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ON MUTUAL FUND
INVESTMENT STYLES

Louis K.C. Chan
Hsiu-Lang Chen
Josef Lakonishok

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ABSTRACT

We provide an exploratory investigation of mutual funds' investment styles. Funds' styles tend to cluster around a broad market benchmark. When funds deviate from the benchmark they are more likely to favor growth stocks with good past performance. There is some consistency in styles, although funds with poor past performance are more likely to change styles. Some evidence suggests that growth funds have better style-adjusted performance than value funds. The results are not sensitive to style identification procedure, but an approach based on fund portfolio characteristics performs better in predicting future fund returns.

Louis K.C. Chan
Department of Finance
College of Commerce and
    Business Administration
University of Illinois Urbana-Champaign
1206 South Sixth Street
Champaign, IL 62820
l-chan2@uiuc.edu

Hsiu Lang Chen
Department of Finance
College of Commerce and
    Business Administration
University of Illinois Urbana-Champaign
1206 South Sixth Street
Champaign, IL 62820

Josef Lakonishok
Department of Finance
College of Commerce and
    Business Administration
University of Illinois Urbana-Champaign
1206 South Sixth Street
Champaign, IL 62820
and NBER
lakonish@ux1.cso.uiuc.edu

Many crucial investment decisions rest on identifying and selecting portfolio managers who are expected to deliver superior performance. Professional investment managers, however, follow a variety of approaches. Some rely solely on quantitative models. Others are more qualitatively-oriented and consider information from sources such as firm managers, press reports and security analysts' recommendations. They adopt different criteria for stock selection – identifying underpriced securities, seeking growth potential, or following past price trends, to use a handful of examples. The bewildering variety of approaches complicates the already difficult problem of evaluating the performance of investment managers.

One segment of the institutional investment community, namely, pension funds, has responded to the proliferation of investment approaches by paying more attention to a manager's investment style. The focus on style stems from several motivations. Taking a manager's style into account helps in performance evaluation by giving a clearer picture about the manager's skill. For example, a manager who invests in small stocks should not necessarily deserve all the credit if the portfolio did well in a particular period; rather, small stocks in general may have done better than the market benchmark. A second stimulus arises from plan sponsors' desires to control the risk of the overall portfolio. A plan sponsor might select a few active managers who are expected to achieve superior performance, but this may be scant comfort if they all follow similar styles. In this case they would tend to select similar stocks, resulting in an overall portfolio that is highly undiversified relative to a broad-based benchmark. By picking managers with different styles, a sponsor can avoid large deviations in performance away from a general index.

The focus on style has gradually carried over into another group of institutional investors, mutual funds. Investor interest in mutual funds has exploded in recent years. At the end of 1990, fund net assets stood at 246 billion dollars but soared to 1.3 trillion dollars by 1995 and 2.4 trillion dollars by 1997. In part, the growth has been fueled by the increase in defined contribution or 401(k) pension assets. Administrators of such plans have a fiduciary responsibility to provide an appropriate variety of asset classes to participants. As a result, many administrators screen

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funds and present to employees a menu of funds representing different styles. More generally, individual investors are becoming more educated and sophisticated about allocating their assets across mutual funds with different objectives. To a growing extent, therefore, fund managers and fund investors alike recognize the importance of differentiating funds in terms of their investment styles. For example one leading vendor of information on mutual funds, Morningstar, classifies funds by investment style in terms of two dimensions: market capitalization and value-growth orientation. Consulting firms and software vendors are also providing investors with the tools to identify investment style.[1]

Academic research has generally lagged behind investors' interest in fund styles. To help correct the imbalance, this paper provides an exploratory investigation of the investment styles of mutual funds. In doing so we hope to improve our understanding of the behavior of this large and growing group of investors. Specifically, we begin by documenting the characteristics of fund portfolios. When placed alongside results on the pension fund industry (see, for example, Lakonishok, Shleifer and Vishny (1997)), our findings help uncover reasons why so few institutional investors demonstrate consistently superior performance. We also provide evidence on consistency in fund styles over time, and the forces that may drive managers to change styles. In addition to being an important practical issue to fund investors, shifts in style may reflect situations where managers' behavior are influenced by considerations other than the maximization of portfolio risk-adjusted performance. Although the issue of fund performance is not our main concern, our analysis also lets us check whether differences in style are associated with differences in performance. Finally, this paper provides a comparative evaluation of the performance of different methodologies for style identification.

In studying the distribution of fund styles we intend to provide some clues to resolve an apparent paradox in fund performance. Previous academic research on mutual funds has extensively studied their investment performance. Important contributions have been made by, among others, Jensen

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[1]Hemmerick (1998), for example, reports on software provided over the Internet, based on work by William Sharpe, to analyze fund style.

(1968), Ippolito (1989), Elton, Gruber, Das, and Hlavka (1993), and Malkiel (1995). Other studies examine whether there is persistence in performance (Grinblatt and Titman (1992), Hendricks, Patel and Zeckhauser (1993), Brown and Goetzmann (1995), Elton, Gruber and Blake (1996)). In general the findings do not seem to indicate that funds as a group out-perform passive benchmarks. This evidence is even more striking when juxtaposed against the voluminous research documenting an assortment of return anomalies. For example, a portfolio of "value" stocks (with high ratios of book-to-market value of equity) generated on paper returns that have in the past averaged five percent per year in excess of the S&P 500 index. The puzzle then is why there is such a scarcity of funds with consistently superior performance.

One place to look for possible explanations is in the pension fund industry. A growing area of research indicates that institutional investors' behavior may be colored by considerations beyond the maximization of portfolio return or diversification. In the case of defined-benefit pension plans, for instance, Lakonishok, Shleifer and Vishny (1992) point out that many parties influence the process of investing pension assets, including corporate managers, treasurers, external consultants and money managers. Given the multiplicity of such interests, an agency problem arises. One result is that external investment managers are evaluated not only in terms of investment performance, but also along dimensions such as prudence, which in practice is influenced by what other managers are doing. Accordingly, a manager's holdings, as well as the return on the portfolio, are scrutinized. For example, Lakonishok, Shleifer and Vishny (1994) speculate that money managers' concerns about their careers lead them to tilt toward investing in growth stocks.[2]

Based on the evidence for pension fund managers, one conjecture is that there are similar non-

[2]The agency problem in pension fund management shows up in other forms as well. For example, Lakonishok, Shleifer, Thaler and Vishny (1991) find evidence that managers tend to rebalance their portfolios at year-end away from poorly-performing (and hence potentially embarrassing) stocks toward larger, more successful firms (which are easier to justify to plan sponsors). Similarly, the pressures of relative performance benchmarking may create an incentive for institutions to herd (buy or sell the same stocks at the same time), as studied by Lakonishok, Shleifer and Vishny (1992).

performance considerations that affect mutual fund managers' choice of investment styles.[3] To the extent that these choices degrade performance, then a result is the general underperformance of mutual funds. Mechanically extrapolating the argument about non-performance distortions within the pension fund industry to mutual funds would not be appropriate, however. Unlike a pension fund, there are typically fewer intermediaries such as firm managers, treasurers or consultants between investors and mutual fund managers. On this account mutual fund managers should be able to concentrate more on maximizing return for a given level of risk. However, other influences may also come into play. Managers' personal career concerns, together with the relatively short horizons over which they are evaluated, may induce them to play it safe and not deviate substantially from popular benchmarks (such as the S&P 500). There may be room for distortions because some investors are slow to move away from poorly-performing funds. Their inertia may reflect search costs (see, for example, Sirri and Tufano (1998)), or cognitive biases (Goetzmann and Peles (1997)).

Our examination of the investment styles followed by U.S. equity mutual funds checks for the importance of non-performance distortions (because of agency or other reasons). Taking at face value the evidence on return anomalies, an outside observer might expect to find that mutual funds should aggressively pursue certain investment strategies that have been documented to produce superior returns in the past. An alternative hypothesis is that managers face high personal career risks for adopting these styles. Instead, they choose portfolios that do not deviate markedly from market benchmarks (Lakonishok, Shleifer and Vishny (1997) refer to such behavior as "bunching at the center"). In so doing they hope to avoid being penalized for under-performance, but sacrifice the opportunity for out-performance.

A second task of this paper is to see if there is consistency in fund styles. The concept of investment style rests on the premise that fund managers select from a well-defined domain such as

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[3]Some evidence is accumulating about the incentives faced by mutual fund managers and how they shape funds' behavior. Grinblatt, Titman and Wermers (1995) investigate herding behavior for mutual funds. Brown, Harlow and Starks (1996), Chavalier and Ellison (1997) find that a mutual fund's past performance affects its future risk-taking behavior. Karceski's (1998) model suggests that funds tend to favor growth stocks over value stocks.

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small stocks or growth stocks. It is possible that managers structure their portfolios very differently. For example, they may choose stocks they believe to be underpriced regardless of underlying traits such as size or book-to-market. In this case, the same manager would tend to drift between stocks with very different features, and hence the idea of a coherent style would not be meaningful. At this most basic level, therefore, it is important to check for consistency in styles to verify that they correspond to meaningful dimensions of fund behavior. In practical terms, an investor structuring a portfolio of funds would be concerned if fund managers deviate from their declared styles. This would introduce additional variability in the overall portfolio relative to a benchmark. A final motivation for checking on style consistency is in the context of the above discussion of distortions in investment behavior. In particular, in some situations a manager may have an incentive to deviate from his declared style, in hopes of recovering from past losses or simply to follow the crowd and adopt whichever style has been successful. For these reasons we check to see if there is any consistency in fund style, and whether funds alter their styles in response to past performance.

A final contribution of this paper is on the methodological front. While there is little disagreement on the importance of style identification, there is scant scientific evidence on how this is to be done most informatively. One approach (Sharpe (1992), Carhart (1997)) which is commonly used by practitioners and academics is to relate the past history of fund returns to observable indices or factors (see also Brown and Goetzmann (1997)). Each index represents a dimension of the behavior of returns corresponding to a particular style (for example, small stocks or value stocks). The fund's estimated sensitivities or loadings are taken as measures of its style. Alternatively, the characteristics of the stocks held by a fund serve as another indicator of the types of firms in which the fund invests, and hence its style. Grinblatt and Titman (1989) use such an approach to evaluate fund performance. While each method has its strengths and limitations, there has been little work evaluating the performance of each approach on actual fund data. On a related note, Daniel and Titman (1997) find that stock characteristics rather than factor loadings explain the cross-sectional behavior of average returns. We confront the different approaches to style classification on a broad

sample of funds. Style measures based on factor sensitivities are compared against measures using portfolio holdings.

Our basic finding is that mutual funds tend to adopt styles that cluster around a broad index such as the Standard & Poor's 500 index. Few funds take extreme positions relative to the index. When they choose to stray from the benchmark, however, they are more prone to favor growth stocks and stocks with good past performance. These results from the mutual fund industry, together with related evidence from the pension fund industry, are consistent with explanations related to agency or behavioral factors.

Funds overall display some consistency in the styles they follow, suggesting that the dimensions we use are meaningful portrayals of fund behavior. However, funds who have performed poorly in the past are more prone to subsequent shifts in style. Such style drifts are particularly notable in the case of value funds which have experienced poor past performance (compared to growth funds with poor returns).

Our basic findings are not sensitive to the procedure used to identify fund style. A fund's portfolio characteristics, and its factor sensitivities, generally give similar readings of its style. Confronting the two approaches in those cases where they differ, however, we find that the approach based on portfolio characteristics tends to do a better job in predicting future fund performance.

The rest of the paper is organized as follows. Section 1 describes the data and gives some details on the characteristics of mutual fund portfolios. Section 2 provides another perspective on funds' styles in terms of their exposures to common return factors. As a bridge to prior research, we also provide some results on average fund performance classified by style in this section. Section 3 deals with funds' style consistency and its relation to past performance. A comparison of the two approaches to style analysis is contained in section 4. A final section concludes.

1. Mutual fund portfolio characteristics

1.1. Data

Our analysis is based on two datasets from Morningstar, Inc. The sample includes all domestic equity funds existing at the end of 1997. Data on defunct funds is available as well, but begins only in 1989. Given that our focus is on fund styles and not fund performance, the presence of a survivorship bias in the earlier years of the sample period may be a less worrisome concern. The first dataset reports monthly fund returns from January 1976 to December 1997. A second dataset reports funds' portfolio holdings, beginning in 1983. After merging the two datasets and checking against the Compustat file, there are 3,336 funds with information on returns and holdings as of the end of 1997.

Table I reports the number of funds at the end of each calendar year over the sample period. The size of the sample grows over time, with particularly high growth during the 1990s. In addition, the table compares the performance of the sample with the return on several market indices. To measure aggregate fund performance, we compute monthly returns on the equally-weighted portfolio of funds and then compound to get calendar year returns. The verdict on aggregate performance is familiar – net of expenses, the fund sample fails to match the performance of the overall market. The average return on the fund portfolio is 16.32 percent, which is lower than the return on any of the other market indices. In particular, funds' average under-performance relative to the S&P 500 index is 1.6 percent. This is not too far from estimates of funds' expense ratios that have been reported in other studies. For example, Carhart (1997), Gruber (1996), Sirri and Tufano (1998) all report average expense ratios between 1.1 and 1.4 percent. Note that the evidence suggests under-performance even before taking into account the survivorship bias that affects this sample before 1989.[4]

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[4]Part of the mutual funds' portfolios may also be held as cash, representing a drag on performance relative to equities over most of this period.

1.2. Mutual fund portfolios

A fund's investment style could be measured along many distinct dimensions. It is common practice, however, for investment managers to break the domestic equity investment universe down into four classes: large-capitalization or small-capitalization growth stocks, and large-capitalization or small-capitalization value stocks. Correspondingly, two dimensions are used to identify a manager's style: whether the manager concentrates on large-capitalization or low-capitalization stocks, and whether the fund is oriented toward value or growth stocks (typically defined by whether the stocks have high or low ratios, respectively, of book to market value of equity).[5] Perhaps not surprisingly, academic research also finds that size and book-to-market are important for capturing the variation in stock returns (see, for example, Fama and French (1992,1993), Chan, Karceski and Lakonishok (1998)). Accordingly, in what follows we focus on these two dimensions of investment style. In addition, following up on the results of Grinblatt, Titman and Wermers (1995), we provide some results on fund styles with respect to prior stock returns.

Table II paints a portrait of fund styles along the dimensions of size (panel A), book-to-market (panel B), and past returns (panels C and D). As a basis of comparison we use the Standard & Poor's 500 index (S&P500). While other benchmarks have begun to be widely accepted by investors, the S&P500 index has been the most popularly used reference portfolio through much of our sample period.

The details underlying the calculations in Table II are as follows. At the end of each calendar year all available domestic stocks are ranked by the relevant characteristic (for example, size) and given a percentile ranking from zero (for the lowest-ranked firm) to one (for the highest-ranked firm).[6] Given the holdings of a portfolio, we can calculate the weighted average of the percentile rankings over all stocks in the portfolio. A stock's weight is the percent of the portfolio's value invested in the stock.

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[5] For example, most pension plan sponsors use these two dimensions when they screen investment managers.

[6] Our use of percentile rankings makes it more meaningful to compute averages over time when the entire distribution of characteristics (such as market value) has undergone considerable shifts.

This procedure can be applied to any portfolio. In our first comparison we consider two portfolios: the S&P500 index, and the fund sample in the aggregate. In the latter case we pool the equity holdings of all funds into a "superfund".[7] This comparison tells us whether funds as a whole are more or less aggressive with respect to size or book-to-market relative to the index.

We also want to make comparisons across funds, so in our second exercise we take the unit of analysis to be an individual fund. For each fund portfolio we compute its weighted average characteristic as above, and place it along a distribution to see whether the fund has a more or less aggressive style. Our benchmark distribution is, as above, given by the set of stocks comprising the S&P500 index. Accordingly we use the size (or book-to-market) ranks of the stocks in the S&P500 to determine decile breakpoints at each year-end. Comparing each fund's weighted average characteristic to these breakpoints lets us place each fund into a decile. We look at the percentage of funds in each decile as one measure of where funds are concentrated. In addition we compare funds and the benchmark in terms of the concentration of market value in each decile. For the benchmark the combined capitalization of all S&P500 stocks in each decile is calculated and expressed relative to the total capitalization of the index. The ratio represents the relative magnitude of the asset pool available in the benchmark for investors who wish to select from a particular category of size or book-to-market. Similarly for all funds falling in a particular decile we calculate the total value of their equity holdings, and express this as a fraction of total fund net assets. This fraction tells us the concentration (in terms of dollars invested) of funds in a decile. Finally, the distributions for the index and for funds are averaged across time.[8] As an illustration, decile 10 for the S&P500 in panel A of Table II contains the largest ten percent (or fifty stocks) in the index, and these issues on average account for 47.01 percent of the value of the index.

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[7]We use the most recently reported holdings as of the year-end for each of the underlying mutual funds.

[8]When we average the distributions of funds we weight each annual observation by the number of funds in the sample that year.

1.2.1. Size

The mutual fund sample in the aggregate tends to hold smaller firms than those in the S&P 500 index (panel A). The weighted-average size characteristic for the index is 0.98, while the weighted-average size for the fund sample (that is, for the superfund) is 0.94. The difference is perhaps not surprising, since the funds cannot all be concentrated in the same set of large S&P stocks, and since there are many firms who are much smaller than those in the index. If anything the comparison with respect to size understates the difference in dollar magnitudes because we use percentile rankings.[9]

The distribution of funds by size indicates that there are many funds concentrating in smaller stocks compared to the S&P500. About 26 percent of the funds, for example, have a weighted-average size rank that places them in the bottom decile. However, these small-capitalization funds do not amount to a large percentage of total fund holdings (for example, the funds in the bottom decile represent only 11 percent of total fund holdings). Arguably, the market for the smaller stocks may be less informationally efficient. In this category, then, fund managers may be operating under the belief that they can distinguish themselves by exploiting such opportunities.

1.2.2. Book-to-market

In panel B we use the same methodology to calculate the distribution of funds across ten categories of book-to-market ratio.[10] The superfund, which has a weighted average book-to-market rank of 0.35, is more oriented toward growth stocks than the S&P500 (its corresponding rank is 0.38). Nonetheless, funds tend to be heavily clustered around the index. The S&P500's weighted average book-to-market rank puts it in the fourth decile. If we look at this and the adjacent two deciles, we find that sixty percent of the funds, representing 67 percent of fund holdings, have average book-to-market ranks falling in the third to fifth deciles.

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[9]For instance, at year-end 1997 the weighted average size for the S&P 500 is about 47 billion dollars while the weighted average size for the mutual fund sample is roughly half as large (26 billion dollars).

[10]In the underlying calculations all stocks with negative book values are excluded.

Conversely, very few funds have average book-to-market ratios that are relatively extreme. Given the extensive evidence on book-to-market effects on returns, for instance, it might be expected that there would be more concentration of funds in stocks with high book-to-market ratios. There is little evidence of this, however. For example, the top three deciles in panel B represent about 17 percent of the capitalization of the S&P500. However, only 3.2 percent of the funds have average book-to-market ranks that put them in these deciles. Moreover, these funds are relatively small. In terms of portfolio values, they only account for 1.9 percent of holdings. At the other tail of the distribution, the bottom decile makes up roughly the same percentage (about 18 percent) of the capitalization of the index as the top three deciles. Here, however, funds appear to have a larger appetite for growth stocks with relatively low book-to-market ratios. The book-to-market ratios of about 4.5 percent of the funds fall in the lowest decile, representing about 3.2 percent of total holdings. Put another way, the holdings of the funds that are relatively more growth-oriented are almost twice the holdings of the value-oriented funds, even though the underlying investable pools in the index have virtually the same amounts.

The upshot from panel B is that very few funds took advantage of the profits that have historically been available from investing in value stocks. This finding is consistent with related research on pension fund portfolios (Lakonishok, Shleifer and Vishny (1997)). Possibly, fund managers were not aware of (or did not believe in) an association between book-to-market and stock returns. Taking extreme bets, either on value stocks or growth stocks, may yield an undiversified portfolio and large errors in tracking a market benchmark. To avoid such errors funds may cluster around the benchmark. Nonetheless, if there is any tilt in fund styles, panel B of Table II says that funds are more aggressive in favor of growth stocks.

1.2.3. Past stock return

A close cousin of the investment strategy based on book-to-market is a strategy based on long-horizon past returns (see, for example, DeBondt and Thaler (1985), Chopra, Lakonishok, and Ritter

(1992)). Hence another characteristic which funds may be taking into account when selecting their portfolios is a stock's past rate of return. Some funds may target stocks which have had low past returns in hopes of capturing the subsequent reversals. Panel C of Table II reports the distribution of funds classified by past three-year returns. Specifically the characteristic under consideration is the weighted average (across all of a fund's holdings) of the return beginning four years and ending one year ago.

In panel C the superfund and the S&P500 index have the same weighted average rank on past three-year return (0.63). The index is periodically revised, however, and stocks that have done well are more likely to be introduced. Accordingly, the fact that the two portfolios share the same rank is more impressive than may first seem, given that there are delays in turning over fund portfolios.

When we compare funds' willingness to take relatively extreme bets, the results for past losers (with low past returns) parallel those for deep-value stocks. The bottom four deciles contain roughly 27 percent of the value of the index. However, funds falling into these deciles account for only 3 percent of fund holdings. In short, there are few takers for strategies based on either deep-value or long-term reversals.

Strategies that focus on deep-value stocks and past losers share a common feature. They both select stocks that appear to be very unattractive by many popular yardsticks. Value stocks, for example, have relatively low past growth rates in earnings or sales, are generally concentrated in unremarkable industries such as utilities, finance or steel, and are less likely to be recommended by security analysts.[11] Long-term past losers are more likely to be in financial distress. In other words, a fund manager would be hard-pressed to provide a persuasive conventional rationale to investors as justification for investing in such stocks. The evidence in Table II is consistent with the conjecture that fund managers shun strategies based on such apparently unattractive stocks, possibly due to personal career risks.

From this perspective, stocks which have performed well in the past should be easier to justify,

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[11]Stickel (1997) finds that analysts issue stronger buy recommendations for stocks with positive earnings and price momentum and higher forecasts of long-term growth in earnings.

and hence relatively more attractive to fund managers. The results in panel C confirm a sharp disparity between funds' appetites for long-term past losers and past winners. The top two deciles are comparable to the bottom four deciles in terms of percentages of the value of the index (the top two deciles represent about 25 percent). This end of the distribution is more popular with funds. Funds placed in these two deciles hold about 10 percent of total fund equity investments.

More intriguingly, there is one set of past winners where the evidence on profitability and the availability of an attractive story happily coincide. In particular, Jegadeesh and Titman (1993), Chan, Jegadeesh and Lakonishok (1996) find price continuations over intermediate horizons. In panel D we provide results based on the weighted average of the past year's return on a fund's holdings. In the aggregate funds are more tilted toward past winners than the index. The weighted average rank for the superfund is 0.62 compared to 0.60 for the index. Further, quite a few funds position themselves in the upper deciles of the distribution. About 11 percent of the funds fall in the top two deciles, and they make up roughly 9 percent of total fund holdings. Grinblatt, Titman and Wermers (1995) also find that funds tend to follow profitable momentum strategies. Our suggestion here is that the attractiveness of this strategy dovetails neatly with behavioral or agency considerations as well.

Since funds who invest in small firms may be more specialized, they may also tend to be more aggressive in terms of their orientation either toward book-to-market or past return. Our preliminary examination of this issue, however, indicates that this is not the case. Overall, there is no strong evidence that small-cap funds take more aggressive styles on either end of the distribution for book-to-market and for past return, compared to large-cap funds.

1.2.4. Interpretation

To sum up, when we look at the distribution of fund styles, funds generally do not deviate notably from a widely-followed benchmark such as the S&P500. While there are many small-capitalization funds, the bulk of fund assets is invested in the largest stocks. While funds generally tend not to

take extreme bets (relative to the S&P500 benchmark) in terms of either book-to-market ratios or past return, they have a relatively stronger tendency to favor glamour stocks and past winners. Put another way, funds seemed to be averse to investment strategies involving deep value stocks or long-term past losers. Viewed in this light, it may not be a complete surprise that historically few mutual funds consistently out-performed market benchmarks.

What is even more striking is that similar findings have been made about the investment styles of pension fund managers (Lakonishok, Shleifer and Vishny (1997)). In the pension fund industry multiple intermediary parties are involved in investment decision-making. Accordingly there is more scope for money managers to follow their own self-interests, with adverse consequences for portfolio performance. The key finding in this section is that in the mutual fund industry intermediaries play a smaller role and yet the evidence for non-performance distortions persists.

Several reasons may explain why both pension fund and mutual fund managers have some preference for glamour stocks and past winners.[12] Since glamour stocks generally have a record of good past returns, a tilt toward glamour may appear to be safe from the standpoint of personal career risk. To the extent that funds tend to herd, possibly as a result of the focus on relative performance, selecting stocks that have done well in the past would also represent a prudent choice. Fund managers' decisions may be swayed by analyst recommendations. Research reports from brokerage firms are widely disseminated and there is some evidence that analysts are more likely to favor glamour stocks and past winners (Stickel (1997)). Additionally, the fact that analysts recommend such stocks may provide a convenient rationalization for a manager to tilt toward such stocks. Another possibility is the perception that value strategies take a long time to become profitable, whereas glamour stocks and past winners at least have price momentum working in their

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[12]It should be noted that some mutual fund managers also provide money management services to pension plans. To maintain good relations with clients a manager generally seeks to avoid large variation across the performance of the different accounts. In many cases this might mean that the same stocks are selected for different clients' portfolios. As a result the non-performance considerations apparent in the pension plan accounts spill over to the mutual fund accounts.

favor over the intermediate term. Finally there may be an element of hubris in fund managers' disposition toward glamour stocks. Insofar as a relatively larger component of the valuations of growth stocks is tied to intangible future prospects, there may be more room for superior analysis to detect and take advantage of such opportunities.

Another possible explanation for funds' tendency to bunch at the center is that fund managers follow strategies that cannot be easily summarized by a single characteristic such as book-to-market or past stock return. Instead they may focus on many other security characteristics so that the end-result is a portfolio that does not deviate too much from a diversified benchmark index. It is also possible that managers realize that superior long-term performance is unachievable in an efficient market and hence are closet indexers. Finally, in the earlier part of the sample period, fund managers may not have been aware of the existence of strategies based on deep value or overreaction, and they may have been slow in adjusting their approaches.

2. Mutual fund factor exposures

In this section we check that our conclusions about fund styles are robust by taking another approach to the analysis of fund styles. Fama and French (1992,1993) find that three factors — the market and mimicking portfolios for size and book-to-market — can explain the cross-section of average returns and the common variation in returns. The sensitivity of a fund's return to these factors can serve as indicators of the investment strategies it follows. A fund whose return is strongly associated with the returns on value stocks, for instance, can be thought of as a value-oriented fund. Accordingly, a fund's exposures to the three factors is another way to identify a fund's style.

In particular, the style measures are taken as the estimated coefficients from three-factor model regressions of the form

$$r_{pt} - r_{ft} = \alpha_p + \beta_{1p}[r_{mt} - r_{ft}] + \beta_{2p}SMB_t + \beta_{3p}HML_t + \epsilon_{pt} \tag{1}$$

based on monthly returns. Here r_{pt} is the return in month t for fund p, r_{ft} is the return on a

one-month Treasury bill, r_{mt} is the return on the value-weighted portfolio of stocks that appear on both the CRSP and Compustat databases, and SMB_t, HML_t are the returns on zero-investment factor-mimicking portfolios for size and book-to-market.[13] In our context, the estimates of β_{2p} and β_{3p} serve as measures of fund p's orientation toward firm size and book-to-market. A positive (negative) β_{2p} coefficient would mean the fund is oriented toward small stocks or large stocks, respectively. Similarly, a positive (negative) coefficient β_{3p} indicates that the fund has a tilt toward value (growth) stocks.

Table III provides another perspective on the distribution of fund styles from the standpoint of the three-factor model (equation (1)). Panel A of the table gives the distribution of funds' loadings on the factors. At each calendar year-end, we estimate the three-factor model for all funds with a complete history of returns over the prior three years. Based on the estimated coefficients, funds are then assigned to deciles. Within each decile we calculate the equally-weighted average of the coefficient estimates; the reported values are the weighted averages over all years of the coefficients (each year's weight is the relative number of funds in the sample that year). As a basis of comparison, panel B of the table reports estimates of the three-factor model applied to popular market style indices including the Russell 1000 Growth Index (denoted R1G), the Russell 1000 Value Index (R1V), the Russell 2000 Growth and Value Indexes (R2G and R2V, respectively), and the Standard & Poor's 500 index. The Russell indices are the most commonly used style-based benchmarks for performance evaluation.[14]

The results for funds' style for size based on sensitivities generally agree with our earlier findings based on funds' holdings. In terms of the number of funds, a large fraction of fund portfolios loads more heavily on small stocks than does the S&P500 index. The S&P500 index has an average

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[13] We thank Gene Fama for supplying the data on returns for the market and the factor-mimicking portfolios.

[14] While historical returns are available for all these composites, data on the historical composition of the indices (required for calculating portfolio characteristics) is less readily available for the Russell indices. Accordingly the comparisons based on portfolio characteristics in the previous section use only the S&P500 index. We defer a discussion of the relative merits of each approach to style identification to a later section of the paper.

sensitivity to the size factor of -0.215. On average 94 percent of funds have sensitivities above this value. Conversely not many funds have stronger sensitivities to returns on large stocks than the S&P500. Only about six percent of funds on average load more negatively on the size factor (that is, covary more strongly with large stocks) than does the S&P 500. This finding may be one reason why a typical fund finds it difficult to keep up with the S&P500 even when large stocks substantially outperform small stocks (as in 1998).

Funds generally do not select portfolio exposures that are strongly tilted toward either value or growth. The distribution of fund loadings on the book-to-market factor is roughly centered around zero, close to the sensitivity of the S&P500. To evaluate the extent of departures away from the market benchmarks, note that the bottom two deciles of funds have average HML loadings less than the sensitivity of the Russell 1000 growth index, $R1G$ (-0.405). At the other tail, the sensitivity of the Russell 1000 value benchmark is 0.374, and only the top decile of funds has an average HML sensitivity larger than this. As in panel B of Table 2, then, funds tend to cluster around the benchmark and, insofar as they take extreme positions, they tilt toward growth rather than value.

To sharpen the last point, note that the Russell value and growth indexes do not represent portfolios that are especially slanted toward extreme value or growth. For instance, effectively half of the market capitalization of the Russell 1000 index (the thousand largest stocks) are assigned to the value index and half to the growth index.[15] In this sense, a fund does not have to take a very extreme position toward value or growth to appear more aggressive than the corresponding Russell indexes. Even so, fund managers do not choose to depart very much from the benchmarks.

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[15]Specifically, every stock in the Russell 1000 index receives a weight between zero and one in the growth and value indexes, such that the stock's combined weight in the two indexes adds to one. Currently, stocks are ranked by a composite measure of value based on the book-to-market ratio and security analysts' forecasts of long-term growth in earnings. Stocks ranked below the first quartile of the value measure receive a full weight of one in the value index (hence zero weight in the growth index); stocks above the third quartile of the value measure get zero weight in the value index (full weight in the growth index). A stock at the median is given a weight of 0.5 in each index.

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2.1. Fund style and fund performance

The bulk of earlier research on fund styles has focused on how to adjust for style when evaluating performance. However, the relation between a fund's style and its performance appears to have received little prior attention. One commonly voiced belief, at least among practitioners in the pension fund industry, is that growth-oriented managers are more likely to out-perform their style benchmarks than are value-oriented managers.[16] Although the issue of fund performance is not the main focus of this paper, this section provides a bridge to the earlier literature by seeing if there is any difference across styles with respect to mutual fund performance.

In particular, Table IV checks whether funds with some styles tend to out-perform funds with other styles, relative to either a three-factor model benchmark (panel A) or a four-factor model with an extra momentum factor included (panel B).[17] The table provides estimates of alphas and loadings for portfolios of equity funds that are sorted by size and book-to-market characteristics. Specifically, at the end of each year from 1984 to 1996 all funds are sorted by their value-weighted average size rank characteristic and assigned to one of three portfolios. The first group comprises funds ranked in the top 20 percent by their size characteristic; the second group includes funds ranked in the middle 60 percent; the third group includes funds ranked in the bottom 20 percent by size. Within each size classification all funds are also sorted by their value-weighted average book-to-market rank characteristic and assigned to one of three portfolios. The first portfolio includes funds ranked in the top 20 percent; the second portfolio includes funds ranked in the middle 60 percent; the third portfolio contains funds ranked in the bottom 20 percent. The categories are chosen so that we can break out funds who take relatively extreme positions with respect to size and book-to-market. For each of the resulting nine portfolios, equally-weighted returns are calculated over the subsequent twelve months, and the process is repeated. At the end of the sample period

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[16]See, for example, Coggin and Trzcinka (1997), who look at pension funds.

[17]The momentum factor is measured as the difference between the return on the top and bottom quintile portfolio of stocks ranked by past one-year return. Equally-weighted portfolios are formed at the end of each calendar-year from all domestic common stocks listed on the New York and American stock exchanges.

the three or four factor model is applied to the complete history of returns on each portfolio.

The evidence in panel A provides some indication that growth managers do better than value managers on a style-adjusted basis. The difference between the alphas of the growth and value managers, for example, is positive in each of the three size categories, averaging 0.143 percent per month (or 1.7 percent per year). In particular, the difference is largest for the small-cap funds and amounts to 0.302 percent per month. One possible explanation for the performance differential between the two groups is that growth funds buy stocks with good past performance and hence benefit from momentum effects. On the other hand momentum effects work against value funds, who are generally invested in past losers.

Panel B confirms that growth and value funds' sensitivities to the momentum factor differ in the hypothesized direction. For instance small-cap growth funds have an exposure to the momentum factor of 0.084, and small-cap value funds have an exposure of -0.026. Adjusting for the momentum factor using a four-factor model benchmark, as in panel B, reduces the performance differential between the two groups. The annualized difference in the alphas, averaged across all three size categories, is 1.2 percent in panel B. Nonetheless, the style-adjusted alphas still slightly favor growth managers. Intriguingly, therefore, growth managers appear to generate stronger performance than value managers. Growth stocks may predominantly represent companies with few tangible assets and where expectations about the future are more important (such as science and technology stocks). In such cases perhaps growth fund managers add value through specialized knowledge. The gap between growth and value is particularly notable for small-cap funds: the difference is 0.235 percent per month. Possibly, inefficiencies may be more prevalent among smaller stocks because they receive less coverage and attention, or because of limits to arbitrage, for example.

3. Consistency in fund style

The premise of an investment style is that a manager's style reflects the nature of the stocks selected in the portfolio. The style dimensions that we use (and which are widely used in practice),

however, may not correspond to the criteria fund managers actually use. A manager selecting stocks thought to be under-priced, for example, may wind up choosing value stocks in one period and growth stocks in another. This apparent inconsistency would certainly create problems for a pension plan administrator or individual investor wishing to build a structured portfolio. One reason to check for style consistency, therefore, is to verify that our style categories are meaningful ways to portray fund behavior.

Additionally, shifts in fund style may reflect the personal career risks discussed in the earlier section. Funds that are performing poorly face the prospect of losing clients. As a result there may be pressures on a manager to adjust the fund's style when certain styles fall in or out of favor, or to try a different approach after a period of poor performance for the fund. For this reason, we also check to see whether past performance is associated with shifts in style. To ensure the robustness of our results, we measure fund style in two ways: based on portfolio characteristics from fund holdings, and based on estimated sensitivities to factors.

3.1. Correlations between past and future styles

At the end of each year we rank funds by a style measure (using either the fund's most recently measured portfolio characteristic or estimated loading) and scale them to fall between zero (the lowest-ranked fund) and one (the highest-ranked fund). A high rank for a fund indicates that it is relatively more extreme in its orientation toward large stocks or toward value stocks.[18]

Style consistency is measured by the correlation between a fund's past style rank, measured at year-end, and its future style rank, measured at the end of the third subsequent year. We choose a three-year gap so that the factor loadings can be estimated over non-overlapping periods. We also

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[18]Note that a fund investing in small stocks would have a relatively low average size and hence a low score under the characteristics approach. A small-cap fund would tend to have a large positive loading on the size factor, since the latter is measured as the difference between the return on small stocks and on large stocks. To preserve the interpretation in both cases, we multiply the size loadings by minus one before ranking and rescaling, so that a low score means the fund is tilted toward small stocks.

calculate the mean absolute difference between the two periods' style ranks. Table V provides the results, based on the pooled sample of fund-year observations.

Regardless of the approach used to measure style, there appears to be some overall consistency in funds' styles over time. For all funds, the correlations between current and future styles are about seventy percent when styles are measured under the loadings-based approach (panel A) and about eighty percent under the characteristics-based approach (panel B). However, the average absolute differences in style ranks are fairly substantial. Based on loadings in the entire fund sample, for example, the mean absolute deviation in style ranks for book-to-market is 0.16. Additionally, there are numerous cases of large shifts in style: for example, the 75-th percentile of the distribution of absolute deviations in book-to-market style ranks is 0.23.

A comparison of the two panels offers some evidence on the relative performance of the two approaches to style analysis. In general, the correlations between current and future styles are higher under the characteristics-based approach than under the loadings-based approach. Further, the average absolute differences between current and future style ranks are generally smaller when portfolio characteristics are used. These findings are consistent with the argument that fund styles are measured more precisely using a characteristics-based approach. Accordingly, we focus on the characteristics-based approach in the remainder of this section.

There is more consistency in funds' styles with respect to size than with respect to book-to-market. The correlations are 0.85 and 0.77 for size and book-to-market, respectively, for the entire fund sample. This finding is consistent with the casual observation that funds' specialization with respect to size is taken more seriously: a small-cap fund generally sticks to small stocks and a large-cap fund holds mostly larger stocks. Furthermore, the distinction between large- and small-cap sectors had an earlier start in the investment management industry.

The remaining rows in each panel of Table V correlate past and future styles for large-cap and small-cap funds; and also for value and growth funds. Small-cap (large-cap) funds are defined to include all funds in the bottom (top) thirty percent by their rank on size. Similarly growth (value)

funds are those in the bottom or top thirty percent based on ranks for book-to-market. There is more consistency within each of these style classes than for the sample as a whole, suggesting that the dimensions we use are informative about funds' investment approaches. For example, the correlation between past and future styles with respect to size is 0.89 for large-cap funds, compared to 0.85 for the overall sample.

3.2. Style consistency and past performance

While most funds may be consistent in following a particular style, there may be specific instances where funds are more prone to switch styles. In particular, a fund manager with poor past performance may be more likely to cave in to pressures to drop a style that has apparently been unsuccessful and try something different. To test this conjecture, we sort funds into portfolios on the basis of a two-way within-group classification. The first sort is by a fund's past performance (the compound return on the fund over the past two years) while the second sort is by the fund's portfolio characteristic (either size or book-to-market).

In the classification by past fund return, there are four groups: group 1 (winners) comprises the twenty percent of funds with the highest past return; group 2 comprises funds ranked in the eighth to sixth deciles by past fund return; group 3 comprises funds ranked in the fifth to third deciles of past return; group 4 (losers) includes the twenty percent of funds with the lowest past return. The second sort by portfolio characteristic assigns a fund to one of three groups. Group 1 includes funds ranked in the top thirty percent on the relevant characteristic (either size or book-to-market); group 2 includes the intermediate forty percent of the ranked funds; group 3 includes the funds ranked in the bottom thirty percent by the characteristic. For each of the resulting twelve portfolios, the simple average of the size or book-to-market characteristic across all component funds is calculated at the portfolio formation year-end to give the portfolio's past style and at the end of the subsequent year to give its future style. Each fund's characteristic is based on its most recently reported holdings prior to the year-end. The average across all portfolio formation years

(weighted by the number of fund observations in each year) is reported in Table VI, as well as the average absolute difference between the characteristics across all funds in each portfolio.

Comparing the results for past winners and for past losers offers up evidence for shifts in style. In panel A, for example, the mean absolute difference between past and future styles on size averages 0.058 across all three groups of past winners and 0.069 across all past losers. Notably, there are large shifts with respect to book-to-market in panel B. The average absolute difference is 0.077 across all past winners and 0.1 across all past losers. Funds with poor returns are thus altering their styles, particularly with respect to book-to-market. From an investor's standpoint, the table suggests that a fund manager who has performed poorly is more prone to style drift, thereby upsetting the structure of the investor's overall portfolio. Such instances thus represent sources of style risk that deserve monitoring.

Panel B indicates that the style shifts for poorly-performing funds is driven by the behavior of value funds. Value funds with poor past performance have an average absolute difference of 0.12 for style with respect to book-to-market. Value funds with good past performance have a corresponding mean absolute difference of only 0.06. Value strategies generally entail investing in stocks which do not look attractive under conventional criteria and which are not highly touted by analysts. When performance has been poor, the manager of a value fund may have even less stomach for holding "ugly" stocks that, unlike more glamorous issues, do not come with appealing stories to justify holding them.

4. Comparing approaches to style measurement

The analyses in the previous sections draw on two approaches to style analysis, based on either portfolio characteristics or factor loadings. Each approach has its merits and drawbacks.

Since a fund's holdings provide a snapshot of its investments at a given date, the characteristics of its portfolio should yield an up-to-date indicator of its investment style. However, data on fund holdings are not widely available. When available, the holdings data are sampled relatively

infrequently. Operationally, the need to cross-reference these data with information (such as the book value of equity or earnings) from stocks' financial statements adds an additional layer of complexity.

The merit of the loadings-based approach is that it is grounded on the behavior of realized returns on the fund. Data on fund returns are more readily accessible. On the other hand, a long record of past returns is needed for the factor loadings to be estimated reliably. In this respect the return earned on the fund several years ago may say little about its current style.

In general we find that the two approaches give similar readings of a fund's investment style. For the whole fund sample, for instance, the correlation between the characteristics-based style rank and loadings-based rank is 83 percent for size and 76 percent for book-to-market. In specific cases, however, the two approaches can give very different readings. These instances are all the more interesting because they provide a natural arena to stress-test the two approaches and evaluate their performance. With this in mind we examine instances where the two approaches are most at odds with one another (for example, a fund is deeply value-oriented based on loadings but deeply growth-oriented based on portfolio characteristics). The evidence in the previous section suggests that funds display less persistence with respect to book-to-market, so we focus on this dimension of fund style.

First, at the end of each year in the sample period we break out those funds that display the largest positive or negative differences between their style ranks under the two approaches. In particular, in panel A of Table VII we examine funds that are classified as value-oriented under the characteristics-based approach, but which are classified as growth-oriented under the loadings-based approach (so they receive high ranks on their portfolios' book-to-market ratios, but low ranks on their loadings on the book-to-market factor, HML). Similarly panel B looks at mis-classifications where the characteristics-based approach indicates a growth fund while the loadings-based approach indicates a value fund. The characteristics-based approach uses funds' most recently reported portfolio holdings prior to the year-end, while the loadings-based approach uses estimates from a

three-factor model from the prior three-year period.

We then see which approach does a better job in predicting the subsequent returns on these two sets of funds. Again, to magnify potential contrasts we look at the forecasting performance in those months where there is a large differential between the returns on value and growth stocks. Specifically, out of the following two years we pick out the two months with the highest realized returns, and the two months with the lowest realized returns, on HML, the Fama-French mimicking portfolio for book-to-market (so we are looking at roughly the ten percent most extreme observations in each tail of the distribution).[19] The approach that gives the lower average forecast error would be the one that does a better job in describing mutual fund styles. Returns are predicted in our experiment as follows. In the characteristics-based approach, we match each stock in a fund's portfolio with an equally-weighted portfolio of stocks falling in the same quintile of size and book-to-market. The predicted return for the stock is the future return realized on the matching portfolio.[20] In the loadings-based approach, the predicted return uses the fund's three-factor model loadings estimated over the prior three years and the realized future returns on the mimicking portfolios. Note that under either approach the relevant parameters (either characteristics or loadings) are measured over a period that is disjoint from the prediction period.

The characteristics-based approach yields smaller mean errors for the experiment in panel A. The funds in panel A earn an average return of 5.19 percent in those subsequent two months where growth stocks do best relative to value stocks.[21] The fitted return under the characteristics-based

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[19]Since we focus on months with extreme returns, the behavior of the cash portion of funds' portfolios becomes important. Accordingly, we limit our sample of funds to those which are holding less than five percent of their portfolios in cash. Additionally, to mitigate the impact of the idiosyncratic component of fund returns, we only consider funds with at least twenty five stocks in their portfolios.

[20]Stocks eligible for the matching portfolios comprise all domestic equities listed on the NYSE, Amex and Nasdaq markets. These are ranked independently by size and book-to-market each calendar year-end and assigned to quintiles, where the quintile breakpoints use only NYSE issues.

[21]The average style rank on book-to-market for the sample of funds in panel A is 0.68 based on holding characteristics and 0.30 based on loadings.

approach is 5.12 percent with an average error of 0.07 percent. On the other hand the loadings-based approach yields a fitted return of 6.14 percent and the error averages -0.95 percent. Conversely, in those subsequent two months where value stocks do best relative to growth stocks, the funds' actual returns average -2.38 percent. Given fitted returns of -1.89 percent and -3.39 percent for the characteristics-based and loadings-based approaches, respectively, the average error is also lower when characteristics are used.[22] The average absolute errors in panel A also tend to be lower under the characteristics-based approach (for example, 1.40 percent versus 1.70 percent in the two months with the lowest average HML).[23]

Panel B of the table also yields a favorable verdict for the characteristics-based approach.[24] In particular, over the two months with the lowest values of HML, the average prediction error under the characteristics-based approach is -0.62 percent, which is lower than the 0.94 percent error under the loadings-based approach. In the two months with the highest values of HML, the corresponding mean errors are -0.16 percent and -1.07 percent. In short, when the two approaches give conflicting readings on a fund's style, the approach based on characteristics more closely matches funds' subsequent actual performance.

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[22] As other studies (see, for example, Chan, Karceski and Lakonishok (1998)) have found, months with the largest out-performance of value stocks relative to glamour stocks are generally down-market months. As a result the fund returns for the two months with the highest values of HML are generally negative. As a further illustration of this point, the average return on the Russell 1000 Growth index is -2.31 percent for these months while the average return on the Russell 1000 Value index is -0.24 percent.

[23] The noise component in monthly returns is large. Although this averages out across months when we work with mean errors, this will not be the case when we work with the absolute errors. This helps explain why the differences across the two approaches are smaller when we compare the average absolute errors.

[24] On average, the funds in this panel have an average style rank of 0.29 on book-to-market based on fund holdings, and an average style rank of 0.68 based on loadings.

5. Conclusion

Mutual funds represent a large and growing segment of the institutional investor community. Within this segment, however, fund managers are by no means homogeneous in terms of their investment choices. Recognizing that fund managers follow a wide variety of approaches, investors are increasingly aware of the importance of a fund's investment style. The evaluation of an investment manager's style is already widespread practice in the pension fund industry. Investment style analysis is important for evaluating fund performance and also for controlling the risk of the investor's overall portfolio.

This paper provides an exploratory investigation of mutual fund investment styles. Previous empirical research on the sources of return covariation, as well as standard practice in the investment management industry, give us some guidance in terms of which dimensions of style we consider, and on our procedures for style identification. We concentrate on two style dimensions: size (equity market capitalization), and book-to-market, although we also provide some results based on past stock return. We employ two procedures for style identification: one is based on the characteristics of fund portfolio holdings, while the other is based on estimated loadings from factor models. The analysis uses an integrated dataset that reports a fund's return and identifies its equity holdings as well.

Beginning with the aggregate portfolio held by funds (the "superfund"), we find that the overall portfolio has a lower rank on size compared to the S&P500 index. This is not surprising, given the large number of smaller stocks that are not in the index. More notably, the superfund has a general tilt toward growth. The superfund's weighted-average book-to-market rank is 0.35 while the corresponding rank for the index is 0.38. Similarly, additional characteristics based on past stock return indicate that the aggregate portfolio tends to favor stocks with superior past performance. For example the superfund has a weighted-average rank with respect to past one-year return of 0.62, above the rank of 0.60 for the index.

We also study the distribution of fund styles in order to judge the extent to which individual

funds deviate from the benchmark. We find that most mutual funds adopt styles that do not differ markedly from an overall market index. For example, when we look at the distribution of funds in terms of their book-to-market ratios, sixty percent of the funds are clustered within the two deciles adjacent to where the S&P500 falls. These funds account for 67 percent of total fund equity holdings.

Few funds take extreme positions away from the index. Lack of diversification may be one reason why funds stay away from the extremes. Moreover, an extreme position would produce large deviations from the return on a broad benchmark. Since it is common practice to measure fund performance against a benchmark, such deviations may be a source of personal career risk to a fund manager. When funds deviate from the index, they are more likely to favor growth over value and high past return over low past return. Using factor sensitivities to measure fund styles yields similar conclusions. For example, only ten percent of funds on average have larger exposures to the book-to-market factor than the Russell 1000 Value index, even though the latter index does not represent an overly aggressive bet on value stocks. Roughly twice as many funds, on the other hand, are more aggressive on the growth dimension than the Russell 1000 Growth index.

Evidently a fund manager who chooses to be bold finds it safer to err on the side of growth. Intriguingly, similar findings – bunching at the center and a tendency to favor glamour stocks – have been found for pension fund manager styles (see Lakonishok, Shleifer and Vishny (1997)). These aspects of mutual fund behavior may be one reason why so few funds consistently beat passive benchmarks. We conjecture that the glamour bias may, at least in part, be due to agency as well as behavioral considerations. Growth stocks generally have a favorable history of past returns and hence may appear to be safe choices as far as managers' personal career risks are concerned. Herding pressures, arising for example from the practice of relative performance evaluation, would also motivate managers to select stocks that have done well in the past. Hubris may lead managers to think that they have superior abilities to detect intangible growth opportunities thereby predisposing them toward growth stocks.

There is generally consistency in fund styles across time, especially with respect to size. Correlations between past and future fund styles are between seventy to eighty percent. The degree of persistence provides some evidence that our style dimensions capture meaningful aspects of fund behavior.

Drifts in style show up more strongly in the case of funds with low past returns. Such funds are more likely to alter their styles, and hence from the standpoint of an investor are a source of style risk that deserves monitoring. In particular, the average absolute difference between past and future style ranks on book-to-market for past winner funds is 0.077 while the corresponding difference for past loser funds is 0.1. The manager of a poorly performing fund may face stronger pressures to try something different, or to follow the crowd and adopt whichever style has been more successful. There is some evidence that managers of value funds that have done poorly are more prone to adjust their styles. Such managers drop the book-to-market ranks of their portfolios from 0.648 to 0.572. Managers of growth funds with poor past performance, on the other hand, barely move toward value.

Our comparison of value and growth managers also uncovers some signs that value managers, on a style-adjusted basis, on average do worse than growth managers. Under a three-factor model, for example, the average difference between the alphas of growth and value funds is 1.7 percent per year. In part, managers of growth funds hold stocks with strong past returns and hence benefit from the momentum effect. Adjusting for the momentum factor accounts for some of the performance differential, but the results still tend to favor growth managers by about 1.2 percent per year on average. The difference in alphas is particularly notable (2.82 percent per year under a four-factor model) for small-capitalization funds.

The two approaches to style identification (portfolio characteristics and factor sensitivities) generally give similar readings of a fund's style (the correlation between the style ranks from the two approaches is 83 percent for size and 76 percent for book-to-market). However when they give different indications of fund style, the approach based on characteristics on average gives more

accurate predictions of future fund returns. Although the approach based on factor sensitivities is directly based on the behavior of fund returns, it requires a relatively long time series (and hence may not provide a sufficiently timely measure) and is subject to measurement error.

In summary, the analysis of investment styles helps to sharpen our understanding of the behavior and performance of mutual funds. Ultimately such analyses may also provide valuable clues for understanding patterns in trading activity and the determination of stock prices.

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Table I

Description of Sample of Mutual Funds and Aggregate Performance

At the end of each calendar year from 1976 to 1997 the number of domestic equity mutual funds with at least one observation on monthly rate of return that year is reported. Monthly rates of return are calculated for the equally-weighted portfolio of funds with available data, and are compounded over the calendar year to obtain annual rates of return. Also reported are the annual returns for the CRSP value-weighted index (denoted CRSP), the Standard & Poor's Composite Index (S&P 500), the Russell 1000 index and the Russell 2000 index. The last two rows report the mean and standard deviation of returns (over the period 1979–97) on the portfolio of funds and the market indices.

Year-end	Total number of funds	Equally-weighted portfolio of funds	Return on:			
			CRSP	S&P500	Russell 1000	Russell 2000
1976	270	26.36	26.52	23.85		
1977	284	2.25	-4.16	-7.18		
1978	294	11.54	7.81	6.57		
1979	300	27.12	23.58	18.44	22.32	43.09
1980	310	32.21	32.74	32.42	31.88	38.60
1981	325	-0.12	-4.27	-4.91	-5.09	2.05
1982	352	26.30	20.18	21.41	20.32	24.95
1983	398	21.02	23.06	22.51	22.12	29.12
1984	452	-0.73	5.10	6.27	4.73	-7.30
1985	519	27.27	31.16	32.16	32.26	31.05
1986	623	14.14	16.89	18.47	17.86	5.68
1987	737	1.95	2.81	5.23	2.93	-8.76
1988	852	14.37	17.50	16.81	17.24	24.91
1989	893	22.47	29.37	31.49	30.41	16.24
1990	962	-5.14	-4.82	-3.17	-4.14	-19.52
1991	1032	33.39	30.57	30.55	33.01	46.03
1992	1177	8.68	8.00	7.67	9.04	18.42
1993	1314	12.76	10.97	9.99	10.17	18.90
1994	1998	-1.75	-0.63	1.31	0.37	-1.83
1995	2440	31.22	35.73	37.43	37.78	28.45
1996	2789	19.95	21.25	23.07	22.42	16.51
1997	3336	24.97	30.46	33.36	32.83	22.37
Mean (1979-97)		16.32	17.36	17.92	17.81	17.31
Standard deviation (1979-97)		12.66	13.58	13.22	13.59	18.13

Table II

Portfolio Characteristics for Mutual Funds

The sample period is January 1984 to December 1997. At every calendar year-end for each fund, weighted average characteristics (expressed as percentile rankings) are calculated across all stocks held in the fund's portfolio. The calculations are based on the fund's most recently reported holdings as of the year-end. The characteristics are: size (equity market capitalization), book-to-market value of equity, past three-year stock return beginning four years and ending one year ago, and the most recent past one-year stock return. Based on its portfolio characteristic a fund is assigned to one of ten groups determined by the decile breakpoints of all domestic stocks in the Standard & Poor's Composite Index. Total market value is calculated across all stocks in the index belonging to the decile and expressed relative to the total value of stocks in the index. Total fund net assets is also calculated across all funds assigned to the decile and expressed relative to the total net assets of all funds. The percentage of fund observations in each decile is also calculated. To compute the overall average characteristic of the index and the aggregate fund portfolio, all domestic equity stocks are ranked by the relevant characteristic and assigned a score from zero (lowest) to one (highest). The portfolio average for the index is the capitalization-weighted average of these ranks across all stocks in the index; the average for the fund portfolio is the weighted average across stocks in the aggregated portfolio of all funds, with weights given by the value of all funds' holdings of the stock. All the reported statistics are weighted averages over all year-ends, where the weights are the number of funds reporting holdings in that year.

Panel A: Distribution (in percent) of fund net assets, by firm size

Sample	Portfolio average	1 (Small)	2	3	4	Firm size category 5	6	7	8	9	10 (Large)
S&P500	0.98	0.66	1.53	2.40	3.26	4.49	5.76	7.56	10.62	16.70	47.01
Funds	0.94	10.71	6.59	6.80	10.60	9.53	12.46	13.90	24.81	4.27	0.32
% of funds		26.12	9.73	8.10	8.62	9.85	11.03	11.93	10.91	3.17	0.54

Panel B: Distribution (in percent) of fund net assets, by book-to-market

Sample	Portfolio average	1 (Growth)	2	3	4	Book-to-market category 5	6	7	8	9	10 (Value)
S&P 500	0.38	17.71	14.52	11.54	10.24	10.75	10.50	8.06	6.35	6.10	4.22
Funds	0.35	3.19	11.65	14.39	25.63	27.31	11.33	4.64	1.41	0.44	0.02
% of funds		4.48	13.38	18.72	22.38	19.32	11.89	6.65	2.07	1.06	0.05

Panel C: Distribution (in percent) of fund net assets, by past 3-year return

Sample	Portfolio average	Past return category									
		1 (Loser)	2	3	4	5	6	7	8	9	10 (Winner)
S&P 500	0.63	4.09	6.63	7.75	8.33	9.90	11.17	12.85	13.91	13.39	11.96
Funds	0.63	0.00	0.03	0.55	2.75	15.37	28.30	28.78	14.61	9.05	0.56
% of funds		0.02	0.34	1.60	4.80	13.58	25.63	28.42	18.52	6.52	0.57

Panel D: Distribution (in percent) of fund net assets, by past 1-year return

Sample	Portfolio average	Past return category									
		1 (Loser)	2	3	4	5	6	7	8	9	10 (Winner)
S&P 500	0.60	4.32	6.50	7.57	8.71	12.59	12.50	11.43	12.62	11.70	12.05
Funds	0.62	0.00	0.04	0.33	2.19	12.39	35.40	26.04	14.68	6.60	2.33
% of funds		0.03	0.28	0.88	4.06	14.91	29.00	24.37	15.78	7.48	3.22

Table III
Distribution of estimated factor loadings for mutual funds

At the end of each year from 1978 to 1997 a three-factor regression model is estimated for every fund with a complete history of monthly returns over the prior three years. Funds are assigned to decile portfolios based on the estimated coefficients from the three-factor model and the equally-weighted average coefficient across funds within a decile is calculated. The numbers reported in panel A are the weighted averages across years, where the weights are the number of fund observations available in that year. The factor model regression is also applied each year to several market benchmarks; averages over the sample period of the loadings for the benchmarks are reported in panel B. The benchmark portfolios are: the Russell 1000 Growth Index (R1G), the Russell 1000 Value Index (R1V), the Russell 2000 Growth Index (R2G), the Russell 2000 Value Index (R2V), and the Standard & Poor's 500 Index (S&P500).

Panel A: Distribution of factor loadings for mutual funds

Loading on:	1 (Low)	2	3	4	5	6	7	8	9	10 (High)
Market	0.510	0.714	0.798	0.860	0.909	0.949	0.987	1.031	1.092	1.240
Size	-0.263	-0.140	-0.062	0.008	0.081	0.173	0.293	0.440	0.624	0.935
Book-to-market	-0.706	-0.412	-0.267	-0.155	-0.065	0.004	0.071	0.143	0.232	0.406

Panel B: Distribution of factor loadings for benchmark indexes

Loading on:	R1G	R1V	R2G	R2V	S&P500
Market	0.985	1.031	1.095	0.966	1.001
Size	-0.164	-0.103	0.989	0.837	-0.215
Book-to-market	-0.405	0.374	-0.316	0.336	-0.014

A portfolio's factor loadings in a given year are estimated from a three-factor time series regression of the form

$$r_{pt} - r_{ft} = \alpha_p + \beta_{1p}[r_{mt} - r_{ft}] + \beta_{2p}SMB_t + \beta_{3p}HML_t + \epsilon_{pt}$$

estimated from monthly returns over the prior three years. Here r_{pt} is the return in month t for portfolio p, r_{ft} is the return on a one-month Treasury bill, r_{mt} is the return on the value-weighted portfolio of stocks listed on both the CRSP and Compustat databases, and SMB_t, HML_t are the returns on zero-investment factor-mimicking portfolios for size and book-to-market, respectively.

Table IV
Mutual fund performance (percent per month) and loadings from
three-factor and four-factor models, classified by investment style

At the end of each year from 1984 to 1996 all funds are sorted by the value-weighted average size rank from their portfolio holdings and assigned to one of three portfolios. The first portfolio comprises funds ranked in the top 20 percent by size ranks; the second portfolio includes funds ranked in the middle 60 percent by size ranks; the third portfolio includes funds ranked in the bottom 20 percent by size ranks. Within each size classification all funds are also sorted by the value-weighted average book-to-market ranks from their portfolio holdings and assigned to one of three portfolios. The first portfolio includes funds ranked in the top 20 percent by book-to-market ranks; the second portfolio includes funds ranked in the middle 60 percent; the third portfolio contains funds ranked in the bottom 20 percent by book-to-market ranks. For each of the resulting nine portfolios, equally-weighted returns are calculated over the subsequent twelve months. This table reports estimated factor loadings from a three-factor model applied to the complete history of returns of each portfolio. An asterisk indicates that the estimated coefficient is at least two standard errors away from zero. Returns are expressed as percent per month.

Panel A: Fund performance under three-factor model

Rank on size	Loading on:	Rank on book-to-market		
		1 (Value)	2	3 (Growth)
1 (Large-cap)	Constant	0.000	-0.049	0.007
	Market	0.756*	0.851*	0.897*
	Size	-0.150*	-0.155*	-0.169*
	Book-to-market	0.118*	-0.027	-0.306*
2 (Mid-cap)	Constant	-0.028	0.007	0.107
	Market	0.828*	0.894*	0.947*
	Size	0.047*	0.080*	0.245*
	Book-to-market	0.176*	-0.084*	-0.525*
3 (Small-cap)	Constant	0.045	-0.005	0.347*
	Market	0.871*	1.012*	1.063*
	Size	0.618*	0.659*	0.799*
	Book-to-market	0.219*	-0.233*	-0.667*

Panel B: Fund performance under four-factor model

Rank on size	Loading on:	Rank on book-to-market		
		1 (Value)	2	3 (Growth)
1 (Large-cap)	Constant	0.018	-0.051	-0.005
	Market	0.754*	0.851*	0.898*
	Size	-0.171*	-0.154*	-0.156
	Book-to-market	0.107*	-0.026	-0.298*
	Past return	-0.031	0.002	0.020
2 (Mid-cap)	Constant	-0.024	-0.005	0.076
	Market	0.827*	0.895*	0.949*
	Size	0.042	0.094*	0.279*
	Book-to-market	0.173*	-0.076*	-0.506*
	Past return	-0.008	0.020*	0.051*
3 (Small-cap)	Constant	0.061	-0.023	0.296*
	Market	0.870*	1.013*	1.067*
	Size	0.600*	0.679*	0.855*
	Book-to-market	0.210*	-0.222*	-0.636*
	Past return	-0.026	0.030	0.084*

In panel A, each portfolio's factor loadings are estimated from a three-factor time series regression of the form

$$r_{pt} - r_{ft} = \alpha_p + \beta_{1p}[r_{mt} - r_{ft}] + \beta_{2p}SMB_t + \beta_{3p}HML_t + \epsilon_{pt}$$

using monthly returns over the sample period. Here r_{pt} is the return in month t for portfolio p, r_{ft} is the return on a one-month Treasury bill, r_{mt} is the return on the value-weighted portfolio of stocks carried on both the CRSP and Compustat databases, and SMB_t, HML_t are the returns on zero-investment factor-mimicking portfolios for size and book-to-market. In panel B, each portfolio's factor loadings are estimated from a four-factor time series regression of the form

$$r_{pt} - r_{ft} = \alpha_p + \beta_{1p}[r_{mt} - r_{ft}] + \beta_{2p}SMB_t + \beta_{3p}HML_t + \beta_{4p}WML_t + \epsilon_{pt}$$

where WML_t is the return on a zero-investment factor-mimicking portfolio for price momentum (return over the prior year).

Table V
Correlations and average absolute differences between past fund style
and future fund style, based on portfolio holdings or factor loadings

At the end of each year from 1984 to 1994 each fund's past style is compared to its future style. A fund's past style is measured over the most recent prior three-year period while its future style is measured over the subsequent three-year period. Style with respect to size and with respect to book-to-market is measured using either its factor loadings (panel A) or the fund's portfolio characteristics (panel B). Under each procedure, style measures (past or future) for all funds are ranked each year and rescaled from zero (the lowest-ranked fund) to one (the highest-ranked fund). The table reports the simple correlation between past and future style ranks under each procedure, pooled over funds and over years. Also reported in parentheses is the average absolute difference between the past and future style ranks. Statistics are reported for: all funds; large-capitalization funds (funds in the top thirty percent when sorted each year by style rank on size); small-capitalization funds (funds in the bottom thirty percent when sorted by size style rank); value funds (funds falling in the top thirty percent when sorted each year by style rank on book-to-market); growth funds (funds ranked in the bottom thirty percent when sorted by style rank on book-to-market).

Panel A: Style based on factor loading

| | Future style for: | |
	Size	Book-to-market
All funds	0.73	0.71
	(0.15)	(0.16)
Large-cap funds	0.79	0.71
	(0.15)	(0.14)
Small-cap funds	0.88	0.71
	(0.11)	(0.18)
Value funds	0.73	0.77
	(0.16)	(0.16)
Growth funds	0.74	0.83
	(0.16)	(0.14)

Panel B: Style based on portfolio characteristics

| | Future style for: | |
	Size	Book-to-market
All funds	0.85	0.77
	(0.11)	(0.14)
Large-cap funds	0.89	0.76
	(0.11)	(0.13)
Small-cap funds	0.93	0.81
	(0.07)	(0.14)
Value funds	0.85	0.86
	(0.11)	(0.12)
Growth funds	0.84	0.85
	(0.11)	(0.13)

The two procedures for measuring fund style with respect to either size or book-to-market are as follows. The first procedure (the loadings approach) is based on the estimated coefficients for the size and book-to-market factors from a three-factor model regression. The regression for a fund's past style uses the past three years of monthly fund returns while the regression for future style uses the subsequent three years of returns

on the fund. The second procedure (the portfolio characteristics approach) is based on the fund portfolio's weighted average firm size or book-to-market (where the weights are the proportion of fund net assets held in each stock), using the most recent prior data on its holdings. A fund's future style under this procedure is based on its most recent value-weighted average characteristic known at the end of the third year following the evaluation year. Under either procedure, the measures (portfolio characteristics or estimated loadings) for all funds are ranked at the evaluation year and rescaled from zero (the lowest-ranked fund) to one (the highest-ranked fund). Simple correlations, and average absolute differences, between past and future styles measured under each procedure are estimated using style measures pooled over funds and over years.

Table VI
Shifts in mutual fund style, classified by prior fund performance

At the end of each year from 1984 to 1994 every fund with available data is assigned to one of twelve portfolios on the basis of a two-way within-group classification. Each portfolio's past style with respect to size or book-to-market is then compared with its future style. In panel A, a fund is assigned to a portfolio on the basis of its past two-year compound return and its value-weighted average firm size characteristic. In panel B the classification is by past two-year compound return and the fund's value-weighted average book-to-market characteristic. In the classification by past return, there are four groups: group 1 (winners) comprises the twenty percent of funds with the highest past return; group 2 comprises funds ranked in the eighth to sixth deciles by past fund return; group 3 comprises funds ranked in the fifth to third deciles of past return; group 4 (losers) includes the twenty percent of funds with the lowest past return. Within each of these four groups, funds are sorted by their value-weighted average characteristic (size or book-to-market) and assigned to one of three groups. Group 1 includes funds ranked in the top thirty percent on the relevant characteristic; group 2 includes the intermediate forty percent of the ranked funds; group 3 includes the funds ranked in the bottom thirty percent by the characteristic. For each of the resulting twelve portfolios, the simple average of the size or book-to-market characteristic ranks across all member funds is calculated at the portfolio formation year-end to give the portfolio's past style and at the end of the subsequent year to give its future style. Each fund's characteristic rank is based on its most recently reported holdings prior to the year-end. The weighted average across all portfolio formation years is reported in the table, where the weights are the number of fund observations in each year. Also reported is the weighted average over years of the mean absolute differences between the past and future characteristic ranks across all funds within a portfolio.

Panel A: Fund style with respect to size

Rank on:		Past 2-year return	Past size rank	Future size rank	Mean absolute difference	Past book-to-market rank	Future book-to-market rank	Mean absolute difference
Past return	Size							
1 (Winner)	1 (Large-cap)	34.38	0.730	0.708	0.065	0.581	0.596	0.073
	2 (Mid-cap)	35.94	0.411	0.412	0.065	0.553	0.572	0.081
	3 (Small-cap)	36.88	0.133	0.153	0.041	0.534	0.549	0.074
2	1	23.19	0.860	0.838	0.050	0.568	0.566	0.072
	2	23.21	0.567	0.566	0.074	0.553	0.558	0.095
	3	23.20	0.216	0.228	0.051	0.502	0.516	0.102
3	1	16.04	0.858	0.832	0.060	0.501	0.493	0.086
	2	15.92	0.566	0.581	0.089	0.522	0.508	0.091
	3	15.63	0.226	0.237	0.050	0.445	0.449	0.111
4 (Loser)	1 (Large-cap)	6.99	0.755	0.734	0.091	0.415	0.386	0.103
	2 (Mid-cap)	5.36	0.369	0.384	0.078	0.379	0.362	0.102
	3 (Small-cap)	2.65	0.116	0.132	0.035	0.397	0.399	0.095

Panel B: Fund style with respect to book-to-market

Rank on: Past return	Book-to-market	Past 2-year return	Past size rank	Future size rank	Mean absolute difference	Past book-to-market rank	Future book-to-market rank	Mean absolute difference
1 (Winner)	1 (Value)	35.16	0.400	0.397	0.050	0.830	0.821	0.060
	2 (Medium)	34.80	0.469	0.468	0.057	0.548	0.556	0.079
	3 (Growth)	37.52	0.405	0.407	0.066	0.277	0.331	0.092
2	1	23.14	0.566	0.567	0.053	0.820	0.781	0.075
	2	23.11	0.579	0.576	0.059	0.551	0.548	0.093
	3	23.38	0.504	0.495	0.068	0.245	0.306	0.101
3	1	15.69	0.565	0.572	0.071	0.765	0.705	0.094
	2	16.09	0.597	0.591	0.067	0.488	0.481	0.094
	3	15.76	0.490	0.494	0.067	0.215	0.265	0.098
4 (Loser)	1 (Value)	4.74	0.423	0.433	0.078	0.648	0.572	0.120
	2 (Medium)	5.03	0.449	0.455	0.074	0.381	0.386	0.105
	3 (Growth)	5.50	0.364	0.360	0.055	0.146	0.171	0.074

Table VII

Return prediction errors (percent per month) from style classification
models based on characteristics and based on loadings

At the end of each year from 1984 to 1995 two approaches are used to measure styles and to predict returns of mutual funds. Each fund's style with respect to book-to-market is measured using either the characteristics of its portfolio holdings (the characteristics approach) or its past returns (the loadings approach). Based on the differences between the style measures under the two approaches, two sets of funds are selected: the ten percent of funds with the largest discrepancies in their style classifications such that they are classified as value-oriented based on characteristics but growth-oriented based on loadings (panel A); and the ten percent of funds with the largest discrepancies such that they are classified as growth-oriented based on characteristics but value-oriented based on loadings (panel B). To be eligible for this analysis a fund must have at most five percent of its net assets held as cash. Subsequent returns on each set of funds are predicted using the characteristics-based and loadings-based approaches. Results of the predictions (averaged over all test years) are presented for the two months with the lowest return and for the two months with the highest return (out of the twenty-four months following the test year-end) on HML, the mimicking portfolio for the book-to-market factor. Summary statistics are presented for the actual return on the funds (in percent per month) and, for each prediction model, the predicted return, error (actual minus predicted return) and absolute error. Returns and errors are measured as percent per month.

Panel A: Funds classified as value-oriented based on characteristics but growth-oriented based on loadings

Months sorted by HML	Funds' actual return	Characteristics-based approach			Loadings-based approach		
		Predicted return	Error	Absolute error	Predicted return	Error	Absolute error
1 (Lowest)	6.571	6.213	0.358	1.394	7.564	-0.993	1.693
2	3.806	4.025	-0.219	1.396	4.720	-0.914	1.711
Average	5.189	5.119	0.070	1.395	6.142	-0.954	1.702
3	-4.157	-4.001	-0.156	1.614	-5.132	0.975	1.857
4 (Highest)	-0.600	0.214	-0.814	1.345	-1.656	1.056	1.674
Average	-2.379	-1.894	-0.485	1.480	-3.394	1.016	1.766

Panel B: Funds classified as growth-oriented based on characteristics but value-oriented based on loadings

Months sorted by HML	Funds' actual return	Characteristics-based approach			Loadings-based approach		
		Predicted return	Error	Absolute error	Predicted return	Error	Absolute error
1 (Lowest)	6.624	7.219	-0.596	1.430	5.483	1.140	2.139
2	4.752	5.384	-0.633	1.304	4.013	0.739	1.140
Average	5.688	6.302	-0.615	1.367	4.748	0.940	1.640
3	-4.453	-4.878	0.425	1.359	-3.822	-0.631	1.731
4 (Highest)	-3.534	-2.791	-0.743	1.620	-2.036	-1.498	2.421
Average	-3.994	-3.835	-0.159	1.490	-2.929	-1.065	2.076

The two procedures for measuring fund style are as follows. The characteristics-based approach is based on the fund portfolio's weighted average size or book-to-market (where the weights are the proportion of fund net assets held in the stock). The portfolio characteristics are calculated at each calendar year-end based on the most recent prior data on its holdings. The loadings-based approach is based on the

estimated coefficients for the size and book-to-market factors from a three-factor model regression using the past three years of monthly fund returns. Under either procedure, the measures (portfolio characteristics or estimated loadings) for all funds are ranked at the evaluation year and rescaled from zero (the lowest-ranked fund) to one (the highest-ranked fund). Given a fund's style classification, future fund returns are predicted under each approach. Under the holdings-based approach, each stock in a fund's portfolio is matched with a portfolio of stocks having the same quintile rank on size and on book-to-market. The fund's predicted return is the value-weighted return on the matching portfolio given the component stocks' realized future returns. Under the returns-based approach, a fund's predicted return is based on the estimated loadings over the prior three-year period and the mimicking portfolios' realized future returns.