Style-related Comovement: Fundamentals or Labels?

BRIAN H. BOYER*

August 4, 2010

ABSTRACT

I find that economically meaningless index labels cause stock returns to covary in excess of fundamentals. S&P/Barra follow a simple mechanical procedure to define their Value and Growth indices. In so doing, they reclassify some stocks from Value to Growth even after their book-to-market ratios have risen, and vice versa. Such stocks begin to covary more with the index they join and less with the index they leave. Backdated constituent data from Barra reveal no such label-related shifts in comovement during the 10 years prior to the actual introduction of the indices in 1992.

*Brigham Young University. I thank Barra for providing data on index constituents. Barra Inc. is an investment software and research company, and the data have been provided as part of a broad academic program to foster the study of investment technology. The author thanks John Ammer, Brandon Bates, Joseph Chen, Michael Gibson, Lars Lefgren, Grant McQueen, Todd Mitton, Matt Pritsker, Brian Reid, Tyler Shumway, Clemens Sialm, Wilbert Van Der Klaauw, Keith Vorkink, Jonathan Wright, Kathy Yuan, Lu Zheng, and seminar participants at Brigham Young University and the University of Michigan Business School for helpful comments. The author particularly thanks Rob Stambaugh (the editor) and an anonymous referee for providing many helpful suggestions.

Investors must choose among thousands of financial assets when allocating capital. Financial institutions seek to reduce the complexity of this task for investors by labeling assets. Bond ratings, index assignments, industry designations, and other labels group assets with similar characteristics into a relatively small number of categories. Investors can then trade entire asset categories without scrutinizing individual assets. In the terminology that Barberis and Shleifer (2003) use, labels define specific asset "styles," and investors who allocate funds across labels rather than individual securities practice a form of "style investing." The capital flows of such an investor in and out of specific assets are perfectly correlated across securities with the same label even though the fundamental values of these securities are at most only partially related. In a model with limits to arbitrage, these flows can actually cause prices to covary in excess of fundamental values (Barberis and Shleifer (2003)).

I investigate whether economically meaningless labels induce excess covariation in returns through the trading activity of investors who allocate capital across styles delineated by these labels. S&P/Barra define their Value and Growth indices by dividing all S&P 500 stocks into two mutually exclusive categories according to simple mechanical rules. I exploit these mechanical rules to identify economically meaningless index reclassifications, and measure changes in comovement around these events to identify the effect of the S&P/Barra index labels on comovement. My empirical tests reject the null hypothesis (fundamental hypothesis) that covariation in returns merely reflects covariation in fundamentals, and support the alternative hypothesis (label hypothesis) that these labels induce excess covariation in returns.

When S&P/Barra switch the label for a given stock from one index to another, the stock suddenly gets buffeted by flows from style investors who trade the index the stock joins as a single asset. Such investors include traders of derivatives, index funds, and exchange-traded funds (ETFs) written on the index, and may also include active mutual fund managers who benchmark against the index and cling to their benchmark for protection against underperformance. At the same time, the stock suddenly becomes immune to flows from investors who trade the index the stock leaves as a single asset. If the covariance structure of fundamental values remains stationary when index labels switch, then the fundamental hypothesis predicts that the covariance structure of returns will not change when S&P/Barra switch the label for a given stock. In contrast, the label hypothesis predicts that a stock begins to comove more with the index it joins and less with the index it leaves when it switches indices. Finding such changes in comovement empirically is not sufficient, however, to reject the fundamental hypothesis. Index labels may tend to switch exactly when the covariance structure of fundamental values also changes. A principal contribution of this paper is to introduce tests that can reject the fundamental hypothesis by drawing on the unique mechanical classification rules of the S&P/Barra indices.

These rules are simple. Stocks in the S&P 500 with a book-to-market ratio above a given boundary constitute the Value index and all others make up the Growth index. The boundary is reset and the indices are rebalanced every June and December so the two indices have equal market cap. No other information influences index membership.

The identification strategy of this paper stands on three unique aspects of these mechanical rules. First, no hidden information causes stocks to switch indices, including hidden information related to fundamentals. The only defining characteristic of a stock that causes its index label to change is the position of its book-to-market (*BM*) ratio relative to the S&P/Barra boundary. On average, therefore, only fundamental characteristics correlated with *BM* ratios change with index labels. Second, as either index outperforms the other, S&P/Barra must reset the boundary to include more stocks in the underperforming index regardless of anything else. As a result, some stocks switch to the Value index after their *BM* ratios actually decrease, and others switch to the Growth index after their *BM* ratios actually increase. I call these stocks "index balancers" because their labels change to balance the market caps of the Value and Growth indices, despite changes in their own *BM* ratios. If fundamental covariation is related to *BM* ratios, then the fundamental hypothesis predicts, in contrast to the label hypothesis, that index balancers comove less with the index they join and more with the index they leave following the label change. Third, the simplicity of the classification rules allow all empirical tests to be conducted using a control sample. While Barra first created the indices in May 1992, they backdated the index constituent data to May 1981, dividing the S&P 500 into two groups and rebalancing the groups every June and December, exactly as if the indices existed over this period. I refer to data before May 1992 as the "control sample" and data from May 1992 through 2004 as the "test sample."

Using the test sample, I regress daily returns of index balancers on returns of the Value and Growth indices simultaneously and find that coefficients change significantly following index reclassifications, contrary to the predictions of the fundamental hypothesis. For example, across the 167 index balancers that switch to the Value index in the test sample, the average regression coefficient on the Value index increases from 0.621 to 0.728 (t-statistic for change is 2.21) and the average regression coefficient on the Growth index decreases from 0.353 to 0.253 (t-statistic for change is -2.20). I find even stronger results over the period from 1998 through 2002, a period of unusually high turnover for the indices. The control sample, on the other hand, yields no evidence to reject the fundamental hypothesis. Changes in covariation estimated using the control sample are statistically different from the same measures estimated using the test sample. Thus, it appears the S&P/Barra labels induce excess covariation following their introduction and popularization among investors.

I also investigate whether investors actually use the S&P/Barra index labels to determine how they should allocate capital, even though these labels sometimes have little connection with underlying fundamentals. I uncover two results suggesting they do. First, I find that when an index balancer changes labels during the test sample, its turnover begins to covary more with that of the index it joins, and less with that of the index it leaves. I also find that changes in turnover covariation estimated using the test sample are statistically different from the same measures estimated using the control sample. Second, I find that the S&P/Barra labels influence the portfolio allocation decisions of active mutual fund managers. Both of these findings indicate that investors, and in particular mutual funds, use the S&P/Barra index labels to determine how they should allocate capital, consistent with the label hypothesis.

Related papers study changes in comovement around S&P 500 reclassifications. When a stock acquires the S&P 500 index label, Vijh (1994) finds that the stock market beta increases and Barberis, Shleifer, and Wurgler (2005) find that comovement with the S&P 500 increases. In contrast to the mechanical determination of the S&P/Barra indices, however, a committee that keeps all discussions confidential determines inclusion in the S&P 500. Hence, these papers cannot conclusively rule out the possibility that inclusion in the S&P 500 coincides with changes in fundamentals. In fact, Denis et al. (2003) argue that inclusion in the S&P 500 actually causes fundamentals to change. I do not consider stocks that move in and out of the S&P 500, but rather, only those stocks that switch between the S&P/Barra Value and Growth indices. Furthermore, I am able to conduct empirical tests that reject the fundamental hypothesis because of the unique mechanical classification rules for these indices.

The paper is organized as follows. Section I introduces the S&P/Barra index constituent data and presents summary statistics. Section II presents empirical methods to test for excess covariation in returns related to index inclusion. Section III investigates the relation between index membership, turnover, and mutual fund holdings. Section IV concludes the paper.

I. The S&P/Barra Indices

I obtain historical constituents of the S&P/Barra Value and Growth indices from May 1981 through March 2003 from Barra, and update these through December 2004 using data on Standard and Poors' website.[1] I briefly highlight some characteristics of the S&P/Barra indices since this paper is the first to use these constituent data.

Figure 1 shows how some of the S&P/Barra index features evolve over time. Panel A plots the number of stocks in each index, Panel B displays index performance (the log value of $1 invested in each index at the beginning of the control sample), and Panel C exhibits monthly index turnover (the equally weighted average across stocks). All panels in Figure 1 include a vertical line that divides the test and control samples. The Value index always contains more stocks, as Panel A illustrates, because Value firms are generally smaller than Growth firms and the indices have equal market cap by construction. Panel B shows performance to be rather similar across the two indices, and Panel C indicates a steep upward trend in turnover beginning around July 1998 that begins to reverse, especially for the Growth index, around December 2002.

[Figure 1 about here.]

Figure 2 displays plots of the cross-sectional average *BM* ratio and decile for each index over time. I construct *BM* ratios at the end of May and November, just before the indices are rebalanced, using the market value observed at the end of May and November and the common equity reported in Compustat at least five months prior. Figure 2 indicates that in both the test and control samples, average *BM* ratios and deciles change little from any one event month to the next, and trend slightly downward over the course of several years.

[Figure 2 about here.]

Panel A of Table I provides summary statistics for the two indices. The left side of Panel A reports statistics for the test sample, while the right side covers the control sample. To eliminate speculation that the crash of October 1987 causes differences across the control and test samples, I calculate results for this table, and all other tables, after eliminating data surrounding the crash. Including these data only further differentiates results across the test and control samples. I report t-statistics for the difference in the summary statistics across indices in parentheses. Standard errors, calculated by GMM using the approach of Newey and West (1987), take into account both time-series and cross-sectional dependence . Average returns across the two indices are not significantly different in either the test or control samples.[2] For example, in the test sample, average monthly returns of the Growth and Value indices are 0.97% and 1.00%, and the t-statistic for the difference is -0.11. Correlation, however, is significantly stronger among stocks within the same index. To measure within-index correlation, stocks in the same index are randomly split into two value-weighted portfolios. I use the complete indices to calculate cross-index correlations. For the test sample, the within-index correlation for the Growth (Value) index is 0.92 (0.95). The correlation between the Growth and Value indices, however, is only 0.76.

[Table I about here.]

Panel B of Table I reports loadings of excess returns on the Carhart (1997) four-factor model. The bottom rows of this panel report differences in loadings across indices. I calculate standard errors for these differences as in Panel A. The loading of the Growth index on HML is significantly negative, while the loading of the Value index on HML is significantly positive for both the test and control samples.

Derivatives, index funds, and ETFs facilitate trading indices as distinct categories. Vanguard launched S&P/Barra index funds in November 1992 (tickers VIVAX and VIGRX). The Chicago Mercantile Exchange created S&P/Barra options and futures contracts in November 1995 (base symbols SU and SG). Barclays issued S&P/Barra ETFs in May 2000 (tickers IVE and IVW). Subsequently, these institutions abandoned the S&P/Barra indices in favor of others. Benchmarks for VIVAX and VIGRX index funds switched to the MSCI U.S. Prime Market Indexes in May 2003. In December 2005, the underlying assets for SU and SG derivatives and for IVE and IVW ETFs switched to the Citigroup style indices. Currently no derivatives, ETFs, or index funds trade publicly on the S&P/Barra indices.

Besides estimating results over the test and control samples, I also estimate results separately over the period from July 1998 through December 2002. This subsample corresponds to the period of high turnover documented in Figure 1. Higher turnover may indicate increased trading activity unrelated to fundamentals.[3] In addition, this subsample begins soon after the CME launched S&P/Barra derivatives and ends just before Vanguard stopped using the S&P/Barra indices as benchmarks for its value and growth index funds. Thus, during this period more trading occurs among S&P 500 stocks, and financial products make it easier to trade the S&P/Barra indices as categories. We may therefore expect any evidence in favor of the label hypothesis to be especially strong over this sample, which I call the "high turnover" sample.

Other data I use include book values from Compustat, mutual fund holdings from Thompson Financial (CDA/Spectrum), and returns, prices, shares outstanding, and volume from CRSP. I now describe empirical tests to determine whether the S&P/Barra labels influence how stocks covary with each other.

II. Testing for Excess Covariation in Returns

I regress returns of stocks that switch from the Value index to the Growth index, or vice versa, on the returns of the two indices,

$$r_{it} = \beta_{i0} + \beta_{iG} r_{Gt} + \beta_{iV} r_{Vt} + e_{it}, \tag{1}$$

where r_{it}, r_{Gt}, and r_{Vt} are daily log returns on stock i, the Growth index, and the Value index, respectively. Let the event month for stock i be the month in which stock i switches labels. For each stock, I estimate regression (1) over the five-month interval before the event month (pre-event window) and over the five-month interval after the event month (post-event window). S&P/Barra rebalance the indices every June and December, which causes the pre- and post-event windows of consecutive event months to perfectly overlap. For example, the post-event window for December of year y, which covers January through May of year $y+1$, is identical to the pre-event window for June of year $y+1$. The first event month for the control sample is December 1981 with a pre-event window that covers July through November of 1981, and the last event month for the control sample is June 1991 with a post-event window that covers July through November of 1991. The first event month for the test sample is December 1992 with a pre-event window that covers July though November of 1992, and the last event month for the test sample is June 2004 with a post-event window that covers July through November of 2004.

I separate stocks that switch from the Value to the Growth index from those that switch from the Growth to the Value index, and then for each group calculate average changes in comovement around event months across stocks,

$$\Delta\overline{\beta}_G = \sum_{i=1}^{n} \left(\beta_{iG}^{pst} - \beta_{iG}^{pre}\right)/n \tag{2a}$$

$$\Delta\overline{\beta}_V = \sum_{i=1}^{n} \left(\beta_{iV}^{pst} - \beta_{iV}^{pre}\right)/n, \tag{2b}$$

where *pre* and *pst* superscripts indicate that the parameter is estimated over the pre- or post-event window, respectively, and n is the number of stocks that switch to an index in a given sample.

The label hypothesis predicts $\Delta\overline{\beta}_G$ to be negative and $\Delta\overline{\beta}_V$ to be positive for stocks that switch to the Value index, and vice versa for stocks that switch to the Growth index. Predictions of the fundamental hypothesis depend on how fundamental covariation changes with *BM* ratios. If fundamental covariation is unrelated to *BM* ratios, then the fundamental hypothesis predicts $\Delta\overline{\beta}_G$ and $\Delta\overline{\beta}_V$ to be zero. On the other hand, if *BM* proxies for sensitivity to common fundamental risk factors (Fama and French (1995)), then the fundamental hypothesis predicts that a stock will begin to covary more strongly with the Value index as soon as its *BM* ratio begins to increase and with the Growth index as soon as its *BM* ratio begins to decrease. In particular, the fundamental hypothesis predicts $\Delta\overline{\beta}_G$ to be positive and $\Delta\overline{\beta}_V$ to be negative for index balancers switching to the Value index, and vice versa for index balancers switching to the Growth index, contrary to the label hypothesis.

Empirically, I define Value index balancers as stocks switching to the Value index with a positive return over the pre-event window. Similarly, I define Growth index balancers as stocks switching to the Growth index with a negative return over the pre-event window. This simple method of classifying index balancers circumvents disputable assumptions regarding the date at which changes in book value become observable to investors, and captures the primary source of variation in *BM* ratios across time.

During the control sample, the S&P/Barra labels do not exist and cannot possibly have any effect on covariance dynamics. If $\Delta\overline{\beta}_G$ and $\Delta\overline{\beta}_V$ are nonzero over this period, changes in fundamental covariation are entirely responsible.[4] As such, I can gauge the actual amount of excess covariation caused by the S&P labels once they are introduced and popularized among investors by comparing average changes in comovement estimated over the test and control samples. In particular, I estimate difference-in-difference statistics by subtracting average changes in comovement estimated using the control sample from those estimated using the test sample.

For clarity, I now summarize the primary null hypotheses to test if the S&P/Barra labels induce excess covariation among the stocks in these indices.

For stocks that switch to the Growth index:

(i) $H_0 : \Delta\overline{\beta}_G^T \leq 0$

(ii) $H_0 : \Delta\overline{\beta}_V^T \geq 0$

(iii) $H_0 : \Delta\overline{\beta}_G^T - \Delta\overline{\beta}_G^C \leq 0$

(iv) $H_0 : \Delta\overline{\beta}_V^T - \Delta\overline{\beta}_V^C \geq 0$

For stocks that switch to the Value index:

(i) $H_0 : \Delta\overline{\beta}_V^T \leq 0$

(ii) $H_0 : \Delta\overline{\beta}_G^T \geq 0$

(iii) $H_0 : \Delta\overline{\beta}_V^T - \Delta\overline{\beta}_V^C \leq 0$

(iv) $H_0 : \Delta\overline{\beta}_G^T - \Delta\overline{\beta}_G^C \geq 0$

Superscripts T and C refer to test and control sample estimates.

I now explain the estimation details. When calculating the index return for a given date in a given pre- or post-event window, I exclude stocks switching indices during the corresponding event month to avoid measuring effects associated with changes in index composition. When calculating average changes in comovement defined in equations (2a) and (2b), I exclude stocks with prices that fall below \$5 during either the pre- or post-event windows to mitigate microstructure effects[5] and stocks switching indices in June 1987 or December 1987 to avoid the perception that the crash of 1987 drives differences in results across the test and control samples. Including either group of stocks only further strengthens results in favor of the label hypothesis. In addition, I exclude stocks that enter or exit the S&P 500 during a pre- or post-event window when calculating average changes in comovement.

I measure significance in two ways. In the first approach, I block-bootstrap the data to estimate p-values that account for cross-sectional dependence in returns. Since pre- and post-event windows of consecutive rebalancing months perfectly overlap, I define each block as the five-month interval between event months. For a given block, I select T dates with uniform probability and replacement, where T equals the number of time-series observations within the block, and then stack together the entire cross-sectional return vectors observed on each date to create a new block. I then stack blocks in sequential order to create a new sample. Using the new sample, I reestimate the necessary statistics to test the null hypotheses outlined above, and I repeat the procedure 1,000 times. I then estimate p-values for a statistic as the fraction of estimates that conform with the null hypothesis for that statistic.

As an alternative approach to measure significance, I calculate t-statistics based on asymptotic theory that account for both cross-sectional and time-series dependence in returns. For example, I calculate the variance of the test statistic $\Delta\overline{\beta}_G$ as

$$Var\left(\Delta\overline{\beta}_G\right) = n^{-2}\sum_{i=1}^{n}\sum_{j=1}^{n} Cov(\beta_{iG}^{pst},\beta_{jG}^{pst}) + Cov(\beta_{iG}^{pre},\beta_{jG}^{pre}) - 2Cov(\beta_{iG}^{pst},\beta_{jG}^{pre}), \tag{3}$$

and estimate the standard error as the square-root of the variance. If the data for regression i and regression j do not overlap, I assume that the covariance between parameters is zero.

Otherwise, I use the overlapping observations to estimate the covariance across parameters using the approach of Newey and West (1987).

Table II presents estimates of average changes in comovement defined in equations (2a) and (2b) in columns labeled "Δ." Below these estimates I report robust *t*-statistics and block-bootstrap *p*-values as described above. Columns labeled "PE" report average coefficients for regression (1) estimated during pre-event windows. I do not report *p*-values or *t*-statistics for these average regression coefficients because nearly all are significant at the 1% level. Columns labeled "Test-Control" ("HT-Control") report difference-in-difference statistics by subtracting average changes in comovement estimated using the control sample from those estimated using the test (high turnover) sample. Panel A provides results for stocks switching to the Growth index, and Panel B provides results for stocks switching to the Value index.

[Table II about here.]

The results of Table II provide evidence that the S&P/Barra labels induce excess covariation in returns. Index balancers during the test sample begin to covary more strongly with the index they join and less with the index they leave after they switch index labels. As an example, for the 167 index balancers that switch to the Value index during the test sample (Panel B), $\Delta\overline{\beta}_V$ is estimated to be 0.107 with a *t*-statistic of 2.21, and $\Delta\overline{\beta}_G$ is estimated to be -0.100 with a *t*-statistic of -2.20. That is, stocks that switch to the Value index but that fundamentally become more like growth stocks still begin to covary more strongly with the Value index after switching. The S&P/Barra labels cause covariation to change despite changes in fundamentals. Similar findings are even stronger for the high turnover sample. On the other hand, precisely the opposite result holds over the control sample: index balancers tend to covary less with the index they join and more with the index they leave after switching. For the 163 index balancers that switch to the Value index during the control sample (Panel B), $\Delta\overline{\beta}_V$ is estimated to be -0.068 with a *t*-statistic of -1.06, and $\Delta\overline{\beta}_G$ is estimated to be 1.21 with a *t*-statistic of 2.23. In contrast to Value index balancers during the test sample, Value index balancers during the control sample begin to covary more strongly with the Growth index after switching, consistent with the fundamental hypothesis.[6] The difference-in-difference statistics on the far right of Table II in both panels are highly significant for all cases using index balancers. Together, the results of Table II indicate the S&P/Barra labels induce statistically significant excess covariation in returns and provide evidence to reject the fundamental hypothesis in favor of the label hypothesis.

To gauge the economic significance of these results, I consider the impact of a negative one-standard deviation shock to the S&P/Barra indices on a portfolio hedged against S&P/Barra index risk, when the hedger overlooks the impact of index reclassification on comovement. Consider a long position in index balancer i, and let β_{iG} and β_{iV} be the slope coefficients from regressing returns of this stock on the Growth and Value indices simultaneously. Variation associated with the S&P/Barra indices can be hedged away by taking short positions in each index, with portfolio weights given by $-\beta_{iG}$ and $-\beta_{iV}$, and depositing short-sale proceeds in a risk-free account. The return from this hedged position at time t, r_{ht}, can then be written as

$$r_{ht} = r_{it} - \beta_{iG}(r_{Gt} - r_f) - \beta_{iV}(r_{Vt} - r_f), \tag{4}$$

where r_f denotes the risk-free rate. If the hedger accurately measures β_{iG} and β_{iV}, the hedged position is independent of the return on the Value and Growth indices. Combining equation (4) with equation (1), the return on the hedged position is reduced to

$$r_{ht} = \beta_{i0} + (\beta_{iG} + \beta_{iV})r_f + e_{it}. \tag{5}$$

Suppose the hedger begins with correct estimates of β_{iG} and β_{iV} but then subsequently ignores the impact of index reclassification on these parameters and assumes that covariation in returns merely reflects covariation in fundamental values. For Growth index balancers, the hedger may then incorrectly assume β_{iG} decreases during the test sample as it does during the control sample. In particular, Table II indicates that the estimate of $\Delta\overline{\beta}_G$ over the control sample for Growth index balancers is -0.227 but over the test sample is 0.157. The corresponding difference-in-difference statistic suggests that the hedger underestimates β_{iG} by 0.385. If the hedger updates the hedged position accordingly, the portfolio is no longer independent of the Growth index, but rather, has a loading of 0.385 on the Growth index. Using results of Table I, this implies the hedged portfolio will fall in a given month by 1.79% in response to a negative one-standard deviation shock to the monthly Growth index return. Conducting this same exercise using Value index balancers, if the hedger ignores the impact of the S&P/Barra labels on covariation, the hedged portfolio will fall in a given month by 73 basis points in response to a negative one-standard deviation shock to the monthly Value index return. Ignoring the impact of the S&P/labels on covariation leads to economically meaningful estimation errors.

Results of Table II in favor of the label hypothesis tend to be stronger for index balancers than for other stocks, another result that cannot easily be explained by the fundamental hypothesis. If changes in fundamentals are merely driving the results of Table II, then estimates of $\Delta\overline{\beta}_G$ should be larger for all stocks that switch to the Growth index than for the subset of Growth index balancers. Similarly, estimates of $\Delta\overline{\beta}_V$ should be larger for all stocks switching to the Value index than for the subset of Value index balancers. Stronger results for index balancers may arise because the marginal impact of the S&P/Barra labels on covariation is stronger on stocks with weaker fundamental links to the indices they join. Estimates of $\overline{\beta}_G$ ($\overline{\beta}_V$) over the pre-event window tend to be somewhat larger for all switchers than index balancers in Panel A (Panel B).

I conduct various robustness checks of the main findings of this section, the results of which can be found in an Internet Appendix available on the *Journal's* website.[7] Using monthly returns, I conduct calendar-time tests similar to Barberis, Shleifer, and Wurgler (2005). In particular, I create a calendar-time portfolio of stocks in the Growth index that either just switched to the Growth index during the most recent rebalancing month or that will switch to the Value index the next rebalancing month. I also create a calendar-time portfolio of stocks in the Value index that either just switched to the Value index during the most recent rebalancing month or that will switch to the Growth index the next rebalancing month. I then regress returns of these portfolios on the Growth and Value index returns. Stocks in these two portfolios, which I refer to below simply as the "growth calendar portfolio" and "value calendar portfolio," should be similar in terms of fundamental characteristics because they are positioned near the S&P/Barra *BM* boundary. Hence, according to the fundamental hypothesis, loadings of the growth calendar portfolio on the Growth and Value indices should be similar to those of the value calendar portfolio. According to the label hypothesis, however, loadings of the growth calendar portfolio on the Growth index should be higher than those of the value calendar portfolio, simply because stocks in the growth calendar portfolio are labeled as Growth stocks. Similarly, the value calendar portfolio should load more heavily on the Value index. In summary, using the control sample I find no significant difference in index loadings across calendar portfolios. For the test sample, however, I find the loading of the growth calendar portfolio on the Growth index to be significantly larger than that of the value calendar portfolio, and the loading of the value calendar portfolio on the Value index to be significantly larger than that of the growth calendar portfolio. These differences are not only significantly different from zero but are also significantly different from the identical measures estimated using the control sample, again indicating that the fundamental hypothesis should be rejected in favor of the label hypothesis.

I also ensure that the results of Table II are not driven by nonsynchronous trading (Lo and MacKinlay (1990)) using three different methods. First, I create the results of Table II after removing stocks that tend to have stale closing prices. I use the TAQ database to determine the time of each closing price for each stock that switches among the S&P/Barra indices on each day. I remove a stock if more than 5% of its daily closing prices are recorded earlier than 3:45 PM during the pre- or post-event window for that stock. Second, I estimate average changes in comovement as in Table II using weekly rather than daily data. Third, I investigate changes in average comovement after including lagged index returns (four lags) in the regression given in (1). For all three experiments, results are very similar to those in Table II. Moreover, the third experiment provides little evidence that cross-autocorrelations change when a stock switches to a new index.

Finally, I estimate changes in univariate measures of comovement between index switchers and each index (correlation and univariate regression slope) and find similar results as in Table II. When a stock switches to the Growth (Value) index, its correlation and slope coefficient with the Growth (Value) index increases significantly more during the test sample than the control sample.

III. Turnover and Mutual Fund Holdings

My interpretation of results given in the previous section presumes that the S&P/Barra indices define generally accepted style classifications that investors use to make capital allocation decisions. In this section I investigate whether investors actually use the S&P/Barra index labels to determine how they should allocate capital, even though these labels sometimes have little connection with underlying fundamentals. I first show that when an index balancer changes labels during the test sample, its turnover begins to covary more with that of the index it joins and less with that of the index it leaves. Hence, even though *BM* ratios of Value index balancers decline prior to switching to the Value index, the evidence suggests that investors become more inclined to trade these stocks along with other stocks in the Value index once they are assigned the Value index label. A similar line of reasoning applies to Growth index balancers.

I next provide some insight regarding who trades in this manner. Specifically, I find some evidence that active mutual fund managers trade stocks based on their S&P/Barra labels rather than fundamentals. Fund managers that benchmark against the Value or Growth index may tend to trade stocks based on their S&P/Barra labels as protection against poor performance. Mutual fund ownership of U.S. equities has grown dramatically over the last few decades (see, for example, Boyer and Zheng (2009)). The evidence of this section provides an interesting perspective on the motives behind some of the trading activity of those who manage these funds.

A. Covariation in Turnover

I regress turnover of stocks that switch among the S&P/Barra indices on turnover of the two indices,

$$\tau_{it} \quad = \quad \gamma_{i0} + \gamma_{iG}\tau_{Gt} + \gamma_{iV}\tau_{Vt} + \varepsilon_{it}, \tag{6}$$

where τ_{it}, τ_{Gt}, and τ_{Vt} are measures of daily turnover for stock i, the Growth index, and the Value index, respectively. For each stock, I estimate the regression over the pre- and post-event windows defined above. I define daily turnover as volume on day t divided by shares outstanding on day $t-1$ adjusted for splits. Index turnover on a given day is the equally weighted average across stocks in the index, excluding stocks that switch indices during the corresponding event month. I follow Lo and Wang (2000) and use raw turnover rather than filter the data through a specific trend process. I separate stocks that switch from the Value to the Growth index from those that switch from the Growth to the Value index, and then for each group calculate average changes in turnover comovement around event months across stocks,

$$\Delta\bar{\gamma}_G = \sum_{i=1}^{n} \left(\gamma_{iG}^{pst} - \gamma_{iG}^{pre}\right)/n \tag{7a}$$

$$\Delta\bar{\gamma}_V = \sum_{i=1}^{n} \left(\gamma_{iV}^{pst} - \gamma_{iV}^{pre}\right)/n, \tag{7b}$$

where, as in equations (2a) and (2b), the *pre* and *pst* superscripts indicate whether the parameter is estimated over the pre- or post-event window, and n is the number of stocks that switch to an index in a given sample.

When S&P/Barra relabel a stock from Growth to Value, the influence of investors who trade the S&P/Barra indices as two distinct assets should increase (decrease) the covariation of the stock's turnover with the Value (Growth) index. A similar line of reasoning applies to stocks that switch from Value to Growth. Covariation in turnover may also be related to fundamental characteristics (Lo and Wang (2000, 2006)). However, any changes in fundamental characteristics should cause the turnover of index balancers to covary more with the index these stocks leave, not the index they join. Further, I can gauge the impact of labels unrelated to fundamentals on turnover covariation by estimating difference-in-difference statistics as in Table II that compare results across the test and control samples. The primary null hypotheses to test if the S&P/Barra labels induce covariation in turnover are identical to those outlined above to test for excess covariation in returns, replacing β with γ.

I present results in Table III, the format of which is identical to that of Table II. These results provide some evidence that the S&P/Barra labels do in fact induce covariation in turnover, especially among stocks that switch to the Value index. During the test sample, index-balancer turnover tends to exhibit an increase in comovement with that of the index these stocks join and a decrease in comovement with that of the index they leave. As an example, for the 167 index balancers that switch to the Value index during the test sample, I estimate $\Delta\bar{\gamma}_G$ to be -0.203 with a t-statistic of -2.53 and $\Delta\bar{\gamma}_V$ to be 0.065 (with an insignificant t-statistic). The S&P/Barra labels cause turnover covariation to change despite changes in fundamentals. In contrast, precisely the opposite result holds over the control sample: index-balancer turnover tends to covary less with that of the index these stocks join and more with that of the index they leave after switching. For the 163 index balancers that switch to the Value index during the control sample, I estimate $\Delta\bar{\gamma}_V$ to be -0.317 with a t-statistic of -2.99, and $\Delta\bar{\gamma}_G$ to be 0.250 with a t-statistic of 2.58. Many of the difference-in-difference statistics on the far right of Table II are significant, including two in Panel A, affirming that the S&P/Barra labels influence turnover covariation separate from any fundamental effects. That is, investors appear to actually use the S&P/Barra index labels to determine how they should allocate capital, even though these labels sometimes have little connection with underlying fundamentals. Results using weekly data can be found in the Internet Appendix, which show similar results as those in Table III.

[Table III about here.]

The results of Table III seem to suggest the S&P/Barra labels have a stronger impact on turnover among stocks switching to Value than stocks switching to Growth. In results reported in the Internet Appendix, I find that this discrepancy arises in part because the impact of the S&P/Barra labels on turnover covariation is particularly strong for stocks switching to either Growth *or* Value following strong performance in the Growth index, when many stocks must subsequently switch to Value. For example, during the test sample, when I define $\Delta\bar{\gamma}_G$ as a weighted average, where the weight on event month i is the number of stocks switching to the Value index divided by the total number of stocks that switch to Value throughout the sample, I estimate $\Delta\bar{\gamma}_G$ to be 0.28 with a t-statistic of 2.99 using stocks that switch to the Growth index. Using this same weighted average does not materially change results for the control sample. Together, these findings suggest that style investors who depend on the S&P/Barra labels are particularly active in trading following strong performance in the Growth index.

B. Mutual Fund Holdings

In this section I investigate whether the S&P/Barra labels influence the holdings of mutual fund managers. Funds that tend to hold value (growth) stocks should naturally increase their holdings, relative to others, of stocks after their *BM* ratios increase (decrease). Hence, value style funds should naturally increase their relative holdings of Growth index balancers as their *BM* ratios increase, and growth style funds should naturally increase their relative holdings of Value index balancers as their *BM* ratios decline. I investigate the relative holdings of value and growth style funds around index rebalancing dates, and find that growth style funds during the test sample actually decrease their relative holdings of Value index balancers despite their declining *BM* ratios. During the control sample, however, I find the opposite result: growth style funds increase their relative holdings of Value index balancers when these stocks switch indices. The difference in results across samples is statistically significant, suggesting that S&P/Barra labels influence the portfolio allocation decisions of mutual fund managers.

I use quarterly data provided by CDA/Spectrum for mutual funds classified as "aggressive growth," "growth," or "growth and income." The data begin June 1981 and end December 2004. For each event month, I estimate the following two cross-sectional regressions across funds, i,

$$\Delta H_{iG} = \theta_{G0} + \theta_{G1} V_i + \theta_{G2} S_i + \theta_{G3} M_i + e_{iG}, \tag{8a}$$

$$\Delta H_{iV} = \theta_{V0} + \theta_{V1} V_i + \theta_{V2} S_i + \theta_{V3} M_i + e_{iV}, \tag{8b}$$

where H_{iG} (H_{iV}) denotes the average change in holdings for fund i of stocks that switch from Value to Growth (Growth to Value), and V_i, S_i, and M_i represent the value score, size score, and fund size for fund i, respectively. I first explain the details behind the variables of these two regressions and then discuss the insights gained from estimation.

I define holdings for a given fund of a given stock as the fraction of total shares outstanding held. The change in holdings for a given fund of a given stock around a given event month is equal to holdings observed at the end of the event month, time t_1, minus holdings at time t_0. For funds that report holdings semiannually, t_0 is six months prior to t_1, and for funds that report quarterly, t_0 is three months prior to t_1.[8] For each event month I compute a simple average of this change across stocks that switch from Value to Growth (Growth to Value) to obtain H_{iG} (H_{iV}) for fund i.

Fund size, M_i, is the log of total equity holdings reported at time t_0 for fund i. I measure size score, S_i, and value score, V_i, using the method of Kacperczyk, Sialm, and Zheng (2005). In particular, I assign each stock traded on a major U.S. exchange into a size quintile and *BM* quintile (independently), where size and *BM* are measured as of time t_0. Size score, S_i, is the value-weighted average size quintile across stocks held by fund i observed at time t_0, where value weights are measured relative to total holdings of fund i. Likewise, value score, V_i, is the value-weighted average *BM* quintile across stocks held by fund i observed at time t_0.

After estimating the two cross-sectional regressions identified above for each event month, I average parameter estimates across event months, as in Fama and MacBeth (1973). To obtain standard errors, I use the estimated variances from the cross-sectional regressions and calculate the variance of the average as the sum of the variances divided by N^2, where N is the number of event months. I then take the square-root to obtain the standard error.

To be included in the analysis for a given event month, a fund must appear in the CDA/ Spectrum data at both t_0 and t_1. At these two points in time, many such funds report no holdings of stocks that switch among the S&P/Barra indices during the corresponding event month. If at time t_0 a fund reports no holdings of a given stock that switches indices during the corresponding event month, I exclude this fund-stock pair from the analysis for that event month. On the other hand, if at time t_1 a fund reports no holdings of a given stock that switches indices during the corresponding event month, I assume the fund holds zero shares of this stock at time t_1.

I report time-series averages of cross-sectional summary statistics for the mutual fund data in Table IV. Panel A is for the test sample while Panel B is for the control sample. Results indicate that those funds that pass the screens described above are primarily large-cap funds, with average size scores in both periods near 5.0. These funds also tilt somewhat towards growth stocks, with value scores in the range of 2.05 to 2.68. A value score of 3.0 implies that the fund is following a neutral value-growth strategy.

[Table IV about here.]

Value style funds should naturally increase their holdings, relative to others, of stocks after their *BM* ratios increase. However, if the S&P/Barra labels influence fund holdings, then value style funds should also increase their relative holdings of Value index balancers after their *BM* ratios decrease. Applying a similar line of reasoning to growth style funds, this implies that using index balancers to create H_{iG} and H_{iV}, the average value of θ_{G1}, $\overline{\theta}_{G1}$, should be negative, and the average value of θ_{V1}, $\overline{\theta}_{V1}$, should be positive for the test sample. That is, an increase in value score should be associated with lower relative holdings of Growth index balancers (despite their increasing *BM* ratios) and higher relative holdings of Value index balancers (despite their declining *BM* ratios) when these stocks switch indices. I therefore formally test if $\overline{\theta}_{G1}$ is negative during the test sample and less than that when estimated over the control sample using index balancers. I also formally test if $\overline{\theta}_{V1}$ is positive during the test sample and greater than that when estimated over the control sample using this same set of stocks.

Table V presents estimates of average coefficients across event months for the two cross-sectional regressions given in (8a) and (8b). Panel A of Table V gives results for index balancers, the focus of the analysis, while Panel B provides results for all switchers. The results of Panel A suggest that the S&P/Barra labels influence fund holdings. For the test sample the estimate of $\overline{\theta}_{V1}$ is significantly positive, whereas for the control sample it is significantly negative. During the test sample, funds with lower size scores (growth style funds) decrease their relative holdings of Value index balancers despite their declining *BM* ratios. In contrast, during the control sample growth style funds naturally increase their relative holdings of these stocks as their *BM* ratios decline. The difference in $\overline{\theta}_{V1}$ across the test and control samples is 0.047 with a *t*-statistic of 2.00. These findings suggest that the S&P/Barra labels influence the stock holdings of mutual fund managers. I do not find similar results for Growth index balancers on the left of Table V. In Table IV, the average cross-sectional standard deviation of value score is 0.45 during the test sample, and in Table V the estimate of $\overline{\theta}_{V1}$ in Panel A for the test sample is 0.017. This implies that a one-standard deviation increase in value score is associated with an increase in ΔH_{iV} of 0.008% for a single fund. In contrast, during the control sample a one-standard deviation increase in value score is associated with a *decrease* in ΔH_{iV} of 0.016% for a single fund.

[Table V about here.]

In Panel B, which provides results for all switchers, estimates of $\overline{\theta}_{G1}$ are significantly negative, and estimates of $\overline{\theta}_{V1}$ are significantly positive for both the test and control samples. Since the *BM* ratios of many stocks that switch to the Growth (Value) index decrease (increase) before switching, these results merely suggest that growth style funds increase their relative holdings of stocks after their *BM* ratios decrease and that value style funds increase their relative holdings of stocks after their *BM* ratios increase.[9]

I investigate whether results are sensitive to the assumption that a fund holds zero shares of a given stock at the end of the event month if it does not report any holdings of this stock. In the CDA/Spectrum data, a fund may not report any holdings for a given stock if it holds less than 10,000 shares or less than $200,000 in the stock. I therefore conduct the analysis assuming a fund holds *S* shares of the stock if it does not report any holdings at the end of the event month, where *S* equals 10,000, or *S* equals 200,000 divided by the price of the stock at the end of the event month, depending on which is larger. In this analysis I find similar results.

I also determine whether results are robust to adjusting standard errors for autocorrelation. In particular, I follow Fama and French (2002), Chakravarty, Gulen, and Mayhew (2004), and Petersen (2007) and multiply standard errors by the square-root of $(1+\phi)/(1-\phi)$, where ϕ is the first-order autocorrelation coefficient of the estimated parameter. The autocorrelation coefficients for θ_{G1} and θ_{V1} in my sample are negative, however, implying that this adjustment actually shrinks standard errors. I therefore calculate standard errors assuming independence to be conservative.

IV. Conclusion

S&P/Barra divide stocks in the S&P 500 into two mutually exclusive Value and Growth indices based on simple mechanical rules. Investors can then trade all stocks within each index as two distinct asset categories without scrutinizing individual assets. Although traded together as a group, the fundamental values of assets within the same index may only be loosely correlated. Because the mechanical rules by which stocks are assigned to each index are very simple and somewhat arbitrary, I am able to identify the effect of trading unrelated to fundamentals on prices. I find that these index labels induce excess covariation in returns, contrary to traditional market efficiency, through the trading activity of investors.

Specifically, because S&P/Barra require that the market cap of the Value index equal that of the Growth index, stocks that I call index balancers switch to the Value index after their *BM* ratios decrease and to the Growth index after their *BM* ratios increase. Further, because the mechanical rules are so simple, Barra backdated the constituent data to 1981, thus providing a control sample. The indices were first created in 1992. Using post-1992 data I find that both returns and turnover of index balancers begin to covary more strongly with the index they join and less with the index they leave after they switch. These changes in comovement are not only statistically significant from zero but are statistically different from similar results estimated using the control sample. I also find some evidence that active fund managers are among the investors that use the S&P/Barra labels to allocate capital regardless of fundamentals, perhaps motivated by a desire to cling to their benchmark index.

Stocks in the S&P 500 are among the most liquid and closely watched by analysts. This paper shows that arbitrary, economically meaningless labels cause the prices of these stocks to diverge from fundamental value through the trading activity of style investors who use these labels for capital allocation decisions.

References

Baker, Malcolm, and Jeremy C. Stein, 2004, Market liquidity as a sentiment indicator, *Journal of Financial Markets* 7, 271-299.

Barberis, Nicholas, and Andrei Shleifer, 2003, Style investing, *Journal of Financial Economics* 68, 161-199.

Barberis, Nicholas, Andrei Shleifer, and Jeffrey Wurgler, 2005, Comovement, *Journal of Financial Economics* 75, 283-317.

Boyer, Brian H., and Lu Zheng, 2009, Investor flows and stock market returns, *Journal of Empirical Finance* 16, 87-100.

Campbell, John Y., Sanford J. Grossman, and Jiang Wang, 1993, Trading volume and serial correlation in stock returns, *Quarterly Journal of Economics* 108, 905-939.

Carhart, Mark M., 1997, On persistence in mutual fund performance, *Journal of Finance* 52, 57-82.

Chakravarty, Sugato, Huseyin Gulen, and Stewart Mayhew, 2004, Informed trading in stock and option markets, *Journal of Finance* 59, 1235-1257.

Denis, Diane K., John J. McConnell, Alexei V. Ovtchinnikov, and Yun Yu, 2003, S&P 500 index additions and earnings expectations, *Journal of Finance* 58, 1821-1840.

Diether, Karl B., Christopher J. Malloy, and Anna Scherbina, 2002, Differences of opinion and the cross section of stock returns, *Journal of Finance* 57, 2113-2141.

Fama, Eugene F., and Kenneth R. French, 1992, The cross-section of expected stock returns, *Journal of Finance* 47, 427-465.

Fama, Eugene F., and Kenneth R. French, 1995, Size and book-to-market factors in earnings and returns, *Journal of Finance* 50, 131-155.

Fama, Eugene F., and Kenneth R. French, 2002, Testing tradeoff and pecking order predictions about dividends and debt, *Review of Financial Studies* 15, 1-33.

Fama, Eugene F., and James D. MacBeth, 1973, Risk, return, and equilibrium: Empirical tests, *Journal of Political Economy* 81, 607-636.

Jegadeesh, Narasimhan, and Sheridan Titman, 2001, Profitability of momentum strategies: An evaluation of alternative explanations, *Journal of Finance* 56, 699-720.

Kacperczyk, Marcin, Clemens Sialm, and Lu Zheng, 2005, On the industry concentration of actively managed equity mutual funds, *Journal of Finance* 60, 1983-2011.

Lo, Andrew W., and A. Craig MacKinlay, 1990, An econometric analysis of nonsynchronous trading, *Journal of Econometrics* 45, 181-212.

Lo, Andrew W., and Jiang Wang, 2000, Trading volume: Definitions, data analysis, and implications of portfolio theory, *Review of Financial Studies* 13, 257-300.

Lo, Andrew W., and Jiang Wang, 2006, Trading volume: Implications of an intertemporal capital asset pricing model, *Journal of Finance* 61, 2805-2840.

Loughran, Tim, 1997, Book-to-market across firm size, exchange, and seasonality: Is there an effect? *Journal of Financial and Quantitative Analysis* 32, 249-268.

Newey, Whitney K., and Kenneth D. West, 1987, A simple, positive semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix, *Econometrica* 55, 703-708.

Petersen, Mitchell A., 2007, Estimating standard errors in finance panel data sets: Comparing approaches, *Review of Financial Studies* 22, 435-480.

Vijh, Anand, 1994, S&P 500 trading strategies and stock betas, *Review of Financial Studies* 7, 215-251.

Wang, Jiang, 1994, A model of competitive stock trading volume, *Journal of Political Economy* 102, 127-168.

Notes

[1]This website no longer reports any information on the Barra indices.

[2]Fama and French (1992) and Loughran (1997), among others, also find almost no performance differential between large-cap value and growth stocks.

[3]See Campbell, Grossman, and Wang (1993), Wang (1994), and Baker and Stein (2004).

[4]Other labels could potentially influence covariation during the control sample. However, these label assignments are unlikely to change with S&P/Barra labels for index balancers.

[5]I follow Jegadeesh and Titman (2001) and Diether, Malloy, and Scherbina (2002) in eliminating stocks with prices less than $5.

[6]Note that the only significant change in covariation for the control sample is that of $\Delta\overline{\beta}_G$ using *all switchers* that switch to the Value index. This result merely suggests *BM* ratios of many of these stocks increase over the pre-event window in contrast to *BM* ratios of Value index balancers.

[7]The latest Appendix is available at http://www.afajof.org/supplements.asp.

[8]The SEC requires all funds to report holdings biannually. However, Thompson Financial investigates fund prospectuses and contacts mutual fund management companies to increase reporting frequency.

[9]In Table V both $\overline{\theta}_{G3}$ and $\overline{\theta}_{V3}$ tend to be negative and highly significant. This finding arises because, first, larger funds trade more in absolute terms, and second, the funds in my analysis are net sellers of S&P/Barra switchers on average because I condition my sample to funds that initially hold a long position in these stocks.

Table I
Summary Statistics and Factor Loadings

Panel A presents summary statistics for monthly returns and turnover of the S&P/Barra Value and Growth indices. Index turnover for a given month is equally weighted average stock turnover, where individual stock turnover is the sum of daily turnover across the month. To calculate the correlation of an index return with itself, I randomly split stocks in the index into two value-weighted portfolios. All stocks in each index are used when calculating the correlation of the Value index with the Growth index. Panel B presents loadings of the S&P 500/Barra Value and Growth indices on the Carhart (1997) four-factor model. The factor loadings are obtained by jointly estimating the regressions

$$(r_{Gt} - r_{ft}) = \alpha_G + b_{G1}MKT_t + b_{G2}SMB_t + b_{G3}HML_t + b_{G4}MOM_t + e_{Gt}$$

$$(r_{Vt} - r_{ft}) = \alpha_V + b_{V1}MKT_t + b_{V2}SMB_t + b_{V3}HML_t + b_{V4}MOM_t + e_{Vt}\ ,$$

where r_{Gt}, r_{Vt}, r_{ft}, MKT_t, SMB_t, HML_t, and MOM_t are the return on the Growth index, the return on the Value index, the one-month Treasury bill return, excess market return, size factor, book-to-market factor, and momentum factor for month *t*. Results for the control sample in both panels exclude the crash of October 1987 by omitting data from June through December of 1987. Rows labeled *t*-stat (d) in each panel give *t*-statistics for the difference in parameters across the Value and Growth indices.

Panel A. Summary Statistics

	June 1992-December 2004 (Test)						May 1981-May 1992 (Control)					
	Returns (percent)		Turnover (percent)		Return Correlation		Returns (percent)		Turnover (percent)		Return Correlation	
	mean	stdev	mean	stdev	Growth	Value	mean	stdev	mean	stdev	Growth	Value
Growth	0.97	4.66	13.53	5.75	0.92		1.46	4.54	6.62	1.32	0.96	
Value	1.00	4.19	10.73	3.79	0.76	0.95	1.53	4.06	6.45	1.49	0.90	0.96
					ρ_{GG}-ρ_{GV}	ρ_{GG}-ρ_{GV}					ρ_{GG}-ρ_{GV}	ρ_{VV}-ρ_{GV}
t-stat (d)	-(0.11)	(1.54)	(4.59)	(4.34)	(3.06)	(3.56)	-(0.42)	(2.61)	(1.55)	-(2.81)	(3.49)	(3.63)

Panel B. Factor Loadings

	June 1992-December 2004 (Test)					May 1981-May 1992 (Control)				
	α	MKT	SMB	HML	MOM	α	MKT	SMB	HML	MOM
Growth	0.25	0.92	-0.31	-0.38	0.06	0.14	0.97	-0.24	-0.30	0.09
t-stat	(2.90)	(35.73)	-(9.81)	-(11.85)	(2.87)	(1.90)	(53.47)	-(7.48)	-(9.22)	(3.76)
Value	-0.04	1.05	-0.09	0.40	-0.13	-0.02	1.05	-0.18	0.34	-0.09
t-stat	-(0.62)	(48.82)	-(4.60)	(16.13)	-(8.42)	-(0.36)	(67.97)	-(8.76)	(11.21)	-(4.69)
t-stat (d)	-(2.11)	(3.03)	(3.53)	(24.35)	-(8.62)	-(1.31)	(2.62)	(0.84)	(19.49)	-(7.59)

Table II
Index Rebalancing and Changes in Return Comovement

Daily log stock returns (r_{it}) are regressed on log index returns (r_{Gt} and r_{Vt}),

$$r_{it} = \beta_{i0} + \beta_{iG} r_{Gt} + \beta_{iV} r_{Vt} + e_{it} \ .$$

The regression is estimated separately over a "pre-event window" and a "post-event window" for each stock where the event month is the month in which the stock switches indices, either June or December for some year. The pre- and post-event windows are the five-month intervals before and after each event month. I exclude stocks switching indices when calculating index returns to avoid measuring effects associated with changes in index composition. For each stock, I calculate the change in each regression parameter as the post-event estimate minus the pre-event estimate. Columns labeled "Δ" report the average change in parameter estimates across stocks that switch to either the Growth or Value index. Columns labeled "PE" report average parameter estimates for pre-event windows. Robust *t*-statistics and block bootstrap *p*-values, both of which take into account overlapping estimation windows, are in parentheses. Difference-in-difference statistics on the far right of the table compare estimates of the average change in regression parameters around event months across the test and control samples (Test-Control) and across the high turnover and control samples (HT-Control). Columns labeled "All" report difference-in-difference statistics for all stocks that switch, while columns labeled "IB" report difference-in-difference results for index-balancers. Index-balancers are stocks that switch to the Growth index with a negative return over the pre-event window or stocks that switch to the Value index with a positive return over the pre-event window. The number of stocks switching for each sample is indicated by *n*. Stocks remain in the same S&P/Barra index throughout the entire pre-event window and in the same S&P/Barra index throughout the entire post-event window. I exclude stocks with prices less than $5 in either window. Results for the control sample exclude the crash of October 1987. Significance of the one-tailed tests discussed in the paper at the 1%, 5%, and 10% levels is indicated respectively by ***, **, and *.

Panel A. Stocks that Switch from the Value Index to the Growth Index

	Test Sample 1992-2004				High Turnover Sample 1998-2002				Control Sample 1981-1991				Difference-in-Difference Statistics			
	All Switchers n=390		Index-Balancers n=36		All Switchers n=152		Index-Balancers n=24		All Switchers n=385		Index-Balancers n=54		Test-Control		HT-Control	
	Δ	PE	Δ	PE	Δ	PE	Δ	PE	Δ	PE	Δ	PE	All	IB	All	IB
$\overline{\beta}_G$	0.033	0.326	0.157	0.266	0.107	0.305	0.165	0.182	-0.050	0.455	-0.227	0.525	0.082	0.385	0.157	0.392
t-stat	(1.00)		(1.66)**		(2.13)**		(1.60)*		-(1.07)		-(2.48)		(1.45)*	(2.92)***	(2.29)**	(2.84)***
Block *p*	(0.17)		(0.06)*		(0.02)**		(0.09)*		(0.86)		(0.99)		(0.09)*	(0.00)***	(0.01)**	(0.01)***
$\overline{\beta}_V$	0.055	0.589	-0.032	0.568	0.006	0.565	-0.166	0.678	0.087	0.492	0.291	0.379	-0.032	-0.323	-0.081	-0.457
t-stat	(1.60)		-(0.32)		(0.12)		-(1.44)*		(1.75)		(2.64)		-(0.53)	-(2.16)**	-(1.15)	-(2.87)***
Block *p*	(0.93)		(0.40)		(0.55)		(0.11)		(0.95)		(1.00)		(0.32)	(0.02)**	(0.15)	(0.01)***

Table II – *Continued*

Panel B. Stocks that Switch from the Growth Index to the Value Index																
	Test Sample 1992-2004				High Turnover Sample 1998-2002				Control Sample 1981-1991				Difference-in-Difference Statistics			
	All Switchers n=507		Index-Balancers n=167		All Switchers n=198		Index-Balancers n=37		All Switchers n=445		Index-Balancers n=163		Test-Control		HT-Control	
	Δ	PE	Δ	PE	Δ	PE	Δ	PE	Δ	PE	Δ	PE	All	IB	All	IB
$\overline{\beta}_G$	-0.042	0.412	-0.100	0.353	-0.067	0.501	-0.343	0.441	-0.055	0.431	0.121	0.341	0.013	-0.221	-0.013	-0.464
t-stat	-(1.31)*		-(2.20)**		-(1.31)*		-(4.76)***		-(1.40)*		(2.23)		(0.25)	-(3.12)***	-(0.19)	-(5.14)***
Block *p*	(0.10)*		(0.02)**		(0.11)		(0.00)***		(0.09)*		(0.99)		(0.57)	(0.00)***	(0.42)	(0.00)***
$\overline{\beta}_V$	0.012	0.634	0.107	0.621	0.037	0.681	0.485	0.584	0.053	0.553	-0.068	0.598	-0.041	0.175	-0.017	0.553
t-stat	(0.35)		(2.21)**		(0.67)		(5.70)***		(1.21)		-(1.06)		-(0.74)	(2.18)**	-(0.24)	(5.19)***
Block *p*	(0.35)		(0.02)**		(0.26)		(0.00)***		(0.13)		(0.85)		(0.73)	(0.02)**	(0.56)	(0.00)***

Table III
Index Rebalancing and Changes in Turnover Comovement

Daily turnover (τ_{it}) of stocks that switch between the S&P/Barra Growth and Value indices is regressed on the turnover of the two indices (τ_{Gt} and τ_{Vt}),

$$\tau_{it} = \gamma_{i0} + \gamma_{iG}\tau_{Gt} + \gamma_{iV}\tau_{Vt} + e_{it} .$$

The regression is estimated separately over a "pre-event window" and a "post-event window" for each stock where the event-month is the month in which the stock switches indices, either June or December for some year. The pre- and post-event windows are the five-month intervals before and after each event month. I define daily turnover as volume on day *t* divided by shares outstanding on day *t*-1 adjusted for splits and index turnover as the equally weighted average. For each stock, I calculate the change in each regression parameter as the post-event estimate minus the pre-event estimate. The stocks I use in this analysis are the same as those used in the analysis of Table II and I report results in the same manner as in Table II. For further details see the caption for Table II. Significance of the one-tailed tests discussed in the paper at the 1%, 5%, and 10% levels is indicated respectively by ***, **, and *.

Panel A. Stocks that Switch from the Value Index to the Growth Index

	Test Sample 1992-2004				High Turnover Sample 1998-2002				Control Sample 1981-1991				Difference-in-Difference Statistics			
	All Switchers		Index-Balancers		All Switchers		Index-Balancers		All Switchers		Index-Balancers		Test-Control		HT-Control	
	n=390		*n*=36		*n*=152		*n*=24		*n*=385		*n*=54					
	Δ	PE	Δ	PE	Δ	PE	Δ	PE	Δ	PE	Δ	PE	All	IB	All	IB
$\bar{\gamma}_G$	0.053	0.313	-0.081	0.226	0.065	0.259	-0.066	0.278	-0.106	0.594	0.120	0.286	0.159	-0.20	0.171	-0.186
t-stat	(0.83)		-(0.63)		(0.79)		-(0.60)		-(1.38)		(0.54)		(1.59)*	-(0.78)	(1.51)*	-(0.75)
Block *p*	(0.24)		(0.74)		(0.21)		(0.74)		(0.92)		(0.29)		(0.06)*	(0.80)	(0.05)*	(0.79)
$\bar{\gamma}_V$	0.003	0.728	0.151	0.665	0.072	0.706	0.153	0.509	0.091	0.442	0.031	0.596	-0.088	0.120	-0.019	0.122
t-stat	(0.03)		(0.88)		(0.45)		(0.88)		(1.16)		(0.13)		-(0.73)	(0.42)	-(0.10)	(0.42)
Block *p*	(0.57)		(0.83)		(0.68)		(0.85)		(0.87)		(0.54)		(0.27)	(0.68)	(0.46)	(0.68)

Table III – *Continued*

Panel B. Stocks that Switch from the Growth Index to the Value Index

	Test Sample 1992-2004				High Turnover Sample 1998-2002				Control Sample 1992-2004				Difference-in-Difference Statistics			
	All Switchers *n*=507		Index-Balancers *n*=167		All Switchers *n*=198		Index-Balancers *n*=37		All Switchers *n*=445		Index-Balancers *n*=163		Test-Control		HT-Control	
	Δ	PE	Δ	PE	Δ	PE	Δ	PE	Δ	PE	Δ	PE	All	IB	All	IB
$\bar{\gamma}_G$	-0.223	0.480	-0.203	0.356	-0.168	0.445	-0.176	0.195	-0.050	0.527	0.250	0.311	-0.172	-0.453	-0.118	-0.427
t-stat	-(3.20)***		-(2.53)***		-(1.47)*		-(1.82)**		-(0.76)		(2.58)		-(1.80)**	-(3.59)***	-(0.89)	-(3.11)***
Block *p*	(0.00)***		(0.01)***		(0.06)*		(0.02)**		(0.22)		(0.99)		(0.032)**	(0.00)***	(0.15)	(0.00)***
$\bar{\gamma}_V$	0.144	0.721	0.065	0.612	0.063	0.887	0.317	0.556	0.117	0.393	-0.317	0.632	0.028	0.382	-0.053	0.634
t-stat	(1.57)*		(0.57)		(0.38)		(1.62)*		(1.59)*		-(2.99)		(0.24)	(2.45)***	-(0.29)	(2.85)***
Block *p*	(0.08)*		(0.27)		(0.33)		(0.04)**		(0.06)*		(1.00)		(0.42)	(0.01)***	(0.60)	(0.00)***

Table IV
Summary Statistics on Mutual Funds

This table presents summary statistics for the mutual fund panel data. The data are quarterly mutual fund holdings from the CDA/Spectrum database provided by Thompson Financial. The data begin June 1981 and end December 2004. I use mutual funds classified as "aggressive growth," "growth," or "growth and income." For a given event month in which the S&P/Barra indices are rebalanced, I select all funds that hold a nonzero position at date t_0 in stocks that switch among the S&P/Barra Value and Growth indices. For funds that report holdings semiannually, t_0 is six months before the end of the corresponding event month, while t_0 is three months before the end of the corresponding event month for funds that report quarterly. For each fund for the given event month, I calculate five variables: 1) average change in holdings of stocks that switch to the Growth index, ΔH_{iG}, 2) average change in holdings of stocks that switch to the Value index, ΔH_{iV}, 3) fund size, 4) value score, and 5) size score. The change in holdings of a stock for the given event month is defined as the fraction of shares outstanding held by the fund at t_1 minus the fraction of shares held at t_0, where t_1 is the end of the event month. Both ΔH_{iG} and ΔH_{iV} are scaled by 100. If a fund reports no holdings of a given stock at t_1, I assume the fund holds zero shares of this stock at t_1. Value score, size score, and fund size are all observable at t_0. Value score and size score are measures of fund style that range on a continuum from 1 to 5, measured using the method of Kacperczyk, Sialm, and Zheng (2005). Fund size is log equity holdings reported at time t_0. For each event month I calculate cross-sectional means and standard deviations across funds. Averages of these statistics across event months are reported in this table for the test sample in Panel A and for the control sample in Panel B. The bottom line of each panel reports the average number of funds per event month. For consistency with other tables, the control sample excludes the crash of October 1987.

Panel A. 1992-2004 (Test)								
	Funds Holding Stocks that Switch from Value to Growth				Funds Holding Stocks that Switch from Growth to Value			
	Value Score	Size Score	Fund Size	ΔH_{iG}	Value Score	Size Score	Fund Size	ΔH_{iV}
Mean	2.06	4.92	18.99	-0.015	2.05	4.91	18.91	-0.017
Stdev	0.45	0.16	1.94	0.11	0.45	0.16	1.95	0.12
	Avg # Funds = 801.7				Avg # Funds = 941.8			

Panel B. 1981-1991 (Control)								
	Funds Holding Stocks that Switch from Value to Growth				Funds Holding Stocks that Switch from Value to Growth			
	Value Score	Size Score	Fund Size	ΔH_{iG}	Value Score	Size Score	Fund Size	ΔH_{iV}
Mean	2.68	4.88	18.23	-0.03	2.66	4.88	18.13	-0.03
Stdev	0.53	0.18	1.64	0.12	0.53	0.17	1.67	0.13
	Avg # Funds = 256.9				Avg # Funds = 302.21			

Table V
Index Reclassifications and Mutual Fund Holdings

Using the data summarized in Table IV, the following two cross-sectional regressions are estimated for each event month:

$$\Delta H_{iG} = \theta_{G0} + \theta_{G1} V_i + \theta_{G2} S_i + \theta_{G3} M_i + e_{iG}$$

$$\Delta H_{iV} = \theta_{V0} + \theta_{V1} V_i + \theta_{V2} S_i + \theta_{V3} M_i + e_{iV},$$

where ΔH_{iG} (ΔH_{iV}) is the average change in holdings for fund i of stocks that switch to the Growth (Value) index around the corresponding event month, and V_i, S_i, and M_i are the value score, size score, and fund size, respectively, for fund i. I aggregate results across event months by averaging parameter estimates, similar to the approach of Fama and MacBeth (1973). Value score, size score, and fund size are all observable at time t_0, where t_0 is six months (three months) before the end of the corresponding event month for funds that report holdings semiannually (quarterly). Changes in stock holdings are measured from time t_0 to the end of the corresponding event month. For further details on these variables see the caption for Table IV. Panel A provides results for index-balancers, while Panel B provides results for all switchers. Significance of the one tailed tests described in the paper is marked as in previous tables.

Panel A: Index Balancers								
	Value to Growth				Growth to Value			
	$\bar{\theta}_{G0}$	$\bar{\theta}_{G1}$	$\bar{\theta}_{G2}$	$\bar{\theta}_{G3}$	$\bar{\theta}_{V0}$	$\bar{\theta}_{V1}$	$\bar{\theta}_{V2}$	$\bar{\theta}_{V3}$
1992-2004 (Test)	0.152	-0.003	0.010	-0.011	0.080	0.017***	0.010	-0.009
t-statistic	(0.84)	-(0.35)	(0.28)	-(6.56)	(0.77)	(2.99)	(0.50)	-(9.34)
1981-1991 (Control)	0.470	-0.009	-0.039	-0.017	-0.114	-0.030	0.016	0.006
t-statistic	(2.09)	-(0.76)	-(0.83)	-(3.63)	-(0.20)	-(1.33)	(0.17)	(0.31)
	Test-Control	0.006			Test-Control	0.047**		
	t-statistic	(0.37)			*t*-statistic	(2.00)		

Panel B: All Switchers								
	Value to Growth				Growth to Value			
	$\bar{\theta}_{G0}$	$\bar{\theta}_{G1}$	$\bar{\theta}_{G2}$	$\bar{\theta}_{G3}$	$\bar{\theta}_{V0}$	$\bar{\theta}_{V1}$	$\bar{\theta}_{V2}$	$\bar{\theta}_{V3}$
1992-2004 (Test)	0.054	-0.007	0.023	-0.009	0.025	0.023	0.022	-0.011
t-statistic	(1.52)	-(3.29)	(3.40)	-(18.15)	(0.76)	(9.91)	(3.50)	-(19.19)
1981-1991 (Control)	0.223	-0.012	-0.003	-0.011	-0.025	0.036	0.014	-0.009
t-statistic	(3.90)	-(3.19)	-(0.31)	-(8.97)	-(0.43)	(9.86)	(1.27)	-(7.41)

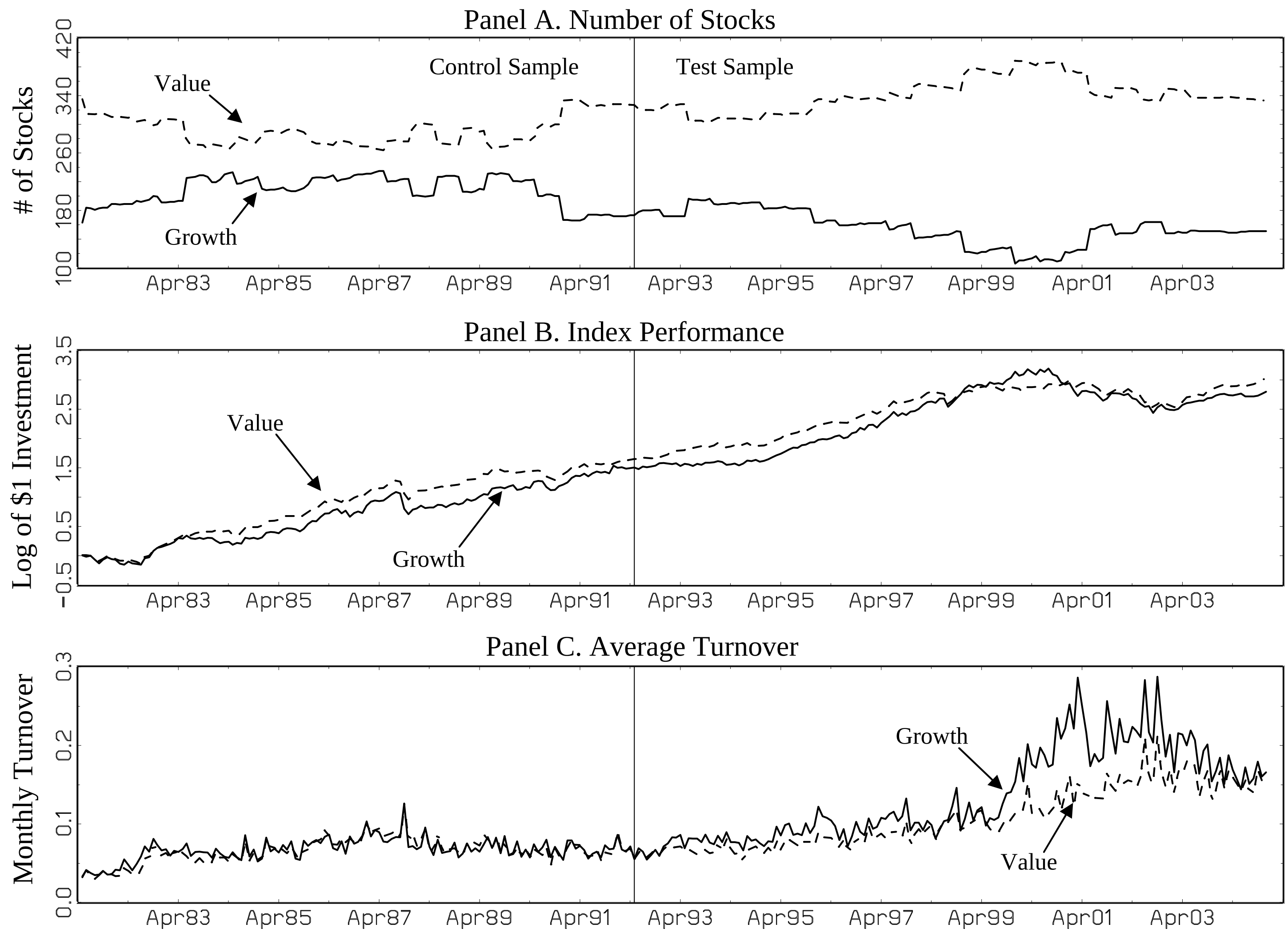

Figure 1. The S&P/Barra Value and Growth indices. This figure plots the number of stocks in each of the S&P/Barra Value and Growth indices (Panel A), the performance of each index measured as the log value of $1 invested in each index at the beginning of the period (Panel B), and average monthly turnover (Panel C). Each chart begins May 1981 and ends December 2004. The solid vertical line in each panel is May 1992, the month the value and growth indices were first introduced.

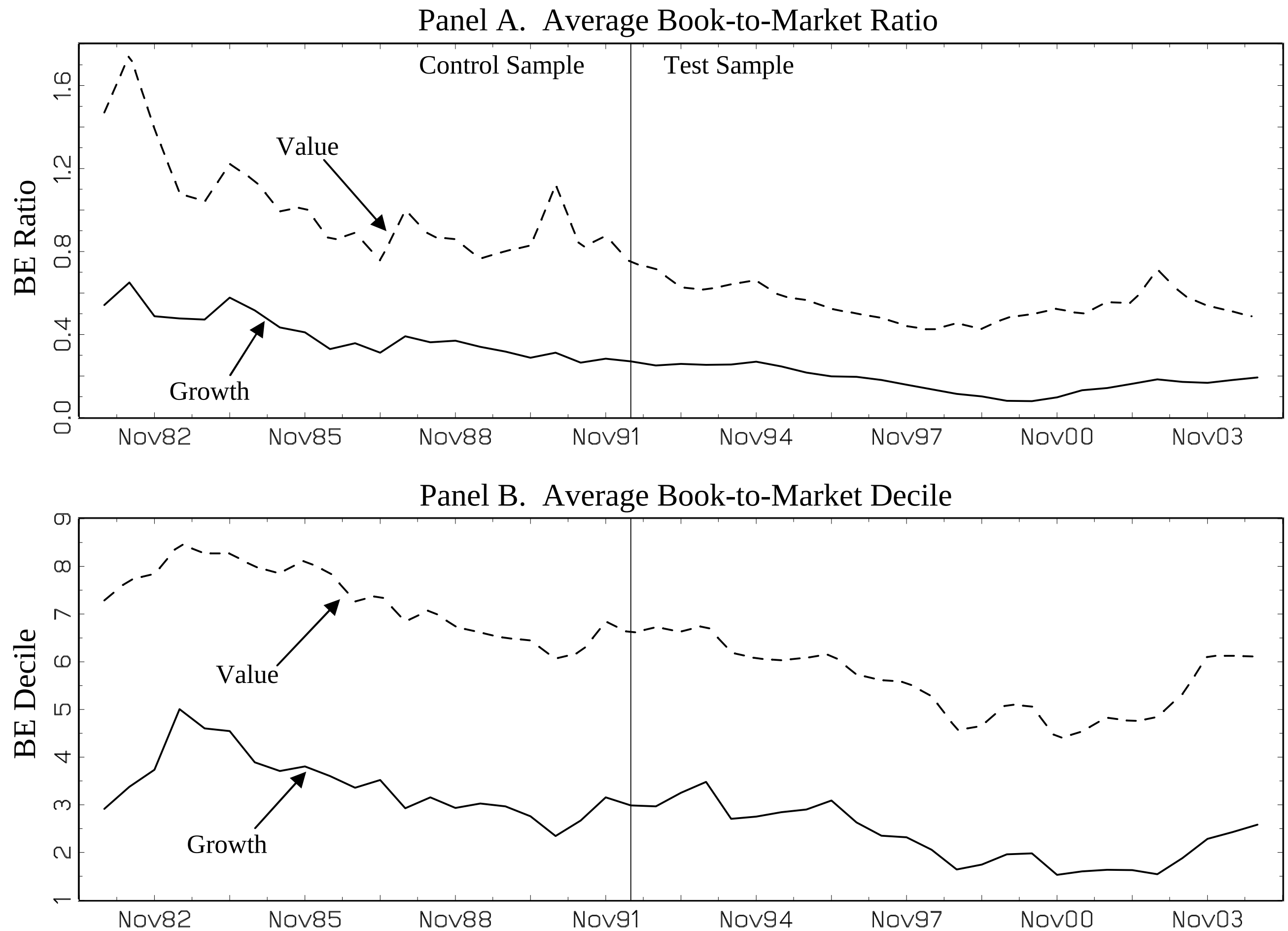

Figure 2. Book-to-Market ratios of the S&P/Barra Value and Growth indices. This figure plots the cross-sectional average book-to-market ratio and decile for the S&P/Barra indices at the end of May and November of each year, just before the indices are rebalanced. Each chart begins May 1981 and ends November 2004. The sold vertical line in each panel separates the control sample from the test sample. The book-to-market ratios are constructed similarly to those used by S&P/Barra when rebalancing the indices. Equity value is defined as size at the end of May and November. Book value is common equity reported in Compustat at the end of the latest fiscal quarter at least six months prior to the end of June or December.