Index Reconstitution and Equity Returns

Ananth Madhavan*

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* Managing Director, ITG Inc., 380 Madison Avenue, New York, NY 10017; Tel: (212)-444-6361; E-mail: Amadhava@itginc.com

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Abstract

We document significant abnormal returns associated with the annual reconstitution of the popular Russell equity indexes from 1996-2001. The cross-sectional variation in abnormal returns is explained by (1) Permanent changes in liquidity associated with changes in index membership and (2) Temporary effects related to price pressure. From a practical perspective, the results indicate that index funds pay a steep price to reduce their tracking error by rebalancing on or near the reconstitution date. Conversely, these results indicate that supplying immediacy at this time can be highly profitable. This strategy, however, is typically undiversified, involves high trading costs, and faces price risk as positions are unwound. Indeed, there is dramatic return volatility on the actual day of reconstitution. These factors might explain the persistence of the reconstitution effects documented here.

The Frank Russell Company's equity indexes are widely used as performance benchmarks for investment managers. At the end of June each year, the Frank Russell Company reconstitutes its indexes based on market capitalization at the end of May. The annual reconstitution of the Russell indexes is accompanied by portfolio rebalancing by investment managers and gives rise to abnormal returns and volumes.[1] These effects are significant and pervasive, but have not previously been analyzed systematically. This paper analyzes the annual reconstitution of the equity indexes of the Frank Russell Company from 1996-2001.

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 attempting to profit from these effects. 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 also of interest because similar effects might be expected with the periodic rebalancing of other equity indexes such as the Nasdaq 100 index. Finally, the criteria for membership in the Russell indexes is based on market capitalization at the end of May, and hence readily computed in the month before the reconstitution.[2] Consequently, equity returns around the reconstitution date provide valuable insights concerning market efficiency.

Previous empirical studies of index revisions focus almost exclusively on the S&P 500 index.[3] By contrast, the equity returns documented here are concentrated in time, and are much larger in magnitude and in the number of stocks affected than the corresponding effects for S&P 500 index revisions. Specifically, a portfolio long additions and short deletions to the Russell 3000 index (constructed after the determination of new index weights at the end of May) had a mean return of 15.1% in the month of June over the period 1996-2001.

The difference in returns across stocks is explained by both permanent changes in liquidity associated with changes in index membership and price pressure effects induced by fund

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[1] Lauricella and Brown (2001) note: "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] By contrast, a committee decides membership in the Standard and Poor's 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 Dow Jones Industrial Average (DJIA) is also revised on a continuous basis.

[3] Beneish and Gardner (1995) examine the Dow Jones Industrial Average; Deininger, Kaserer, and Roos (2000) analyze the DAX indexes in Germany; and Li, Pinfold, and Elayan (2000) provide evidence from New Zealand.

flows. These findings are confirmed by a decomposition of returns around the reconstitution. Interestingly, the temporary return effects for stocks being added to an index are larger in magnitude than the corresponding effects for deletions. One explanation is that investment managers do not hold very low capitalization stocks because of illiquidity concerns, so that price pressure upon deletion from an index is weak.

Our findings have immediate practical implications. In particular, the return effects documented here represent large "hidden" transaction costs for investment managers who rebalance their portfolios on reconstitution date to match index revisions. These findings suggest that investment managers can obtain higher realized or net returns by trading ahead of the reconstitution or achieving their desired exposures through swaps or derivatives. Alternatively, a passive fund that does not immediately rebalance to match changes in the benchmark can use passive trading strategies to reduce trading costs albeit at the risk of increased tracking error. Such a trading strategy can, as Keim (1999) shows, have a very high Sharpe ratio. These considerations might also drive the creation of new funds benchmarked to non-disclosed indexes (see, e.g., Gastineau, 2002) or alternative methods of index construction or revision.

Conversely, the results indicate that a strategy of trading on projected index revisions can be profitable. Forecasts of future index revisions can be made at the end of May with a high degree of precision given the transparency of the reconstitution process. Out of sample tests reported here indicate that these returns closely mimic the actual returns in June. However, such a strategy can be very risky. Specifically, portfolios based on projected additions and deletions typically involve sectoral bets. In 2001, for example, the technology sector was heavily represented among the projected deletions while the financial services sector was prominent among projected additions. There is also significant timing risk arising when traders unwind their positions on or around the actual reconstitution date. Dramatic intraday price movements on the reconstitution date itself are indicative of the difficulty in anticipating excess demand from index funds whose positions may be large relative to the risk arbitrageurs on the opposite side. Liquidity is also paramount. The transaction costs associated with trading small capitalization stocks are large, implying difficulty in scaling positions, and short positions in some stocks might simply be impossible. These considerations explain the persistence of index reconstitution effects in an efficient market.

Empirical Hypotheses

Previous research documents large stock price reactions to index revisions. I consider two possible explanations for these phenomena:

(1) **The Price Pressure Hypothesis**, which holds that transitory order imbalances associated with index additions and deletions are the primary source of price movements.

(2) **The Index Membership Hypothesis**, which holds that index itself is a source of value, possibly because of changes in liquidity or information flows.

The price pressure hypothesis has a theoretical justification in the temporary price concession dealers and market makers charge to accommodate a large imbalance from their own inventory. Extensive research (see, e.g., Keim and Madhavan, 1998, for a survey) documents significant temporary price impacts to block transactions. In a reconstitution price effects might be especially important because index funds concerned with tracking error often simultaneously trade large positions towards the close on the reconstitution date.

The theoretical basis for the index membership hypothesis rests on arguments relating to permanent changes in liquidity, information flows, or both. Amihud and Mendelson (1986) show that asset values are inversely related to transaction costs. Since index inclusion is usually associated with permanent increases in trading volumes and liquidity, we expect lower future trading costs, and hence a permanent increase in intrinsic value. The opposite is true for index deletions. From an information perspective too, index inclusion may be associated with changes in analyst coverage, etc. that affect the degree of information asymmetry, hence trading costs, thereby affecting returns. Better information also lowers the cost of gathering information for traders, again resulting in higher values upon index inclusion.

As discussed above, the empirical literature on index return effects focuses almost exclusively on the S&P 500 index. Although several studies document significant return movements associated with index additions and deletions, they differ in their interpretation of the evidence. Harris and Gurel (1986) find significant abnormal announcement day returns of 3.1% for additions and -1.4% for deletions, together with large announcement day volumes. They interpret these results as price pressure effects. Other studies report results of similar magnitudes.

If price pressure is the source of return anomalies, these effects should not be persistent. Lamoureux and Wansley (1987) and Lynch and Mendenhall (1997) find no evidence of a permanent increase in the value of shares traded following inclusion in the S&P 500 index, supporting the price pressure hypothesis. Pruitt and Wei (1989) study the portfolio rebalancing of institutional investors following index replacements and find a positive relation between the average change in a stock's portfolio weight and its announcement period abnormal return. Their results suggest that institutional trading volumes are the source of price pressure.

Other studies, however, argue that the price effects associated with index additions and deletions are permanent, indicating that index membership itself is a factor in returns. Goetzmann and Garry (1986) study the effect of delisting from the S&P 500 index of seven stocks on November 30, 1983 and find significant, long-term price declines for the delisted stocks.[4] Jain (1987) finds S&P 500 index additions to have persistent price impacts, again suggesting that temporary price pressure is not the explanation for return anomalies. Beneish and Whaley (1996), and Hegde and McDermott (2001) find permanent changes in trading volumes following S&P 500 index revisions, supporting the idea that liquidity explains the price reactions documented in other studies.[5] Jain (1987) and Dhillon and Johnson (1991) provide indirect evidence against the price pressure hypothesis. Jain finds the return effects to index revisions are independent of firm size, inconsistent with the price pressure hypothesis, which predicts effects concentrated in smaller, less liquid stocks. Dhillon and Johnson show that a stock's addition to the S&P 500 index generates a positive price reaction to both its equity *and* debt, a fact difficult to reconcile with price pressure in the equity market.

There is, however, no reason to view the two hypotheses regarding index revisions as mutually exclusive. Indeed, the Russell reconstitution is unusual because it *simultaneously* affects a *large* universe of stocks, many of them less liquid stocks, so that both price pressure and index membership effects are likely to be observed. Our tests focus on jointly examining the factors that might affect the cross-sectional pattern of returns, recognizing that both hypotheses may be valid. Before I turn to the evidence, however, a review of the institutional details is appropriate.

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[4] As noted above, companies are typically added singly. The seven companies were replaced by the "Baby Bells" created by the breakup of AT&T in 1983.

[5] Outside the US, Deininger, Kaserer, and Roos (2000) analyze stock price reactions associated with additions and deletions from the German DAX index and the mid-cap MDAX index. On the announcement day, additions to the DAX index had a 1.7% return while deletions had a -1.2% return.

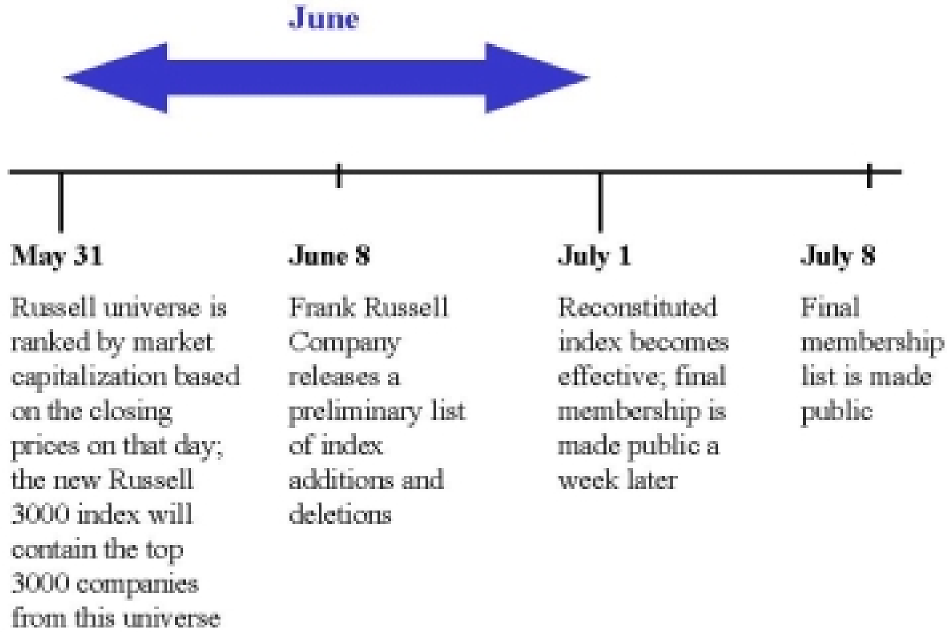
The Russell Reconstitution Process

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 and style indexes in Canada, Japan, and the United Kingdom. Over $750 billion in funds is benchmarked against the global Russell indexes. The Russell US 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 such as royalty trusts or closed-end mutual funds are excluded from the Russell universe.

Our focus is on the Russell 3000 index, which represents about 98% of the investible U.S. equity market. The Russell 3000 index measures the performance of the 3,000 largest U.S. companies in the Russell universe based on total market capitalization. The Russell 3000 index comprises the Russell 1000 and Russell 2000 indexes. The Russell 1000 index measures the performance of the 1,000 largest companies in the Russell 3000 index; The Russell 2000 index measures the performance of next 2,000 Russell 3000 companies. As of the latest reconstitution in June 2001, the median market capitalization of firms in the Russell 3000 was $731.8 million.

The Frank Russell Company re-ranks each company by market capitalization once a year to establish the year's new index membership. The newly adjusted index membership takes effect July 1, and remains in place until the following year's reconstitution process. The reconstitution process is generally transparent and the criteria for index membership – market capitalization as of May 31 – 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, either because they wish to trade on the reconstitution, or simply be aware of buying/selling pressures in stocks they plan to trade routinely. Indeed, firms providing estimates of Russell additions and deletions typically have success rates in predicting these changes of 90-95% as of the end of May and even before. Errors arise because some factors (e.g., computation of float, the treatment of IPO lockout periods, and adjustments for dual-class shares) affecting membership are either subjective or require proprietary data.

Time Line of the Russell Reconstitution



In recent years a relatively large fraction of the Russell indexes have experienced movements. Consider, for example, 2001 where there were 527 additions to the Russell 3000 and 291 deletions. The corresponding figures for the Russell 2000 index were 609 and 431. Observe that annual reconstitution implies there are more additions than deletions because some stocks are delisted over the year.

Empirical Results

Portfolio Returns

Table 1 shows the mean returns, by month and year, of portfolios equally-weighted by number of stocks consisting of Russell 3000 additions, deletions, and a spread portfolio long index additions and short index deletions.[6] The corresponding standard errors are shown in parentheses. Standard errors are computed as follows: For a portfolio with N stocks and T trading days, we compute the $N \times N$ variance-covariance matrix, Ω estimated from the daily returns in the

[6] Historical data on Russell index membership is obtained from the Frank Russell Company's web site where the constituents of the Russell indexes are listed each year following the reconstitution. Daily return and volume data are obtained from Factset Research Systems and Bloomberg L.P. Intraday data for some analyses are drawn from the NYSE's TAQ database.

month. The portfolio standard error for the month is $\sqrt{\omega'\Omega\omega}$, where ω is a $N \times 1$ vector of portfolio weights (i.e., $1/N$). The table covers March through July for each of the six years 1996-2001.

The Russell reconstitution effect is evident in each of the years shown. In general, additions have positive stock price responses in June and before, while deletions have the opposite pattern. In particular, the spread portfolio in particular shows a mean return over the six-year period of 15.1% in June alone, with a *cumulative* total rise from March of 35.0%.[7] Mean returns are positive to the spread portfolio from March-June, but the mean return in July is –5.3%. Indeed, returns in all five years from 1996-2000 are negative in July, perhaps consistent with overreaction in June. I return to this issue when I analyze the sources of the index revision effects.

The corresponding information for the Russell 2000 index is contained in table 2. The return effects are very similar to those shown in table 1. Specifically, the mean return over these six years to a portfolio long Russell 2000 index additions and short index deletions is 10.9% in June alone. All six returns in June are positive, and the cumulative return for months from March to June is 27%. There spread portfolio has a mean return of –5.9% in July, again with five of the six years showing negative returns.

The effects shown in tables 2 and 3 are much larger than the corresponding S&P 500 index effect reflecting lower overall liquidity of the Russell stocks and the simultaneous rebalancing by different investment managers on or around a single reconstitution date. Further, the returns to projected additions and deletions in the months prior to May (when index membership is decided based on market capitalization) may reflect a positive feedback effect. A stock likely to be added to the Russell 3000 index might be purchased by hedge funds speculating on the reconstitution, thereby generating additional price increases. The opposite is 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 1 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, (with initial value 100) for the years 1996-1998. Figure 2 presents the corresponding graphs for 1999-2001.

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[7] Reported portfolio returns are constructed using daily rebalancing; the corresponding figures for monthly rebalancing are similar in magnitude.

In both figures, the vertical line at day 0 represents the last trading day in June, i.e., the reconstitution date. Clearly evident in the graphs are the sharp price movements on or around the reconstitution date itself. Interestingly, these "spikes" are not always coincident, suggesting that traders only imperfectly anticipate order imbalances related to the reconstitution. These daily return movements in turn prompt a further examination of returns at a higher frequency basis.

Intraday Effects

The sharp price movements around the reconstitution date itself suggest an examination of returns at a higher-frequency level. Previous studies examine returns at the daily level, perhaps masking significant price movements that occur within the day. Indeed, price pressure effects are most likely to be manifested on the reconstitution date itself because index funds are benchmarked against closing prices and trade towards the close to minimize their tracking error. However, some indexers trade earlier in the day to avoid trading at the close when price pressure effects (Cushing and Madhavan, 2001) are especially large. Similarly, hedge funds that generally take long positions in index additions and short positions in index deletions unwind their positions on or soon after the actual reconstitution date. Order imbalances created by these traders might give rise to sharp price movements on the reconstitution date itself.

Accordingly, I formed portfolios consisting of Russell 2000 adds and deletes on the actual reconstitution date (i.e., the last trading day of June or day 0 in figures 1 and 2) for the years 1999, 2000, and 2001. Figure 3 plots the cumulative returns to a spread portfolio (long additions and short deletions) of the Russell 2000, on the three days. The returns are strikingly large in absolute terms. Especially noteworthy is June 30, 2000, when the spread portfolio's return peaked in the early afternoon and then experienced a sharp reversal, ending the day down nearly 9%. By contrast, in 1999 and 2001, returns increased steadily over the day with cumulative increases of 4-8%.

The intraday volatility exhibited in figure 3 reflects order imbalances that in turn arise because of uncertainty on the part of traders about the strategic behavior of others. Specifically, hedge funds speculating on the reconstitution will 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 since many funds trade earlier or lock-in positions with options or futures contracts. If so, we would observe return behavior of the type we saw on June 30, 2000.

Analysis of Returns and Volumes

A Cross-Sectional Model

The results so far document large return effects around the reconstitution, but do not shed much light on their determinants across stocks. This section provides an analysis of this issue.

Amihud and Mendelson (1986) show that the fundamental value of a stock is the present value of future cash flows *less* the present value of all future transaction costs. Formally:

$$Value = PV(\text{Cash Flows}) - PV(\text{Transaction Costs}), \tag{1}$$

where $PV(x)$ is present value. Numerous market microstructure studies show that transitory order imbalances cause divergences between price and value. Market makers or specialists require compensation to provide immediacy by taking on unwanted inventories. In the prototypical microstructure model, price concession from value is proportional to the deviation between a dealer's desired (target) inventory level, *DesInv*, and actual inventory, *Inv*:

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

where λ is a positive coefficient. Substituting equation (1) into equation (2) and taking first differences, we see that the reconstitution can affect price even if the discounted sum of future cash flows is unchanged. In particular, the change in the discounted sum of transaction costs is likely to be inversely related to *expected* changes in long-term liquidity (volume) and information flows resulting from changes in index membership. Similarly, the change in dealer inventory is simply the *negative* of the order imbalance resulting from index revisions. So, we can express the change in price upon index reconstitution (assuming target inventory is constant) as:

$$\Delta Price = \gamma \Delta Liquidity + \lambda Imbalance. \tag{3}$$

The first term, $\gamma\Delta Liquidity$, is the *expected* long-term change in liquidity (volume) for the stock; it captures the permanent effect associated with the index reconstitution. The second term, $\lambda Imbalance$, captures the temporary price effects associated with order flows related to index rebalancing. I expect positive imbalances for additions and negative imbalances for deletions.

Equation (3) is the basis for analyzing returns around the reconstitution date. I use a two-stage (instrumental variable) econometric procedure using a sample universe of stocks in the Russell 3000 stock index or eligible for inclusion in the index in the month of May for 2000 and 2001, a total of 6,160 observations. In the first stage, the permanent change in liquidity (measured by average daily volume) across stocks is modeled as a function of changes in past volumes, firm size, and volatility. In the second-stage, I model the cross-sectional pattern in returns in the reconstitution month using the estimated permanent change in liquidity from the first stage and dummy variables to capture order imbalances related to index movements. I also control for other factors known to affect returns across stocks including risk, size, and growth factors.

The logic of using such this two-stage procedure is straightforward. Clearly, the price pressure and index membership hypotheses are not mutually exclusive. However, both hypotheses imply changes in volume, so that one cannot simply estimate equation (3) by running a cross-sectional regression of returns using *actual* changes in liquidity. Rather, the appropriate proxy for permanent changes in liquidity is the predicted volume change from the first-stage regression. The index revision dummy variables then capture any unanticipated effects from index revision unrelated to predictable changes in volumes from changes in market capitalization, volume trends, or volatility.

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

$$\underset{}{\Delta ADV_{i,A}} = \underset{(3.61)}{5.34} + \underset{(0.01)}{0.65}\,\Delta ADV_{i,b} + \underset{(2.66)}{37.55}\,\Delta MC_i + \underset{(2.32)}{12.18}\,Volat_i - \underset{(4.07)}{3.21}\,LagRet_i$$

where, for stock *i*, $\Delta ADV_{i,A}$ represents the ratio of Average Daily Dollar Volume (ADV) in July to ADV in the previous calendar year (in percent), $\Delta ADV_{i,B}$ is the ratio of ADV in May to ADV in the previous year (in percent), ΔMC_i is the ratio of the market capitalization between end of May and end of the previous year, and $Volat_i$ is the stock return volatility in May, and $LagRet_i$ is the stock return from March-May. Changes in average daily trading volume and market capitalization are included to control for size and information. Volumes are likely to be autocorrelated, and larger firms normally have higher trading volumes and are followed by more analysts. Similarly, volumes are likely to be higher in volatile stocks where there is a greater divergence of opinion. Returns in the previous months are included because volume effects are typically greater for stocks that have appreciated in price.

The volume model fits well overall with R-squared of 0.41. The only variable that is not statistically significant is the previous signed return. The change in liquidity around the reconstitution is positively and significantly related to lagged volume growth and changes in firm size. Volatility enters positively and significantly. Intuitively stocks with news (either positive or negative) have higher volumes relative to those whose fortunes are relatively stable. There is likely to be a greater dispersion in beliefs for such stocks, and hence higher volumes, than for stocks that are more stable. This result is consistent with previous empirical evidence documenting a positive relation between price variability and volume.

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

$$\underset{}{r_i} = \underset{(1.66)}{13.28} + \underset{(0.22)}{0.43}\,\Delta A\hat{D}V_{i,A} + \underset{(0.06)}{0.04}\, Beta_i + \underset{(0.32)}{3.99}\, MB_i - \underset{(0.23)}{2.07}\, Size_i + \underset{(0.92)}{15.10}\, Add_i - \underset{(1.20)}{11.01}\, Del_i$$

Here, for stock *i*, r_i is the return in June, $\Delta A\hat{D}V_{i,A}$ is the estimated change in ADV from the first regression (in percent), $Beta_i$ is the estimated beta (from a time-series regression of 5 years of monthly stock returns on the S&P 500 index), MB_i is the (log) price to book ratio, $Size_i$ is the (log) of market capitalization, Add_i is a binary variable taking the value 1 for new additions to the Russell 3000, and 0 otherwise, and Del_i is a binary variable taking the value 1 for stocks deleted from the Russell 3000 index, and 0 otherwise. Log transformations of price to book and size are used because these variables are highly right-skewed.

Returns are positively related to changes in predicted volumes, consistent with the liquidity hypothesis, and this result is statistically significant after controlling for risk, firm size, and the value-growth factor. Given controls for size and value, beta is insignificant, as shown by other studies. Consistent with past research, larger firms and firms with high book-market ratios have lower expected returns. The coefficients of the dummy variables representing the Russell 3000 index revisions capture the residual effect of index membership, after controlling for changes in expected volumes and risk factors. These effects are surprisingly large, indicating that transitory imbalances are important drivers of equity returns. For example, a stock classified as a new addition to the Russell 3000 index has an estimated positive return of 15.1%, after controlling for all other factors. Similarly, deletions have a 11.0% loss, again consistent with the results reported earlier. Overall R-squared is lower, 0.12, but I can reject with an *F*-test the null hypothesis that liquidity changes and risk alone can explain the cross-section of returns.[8] The regression analysis suggests the return movements documented here are a function of changes in liquidity *and* price pressure.

Permanent and Temporary Price Effects

The relative importance of the various effects is difficult to gauge from the cross-sectional regression model above. An alternative approach is to decompose price movements around the reconstitution into permanent and transitory components. 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 June 30, and let p_2 represent the price at the end of July, one month after the reconstitution date. I 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 while equation (5) defines the permanent impact. The sum of the two impacts is merely the total (logarithmic) return from May-end to June-end.

In general, I expect both impacts to be positive for additions and both to be negative for deletions. The choice of the end-July date as the final date by which any transitory price impacts have dissipated is, of course, a matter of judgement. The use of longer horizons adds noise to estimation, while 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 pre-trade benchmark at the end of May could be criticized as understating the permanent impact because it ignores the return movements prior the end of May. The end-May benchmark is the most conservative price benchmark, however, since earlier benchmarks might include effects caused by the positive feedback trading discussed earlier.

The figure below shows the stock price over the period May-August to illustrate the decomposition into permanent and temporary effects.

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[8] Results from two-stage analysis of the Russell 2000 universe are very similar (as expected from the similarity in tables 1 and 2) and hence are not reported here.

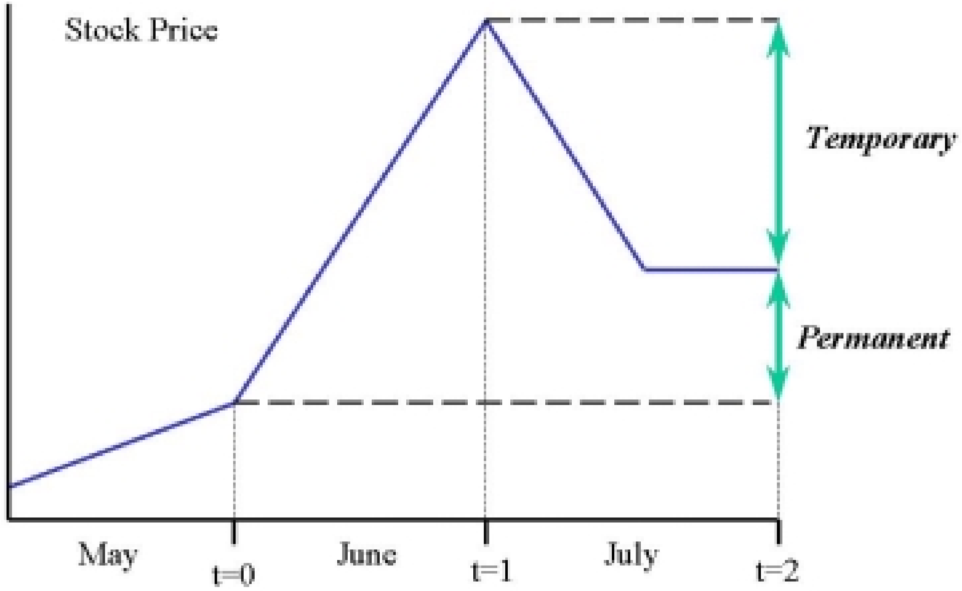

Table 3 summarizes the temporary and permanent effects for additions and deletions over the period 1996-2001, for both the Russell 3000 and Russell 2000 indexes. The decomposition of returns around the reconstitution confirms our previous conclusion that both price pressure and liquidity hypotheses explain the observed reconstitution effects. Interestingly, the temporary return effects for stocks being added to an index are larger in magnitude than the corresponding effects for deletions. For instance, for the Russell 3000 additions the mean temporary impact is 5.4% while the permanent impact is 5.9%. By contrast, the mean Russell 3000 temporary impact is 0.1% and the permanent effect is –3.9%. (Given our signing convention, temporary impacts are manifested by a significant negative return reversal in July.) More modest effects for deletions might be explained by the difficulty of shorting low priced stocks and the fact that transactions costs in these stocks, many of which trade thinly and at low prices, might be large. Also, some fund managers simply might not hold low capitalization stocks with small weights, electing against perfectly replicating the underlying index.

Practical Implications

Transaction Costs and Index Rebalancing

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, but apply to all equity indexes where revisions are disclosed in advance and result in widespread trading by index funds and others concerned with tracking error.

These managers can obtain higher realized or net returns were they to reduce the liquidity premiums they pay to trade near the reconstitution date. This objective could be achieved in several ways. First, investment managers could trade ahead of the reconstitution or achieve their desired exposures through swaps or derivatives. Alternatively, a passive fund might not immediately rebalance to match changes in the benchmark index, reducing trading costs by using a passive strategy. Keim (1999) provides an analysis of the returns of a passive upstairs trading strategy for a small capitalization index fund and shows that it "outperforms" its benchmark on average by as much as 200 basis points.[9]

Many fund managers, however, are unwilling to incur higher tracking error, 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 those associated with index rebalancing. For example, Gastineau (2002) argues that an exchange-traded "Self-Indexing" fund based on a *non-disclosed* index would 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 does not necessarily imply more frequent index rebalancing because this could actually increase turnover, raising trading costs for index funds. Gardner, Kondra, and Pritamani (2001), using simulations, show that quarterly or semi-annual reconstitution of the Russell index substantially increases turnover measured either by number of name changes or fraction of portfolio value traded.

[9] See Keim and Madhavan (1996) for further details of the fund's trading strategy.

Return Predictability

The opposite issue, namely the extent to which a strategy of trading on projected index revisions is profitable is a natural concern for traders, but also sheds light on market efficiency. Tables 2 and 3 show that the returns to strategy based upon a long-short portfolio involving index additions and deletions are positive and substantial in June. Such a portfolio can be formed with a relatively high degree of accuracy based on public data at the end of April or May. In general, the returns in June in tables 2 and 3 are close representations of returns to portfolios formed *ex ante*, before index membership is 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 forecasts of likely additions and deletions for their clients. The differences from the actual lists are generally very minor (see, e.g., Kumble, 2001), reflecting 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.

It is instructive to compute the *ex ante* returns to a hypothetical or projected Russell portfolio. Since the Russell universe is easily identified, and since data on market capitalization is freely available, it is possible to produce naïve forecasts of the top 3000 stocks by market capitalization and form portfolios of projected adds and deletes. To obtain a conservative estimate of return predictability, no effort is made to refine these forecasts with careful scrutiny of the individual names to ensure that they are in fact members of the Russell universe, as done by market professionals. I perform this experiment for 2000 and 2001, forming portfolios at the end of February based on market capitalization, and rebalancing each month as stock prices change.

Figure 4 plots the actual and projected cumulative returns to the Russell 2000 spread portfolio in June 2000 (top) and June 2001 (bottom). There is generally a close correspondence between actual and projected returns. Observe that in June 2000, the differences in returns largely arise from large abnormal intraday returns (as shown in figure 3) on the actual reconstitution date. A more formal analysis is contained in table 4, which shows the mean difference, by month, between returns (in percent, on a monthly basis) for an equal-weighted spread portfolio of Russell 2000 stocks (long index additions and short index deletions) and the returns of the naive projected Russell 2000 spread portfolio. The period covered is March-July, 2000-2001. The projected returns are based on a portfolio formed by a market capitalization sort at the beginning of the month. Figures in parentheses represent the *p*-values from a paired *t*-test of equality in daily returns, with values below 0.05 indicating significance at the 5% level. Observe that the return differences prior to July are positive, indicating that the projected portfolio returns fell below those of the actual returns. The return differences are not large relative to absolute returns. For example, in March 2000, the return difference is 0.7% for the month. In particular, the shortfall is not statistically different from zero in the months of May and June, 2000 and 2001, although the errors are larger in some earlier months. Indeed, the correlation coefficient between the projected daily returns of the add-delete portfolio and the actual daily returns for the period 3/1/00-7/31/00 and 3/1/01-7/31/01 was 0.98. These results indicate that it is possible to predict the Russell returns with a high degree of accuracy simply using public information.

Why Do the Russell Effects Persist?

The results above demonstrate that the returns to an investment strategy based on index revisions are large and can be predicted with increasing accuracy as the actual reconstitution date is approached. This raises the question as to why these effects persist over time. Several factors merit consideration. Risk – both sectoral and timing – might deter some investors from trading on their capital. Specifically, the weighting among sectors exhibits considerable volatility from year to year. For example, the share of the S&P financial sector in the Russell indexes fell from 1999-2000 only to rise again in 2000-2001. The opposite was true of the technology sector. Any long-short strategy purely based on index revisions thus represents a sectoral bet. Further, as shown by our intraday analysis, the portfolio returns to any strategy that attempts to profit from reconstitution effects is subject to considerable risks arising from the strategic reactions of other traders. A strategy that involves liquidating a long-short portfolio of adds and deletes at the end of June would have experienced sharply negative returns on the reconstitution date in 2000. In other words, there is considerable *timing risk* 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 Russell effects is critically related to liquidity. The transaction costs involved in trading low priced, illiquid stocks are large (Keim and

Madhavan, 1998), implying difficulty in scaling positions. These cost significantly erode the notional "paper" return from trading on the reconstitution. Further, short positions in some low-priced stocks simply might be infeasible, precluding seemingly profitable trades. These considerations help explain the persistence of index reconstitution effects, even if markets were efficient. Ultimately, as more investors become aware of the Russell effects, their trading is likely to move the observed phenomena back in time and also dampen the observed stock price reactions.

Conclusions

The extent and pervasiveness of return anomalies associated with the annual reconstitution of the stock indexes of the Frank Russell Company merits analysis. I document significant abnormal returns around the annual reconstitution of the Russell 2000 and 3000 indexes from 1996-2001. Specifically, stocks projected to be index additions (deletions) experience positive (negative) abnormal returns in June and before. The subsequent return reversals in July suggest that a significant portion of these excess returns is due to price pressure, with the remainder attributable to permanent changes in liquidity. A more formal model of cross-sectional returns supports this view and demonstrates that liquidity is an important factor in expected returns.

The results have several important implications for practitioners. Investment managers who rebalance their portfolios to match their benchmark indexes on or near the dates of actual index revision pay an extremely steep liquidity premium. This is especially the case for index funds benchmarked against popular indexes where there is a concentration of trading around pre-disclosed index revisions. Such funds, and their investors, would experience higher net returns (albeit with some risk of tracking error) were they to trade ahead of the reconstitution based on predictions of index additions and deletions, or to undertake derivative transactions in the options or futures markets or use equity swaps. Such a strategy is increasingly used by index funds including those benchmarked against the S&P 500 indexes. Alternatively, these findings provide a rationale for the creation of alternative investment vehicles that provide investors with diversification but are designed to incur lower trading costs while tracking a given index.

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

In conclusion, the results here point to the importance of understanding implicit transaction costs associated with demanding liquidity at specific points in time, and at a broader level, the relationship between liquidity and stock prices.

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Table 1
Monthly Returns for Portfolios of Russell 3000 Additions and Deletions, 1996-2001

The table shows the monthly returns (in percent) and the corresponding standard errors (in parentheses), by month and year, of three equal-weighted (by stock) portfolios consisting of, respectively, Russell 3000 additions (Panel A), deletions (Panel B), and a long-short portfolio formed by buying the additions and shorting the deletions (Panel C). The period covered is March to July 1996-2001. Monthly averages are shown in the last two rows of each panel. Standard errors are reported on a monthly basis based on a time-series of daily portfolio returns suitably scaled.

Panel A: Additions

	March	April	May	June	July
2001	-3.23	14.49	22.88	3.66	-5.55
	(7.29)	(7.78)	(3.88)	(8.68)	(5.61)
2000	-7.58	-19.23	-9.62	36.24	-9.27
	(13.99)	(27.52)	(14.01)	(10.81)	(9.82)
1999	14.92	18.04	1.15	14.70	-6.04
	(5.62)	(9.54)	(7.05)	(10.34)	(5.98)
1998	11.55	4.74	-2.79	3.61	-6.65
	(2.34)	(4.6)	(3.47)	(3.77)	(3.99)
1997	-5.06	-0.52	17.53	12.56	3.27
	(3.64)	(4.17)	(3.62)	(2.70)	(2.58)
1996	2.77	6.76	4.39	-2.72	-8.27
	(3.36)	(2.45)	(2.62)	(3.15)	(6.52)
Mean	2.23	4.05	5.59	11.34	-5.42
	(6.04)	(9.34)	(5.78)	(6.58)	(5.75)

Panel B: Deletions

	March	April	May	June	July
2001	-24.78	12.55	2.24	-7.39	-10.73
	(13.48)	(17.03)	(10.62)	(9.25)	(6.85)
2000	-4.09	-14.79	-13.56	1.91	2.47
	(4.72)	(11.2)	(6.01)	(7.14)	(5.25)
1999	-6.21	9.12	-1.04	-2.76	8.94
	(3.95)	(4.75)	(3.41)	(5.52)	(6.03)
1998	-0.06	-0.50	-11.05	-2.33	-8.63
	(3.18)	(4.3)	(3.47)	(7.41)	(3.80)
1997	-11.25	-6.61	13.41	-1.88	10.2
	(3.55)	(4.22)	(4.22)	(4.73)	(2.57)
1996	1.16	5.43	2.08	-10.08	-3.04
	(2.83)	(2.35)	(2.22)	(4.75)	(6.12)
Mean	-7.54	0.87	-1.32	-3.76	-0.13
	(5.29)	(7.31)	(4.99)	(6.47)	(5.10)

Panel C: Spread

	March	April	May	June	July
2001	21.55	1.94	20.64	11.05	5.18
	(8.30)	(10.14)	(9.20)	(13.95)	(8.85)
2000	-3.49	-4.44	3.94	34.33	-11.74
	(10.74)	(17.02)	(9.11)	(11.06)	(8.24)
1999	21.13	8.92	2.19	17.46	-14.98
	(4.57)	(10.28)	(6.02)	(11.76)	(7.26)
1998	11.61	5.24	8.26	5.94	1.98
	(2.10)	(2.77)	(2.21)	(6.47)	(2.89)
1997	6.19	6.09	4.12	14.44	-6.93
	(2.61)	(2.02)	(2.32)	(4.78)	(3.59)
1996	1.61	1.33	2.31	7.36	-5.23
	(1.37)	(1.45)	(1.69)	(3.66)	(2.37)
Mean	9.77	3.18	6.91	15.10	-5.29
	(4.95)	(7.28)	(5.09)	(8.61)	(5.53)

Table 2
Monthly Returns for Portfolios of Russell 2000 Additions and Deletions, 1996-2001

The table shows the monthly returns (in percent) and the corresponding standard errors (in parentheses), by month and year, of three equal-weighted portfolios consisting of, respectively, Russell 2000 additions (Panel A), deletions (Panel B), and a long-short portfolio formed by buying the additions and shorting the deletions (Panel C). The period covered is March-July, 1996-2001. Monthly averages are shown in the last two rows of each panel. Standard errors are reported on a monthly basis based on a time-series of daily portfolio returns suitably scaled.

Panel A: Additions

	March	April	May	June	July
2001	-6.32	13.42	19.32	2.98	-6.49
	(8.32)	(10.81)	(5.41)	(9.48)	(6.17)
2000	-3.20	-18.46	-9.12	26.20	-7.20
	(11.38)	(22.57)	(11.74)	(10.11)	(8.55)
1999	11.38	14.31	1.93	13.75	-5.77
	(4.87)	(7.03)	(5.71)	(8.88)	(5.32)
1998	10.33	3.92	-3.91	1.72	-7.23
	(2.39)	(4.58)	(3.35)	(3.74)	(3.95)
1997	-6.04	-1.85	17.41	11.60	3.16
	(3.75)	(4.11)	(3.76)	(2.67)	(2.62)
1996	4.32	14.81	8.40	-4.05	-14.75
	(3.99)	(3.04)	(3.65)	(6.04)	(10.4)
Mean	1.75	4.36	5.67	8.70	-6.38
	(5.78)	(8.69)	(5.60)	(6.82)	(6.17)

Panel B: Deletions

	March	April	May	June	July
2001	-18.74	9.97	0.33	-5.20	-6.37
	(11.07)	(13.55)	(7.77)	(7.43)	(5.70)
2000	-4.86	-12.00	-11.14	5.90	-0.56
	(6.73)	(13.85)	(8.28)	(7.88)	(5.38)
1999	-0.13	8.84	-1.43	-1.46	5.99
	(4.41)	(4.68)	(3.89)	(5.26)	(5.78)
1998	2.02	0.14	-9.17	-0.76	-7.77
	(2.99)	(4.51)	(3.38)	(6.39)	(3.64)
1997	-9.65	-5.30	11.86	-1.83	10.12
	(3.48)	(3.94)	(3.81)	(3.96)	(2.53)
1996	1.81	7.04	2.75	-10.12	-4.30
	(3.26)	(2.31)	(2.68)	(4.31)	(7.26)
Mean	-4.93	1.45	-1.13	-2.25	-0.48
	(5.32)	(7.14)	(4.97)	(5.87)	(5.05)

Panel C: Spread

	March	April	May	June	July
2001	12.42	3.45	18.99	8.18	-0.12
	(4.52)	(4.56)	(4.65)	(12.94)	(7.33)
2000	1.66	-6.46	2.02	20.3	-6.64
	(6.33)	(9.42)	(4.44)	(11.22)	(4.76)
1999	11.51	5.47	3.36	15.21	-11.76
	(3.43)	(4.58)	(3.27)	(9.50)	(6.03)
1998	8.31	3.78	5.26	2.48	0.54
	(1.55)	(2.00)	(1.52)	(5.16)	(2.24)
1997	3.61	3.45	5.55	13.43	-6.96
	(2.28)	(1.18)	(1.82)	(4.08)	(3.41)
1996	2.51	7.77	5.65	6.07	-10.45
	(1.73)	(1.57)	(1.79)	(4.03)	(4.42)
Mean	6.67	2.91	6.81	10.95	-5.90
	(3.31)	(3.89)	(2.92)	(7.82)	(4.70)

Table 3
Permanent and Temporary Price Impacts for Russell Equity Index Additions and Deletions 1996-2001

The table shows the mean permanent and temporary price effects (in percent) of equal-weighted portfolios consisting of Russell 2000 and Russell 3000 index additions and deletions. The period covered is 1996-2001. For each stock, the temporary and permanent effects are defined as (respectively):

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

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

where p_0 is the price at the end of May, p_1 be the price on the date of the reconstitution date, and p_2 represent the price at the end of July.

	Russell 3000 Index		**Russell 2000 Index**	
	Additions	**Deletions**	**Additions**	**Deletions**
Permanent Impact	5.92	-3.89	2.32	-2.73
Temporary Impact	5.42	0.13	6.38	0.48

Table 4
Differences in Actual and Projected Returns to Russell 2000 Spread Portfolio 2000-2001

The table shows the mean difference, by month, between returns expressed on a monthly basis (in percent) for an equal-weighted spread portfolio of Russell 2000 stocks (long index additions and short index deletions) and the returns of a projected Russell 2000 spread portfolio. The projected returns are based on a portfolio formed by a market capitalization sort at the beginning of the month. The period covered is March-July, 2000-2001. Figures in parentheses represent the *p*-values from a paired *t*-test of equality in daily returns, with values below 0.05 indicating significance at the 5% level.

	March	April	May	June	July
2001	0.46	4.84	4.83	3.30	-0.42
	(0.00)	(0.04)	(0.00)	(0.07)	(0.62)
2000	0.69	6.44	0.46	0.88	-0.84
	(0.64)	(0.00)	(0.62)	(0.48)	(0.44)

Figure 1
Value of Russell 2000 Spread Portfolio Around Reconstitution Date: 1996-1998

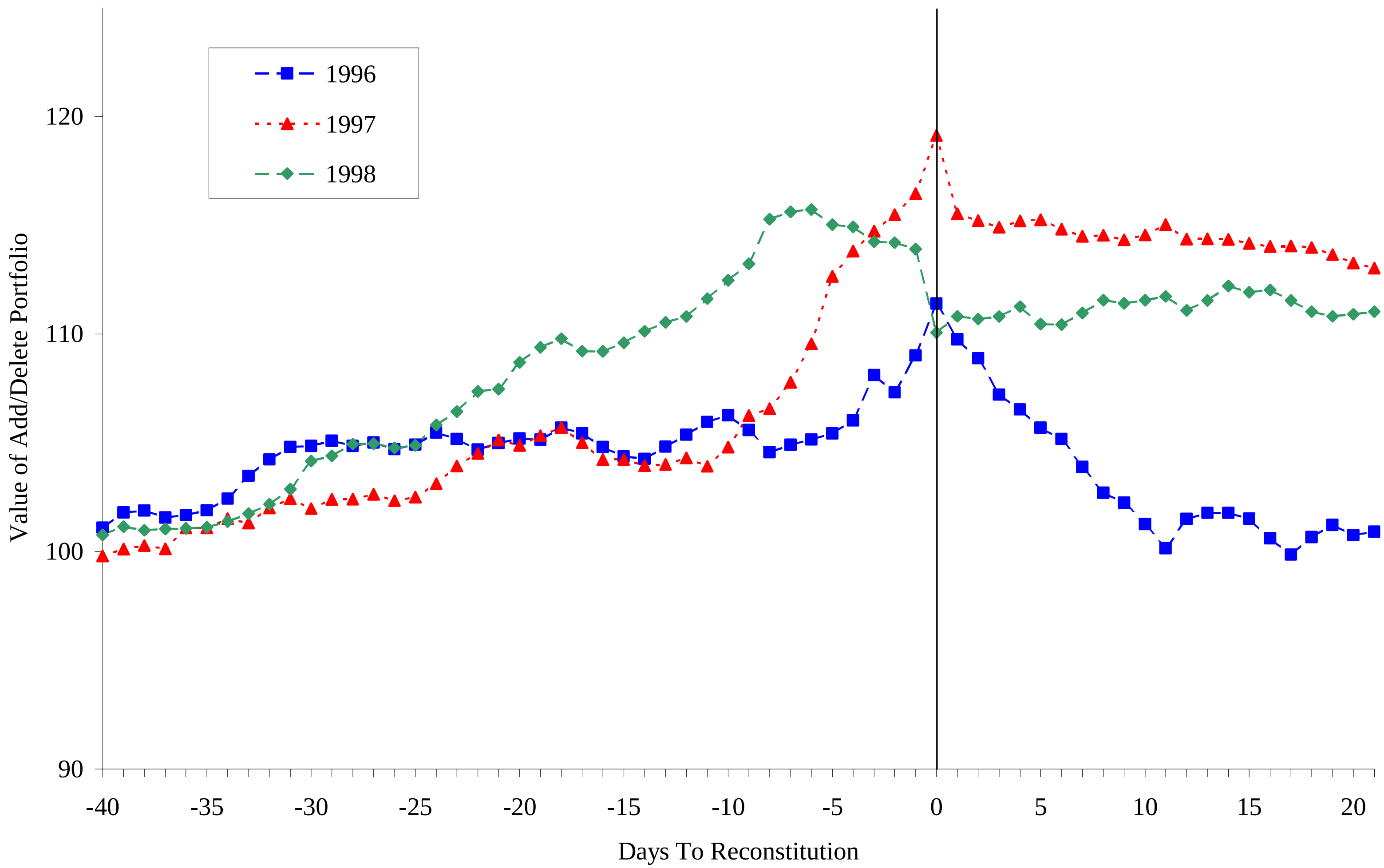

Figure 2
Value of Russell 2000 Spread Portfolio: 1999-2001

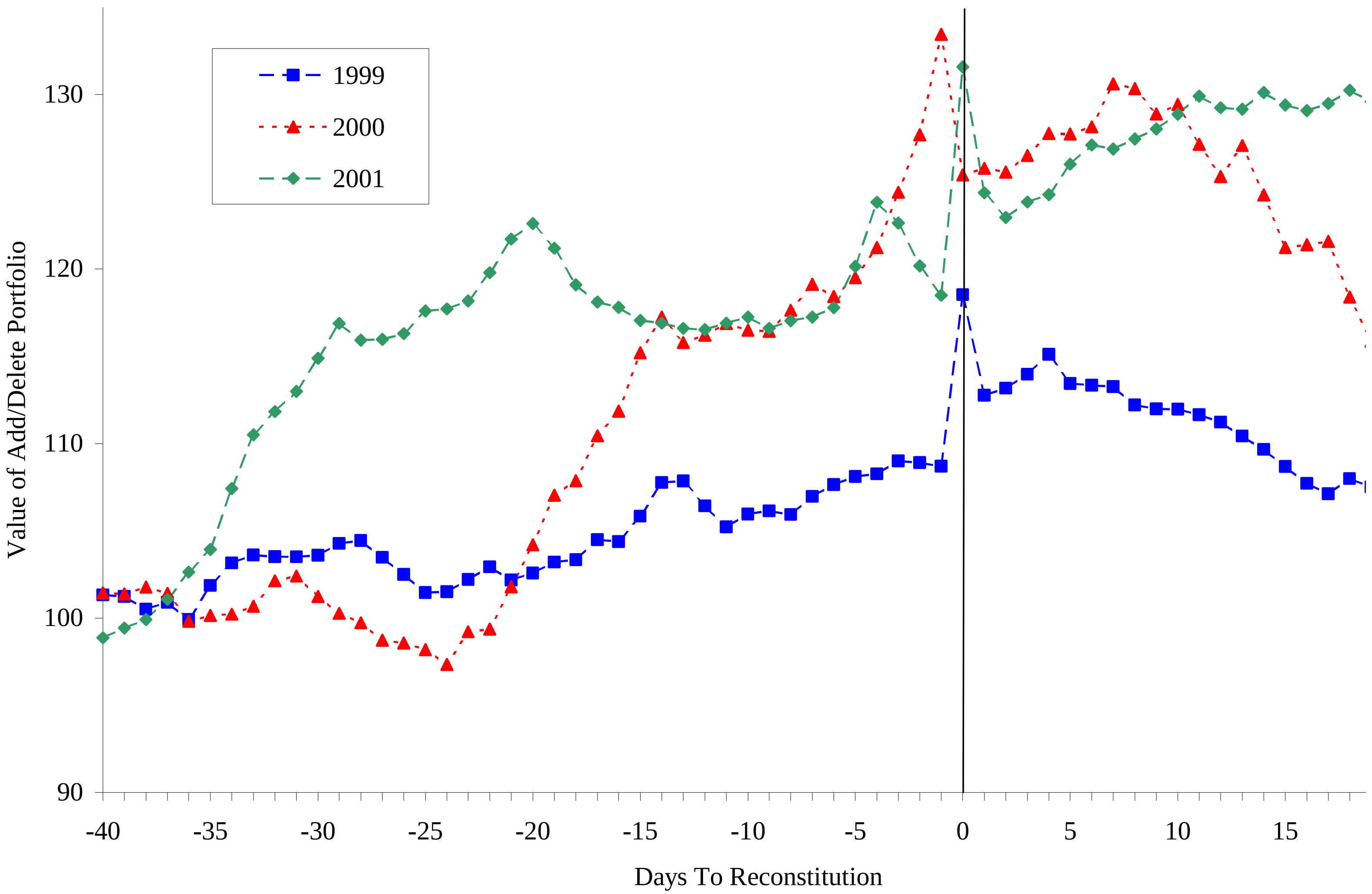

Figure 3
Intraday Cumulative Returns to Russell 2000 Spread Portfolio on Date of Reconstitution, 1999-2001

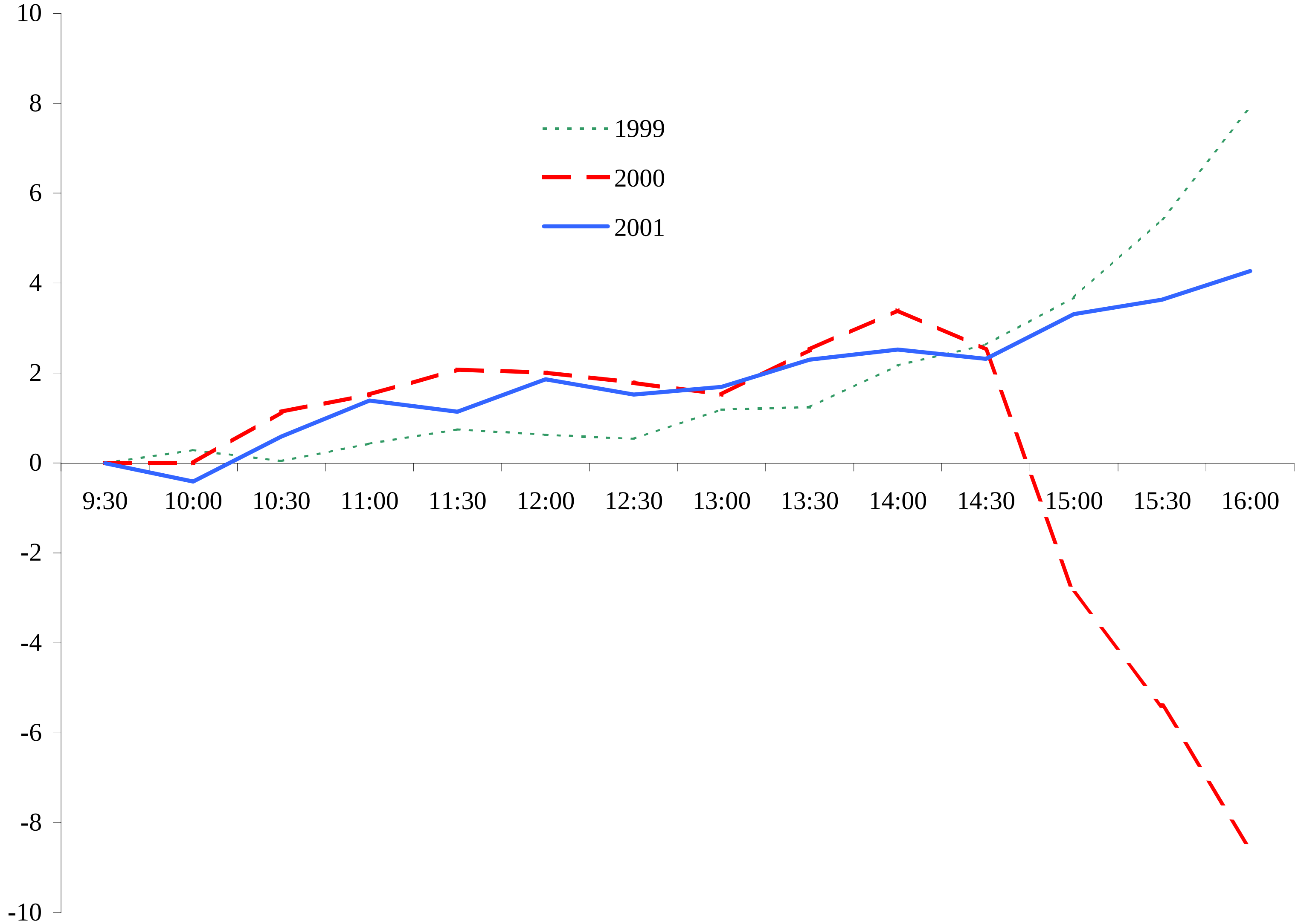

Figure 4
Actual and Projected Returns to Russell 2000 Spread Portfolios: June 2000 and 2001