The Russell Reconstitution Effect

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The Russell Reconstitution Effect

Ananth Madhavan

Significant returns were associated with the annual reconstitution of the Russell equity indexes from 1996 through 2002, which can be explained by both transitory price pressure and the permanent effects of index membership. On the one hand, the return effects represent a significant cost to index funds that rebalance on the reconstitution date. On the other hand, supplying immediacy at this time can be highly profitable. This strategy is typically undiversified, however, and involves high trading costs and price risk as positions are unwound. Indeed, dramatic intraday return volatility characterizes the day of reconstitution. These factors explain the persistence of the reconstitution effects documented here.

The Frank Russell Company's equity indexes are widely used by investment managers as performance benchmarks. At the end of June each year, the Frank Russell Company reconstitutes its indexes on the basis of market capitalizations at the end of May. The reconstitution requires portfolio rebalancing by investment managers who are benchmarking Russell indexes and gives rise to abnormal returns and volumes.[1] These effects are significant and pervasive but have not previously been analyzed systematically.[2] This article reports an analysis of the effects of the annual reconstitution of the equity indexes of the Frank Russell Company from 1996 through 2002.

The reconstitution of the Russell equity indexes is of considerable practical interest. Investment managers are clearly interested in equity returns around index reconstitution, as are hedge funds that attempt to profit from the effects. In addition, even traders and portfolio managers whose performance benchmarks are not based on the Russell indexes follow the reconstitution closely to anticipate buying and selling pressure in securities they plan to trade. The Russell reconstitution is of interest also because similar effects might be expected with the periodic rebalancing of other equity indexes. Indeed, the changes in the composition of the S&P 500 Index on 19 July 2002 were also associated with significant return effects, as shown in Madhavan and Ming (2002). Finally, membership in the Russell indexes is based on market capitalization at the end of May, so the criterion can readily be computed in the month before the reconstitution.[3] Consequently, analysis of the effects of reconstitution on returns can provide valuable insights concerning market efficiency.

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Russell Reconstitution Process

The Russell family of stock indexes was created in 1984 by the Frank Russell Company to measure the performance of investment managers. The Frank Russell Company now maintains 21 U.S. stock indexes and has launched similar broad market indexes and style indexes in Canada, Japan, and the United Kingdom. More than $750 billion in funds is benchmarked against the global Russell indexes. The Russell U.S. indexes are weighted by float and include only common stocks domiciled in the United States and its territories. In addition, companies trading below $1.00 on the ranking day and certain types of issues, including royalty trusts and closed-end mutual funds, are excluded from the Russell universe.

The Russell 3000 Index, which represents about 98 percent of the investable U.S. equity market, measures the performance of the 3,000 largest U.S. companies in the Russell universe based on total market cap. The Russell 3000 comprises the Russell 1000 and Russell 2000 indexes. The Russell 1000 measures the performance of the 1,000 largest companies in the Russell 3000. The Russell 2000 measures the performance of the next 2,000 companies in the Russell 3000. As of the reconstitution in June 2002, the median market cap of companies in the Russell 3000 was $700 million. Although I report statistics on the Russell 3000 and 2000 indexes, the focus here is primarily on the less-liquid Russell 2000, where reconstitution effects are particularly evident.

The Frank Russell Company reranks each company by market cap once a year to establish the year's new index membership. The newly adjusted index membership takes effect 1 July and remains in place until the following year's reconstitution. The rerankings are generally transparent, and the primary criterion for index membership—market cap as of 31 May—is public information as of that date. Consequently, index constituents can be predicted with a high degree of accuracy at the start of June. Investment banks and brokers routinely make projections of additions and deletions for their clients because they wish to either trade on the reconstitution or simply be aware of buying/selling pressures in stocks they plan to trade routinely. Indeed, companies providing estimates of Russell additions and deletions typically have success rates in predicting the changes by the end of May of 90–95 percent. Errors arise because some factors that affect membership (e.g., computation of float, the treatment of IPO lockout periods, and adjustments for dual-class shares) are either subjective or require proprietary data. In a typical year, the time line for reconstitution is as shown in **Figure 1**.

In recent years, a relatively large portion of the Russell indexes has changed. In 2002, for example, turnover in names from the Russell 3000 exceeded 28 percent, with 404 companies added and 242 companies deleted. (Note that annual reconstitution implies more additions than deletions because some stocks are delisted during the year.)

Index Reconstitution and Stock Returns

I studied reconstitution effects of the Russell 3000 and 2000 indexes by forming and examining portfolios of stock additions, portfolios of stock deletions, and portfolios long the additions and short the deletions. I report monthly returns around the time of reconstitution and intraday effects on the reconstitution day.

Monthly Returns. I first created portfolios, equally weighted by number of stocks, consisting of additions and deletions from the index and created a spread portfolio that was long index additions and short index deletions. I obtained historical data for 1996 through 2002 on Russell index membership from the Frank Russell Company's website, where the constituents of the Russell indexes are listed each year following the reconstitution. Daily return and volume data are from FactSet Research Systems and Bloomberg. Intraday data for some analyses were drawn from the NYSE's TAQ (Trade and Quote) database.

Table 1 shows the mean returns and standard errors, by month and year, for the Russell 3000 portfolios, and **Table 2** provides the same information for the Russell 2000 portfolios.[4] The Russell reconstitution effect is evident in each of the years shown. In general, additions to the Russell 3000 exhibit positive stock price responses in March–June whereas deletions exhibit the opposite pattern.

Panel C of Table 1 shows that the Russell 3000 spread portfolio earned a mean return in June alone for the seven-year period of 14.94 percent, with a cumulative total rise from March of 39.28 percent.[5] Mean returns on the spread portfolio were positive for March–June, but the mean return for July was –4.97 percent. Indeed, returns in five of the seven years of 1996–2002 were negative for July, which is perhaps consistent with overreaction in June (more on this issue when I analyze the sources of the index revision effects).

The data in Table 2 for the Russell 2000 show return effects that are very similar to those shown

Figure 1. Time Line for Russell Index Reconstitution

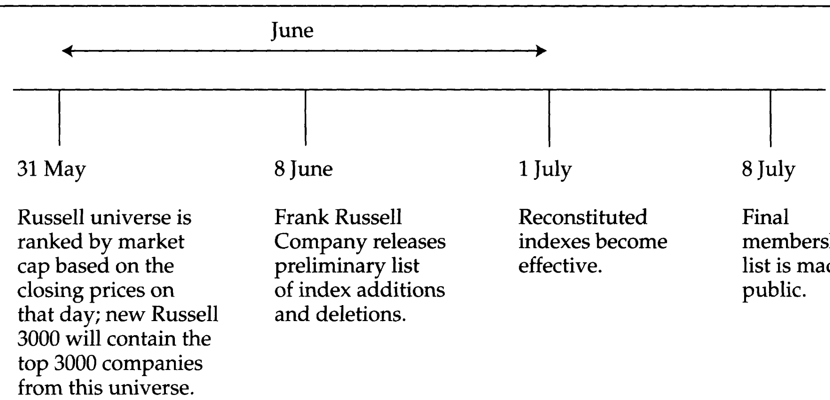


Table 1. Monthly Returns for Russell 3000 Portfolios, 1996–2002 (standard errors in parentheses)

Year	March	April	May	June	July
A. Additions portfolio					
1996	2.77%	6.76%	4.39%	–2.72%	–8.27%
	(3.36)	(2.45)	(2.62)	(3.15)	(6.52)
1997	–5.06	–0.52	17.53	12.56	3.27
	(3.64)	(4.17)	(3.62)	(2.70)	(2.58)
1998	11.55	4.74	–2.79	3.61	–6.65
	(2.34)	(4.6)	(3.47)	(3.77)	(3.99)
1999	14.92	18.04	1.15	14.70	–6.04
	(5.62)	(9.54)	(7.05)	(10.34)	(5.98)
2000	–7.58	–19.23	–9.62	36.24	–9.27
	(13.99)	(27.52)	(14.01)	(10.81)	(9.82)
2001	–3.23	14.49	22.88	3.66	–5.55
	(7.29)	(7.78)	(3.88)	(8.68)	(5.61)
2002	12.48	8.38	5.79	0.72	–13.40
	(1.99)	(2.81)	(2.82)	(4.43)	(9.10)
Mean	3.69%	4.67%	5.62%	9.82%	–6.56%
	(5.46)	(8.41)	(5.35)	(6.27)	(6.23)
B. Deletions portfolio					
1996	1.16%	5.43%	2.08%	–10.08%	–3.04%
	(2.83)	(2.35)	(2.22)	(4.75)	(6.12)
1997	–11.25	–6.61	13.41	–1.88	10.2
	(3.55)	(4.22)	(4.22)	(4.73)	(2.57)
1998	–0.06	–0.50	–11.05	–2.33	–8.63
	(3.18)	(4.3)	(3.47)	(7.41)	(3.80)
1999	–6.21	9.12	–1.04	–2.76	8.94
	(3.95)	(4.75)	(3.41)	(5.52)	(6.03)
2000	–4.09	–14.79	–13.56	1.91	2.47
	(4.72)	(11.2)	(6.01)	(7.14)	(5.25)
2001	–24.78	12.55	2.24	–7.39	–10.73
	(13.48)	(17.03)	(10.62)	(9.25)	(6.85)
2002	6.77	–13.02	–18.33	–13.27	–10.31
	(6.84)	(7.87)	(8.62)	(9.69)	(9.64)
Mean	–5.49%	–1.12%	–3.75%	–5.11%	–1.59%
	(5.51)	(7.39)	(5.51)	(6.93)	(5.75)
C. Spread portfolio					
1996	1.61%	1.33%	2.31%	7.36%	–5.23%
	(1.37)	(1.45)	(1.69)	(3.66)	(2.37)
1997	6.19	6.09	4.12	14.44	–6.93
	(2.61)	(2.02)	(2.32)	(4.78)	(3.59)
1998	11.61	5.24	8.26	5.94	1.98
	(2.10)	(2.77)	(2.21)	(6.47)	(2.89)
1999	21.13	8.92	2.19	17.46	–14.98
	(4.57)	(10.28)	(6.02)	(11.76)	(7.26)
2000	–3.49	–4.44	3.94	34.33	–11.74
	(10.74)	(17.02)	(9.11)	(11.06)	(8.24)
2001	21.55	1.94	20.64	11.05	5.18
	(8.30)	(10.14)	(9.20)	(13.95)	(8.85)
2002	5.71	21.40	24.12	13.99	–3.09
	(6.33)	(6.08)	(7.59)	(9.48)	(6.96)
Mean	9.19%	5.78%	9.37%	14.94%	–4.97%
	(5.15)	(7.11)	(5.45)	(8.74)	(5.74)

Note: Standard errors are reported on a monthly basis from a time series of daily portfolio returns suitably scaled.

Table 2. Monthly Returns for Russell 2000 Portfolios, 1996–2002 (standard errors in parentheses)

Year	March	April	May	June	July
A. Additions portfolio					
1996	4.32%	14.81%	8.40%	–4.05%	–14.75%
	(3.99)	(3.04)	(3.65)	(6.04)	(10.40)
1997	–6.04	–1.85	17.41	11.60	3.16
	(3.75)	(4.11)	(3.76)	(2.67)	(2.62)
1998	10.33	3.92	–3.91	1.72	–7.23
	(2.39)	(4.58)	(3.35)	(3.74)	(3.95)
1999	11.38	14.31	1.93	13.75	–5.77
	(4.87)	(7.03)	(5.71)	(8.88)	(5.32)
2000	–3.20	–18.46	–9.12	26.20	–7.20
	(11.38)	(22.57)	(11.74)	(10.11)	(8.55)
2001	–6.32	13.42	19.32	2.98	–6.49
	(8.32)	(10.81)	(5.41)	(9.48)	(6.17)
2002	12.82	2.76	2.12	–1.56	–15.31
	(3.42)	(3.89)	(4.67)	(5.69)	(10.05)
Mean	3.33%	4.13%	5.16%	7.23%	–7.66%
	(5.45)	(8.00)	(5.47)	(6.66)	(6.72)
B. Deletions portfolio					
1996	1.81%	7.04%	2.75%	–10.12%	–4.30%
	(3.26)	(2.31)	(2.68)	(4.31)	(7.26)
1997	–9.65	–5.30	11.86	–1.83	10.12
	(3.48)	(3.94)	(3.81)	(3.96)	(2.53)
1998	2.02	0.14	–9.17	–0.76	–7.77
	(2.99)	(4.51)	(3.38)	(6.39)	(3.64)
1999	–0.13	8.84	–1.43	–1.46	5.99
	(4.41)	(4.68)	(3.89)	(5.26)	(5.78)
2000	–4.86	–12.00	–11.14	5.90	–0.56
	(6.73)	(13.85)	(8.28)	(7.88)	(5.38)
2001	–18.74	9.97	0.33	–5.20	–6.37
	(11.07)	(13.55)	(7.77)	(7.43)	(5.70)
2002	6.92	–6.56	–12.17	–11.33	–8.39
	(5.22)	(6.32)	(6.95)	(7.58)	(9.04)
Mean	–3.23%	0.30%	–2.71%	–3.54%	–1.61%
	(5.31)	(7.02)	(5.25)	(6.12)	(5.62)
C. Spread portfolio					
1996	2.51%	7.77%	5.65%	6.07%	–10.45%
	(1.73)	(1.57)	(1.79)	(4.03)	(4.42)
1997	3.61	3.45	5.55	13.43	–6.96
	(2.28)	(1.18)	(1.82)	(4.08)	(3.41)
1998	8.31	3.78	5.26	2.48	0.54
	(1.55)	(2.00)	(1.52)	(5.16)	(2.24)
1999	11.51	5.47	3.36	15.21	–11.76
	(3.43)	(4.58)	(3.27)	(9.50)	(6.03)
2000	1.66	–6.46	2.02	20.3	–6.64
	(6.33)	(9.42)	(4.44)	(11.22)	(4.76)
2001	12.42	3.45	18.99	8.18	–0.12
	(4.52)	(4.56)	(4.65)	(12.94)	(7.33)
2002	5.90	9.32	14.29	9.77	–6.92
	(3.47)	(3.79)	(4.00)	(6.87)	(4.89)
Mean	6.56%	3.83%	7.87%	10.78%	–6.04%
	(3.33)	(3.87)	(3.07)	(7.69)	(4.73)

Note: See note to Table 1.

in Table 1. Specifically, Panel C reports a mean return in June alone over these seven years to a portfolio long Russell 2000 additions and short deletions of 10.78 percent. All returns for this spread portfolio in June were positive, and the cumulative return for March–June is 29.04 percent. Again, for July, the mean return and six of the seven years' returns on the spread portfolio turned negative.

The effects of reconstitution shown in Tables 1 and 2 are much larger than the corresponding effects for the S&P 500 found by Madhavan and Ming, among others, reflecting the lower liquidity of the Russell stocks and the simultaneous rebalancing by various investment managers on or around a single reconstitution date. Furthermore, the returns to projected additions and deletions in the months prior to May (when index membership is decided based on market cap) may reflect a positive-feedback effect. A stock likely to be added to the Russell 3000 might be purchased by hedge funds speculating on the reconstitution, which would generate additional price increases. The opposite would be true for a stock likely to face deletion. These pressures reinforce market movements, and the subsequent unwinding of these positions after the reconstitution date may explain the observed July return reversals.

Figure 2 shows the cumulative value of the Russell 2000 spread portfolio on a daily basis for two months before the reconstitution date at the end of June to one month after, plotted by trading days. Panel A is a picture of 1996–1998, and Panel B is a picture of 1999–2001. In both figures, the vertical line at Day 0 indicates the last trading day in June (i.e., the reconstitution date). Clearly evident in the graphs are sharp price movements on or close to the reconstitution date itself. Interestingly, these spikes are not always coincident, which suggests that traders only imperfectly anticipate order imbalances related to the reconstitution.

The 2002 reconstitution is of particular interest because of the increased visibility of the Russell reconstitution process and recent focus on transaction costs. **Figure 3** is a graph of the Russell 2000 spread portfolio for the reconstitution of June 2002. Bok, Ming, and Wang (2002) estimated the tracking error between the prereconstitution and postreconstitution Russell indexes to be significant. They reported, for example, that the Russell 2000 has a reconstitution tracking-error risk of 2.6 percent, a relatively large figure for an index manager. As intuition suggests, changes in market and in value–growth exposures explain most of the shift in the indexes' risk profiles. Also, in 2002, turnover was lower than in previous years. Yet, despite the differences in the market environment from previous years, the pattern for 2002 is strikingly similar to the past. In 2002, the Russell 2000 spread portfolio's cumulative return peaked at about 25 percent, comparable in magnitude to effects in previous years. In a down market, however, this return reflected sharply lower prices for deletions accompanied by stable prices for additions. These results suggest that the reconstitution effects are pervasive, manifest in a wide range of economic environments.

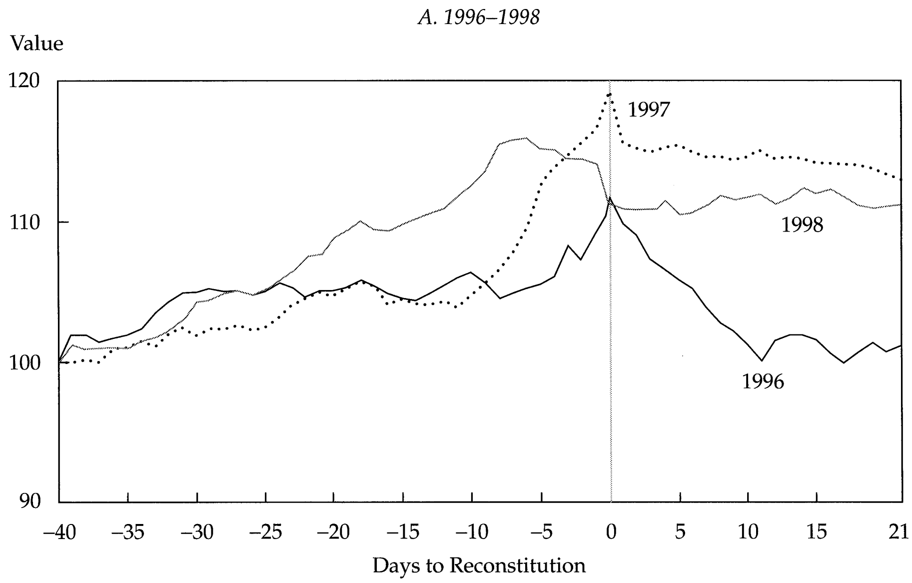
The sharp price movements around the reconstitution date itself that are visible in the monthly data suggest that an examination of returns at a higher frequency would be useful.

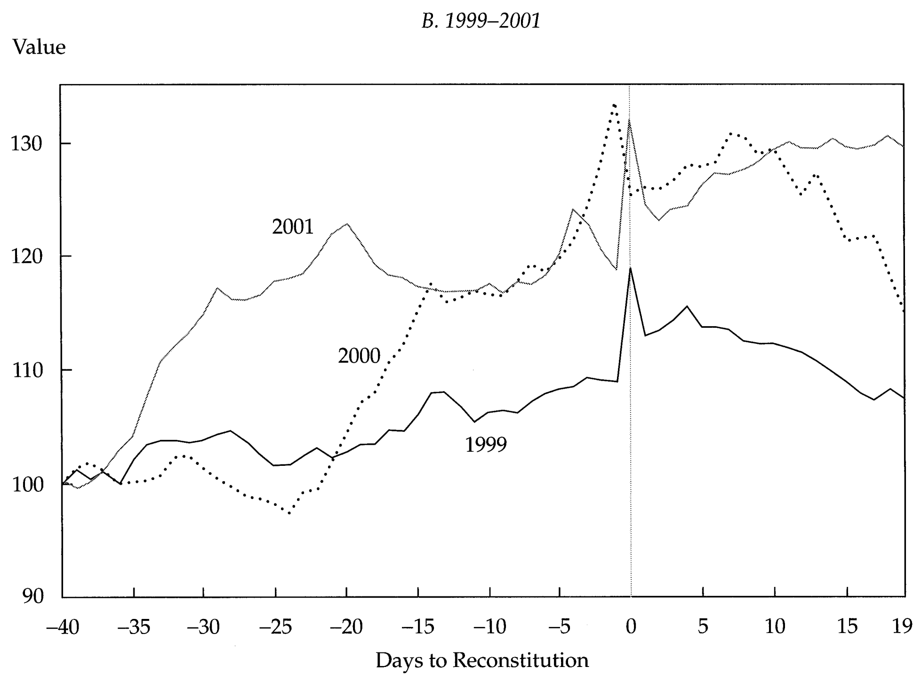
Intraday Effects. Previous examinations of returns at the daily level could be masking significant price movements that have occurred within the day. Indeed, the effects of price pressure are most likely to be felt on the reconstitution date itself because index funds are benchmarked against closing prices and trade toward the close to minimize their tracking error. Some indexers trade earlier in the day, however, to avoid trading at the close, when price-pressure effects are especially large (Cushing and Madhavan 2001). Hedge funds that are taking long positions in index additions and short positions in index deletions generally unwind their positions on or soon after the actual reconstitution date. Order imbalances created by these traders might give rise to sharp price movements within the reconstitution day itself.

Accordingly, I formed portfolios consisting of Russell 2000 additions and deletions on the actual reconstitution date (i.e., the last trading day of June, Day 0) for the years 1999–2002. **Figure 4** plots the cumulative returns to the spread portfolio (long additions, short deletions) of the Russell 2000 on the four reconstitution days for intervals of a half hour or quarter hour (to highlight the close). The returns are strikingly large in absolute terms. Especially noteworthy is Day 0 of 2000 (30 June), when the spread portfolio's return peaked in the early afternoon and then experienced a sharp reversal, ending the day down nearly 9 percent. In contrast, in 1999 and 2001, returns increased steadily over the day, with cumulative increases of 4–8 percent. On Day 0 of 2002 (28 June), the spread portfolio showed modest declines over most of the day but recovered sharply after 2:45 p.m. (14:45) to end the day up; the intraday swing was 7.56 percentage points.

The intraday volatility exhibited in Figure 4 reflects order imbalances that arise because of uncertainty on the part of traders about the strategic behavior of others. Specifically, hedge funds

Figure 2. Value of Russell 2000 Spread Portfolio around Reconstitution Date, 1996–2001





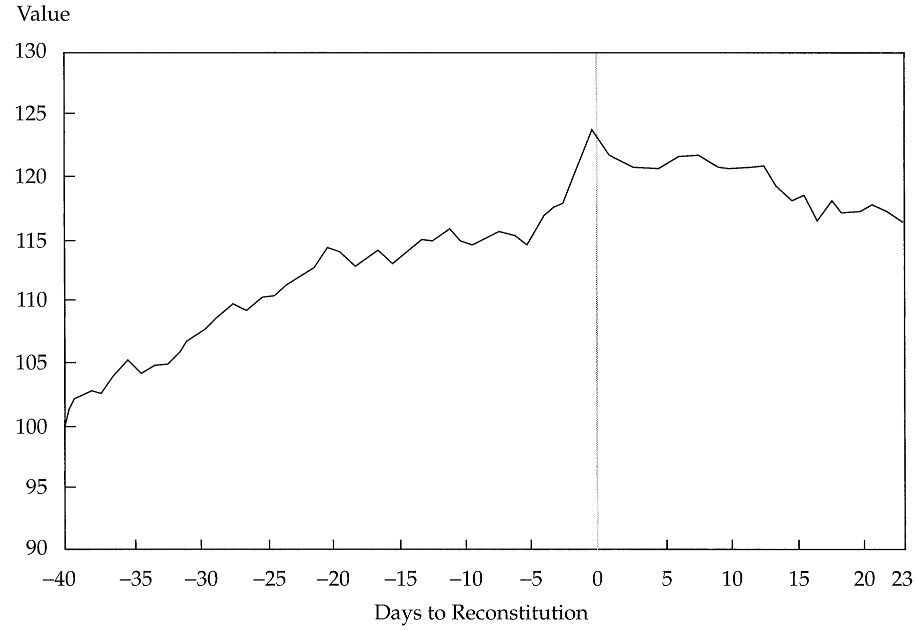
Note: Cumulative value on a daily basis; initial value 100.

speculating on the reconstitution typically take long positions in stocks to be added to the index and short positions in stocks to be deleted. These funds face a timing risk, in the sense that the price they receive when they unwind their portfolios depends on the timing of other funds with similar strategies. Such funds may also misjudge the amount of excess demand by index funds on the reconstitution date because many funds trade before that day or lock in positions with options or futures contracts. If so, return behavior of the type exhibited on 30 June 2000 would be observed.

Model of Index Rebalancing

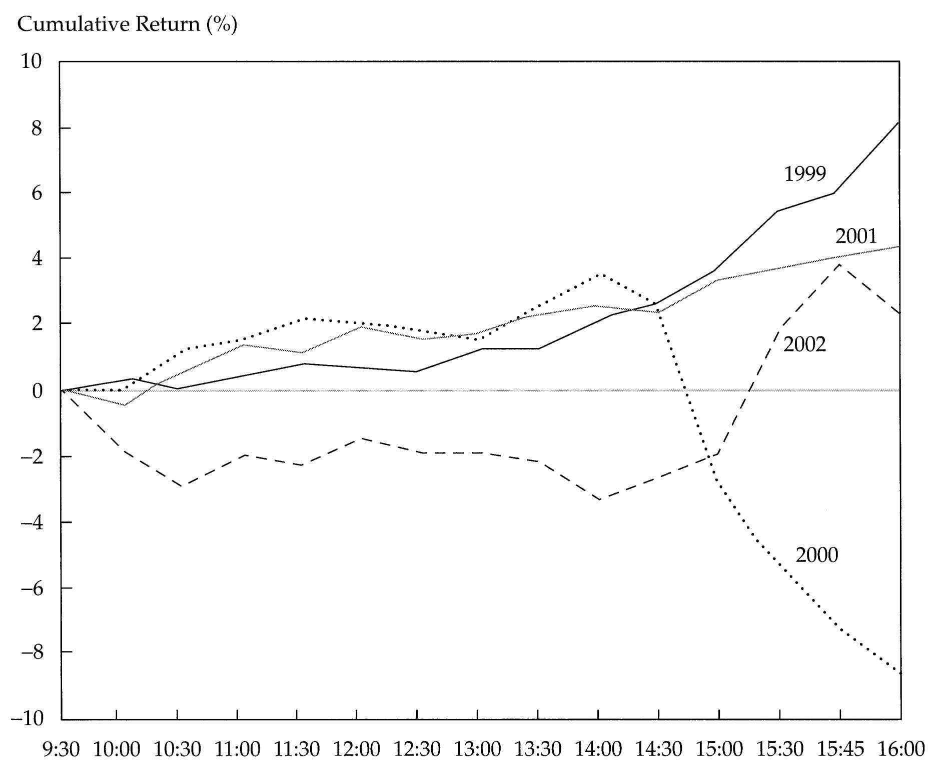
The previous results document large stock price reactions to index revisions. This section provides a framework for interpreting these effects. Several hypotheses have been advanced to explain the

Figure 3. Value of Russell 2000 Spread Portfolio around Reconstitution Date, 2002



Note: Cumulative value on a daily basis; initial value 100.

Figure 4. Intraday Cumulative Returns to Russell 2000 Spread Portfolio on Date of Reconstitution, 1999–2002



Note: Last half hour expanded to highlight cumulative return toward the close.

reconstitution effects. One is that index membership itself has value because it is associated with permanent changes in liquidity, information flows, or both. Amihud and Mendelson (1986) showed formally that the fundamental value of a stock is the present value of future cash flows less the *PV* of all future transaction costs:

$$\text{Value} = PV(\text{Cash flows}) - PV(\text{Transaction costs}). \quad (1)$$

Because inclusion in an index is usually associated with a permanent increase in trading volume and liquidity, inclusion lowers future trading costs and, therefore, permanently increases intrinsic value. Discounting could have a potentially large impact on returns. The opposite is true for index deletion. From an information perspective, index inclusion may be associated with changes in analyst coverage that might reduce information asymmetries, lowering trading costs and, thereby, increasing the stock price. Better information also lowers the cost to traders of gathering information, which again leads to higher asset values upon index inclusion. I refer to this explanation as the "index membership" hypothesis.

Alternatively, reconstitution effects could be explainable in terms of temporary price concessions required by market makers to provide immediacy to indexers by taking on unwanted inventories. In the prototypical microstructure model, the price concession from value is proportional to the deviation between a dealer's desired (target) inventory level, *DesInv*, and actual inventory, *Inv*:

$$\text{Price} = \text{Value} - \lambda(Inv - DesInv), \quad (2)$$

where $\lambda > 0$ is a coefficient that is inversely related to market liquidity. In other words, dealers will bid down from value to take on an unwanted long position.

This hypothesis is supported by extensive research (e.g., Keim and Madhavan 1998) documenting significant temporary price impacts of large transactions. The change in dealer inventory is simply the *negative* of the order imbalance resulting from index revisions (i.e., $\Delta Inv = -\text{Imbalance}$). In a reconstitution, price effects might be especially important because index funds concerned with tracking error often simultaneously trade large positions toward the close on the reconstitution date. Thus, one would expect positive returns for additions for which price pressure arises from positive order imbalances (from indexers) and the opposite for deletions. I refer to this explanation as the "price pressure" hypothesis.

The two explanations are not mutually exclusive; both index membership and price pressure can affect stock returns. To see how, substitute Equation 1 into Equation 2 and take the first difference to express the change in price upon index reconstitution as

$$\Delta\text{Price} = \gamma\Delta\text{Liquidity} + \lambda\text{Imbalance}. \quad (3)$$

The first term, $\gamma\Delta$Liquidity, is the change in the present value of transaction costs, which I model as proportional to the *expected* long-term change in liquidity (volume) for the stock. The proportionality factor, $\gamma > 0$, reflects the discount factor and the effect of liquidity on trading costs. The first term in Equation 3 thus captures the permanent effect associated with index reconstitution. The second term in Equation 3, λImbalance, captures the temporary price effects associated with order flows related to index rebalancing. Thus, reconstitution can affect stock prices through index membership, price pressure, or both.

Determinants of Reconstitution Effects

In terms of empirical evidence, several studies have documented significant return movements associated with index additions and deletions, but they differ in their interpretations of the evidence. Harris and Gurel (1986) found significant abnormal announcement-day returns, which they interpreted as price-pressure effects. Analysis by Lynch and Mendenhall (1997) provides additional support for this conclusion. Dash (2002), for a Standard & Poor's research paper, studied 53 S&P 500 deletions from 1 January 1998 to 25 June 2002 and found significant short-term price declines between the announcement and change date. But losses were nearly fully recovered by the sixth day after the change, which suggests that such effects are driven by price pressure. These findings are consistent with results reported by Madhavan and Ming.

Other studies, however, have suggested that the price effects associated with index additions and deletions are permanent, which would indicate that index membership itself is a factor in returns. Goetzmann and Garry (1986) studied the effect of delisting from the S&P 500 of seven stocks on 30 November 1983 and found significant long-term price declines for the delisted stocks.[6] Jain (1987) found that S&P 500 additions have persistent price impacts, suggesting, again, that temporary price pressure is not the explanation for return anomalies. Furthermore, he reported that return effects are independent of company size, whereas the price-pressure hypothesis would predict stronger effects in the stocks of smaller, less liquid companies. Beneish and Whaley (1996) and Hegde and McDermott (2001) found permanent changes in trading volume following S&P 500 revisions, which supports the idea that liquidity explains the price reactions documented in other studies.

Evidence of Effects. The relative importance of index-membership and price-pressure effects is an empirical issue. A simple approach is to decompose price movements around the reconstitution day into permanent and transitory components. Specifically, the transitory order imbalance resulting from rebalancing should dissipate over a long horizon, so from Equation 3, price change over the long term is, other things being equal, $\gamma\Delta$Liquidity. The long-term price change thus reflects the permanent effect of index membership. Similarly, the difference between the total price change at the time of reconstitution and the long-term price change (ΔPrice – $\gamma\Delta$Liquidity) is the temporary effect attributable to price pressure.

To make these concepts operational, consider a stock whose price at the end of May is p_0. Let p_1 be the price on the date of the reconstitution on 30 June and let p_2 represent the price at the end of July, one month after the reconstitution date. Define two (logarithmic) returns as follows:

$$R_{temp} = \ln(p_1) - \ln(p_2); \tag{4}$$

$$R_{perm} = \ln(p_2) - \ln(p_0). \tag{5}$$

Equation 4 defines the temporary impact; Equation 5 defines the permanent impact. The sum of the two impacts is merely the total (logarithmic) return from May-end to June-end. To illustrate the decomposition of price into permanent and temporary effects, **Figure 5** shows stock price over the May–August period. In general, the impact of both effects should be positive for additions and negative for deletions, net of market movements. The choice of the end of July as the final date by which any transitory price impacts have dissipated was, of course, a matter of judgment. The use of longer horizons adds noise to estimation, and the use of shorter horizons runs the risk of confounding permanent and transitory price movements. On balance, the use of a month-ahead benchmark appears reasonable. Similarly, the use of a pretrade benchmark at the end of May could be criticized as understating the permanent impact because it ignores the return movements prior to the end of May. The end-of-May benchmark is the benchmark with the most conservative price, however, because earlier benchmarks might include effects caused by the positive-feedback trading discussed previously.

Figure 5. Permanent and Temporary Effects

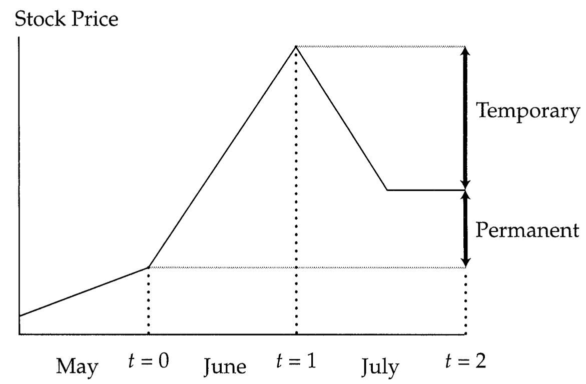


Table 3 summarizes the temporary and permanent effects for equal-weighted portfolios of additions or deletions to the Russell 3000 and Russell 2000 over the 1996–2002 period adjusted for market movements over the May–July period. The decomposition of returns around the reconstitution confirms the previous conclusion that both the price-pressure and liquidity (index-membership) hypotheses explain the observed reconstitution effects. The second row shows that the temporary effects for stocks being added to the index are much larger in magnitude than the corresponding effects for deletions. This result might be explained by the difficulty of shorting low-priced stocks and the high transaction costs for these stocks, many of which trade thinly and at low prices. Furthermore, some fund managers, electing not to replicate the underlying index perfectly, simply may not hold low-cap stocks with small weights.

Cross-Sectional Evidence. The previous section provided evidence that both price-pressure and index-membership effects are manifest around index reconstitutions. Could these return effects be explained by factors unrelated to index reconstitution, however, such as risk or company size? To

Table 3. Permanent and Temporary Price Impacts for Russell Index Additions and Deletions, 1996–2002

	Russell 3000		Russell 2000	
Impact	Additions	Deletions	Additions	Deletions
Permanent	4.68%	–7.01%	1.41%	3.94%
Temporary	5.82	1.54	5.79	0.16

examine this issue, I considered factors that could explain the pattern of reconstitution returns across stocks.

Again, Equation 3 was the basis for analyzing returns around the reconstitution date. Both price pressure and index membership imply changes in volume, so simply using actual changes in liquidity to estimate Equation 3 would be misleading. Accordingly, I used a two-stage (instrumental variable) econometric procedure based on a universe of all 9,135 stocks in (or eligible for inclusion in) the Russell 3000 in the month of May for the three years 2000–2002.

In the first stage, I modeled changes in average daily volume across stocks as a function of changes in past volume, company size, and volatility. In the second stage, I modeled the cross-sectional pattern in returns in the reconstitution month as a function of the predicted volume change from the first-stage regression (as a control for expected changes in liquidity) and—as a control for other factors known to affect returns across stocks—risk and company size. I used dummy variables for additions or deletions to capture any effects from index revision unrelated to predictable changes in volume, risk, and other factors affecting returns. These dummy variables are the primary focus of the analysis.

The model for estimated first-stage volume (with standard errors in parentheses) is:

$$\begin{aligned}\Delta ADV_{i,A} = \; & \underset{(2.77)}{43.14} + \underset{(0.01)}{0.74\Delta ADV_{i,B}} \\ & + \underset{(1.30)}{9.43\Delta MC_i} + \underset{(0.03)}{(-0.05)Volat_i} \\ & - \underset{(4.80)}{30.59 LagRet_i},\end{aligned} \tag{6}$$

where, for stock i,

$\Delta ADV_{i,A}$ = ratio of average daily dollar volume (*ADV*) in July to *ADV* in the previous calendar year (in percentage)

$\Delta ADV_{i,B}$ = ratio of *ADV* in May to *ADV* in the previous year (in percentage)

ΔMC_i = ratio of market cap between end of May and end of the previous year

$Volat_i$ = stock return volatility in May

$LagRet_i$ = stock return for March–May, net of market movements

Changes in average daily trading volume and size were included because volume is likely to be autocorrelated and because larger companies normally have higher trading volumes and are followed by more analysts. Similarly, volumes are likely to be higher in volatile stocks, which produce greater divergence of opinion. Returns in the previous months, *LagRet*, were included because volume effects are typically greater for stocks that have appreciated in price.

The volume model, Equation 6, fit well overall, with an R^2 of 0.30. The change in liquidity around the reconstitution was positively and significantly related to lagged volume growth (ADV_B) and changes in company size, ΔMC. These results also held in the three individual years, details of which are not reported here. Past returns entered the model positively and significantly, which is consistent with previous empirical evidence. The only variable that was not statistically significant was volatility, possibly because previous returns captured the volatility effects.

The second-stage regression model is the empirical analog of Equation 3. I estimated the model using two-stage least squares, which is appropriate in light of the use of predicted changes in volume as an explanatory variable. The estimated model (with standard errors in parentheses) is:

$$\begin{aligned}r_i = \; & \underset{(1.20)}{9.12} + \underset{(0.15)}{0.18\Delta A\hat{D}V_{i,A}} + \underset{(0.04)}{(-0.11)Beta_i} \\ & + \underset{(0.24)}{4.09MB_i} - \underset{0.17}{2.03Size_i} + \underset{(0.70)}{11.15Add_i} \\ & - \underset{(0.90)}{11.93Del_i},\end{aligned} \tag{7}$$

where, for stock i,

r_i = market-adjusted return in June

$\Delta A\hat{D}V_{i,A}$ = estimated change in *ADV* from the first regression (in percentage)

$Beta_i$ = estimated beta (from a time-series regression of five years of monthly stock returns on the S&P 500)

MB_i = (log) ratio of market price to book value

$Size_i$ = (log) market cap

Add_i = binary variable taking the value 1 for new additions to the Russell 3000 and 0 otherwise

Del_i = binary variable taking the value 1 for stocks deleted from the Russell 3000 and 0 otherwise

Log transformations of price-to-book ratios and size were used because these variables are highly skewed to the right.

The regression results given in Equation 7 show returns to be positively related to changes in predicted volumes, which is consistent with the liquidity hypothesis. The coefficient was statistically significant in the individual years 2000 and 2002 but not in the pooled data. Consistent with past research, larger companies and companies with high book-to-market ratios have lower expected returns. Beta, however, enters negatively, perhaps as a reflection of the bursting of the technology bubble. Of special interest are the coefficients of the dummy variables representing the Russell 3000 revisions, which are economically and statistically significant even after changes in expected volumes and risk factors have been controlled for. For example, a stock classified as a new addition to the Russell 3000 had an estimated positive return of 11.15 percent after all other factors were controlled for. Similarly, deletions experienced an estimated loss of 11.93 percent, which is consistent with the results reported previously. This pattern held in each of the three individual years. Overall, the R^2 is 0.11, and the null hypothesis that liquidity changes and risk alone can explain the cross-section of returns can be rejected with an F-test.

To sum up, the regression analyses support the conclusion that the return effects documented here are directly related to index additions and deletions even after control for risk and other factors known to affect returns.

Practical Implications

In this section, I discuss topics that are important for portfolio managers and equity strategists: transaction costs in portfolio rebalancing, the opposite issue of potential profits to be made from the information contained in reconstitutions, and reasons the reconstitution effects persist.

Transaction Costs. The return effects documented here represent "hidden" transaction costs for investment managers who trade on or around the reconstitution date to match index revisions. Essentially, these managers pay a steep premium—in the form of transitory price pressure—to rebalance their portfolios when other managers are simultaneously demanding liquidity in the same stocks. In this sense, the effects shown here are not particular to the Russell indexes; they apply to all equity indexes for which revisions are disclosed in advance, with resulting widespread trading by index funds and others concerned with tracking error.

These managers can obtain higher realized or net returns by reducing the liquidity premiums they pay to trade near the reconstitution date. This objective can be achieved in several ways. First, investment managers can trade ahead of the reconstitution or achieve their desired exposures through swaps or derivatives. Second, a passive fund might choose to postpone rebalancing to match changes in the benchmark index. Keim (1999) provided an analysis of the returns of such a passive upstairs trading strategy for a small-cap index fund and showed that it can outperform its benchmark, on average, by as much as 200 bps.[7]

Many fund managers are unwilling to incur the higher tracking error of such strategies, however, despite the promise of higher expected returns. This reluctance provides an opportunity for investment managers to create highly diversified passive funds that do not incur the transaction costs of traditional index funds, including the costs associated with index rebalancing. For example, Gastineau (2002) argued that an exchange-traded "self-indexing" fund based on a nondisclosed index will produce substantially higher after-tax returns than a traditional index fund.

Index providers might also respond by altering the way they reconstitute their indexes. Note that this suggestion does not necessarily mean more frequent index rebalancing, which could actually increase turnover and raise trading costs for index funds. Gardner, Kondra, and Pritamani (2001) showed through simulations that quarterly or semiannual reconstitution of the Russell indexes would substantially increase turnover, as measured either by number of name changes or fraction of portfolio value traded.

Predictability and Profitability. If index reconstitution can be costly to some managers, it may be profitable to others. The extent to which a strategy of trading on projected index revisions has potential for profits is a natural concern for traders. And analyzing it also sheds light on market efficiency. Tables 1 and 2 showed that the returns to a long–short strategy based on index additions and deletions were positive and substantial in June of the years studied. Such a portfolio can be formed from public data at the end of April or May with a relatively high degree of accuracy. In general, the returns in June in Tables 1 and 2 are close representations of returns to portfolios formed before index membership was formally determined. Thus, the transparency of the reconstitution process allows the construction of portfolios on an *ex ante* basis that yield returns extremely close to the actual portfolio returns in June. Indeed, many broker/dealers provide their clients with forecasts of likely additions and deletions. The differences from the actual lists are generally minor (Bok et al.) and reflect either forecast errors or revisions to the index-membership lists in June based on corrections to closing prices at the end of May, shares outstanding, or eligibility in the Russell universe.

To investigate the predictability of returns to index additions and deletions, it is instructive to compute the *ex ante* returns to a hypothetical or projected Russell portfolio. Because the Russell universe is easily identified and data on market cap are freely available, naive forecasts of the top 3,000 stocks by market cap can be produced and portfolios of projected additions and deletions can be formed. In the tests I report here, to obtain a conservative estimate of return predictability, I made no effort to refine these forecasts with careful scrutiny of the individual names to ensure that they were, in fact, members of the Russell universe (as would be done by market professionals). I performed this experiment for 2000–2002 by forming portfolios at the end of February based on market cap and rebalancing each month as stock prices changed.

The projected returns were based on a portfolio formed by a market-cap sort at the beginning of the month. In the months prior to June, the simply formed portfolio tracked actual returns quite noisily. In the month of June in all three years, however, the return difference between an equal-weighted spread portfolio of Russell 2000 stocks and the naive projected Russell 2000 spread portfolio (from a paired t-test of equality in daily returns) was not statistically different from zero. Specifically, the absolute return differences between the projected and actual portfolios in June 2000, 2001, and 2002 were, respectively, 0.88 percent, 3.30 percent, and 0.20 percent. The corresponding p-values (with values below 0.05 indicating significance at the 5 percent level) were 0.48, 0.07, and 0.96. In short, even a naive forecast of returns using public information in June when index constituents are highly predictable can track actual returns well. The differences largely arise from large abnormal intraday returns (as shown in Figure 4) on the actual reconstitution date.

Persistence in Effects. The results presented here demonstrate that the returns to an investment strategy based on index revisions are large and can be predicted with increasing accuracy as the reconstitution date approaches. These findings raise questions. Why do the Russell reconstitution effects persist? Why are the effects not traded away?

In the search for answers, several factors merit consideration. Risk—both sectoral and timing—may deter some investors from trading. Specifically, index sector weighting exhibits considerable volatility from year to year. For example, the share of the S&P financial sector in the Russell indexes fell in 1999–2000 only to rise again in 2000–2001. The opposite was true of the technology sector. Any long–short strategy based purely on index revisions thus represents a sectoral bet.

Furthermore, as shown by the intraday analysis, the portfolio returns to any strategy that attempts to profit from reconstitution effects is subject to considerable risk arising from the strategic reactions of other traders. A strategy that involves liquidating a long–short portfolio of additions and deletions at the end of June would have experienced sharply negative returns on the reconstitution date in 2000. In other words, the timing risk is considerable when unwinding a portfolio based on index revisions. To the extent that these risks limit the amount of capital committed to supplying liquidity (relative to the pool of passive index funds demanding liquidity), the reconstitution effects are unlikely to disappear quickly.

In addition, the profitability of trading on the reconstitution effects is critically related to liquidity. The transaction costs involved in trading low-priced, illiquid stocks are often large (Keim and Madhavan 1998). These costs significantly erode the notional, "paper" return from trading on the reconstitution. Many deletions trade on small volumes, which makes scaling positions difficult. Finally, short positions in some low-priced stocks may simply not be feasible, so some seemingly profitable trades are impossible.

These considerations help explain the persistence of the Russell reconstitution effects whether markets are efficient or not. Ultimately, however, as more investors become aware of the effects, trading is likely to move the observed phenomena back in time away from the reconstitution date and also dampen the observed stock price reactions.

Conclusions

I documented significant abnormal returns around the annual reconstitution of the Russell 2000 and 3000 indexes for 1996 through 2002. I found that, on average, stocks projected to be index additions (deletions) experienced positive (negative) abnormal returns in March–June. The equity returns documented here were concentrated in time and were much larger in magnitude and in the number of stocks affected than the corresponding effects for S&P 500 revisions, the focus of much previous research. I found a significant portion of these excess returns to be attributable to temporary price pressure, with the remainder attributable to permanent changes in liquidity.

These results have several important implications for practitioners. Investment managers who rebalance their portfolios to match benchmark indexes on or near the dates of actual index revision pay an extremely steep liquidity premium. The cost is especially significant for index funds benchmarked against popular indexes, which will experience a concentration of trading around predisclosed index revisions. Index funds and their investors would experience higher net returns (albeit with some risk of tracking error) by trading ahead of the reconstitution on the basis of predictions of index additions and deletions, by undertaking derivative transactions in the options or futures markets, or by using equity swaps. Indeed, these findings provide a rationale for the creation of alternative investment vehicles that would offer investors diversification but be designed to incur lower trading costs while tracking a given index.

Conversely, providing liquidity during the reconstitution can reap significant rewards. Such a strategy, however, is typically undiversified, involves high trading costs, and faces price risk as positions are unwound. Indeed, I documented dramatic return volatility on the actual day of reconstitution. These factors help explain the persistence of the Russell reconstitution effect over time.

Finally, the results presented here highlight the importance of understanding implicit transaction costs associated with demanding liquidity at specific times and, on a broader level, the relationship between liquidity and stock prices.

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Notes

1. Lauricella and Brown (2001) noted, "For the third straight year, the so-called Russell Shuffle changes to the indexes will be significant, affecting hundreds of companies and billions of dollars of investor money."
2. Chen (2003) independently provided an analysis of the Russell reconstitution that focused on distinguishing among the hypotheses proposed in the academic literature to explain return effects.
3. In contrast, a committee decides membership in the S&P equity indexes and revisions occur on a stock-by-stock basis throughout the year. (Certain S&P indexes are rebalanced quarterly to reflect changes too small to be incorporated continuously.) The DJIA is also revised on a continuous basis.
4. Standard errors were computed as follows: For a portfolio with N stocks and T trading days, I computed the $N \times N$ variance–covariance matrix, $\boldsymbol{\Omega}$, estimated from the daily returns in the month. The portfolio standard error for the month is $\sqrt{\boldsymbol{\omega}'\boldsymbol{\Omega}\boldsymbol{\omega}}$, where $\boldsymbol{\omega}$ is an $N \times 1$ vector of portfolio weights (i.e., $1/N$).
5. Daily rebalancing was used in constructing reported portfolio returns; the figures for monthly rebalancing (not reported) are similar in magnitude.
6. As noted previously, companies are typically added singly. The seven companies in the Goetzmann–Garry study were replaced by the "Baby Bells" created by the breakup of AT&T in 1983.
7. See Keim and Madhavan (1996) for further details of the fund's trading strategy.

References

Amihud, Y., and H. Mendelson. 1986. "Asset Pricing and the Bid–Ask Spread." *Journal of Financial Economics*, vol. 17, no. 2 (December):223–249.

Beneish, M.D., and R.E. Whaley. 1996. "An Anatomy of the 'S&P Game': The Effects of Changing the Rules." *Journal of Finance*, vol. 51, no. 5 (December):1909–30.

Bok, T., K. Ming, and Y. Wang. 2002. "Year 2002 Russell Reconstitution." Unpublished working paper, ITG Inc.

Chen, H.L. 2003. "On Reconstitution of Russell Style Indexes." Unpublished working paper, University of Illinois at Chicago.

Cushing, D., and A. Madhavan. 2001. "The Hidden Cost of Trading at the Close." In *Investment Guide: Transaction Costs*. Edited by Brian Bruce. New York: Institutional Investor.

Dash, S. 2002. "Price Changes Associated with S&P 500 Deletions: Time Variation and Effect of Size and Share Prices." Standard & Poor's: www.spglobal.com/research.html.

Gardner, G., A. Kondra, and M. Pritamani. 2001. "Russell Indexes: Examining the Frequency of U.S. Reconstitution." Unpublished working paper, Investment Policy & Research, Frank Russell Company.

Gastineau, G. 2002. "Equity Index Funds Have Lost Their Way." *Journal of Portfolio Management*, vol. 28, no. 2 (Winter):55–64.

Goetzmann, W., and M. Garry. 1986. "Does Delisting from the S&P 500 Affect Stock Price?" *Financial Analysts Journal*, vol. 42, no. 2 (March/April):64–69.

Harris, L., and E. Gurel. 1986. "Price and Volume Effects Associated with Changes in the S&P 500 List: New Evidence for the Existence of Price Pressures." *Journal of Finance*, vol. 41, no. 4 (September):815–829.

Hegde, S., and J. McDermott. 2001. "The Liquidity Effects of Revisions to the S&P 500 Index." Working paper, University of Connecticut.

Jain, P.C. 1987. "The Effect on Stock Price of Inclusion or Exclusion from the S&P 500." *Financial Analysts Journal*, vol. 43, no. 1 (January/February):58–65.

Keim, D. 1999. "An Analysis of Mutual Fund Design: The Case of Investing in Small-Cap Stocks." *Journal of Financial Economics*, vol. 51, no. 3 (February):173–194.

Keim, D., and A. Madhavan. 1996. "The Upstairs Market for Large-Block Transactions: Analysis and Measurement of Price Effects." *Review of Financial Studies*, vol. 9, no. 1 (Spring):1–36.

———. 1998. "The Costs of Institutional Equity Trades: An Overview." *Financial Analysts Journal*, vol. 54, no. 4 (July/August):50–69.

Lauricella, T., and K. Brown. 2001. "Small Stock Focus: What Constitutes a Russell 2000 Stock Is No Small Matter." *Wall Street Journal* (31 May):C1.

Lynch, A., and R. Mendenhall. 1997. "New Evidence on Stock Price Effects Associated with Changes in the S&P 500." *Journal of Business*, vol. 70, no. 3 (July):351–384.

Madhavan, A., and K. Ming. 2002. "The Hidden Costs of Index Rebalancing: A Case Study of the S&P 500 Composition Changes of July 2002." Unpublished working paper, ITG Inc.