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Determining a mutual fund's equity class

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Abstract

Mutual fund investors who use an asset allocation model must be able to readily identify each fund's equity class. Prior studies examine two approaches to classifying equity funds, factor loadings and portfolio characteristics. Their implementation is not feasible for many investors, however. I investigate a practicable alternative, Morningstar's characteristics-based style box. I find that it does not predict mutual fund returns as well as a discrete factor-loadings-based alternative during 1994 to 2004 overall, but predicts better in 2003 to 2004 after Morningstar changed its methodology. I also find that fund classifications drift considerably over the years. Actively-managed-fund investors need to monitor their portfolios regularly.

JEL classification: G11

Keywords: Mutual funds; Asset allocation; Equity class; Investment style

1. Introduction

Knowledgeable mutual fund investors recognize that before they invest their first dollar, they need to develop a clear strategy to guide their investment selections. As Reilly and Brown (2000) explain, developing an investment strategy generally consists of four steps: (1) identifying the asset classes to be included in the portfolio, (2) determining the proportion of the portfolio to assign to each class, (3) specifying ranges within which the actual proportions will be allowed to vary, and (4) locating the specific mutual funds to purchase. This study assists investors in accomplishing the fourth step.

As generally defined, asset classes are groups of investments that have similar attributes,

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particularly with regard to risk and return. At the broadest level, the typical asset classes are stocks (equities), bonds, and cash. The stock and bond classes are usually divided into more narrowly delineated categories. Stocks, for example, are subdivided into domestic and international classes, then further subdivided into classes such as large capitalization (large cap) growth and value and small capitalization (small cap) growth and value.

Thus, mutual fund investors who want to construct a broadly diversified portfolio of U.S. equity funds might allocate their portfolio to each equity class in accordance with its U.S. stock market weighting, then select one mutual fund from each. In hope of beating the market, they might choose actively managed funds to represent one or more of the classes. The evidence in Chan, Chen and Lakonishok (2002) suggests that funds in the small cap growth class are worth considering. They find that small cap growth funds tend to achieve significant abnormal performance (on average, more than 3% per year during 1985–1997) even when measured against the Carhart (1997) four-factor benchmark.

Alternatively, investors trying to beat the market might overweight a particular class, relying on research that suggests one class tends to outperform the others. Fama and French (1992, 1993), for example, find that stocks with the smallest market equity and the highest book-to-market ratios tend to outperform other stocks. Trecartin (2000) finds that the strategy is reliable only over long investment horizons. Loughran (1997) concludes that to really exploit the difference between value and growth requires concentrated portfolios of small quintile firms, which only small funds can hold. Dhatt, Kim and Mukherji (1999), however, find an exploitable value premium in reasonably liquid small-cap stocks in the Russell 2000 index. During 1979 through 1997, the value stocks in their study outperformed the growth stocks by more than five percentage points per year. All in all, the evidence suggests that small cap value funds should achieve higher returns than funds in the other equity classes when measured over long investment horizons.

Whether investors want to construct a broadly diversified portfolio with funds from each equity class or a more focused portfolio that overweights a particular class, they face the daunting task of classifying domestic-stock mutual funds into “size” and “style” classes before they execute a selection strategy.[1] How can they accomplish this task? Prior mutual fund performance studies suggest two alternatives: factor loadings or portfolio characteristics.

Factor loadings are coefficients estimated in linear regressions of mutual fund returns on contemporaneous factor-portfolio returns. They indirectly reflect characteristics, such as size and style, of the stocks in the mutual fund portfolios. Carhart (1997) finds that size and style factors explain considerable variation in mutual fund returns, which suggests that the related factor loadings would be useful in classifying mutual funds. Davis (2001) uses market-capitalization and book-to-market factor loadings to classify mutual funds along size and style dimensions in his investigation of mutual fund performance by asset class. In contrast to Chan et al. (2002), Davis (2001) finds that no equity class generated significant abnormal performance during 1965 through 1998.

An obvious alternative to inferring a mutual fund’s size-and-style asset class from its factor loadings is to look at some more direct measure of the market-capitalization and book-to-market characteristics of the stocks in its portfolio. Daniel and Titman (1997) find these characteristics better than factor loadings at explaining cross-sectional variation in

corporate stock returns. Similarly, Daniel, Grinblatt, Titman and Wermers (1997) find characteristics-based benchmarks somewhat better able to explain mutual fund performance than factor portfolios.

These mutual fund performance studies do not directly compare the effectiveness of factor loadings and portfolio characteristics in classifying mutual funds. Chan et al. (2002) address this issue. They find that although continuous mutual fund portfolio characteristics and corresponding factor loadings produce similar conclusions regarding fund size and style ranks, the portfolio characteristics approach is somewhat better able to predict mutual fund returns.

None of these studies, however, employ data or methodologies that are currently feasible for the typical individual investor to use in determining a mutual fund's discrete equity class. One straightforward alternative is to use a readily available classification system from a commercial source. Large mutual fund data providers such as Lipper and Morningstar classify funds into discrete size-and-style asset classes. However, it is not clear that the Lipper and Morningstar characteristics-based approaches classify mutual funds as well as a factor-loadings alternative.

The primary objective of this study is to determine whether they do. Because Morningstar's equity style box classifications appear to be more readily available to individual investors, I select them for the comparison. The fundamental question is: Are the style boxes as useful in determining a mutual fund's size-and-style equity class as a discrete factor-loadings-based alternative? Taking an investor's perspective, I equate usefulness in classifying mutual funds with effectiveness in "predicting" mutual fund performance.

I also assess the longevity of the classifications. When faced with the task of initially selecting mutual funds for their portfolios, investors need to be able to determine a fund's equity class. However, as Reilly and Brown (2000) note, monitoring is also an important step in the portfolio management process. To assist in this process, investors need to know whether the mutual funds they select are likely to remain true to their respective equity classes.

The results of this study indicate that the equity style boxes do not predict mutual fund returns as well as a discrete factor-loadings-based alternative when the entire study period, 1994 to 2004, is taken into account. Nevertheless, when considering only 2003 to 2004, the period in the study after Morningstar changed its methodology, the style boxes predict better than the factor-loading alternative. The results also indicate that mutual fund equity classifications drift considerably over the years. For example, after one year, only 66% of equity funds retain their prior-year style box classification.

2. Data

I obtain the data from Morningstar, Inc. CDs, which are readily available to investors when they are issued. I include all open-end, diversified-domestic-equity funds with the required data in any of the twelve December-31-effective-date CD databases for the years 1993 through 2004. Each of these Morningstar CDs includes virtually all mutual funds that were available to investors at the time. The required data include mutual fund monthly total

returns and equity style box classifications. The December 31, 1993, CD is the first issued as of year-end in which the style box classifications were reported.

Morningstar's equity style box is a 3 × 3 table, like the following, in which equity mutual funds are classified vertically by size (large-, mid, or small-cap) and horizontally by style (value, blend, or growth) based on investment-weighted characteristics-scores of the stocks held in the fund portfolios.

		Investment Style		
		Value	Blend	Growth
Investment Size	Large	LV	LB	LG
	Mid	MV	MB	MG
	Small	SV	SB	SG

(1)

A stock's size score is determined by its market capitalization. Until May 30, 2002, a stock's style score was derived from a combination of its price-to-book and price-to-earnings characteristics. Since then, the style score has been based on ten characteristics, five representing a value component and five a growth component. The five value characteristics are price-to-projected earnings, price-to-book, price-to-sales, price-to-cash flow, and dividend yield. The five growth characteristics are long-term projected earnings growth, historical earnings growth, sales growth, cash flow growth, and book value growth. Morningstar determines each fund's style box based on the most current portfolio-holdings report it has obtained by the CD effective date. The number of funds satisfying the data requirement ranges from 670 at the beginning of the study period to 4,687 at the end. More details regarding Morningstar's style box methodology may be found on each CD and on its Website at http://www.morningstar.com/.

3. Methodology

To assess the usefulness of equity style boxes in determining a mutual fund's equity class, I compare the effectiveness of the style boxes and a discrete factor-loading-based alternative in predicting mutual fund performance. The factor-loading alternative is developed following Davis (2001). First, factor loadings (regression slope coefficients) are estimated over the 36 months through December of year T employing the following Fama and French (1993) three-factor regression model:

$$(R_{it}\text{-}RF_t) = a_{iT} + b_{iT}\,RMRF_t + s_{iT}\,SMB_t + h_{iT}\,HML_t + e_{it} \quad (2)$$

where

t = Each of the 36 months ending with December, year T

T = Each year 1993 through 2003

R_{it} = Mutual fund *i* total return in month *t*

$RMRF_t$ = Market return minus risk-free return, computed as the *CRSP* value-weighted aggregate market portfolio return in excess of the one-month Treasury-bill return, in month *t*

SMB_t = Return of value-weighted, zero-investment, *size* factor portfolio computed as "*S*mall *M*inus *B*ig," the average return on a portfolio of small capitalization stocks minus the average return on a portfolio of large capitalization stocks in month *t*

HML_t = Return of value-weighted, zero-investment, *style* factor portfolio computed as "*H*igh *M*inus *L*ow," the average return on a portfolio of high book-to-market equity (value) stocks minus the average return on a portfolio of low book-to-market equity (growth) stocks in month *t*

s_{iT}, h_{iT} = Mutual fund *i* SMB and HML factor loadings at end of year *T*

Thus, factor loadings are estimated over the 36 months January 1991 - December 1993, January 1992–December 1994, and so on through January 2001–December 2003. Factor portfolio returns are obtained from http://web.mit.edu/kfrench/www/Data_Library/f-f_factors.html, the Kenneth French Website.

Next, as of the beginning of each year $T+1$, 1994–2004, funds are sorted independently into one of three equal SMB and HML categories based on their respective factor loadings, s_{iT} and h_{iT}, at the end of the preceding year. Finally, they are placed into one of nine size-and-style equity classes based on the intersection of their SMB and HML ranks. Listed in equity style box numerical order, the nine classes are: large-cap value, blend, and growth (LV, LB, LG); midcap value, blend, and growth (MV, MB, MG); and small-cap value, blend, and growth (SV, SB, SG). Because of the construction of the SMB and HML factor portfolios, funds with the highest (lowest) s_{iT} tend to invest in small (large) cap stocks and funds with the highest (lowest) h_{iT} tend to invest in value (growth) stocks. In this discrete factor-loadings-based classification system, a fund with, for example, the highest s_{iT} rank and the lowest h_{iT} rank is placed in the small cap growth equity class.[2]

To evaluate the two classification methods, I compare their ability to predict following year monthly returns. Similar to Chan et al. (2002), I focus on the situations in which they are most different. I identify those instances in the following manner. First, I compare the mean monthly returns of the corresponding style-box and factor-loading equity-class portfolios. Each portfolio consists of all funds within a class at the beginning of the year based on either their equity-style-box or discrete-factor-loading classification. The portfolios are established at the beginning of each year 1994–2004. Portfolio returns are computed as the equally weighted returns of all funds in the portfolio. I highlight each equity class with a significant difference in monthly returns

between the two classification methods. Then, I select for prediction accuracy tests the funds that are included in one of these highlighted classes using one of the classification methods but not in that class using the other method.

Similar to Chan et al. (2002), "to magnify potential contrasts," I focus the tests on the months in the following year with the largest differences between value and growth stock returns.[3] These are the months in which the realized return on HML is the highest and the months it is the lowest. I develop predicted return equations for the selected funds in these months using the following regression model and data for all other funds (i.e., not including the selected funds):

$$R_{it} = \alpha_t + \sum_{j=1}^{8} \beta_{jt} D_{ijT} + \varepsilon_{it} \tag{3}$$

where

T = Each year 1993 (the first for which equity style box classifications were available) through 2003

t = Month HML is highest or lowest in year T+*1*

R_{it} = Total return of mutual fund *i* in month *t*, year *T+1*

D_{ijT} = Dummy variables for the eight equity classes other than small-cap-value. The dummy variable is 1 if a fund is, 0 if it is not, classified in one of the eight classes (large-cap-value, blend, growth; midcap-value, blend, growth; small-cap-blend, growth) using either the equity-style-box or the discrete-factor-loading classifications as of December 31, year *T*

α_t = Regression intercept, which represents the average monthly return to small-cap-value funds

β_{jt} = Regression parameters, each of which represents the difference between the average monthly return to small-cap-value funds and that of funds in one of the other eight equity classes

I compute predicted returns, errors, and absolute errors for the selected funds and months using, alternatively, the discrete-factor-loading equation and the equity-style-box equation for the respective month, then examine the differences. The results answer the question: Are the style boxes as useful in determining a mutual fund's equity class as a discrete factor-loadings-based alternative?

Finally, I evaluate the stability of fund size-and-style classifications. I compare a fund's equity class at the end of one year with its class one and three years later. I also examine whether funds in particular classes are more likely to drift and whether funds that do are more likely to change their size or style characteristic.

Table 1A Descriptive statistics by equity class and classification method based on discrete factor loading classification

Equity class	Number of funds	Net assets ($ million)	SMB factor loading	Market cap ($ million)	HML factor loading	Price-to-book	Annual return (%)
LV	164	1290	−0.13	20008	0.34	3.82	11.2
LB	326	1064	−0.17	34773	0.03	5.18	10.7
LG	219	892	−0.19	42268	−0.33	6.59	10.5
MV	284	797	0.10	10765	0.39	3.40	11.8
MB	217	859	0.10	16936	0.06	4.73	10.3
MG	210	941	0.13	19098	−0.36	6.23	10.8
SV	262	390	0.65	1383	0.45	2.86	12.8
SB	168	324	0.65	2221	0.05	4.29	10.7
SG	281	451	0.68	3016	−0.45	6.02	10.5

LV, LB, LG, MV, MB, MG, SV, SB, and SG refer, respectively, to large cap value, blend, and growth; mid-cap value, blend, and growth; and small-cap value, blend, and growth equity classes. Funds are classified as of the beginning of each year $T+1$, 1994–2004, based on their prior year-end discrete factor loading (DFL) or equity style box (ESB) classification. DFL classification results from independent sorts of funds into three equal size (large-, mid-, and small-cap) and style (value, blend, and growth) classes based, respectively, on their SMB and HML factor loadings. Factor loadings are estimated using the Fama and French (1993) three-factor model over the 36 months ending December 31, year T. ESB classification is determined by Morningstar based on investment-weighted size and style characteristics-scores of the stocks held in the fund portfolios. Mutual fund market capitalization and price-to-book portfolio characteristics are computed by Morningstar using the most recent mutual fund portfolio reports as of December 31, year T. Equally weighted-mutual-fund annual means of the reported items are computed for each equity class. Table 1 reports the eleven-year averages of the annual means.

4. Empirical results

Tables 1A and 1B, respectively, report for each of the two classification methods, discrete factor loading (DFL) and equity style box (ESB), descriptive statistics by equity class. The statistics include time-series-mean number of funds, net assets, SMB and HML factor loadings, market capitalization and price-to-book portfolio characteristics, and annual returns. Virtually all reflect considerable differences between the two classification methods. Differences in the mid- and small-cap fund statistics are particularly noteworthy.

DFL classifies more funds than ESB as mid- and small-cap (and fewer as large-cap). The average number of funds classified as mid- and small-cap using DFL is 237 each while the averages using ESB are 165 and 141. On average, mid- and small-cap funds tend to be larger under DFL than ESB. DFL mid- and small-cap funds have average net assets of $866 and $388 million, while ESB mid- and small-cap funds have $510 and $269 million.

The mutual fund portfolio size characteristic, market capitalization, is another example of large differences between DFL and ESB. On average, funds classified as mid- and small-cap using DFL held portfolios with an investment-weighted market capitalization of $15,600 and $2,207 million. Funds classified as mid- and small-cap using ESB tended to hold portfolios with a much smaller market capitalization: $3,715 and $688 million. Differences in the mutual fund portfolio style characteristic, price-to-book, suggest that DFL-classified mid- and small-cap funds tend to have less of a value orientation than the corresponding ESB-classified funds. Using DFL, the midcap fund investment-weighted price-to-book ratio

Table 1B Descriptive statistics by equity class and classification method based on equity style box classification

Equity class	Number of funds	Net assets ($ million)	SMB factor loading	Market cap ($ million)	HML factor loading	Price-to-book	Annual return (%)
LV	385	1099	−0.05	20449	0.27	3.81	10.3
LB	487	1090	−0.09	32892	−0.02	5.39	10.3
LG	339	1028	−0.01	32310	−0.33	7.01	10.9
MV	120	501	0.19	4185	0.39	2.90	12.6
MB	131	511	0.31	3508	0.12	4.01	12.5
MG	245	519	0.48	3451	−0.33	6.29	11.1
SV	105	255	0.64	565	0.44	2.32	14.5
SB	126	267	0.72	698	0.22	3.38	13.3
SG	191	286	0.83	801	−0.27	5.35	12.4

LV, LB, LG, MV, MB, MG, SV, SB, and SG refer, respectively, to large cap value, blend, and growth; mid-cap value, blend, and growth; and small-cap value, blend, and growth equity classes. Funds are classified as of the beginning of each year $T+1$, 1994–2004, based on their prior year-end discrete factor loading (DFL) or equity style box (ESB) classification. DFL classification results from independent sorts of funds into three equal size (large-, mid-, and small-cap) and style (value, blend, and growth) classes based, respectively, on their SMB and HML factor loadings. Factor loadings are estimated using the Fama and French (1993) three-factor model over the 36 months ending December 31, year T. ESB classification is determined by Morningstar based on investment-weighted size and style characteristics-scores of the stocks held in the fund portfolios. Mutual fund market capitalization and price-to-book portfolio characteristics are computed by Morningstar using the most recent mutual fund portfolio reports as of December 31, year T. Equally weighted-mutual-fund annual means of the reported items are computed for each equity class. Table 1 reports the eleven-year averages of the annual means.

averages 4.79 and that of the small-cap fund, 4.39. The price-to-book characteristic averages 4.40 and 3.68 for mid- and small-cap funds when ESB is used.

In summary, under ESB funds classified as mid- and small-cap tend to be smaller and invest in smaller, more value-oriented firms. If market capitalization and price-to-book are inversely related to returns, as prior research suggests, ESB mid- and small-cap funds should have somewhat higher returns over long investment horizons than corresponding DFL funds. The mean annual returns in Table 1 appear to confirm this expectation, although as Trecartin (2000) suggests, an eleven year study period will not always find that smaller outperforms larger or that more-value-oriented outperforms more-growth-oriented. During 1994–2004, the average ESB mid- and small-cap fund in each of the three style classes generated a mean annual return that was more than the corresponding DFL fund. For example, the average ESB small-cap-growth fund earned 12.4% per year while the average DFL fund earned 10.5%.

The average ESB small-cap-value fund also outperformed the corresponding DFL fund: 14.5% per year versus 12.8%. This result appears to be consistent with Loughran (1999). As Table 1 statistics show, the average ESB small-cap-value fund is smaller than the average DFL fund (net assets: ESB, $255 million; DFL, $390 million), invests in smaller firms (portfolio market capitalization: ESB, $565 million; DFL, $1,383 million) and invests in more value-oriented firms (portfolio price-to-book: ESB, 2.32; DFL, 2.86).

Table 2 takes a closer look at the performance differences by comparing mean monthly returns for corresponding DFL and ESB equity class portfolios. The portfolios are formed at the beginning of each year 1994 through 2004 based on prior year-end DFL or ESB

classifications. Monthly returns are computed for each portfolio as the equally weighted-average monthly total returns of all funds in the portfolio. This process creates a 132-month series of post-portfolio-formation returns for each DFL and ESB equity class portfolio. Table 2 reports the means of each series (in percent per month).

There appear to be large differences in the midcap-blend (−0.20%) and three small-cap portfolios (value, blend, and growth: −0.15%, −0.21%, and −0.20%, respectively). The small-cap-value difference (−0.15%) is significantly different from zero at a 0.01 level. As expected in light of the Table 1 annual returns, the signs on the monthly return differences are negative, which indicates that the DFL portfolio mean monthly returns are less than the corresponding ESB portfolio returns. Together, Tables 1 and 2 indicate that the relative underperformance in monthly returns occurs when the DFL equity-class-average market cap is greater than that of the corresponding ESB class, which is consistent with the earlier observation regarding annual returns.

Results in the preceding tables establish that the factor loading and style box methodologies do not produce the same classification for all funds. The question now is, Which is better? The factor loading approach has credibility because of its rich heritage (beginning with Fama & French, 1993). In addition, it has been used in prior studies to classify mutual funds (e.g., Davis, 2001). Although the style box method has not been tested or used in prior studies, it appears to be widely employed in practice. The *CNN Money Magazine* and *CNBC MSN Money*, as well as the Charles Schwab and TD Waterhouse Websites, for example, all rely on this system to determine mutual fund equity classes.

Comparisons of the ability of each method to predict following-year monthly mutual fund returns address the question of which is better. As explained earlier, return prediction models are estimated using linear regressions of certain following-year monthly returns on qualitative variables that represent the eight equity classes other than small-cap-value, which is represented by the regression constant. The following-year monthly returns for each fund are the one from the month in which HML is the highest for the year and the one from the month in which it is the lowest. The prediction models are estimated using all funds other than those for which returns are predicted. Returns are predicted for funds classified significantly differently by the two discrete classification methods, more specifically, for funds classified as small-cap-value using either DFL or ESB; but not both DFL and ESB.

The (unreported) 46 percent average adjusted R^2 of each series of prediction model regressions indicates that the discrete classification methods, DFL and ESB, are similar in their ability to explain variation in following year monthly returns. These statistics also indicate that the discrete classification variables do well in comparison to the continuous factor-loading variables, s_{iT} and h_{iT}, and the continuous portfolio characteristics, market cap and price-to-book. Using s_{iT} and h_{iT} (natural logs of market cap and price-to-book) rather than the qualitative variables as the predictors produces a 51 (47) percent average adjusted R^2.

The results in Table 3 more specifically address which of the two discrete methods better determines a mutual fund's equity class by comparing which better predicts future returns. Actual and predicted monthly returns and errors (in percent per month) are averaged over the months in which HML is lowest and highest. Panel A reports results for the overall study period, 1994 through 2004. During this period, the DFL method appears to generate

Table 2 Equity class mean monthly returns by classification method

Equally weighted mean monthly returns (percent)					
Equity class	DFL	ESB	Difference	*t*	*p*-value
LV	0.88	0.81	0.07	1.09	0.28
LB	0.82	0.78	0.04	0.64	0.52
LG	0.77	0.80	−0.03	−0.40	0.69
MV	0.93	1.00	−0.07	−1.30	0.20
MB	0.81	1.01	−0.20	−1.89	0.06
MG	0.80	0.88	−0.08	−0.50	0.62
SV	1.02	1.17	−0.15	−3.01	0.00
SB	0.87	1.08	−0.21	−1.58	0.12
SG	0.82	1.02	−0.20	−1.76	0.08

DFL and ESB refer, respectively, to the discrete-factor-loading and equity-style-box classification methods. Table 2 reports mean monthly returns (in percentage) for corresponding DFL and ESB equity class portfolios. The portfolios are formed at the beginning of each year 1994 through 2004 based on prior year-end DFL or ESB classifications. Monthly returns are computed as the equally weighted-average monthly total returns of all funds in an equity class portfolio.

somewhat more accurate predictions. In months HML is lowest, the average monthly prediction error of −0.28% using the DFL classification method is closer to zero than the 1.15% average error using the ESB method. DFL's 2.32% mean absolute error also is less than ESB's 2.56%. Although the average monthly prediction errors are similar in the months HML is highest (DFL, 1.41%; ESB, −1.42%), the mean absolute errors again are lower using DFL (DFL, 2.20%; ESB, 2.36%).

As the results in Panels B and C suggest, however, the relative shortcomings of the ESB approach may have been eliminated in May 2002 when Morningstar changed its methodology. As Panel B shows, during 1994 through 2002, the study period before the ESB changes, the DFL method better predicts following-year monthly returns according to all reported measures. DFL average monthly prediction errors are closer to zero when HML is lowest (DFL, −0.73%; ESB, 2.27%) and when it is highest (DFL, 1.56%; ESB, −2.28%). Similarly, DFL mean absolute errors are lower in both cases (by −0.52% and −0.58%).

The results change noticeably in Panel C. In all reported comparisons, ESB predicted returns appear to be more accurate than those using the DFL approach. For example, ESBs mean absolute errors are less than DFLs by 0.11% in months HML is lowest and 0.34% when HML is highest. The two years reflected in Panel C are not sufficient time to conclude that the new ESB methodology is better than the DFL approach, but the new ESB seems to be a considerable improvement over the old and seems to provide investors with a feasible method for determining a mutual fund's equity class.

The results in Tables 4A and 4B, relating to equity class drift, indicate why it is important for investors to have a practicable method for classifying a mutual fund and for employing it, regularly, to evaluate the equity class allocations within their portfolios. Table 4A reports the percentage remaining in a class and the percentages "drifting" into one of the other eight classes one (three) years after the initial classification. As the diagonal averages show, on average only 66% of funds are still in the same equity class one year later and only 51% are in the same class three years later.

Table 3 Realized and predicted monthly returns and return prediction errors (percent per month)

Months HML lowest highest	Mutual fund monthly return	Using distrete-factor-loading (DFL) model			Using equity-style-box (ESB) model			Absolute error difference
		Predicted return	Error	Absolute error	Predicted return	Error	Absolute error	
Panel A: 1994–2004								
Lowest	2.13	1.85	−0.28	2.32	3.18	1.15	2.56	−0.23
Highest	−3.04	−1.63	1.41	2.20	−4.48	−1.42	2.36	−0.16
Panel B: 1994–2002								
Lowest	4.50	3.77	−0.73	3.01	6.77	2.27	3.53	−0.52
Highest	−3.66	−2.10	1.56	2.58	−5.94	−2.28	3.16	−0.58
Panel C: 2003–2004								
Lowest	−0.67	−0.41	0.25	1.51	−0.94	−0.16	1.40	0.11
Highest	−2.31	−1.07	1.24	1.75	−2.80	−0.39	1.41	0.34

The monthly return prediction errors are computed as the differences between realized monthly returns and predicted returns that are computed using coefficients estimated in regression model 3 and fund discrete-factor-loading or equity-style-box classifications. The regression prediction models are estimated using all funds in the study except the ones for which returns are predicted.

The data also suggest that growth funds tend to be more stable than value or blend funds, and that large-cap funds tend to be more stable than mid- or small-cap funds. In each size class, higher proportions of growth funds retain their equity class than either blend or value funds. In each style class, a higher proportion of large-cap funds retain their equity class than either mid- or small-cap funds. For example, among large-cap funds, 81 (76) percent of large-cap-growth funds retain their equity class after one (three) year(s), while only 75 (65) percent of large-cap-blend funds and 70 (55) percent of large-cap value funds do.

Chan et al. (2002) suggest that a fund manager may shift a fund's equity class in an effort to time size or style trends in the market (e.g., to obtain expected superior relative performance by large-cap or growth stocks) or, for self-preservation, to replace what appears to be a failing investment strategy. The results in Table 4B suggest that fund managers are more likely to change their portfolio style than size characteristics. For example, of the approximately 34% of funds drifting over one year from one equity class to another, 22.5% change style and 8.3% change size characteristics. Fund prospectuses may be more restrictive with regard to size than style.

All in all, this evidence implies that an investor needs to monitor the size and style classification of each actively-managed mutual fund in the portfolio. Otherwise, the proportion invested in a particular asset class may drift outside the range specified in the investment policy statement and adversely affect the risk and return characteristics of the portfolio.

5. Conclusions and implications

To implement the fourth step in the investment strategy described by Reilly and Brown (2000), locating the specific mutual funds to purchase, investors must first be able to sort funds into equity classes. Prior studies have established the usefulness of factor loadings and

Table 4A Funds remaining in, and drifting from, initial equity class after one (three) years—indicated by percentages in each row

	Percentage in equity class after one (three) years									
Initial Equity Class	LV	LB	LG	MV	MB	MG	SV	SB	SG	Total
LV	**75 (65)**	18 (25)	2 (4)	4 (4)	1 (1)	0 (0)	– (0)	0 (0)	– (–)	100 (100)
LB	13 (20)	**70 (55)**	14 (21)	1 (2)	1 (1)	1 (1)	– (–)	0 (0)	0 (0)	100 (100)
LG	1 (2)	13 (14)	**81 (76)**	0 (0)	1 (1)	4 (7)	– (–)	0 (–)	– (0)	100 (100)
MV	20 (28)	4 (10)	1 (2)	**53 (35)**	17 (16)	2 (5)	1 (2)	1 (2)	0 (1)	100 (100)
MB	4 (8)	8 (17)	3 (10)	14 (10)	**45 (28)**	20 (21)	1 (1)	3 (2)	2 (2)	100 (100)
MG	0 (1)	1 (4)	6 (12)	1 (1)	10 (9)	**72 (59)**	0 (0)	1 (2)	8 (12)	100 (100)
SV	0 (1)	– (0)	– (0)	3 (5)	3 (6)	1 (2)	**65 (42)**	25 (35)	4 (9)	100 (100)
SB	– (–)	0 (1)	0 (0)	1 (3)	5 (5)	2 (9)	16 (14)	**54 (36)**	21 (32)	100 (100)
SG	0 (–)	0 (1)	– (1)	0 (1)	1 (4)	12 (18)	1 (1)	10 (10)	**75 (65)**	100 (100)
Diagonal Average										**66 (51)**

For funds classified into one of nine equity classes using the Equity Style Box (ESB) methodology at the end of year *T*, Table 4A shows the percentage remaining in that class and the percentages "drifting" into one of the other eight classes after one (three) year(s). "–" indicates that there are no funds in the category, "0" that the number of funds rounds to zero.

portfolio characteristics to classify funds. But these studies have evaluated continuous variables. It is unlikely that individual investors would be willing or able to determine appropriate equity class "break points" along these continuous dimensions.

As a result, their implementation is not feasible for many investors. I evaluate a practicable alternative, Morningstar's characteristics-based equity style box, by comparing it to a "theoretical benchmark," a discrete factor-loadings-based alternative. I find that the equity style box approach does not predict mutual fund returns as well as the discrete factor-loadings-based alternative during the overall study period, 1994 through 2004.

Table 4B Aggregation of changes in equity class by size, style, and combination of size and style

Initial equity class	Of funds drifting over one year from initial equity class, percentage changing:			Of funds drifting over three years from initial equity class, percentage changing:		
	Size class	Style class	Size and style classes	Size class	Style class	Size and style classes
LV	3.9%	20.1%	1.2%	4.2%	29.7%	1.1%
LB	1.3%	27.0%	1.6%	1.2%	41.0%	2.6%
LG	3.6%	14.3%	0.8%	7.3%	15.4%	1.1%
MV	20.7%	19.3%	6.5%	30.1%	20.6%	14.0%
MB	11.0%	34.0%	10.1%	19.3%	31.3%	21.6%
MG	13.8%	11.1%	3.0%	23.9%	9.9%	6.7%
SV	3.4%	28.7%	3.3%	5.8%	43.6%	8.8%
SB	4.6%	37.2%	4.0%	5.6%	46.4%	12.5%
SG	12.1%	11.0%	1.4%	18.5%	11.6%	4.7%
Mean	8.3%	22.5%	3.5%	12.9%	27.7%	8.1%

Table 4B shows Aggregate changes by size alone (e.g., LV to MV), style alone (for example, LV to LB), and combination of size and style (LG to MB).

Morningstar changed its equity style box methodology in May 2002, however. When I split the study around this event, I find that the style boxes predict worse than the factor-loadings alternative in the period before the change (1994–2002) but better in the period after (2003–2004). It is too soon to tell whether the new methodology makes the equity style boxes a reliably better approach to determining a mutual fund's asset class than the discrete factor-loadings-based alternative tested in this study. Nevertheless, today they are one of the few methods readily available to individual investors. As such, the results in this study suggest that they currently provide a serviceable approach to classifying mutual funds.

Whether there might be a better factor-loadings-based alternative is another question. This study tested several discrete size-and-style factor-loadings-based methods for classifying mutual funds. It did not, however, attempt to develop a more robust alternative. Similar to the improved equity style box methodology, which increases the number of portfolio characteristics that are taken into account in determining style box classifications, an enhanced discrete factor loadings alternative might be based on more than just the size (SMB) and style (HML) factors. An obvious addition is the Carhart (1997) momentum factor (UMD). Although not readily available to individual investors today, if found to be more accurate and reliable in classifying mutual funds, such a discrete factor-loadings based system could easily be developed and made available to individual investors by a firm like Morningstar.

Finally, the findings in this study indicate that investors should monitor their fund size and style characteristics regularly if they use actively managed funds. There is considerable evidence that fund size and style classifications tend to drift over the years. Investors should not be blasé about this task because equity class drift can drastically change the risk and return characteristics of their portfolios. Investors looking for a simple solution might consider using size-and-style index funds instead of actively managed funds.

Notes

1. I use the terms "size" and "style" to distinguish, respectively, the small-to-large and value-to-growth dimensions of equity investments.
2. I also tested two discrete factor-loadings-based alternatives to assess whether the classification methodology made a difference. For one, I sorted funds into size and style equity classes based on whether their SMB and HML factor loadings were significant at the 0.10 level. For the other, I classified funds using a 20%/60%/20% rule rather than the equal-33⅓% rule described above. Neither significantly changed the discrete factor loading results.
3. In contrast to Chan et al. (2002), however, and in light of evidence presented later regarding considerable equity class drift over the years, I include only the one (not the two) month(s) with the highest and the one (not the two) with the lowest realized returns in the following one (not two) years.

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