentheses.

Type	Sub-Period	a	b	c	d	e
Additions	1990-1992	0.05 (0.74)	-0.01 (0.18)	-0.00 (0.00)	0.00 (0.20)	0.01 (0.64)
	1993-1995	-1.98 (0.00)	-0.01 (0.24)	-0.00 (0.42)	0.08 (0.00)	0.01 (0.29)
	1996-1999	-1.77 (0.00)	-0.00 (0.62)	-0.00 (0.63)	0.07 (0.00)	-0.03 (0.00)
Deletions	1990-1992	-0.47 (0.00)	0.02 (0.01)	0.00 (0.51)	0.01 (0.11)	0.00 (0.98)
	1993-1995	-1.22 (0.00)	0.02 (0.01)	0.00 (0.19)	0.03 (0.01)	0.02 (0.05)
	1996-1999	-1.98 (0.00)	0.02 (0.00)	-0.00 (0.92)	0.06 (0.00)	0.01 (0.59)
Retentions	1990-1992	-0.11 (0.13)	0.00 (0.72)	-0.00 (0.00)	0.00 (0.01)	0.01 (0.03)
	1993-1995	-0.73 (0.00)	0.01 (0.04)	0.00 (0.87)	0.02 (0.00)	0.01 (0.02)
	1996-1999	-0.67 (0.00)	0.01 (0.01)	-0.00 (0.00)	0.02 (0.00)	-0.01 (0.23)