Momentum Investment Strategies of Mutual Funds, Performance Persistence, and Survivorship Bias

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Abstract

We show that the persistent use of momentum investment strategies by mutual funds has important implications for the performance persistence and survivorship bias controversies. Using mutual fund portfolio holdings from a database free of survivorship bias, we find that the best performing funds during one year are the best performers during the following year, with the exception of 1981, 1983, 1988, and 1989. This pattern corresponds exactly to the pattern exhibited by the momentum effect in stock returns, first documented by Jegadeesh and Titman (1993) and recently studied by Chan, Jegadeesh, and Lakonishok (1996).

Our evidence points not only to the momentum effect in stock returns, but to the persistent, *active* use of momentum strategies by mutual funds as the reasons for performance persistence. Moreover, essentially no persistence remains after controlling for the one-year momentum effect in stock returns. We also explain why most recent studies have found that survivorship bias is a relatively small concern. Funds that were the best performers during one year are the worst performers during the following year whenever the momentum effect in stock returns is absent, and these funds tend to disappear with a frequency not appreciably lower than that of consistently poor performers. Therefore, the pool of non-surviving funds is more representative of the cross-section of all funds than previously thought. Specifically, we find a difference of only 20 basis points per year in risk-adjusted pre-expense returns between the average fund and the average *surviving* fund.

1 Introduction

A spirited debate is in progress on the issue of whether some mutual funds can consistently outperform the market, on a risk-adjusted basis, and on the related topic of whether survivorship-truncated datasets have so biased the findings of some of the studies as to make them unreliable. For example, Grinblatt and Titman (1989a, 1993) find that some mutual fund managers are able to consistently earn positive abnormal returns before fees and expenses, while Brown and Goetzmann (1995; BG) and Carhart (1997) attribute performance persistence mainly to inferior funds consistently earning negative abnormal returns before fees and expenses. Meanwhile, Malkiel (1995) asserts that the impact of survivorship bias on performance studies is much larger than prior work has estimated.

In a widely cited study of survivorship bias, Brown, Goetzmann, Ibbotson, and Ross (1992; BGIR) demonstrate how dispersion in total portfolio risk in a cross-section of mutual funds can create the appearance of performance persistence, even when none is present. High risk funds tend to achieve more-extreme portfolio returns (either higher or lower) than low risk funds in any given period. If poorly performing high-risk funds tend to drop out of the sample, then we may conclude (from looking only at funds that survive the entire time period) that high-risk funds can consistently outperform other funds. This bias occurs when survival depends on short-term fund performance.

Grinblatt and Titman (1992; GT) provide an alternative viewpoint to BGIR. If survival depends on longer-term past performance, then tests would be biased toward *not* finding persistence in a dataset that includes only surviving funds. Funds with persistent poor performance are removed from the sample, while funds with alternating good and bad performance are not, leaving the impression that performance reversals are more common than either persistent good or bad performance.

Using a database that includes both survivors and non-survivors, BG develop a model to explain the disappearance of funds. Empirical results from the model seem to provide partial support for both the BGIR and the GT viewpoints. An important predictor of fund survivorship during a given year is the return of the fund, relative to the average of all funds, over the past year. Significant, but less important predictors include the relative returns two and three years prior to the given year.

Controlling for survivorship bias, BG find clear evidence of *relative* performance persistence.[1] They measure performance persistence on a year-to-year basis, and show that persistence is likely due to common strategies among mutual funds. In addition, they find a strong, positive correlation between the risk-adjusted performance and the total portfolio risk of funds. As a result, during 10 out of 12 years between 1976 and 1987, the best performers during one year were also the best performers (or close to it) during the next year. However, the best performers during the other two years (1980 and 1987) were the worst performers during the following years (1981 and 1988). As BG noted, chasing winners is a volatile strategy.

In this paper, we contribute to the mutual fund performance literature by clearly showing the link between the investment styles chosen by mutual funds and the patterns of performance persistence and the levels of survivorship bias in fund returns. We demonstrate that persistence in mutual fund gross returns is significant, and that it is closely related to the "momentum effect" in stock returns [Jegadeesh and Titman (1993) and Chan, Jegadeesh, and Lakonishok (1996)], and to the tendency of the majority of mutual funds to *actively* invest on momentum [Grinblatt, Titman, and Wermers (1995; GTW)]. Investing in last year's best performing mutual funds amounts to investing in stocks based on a momentum strategy this year. Further, we find that last year's best funds actively invest on momentum (this year) more strongly than last year's average fund, ruling out the possibility that last year's best funds perform well this year solely because they hold on to their winning stocks (a *passive* momentum strategy).[2] Further, we show that last year's best funds persist in outperforming last year's worst funds during years when the momentum effect in stocks is present, but underperform when the effect is absent. These observations explain why BG found that performance persistence is vulnerable to reversals during some years.

Our evidence also complements Carhart (1997), who includes a momentum factor in estimating abnormal returns of mutual funds. Like Carhart's after-expense findings, we show that pre-expense performance persistence appears to be largely tied to the momentum factor in stocks. However, we provide the first clear evidence that persistence in following *active* momentum strategies plays

[1] Relative performance persistence occurs when the performance of a fund is consistently above the average performance of a group of cohort funds. BG's evidence of performance persistence on an *absolute* basis (funds consistently outperforming an appropriate benchmark) was weaker. However, GT (1992) present evidence supportive of absolute persistence.

[2] Further evidence of the importance of active momentum strategies is provided by Wermers (1997), who shows that mutual funds may have a role in the momentum effect in stock returns due to the tendency of funds to herd into stocks with high past returns.

a large role in the persistence of pre-expense fund performance.[3] Our database, which includes the quarterly equity portfolio holdings (of each stock) for virtually all mutual funds existing between 1975 and 1994, allows us to examine the stock selection strategies used by all mutual funds holding equities as all or part of their portfolio holdings. The data also allow us to generate more precise estimates of mutual fund returns, before expenses and transaction costs, than past studies. Thus, we provide the clearest evidence to date of pre-expense performance persistence.

We also help to clarify the survivorship bias controversy by demonstrating why most recent studies have found a small level of survivorship bias. Last year's best funds outperform other funds during most years, but underperform during years when the momentum effect in stocks is absent. The empirical survival model of BG suggests that these funds may disappear after short periods of poor performance, thus making the sample of disappearing funds more representative of the universe of funds. Indeed, we find that last year's best funds (which generally consist of funds actively investing on momentum) disappear from our sample at rates not appreciably different from other funds. Survivors, therefore, have returns not appreciably different from the universe of funds.

We begin by analyzing the average returns of all mutual funds (gross of expenses and transaction costs) from 1975 to 1994. We find that the average mutual fund outperformed a market index during the 1970s, but underperformed during the 1980s, a result which is similar to the findings of Malkiel (1995) for fund returns after expenses and transaction costs.

Interestingly, results are different when we look at the risk-adjusted performance of the funds. Here, we find that, between 1976 and 1994, mutual funds have provided an average performance of 169 basis points per year, before adjusting for fees and expenses.[4] The average from 1976 to 1984 was 195 basis points per year, while the average was 146 basis points per year after 1984. Therefore, the average mutual fund, before all expenses, has provided a reasonably consistent performance, although it has been small.[5] Using an estimate for the average expense ratio of the funds of 125-130

[3]In the absence of portfolio holdings, Carhart (1997), working with net returns, found that buying last year's best funds works not because fund managers successfully follow *active* momentum strategies, but more likely because they (by not rebalancing) hold large positions in last year's winning stocks, thus avoiding transaction costs with a *passive* momentum strategy. In contrast, having portfolio holdings allows us to use a measure of momentum investing developed by GTW which controls for price changes and, therefore, only measures active momentum investing. We find that funds actively investing on momentum strongly outperform other funds, before fees and transaction costs, and that persistence by some funds in following active momentum strategies plays a large role in explaining the observed persistence in gross returns. Our evidence on gross return persistence, together with Carhart's evidence on net return persistence, indicates that active momentum investors may have much higher costs (perhaps due to more frequent trading) than other funds.

[4]The Grinblatt and Titman (1993) method of using past portfolio weights to compute the risk-adjusted performance of a mutual fund requires a one-year fund history, which is why this analysis begins in 1976.

[5]In examining the subgroup of mutual funds that most actively invested on momentum, however, we find stronger

basis points per year,[6] we find that an individual investor would have received a fair return from investing in the average no-load mutual fund over the long-run.[7]

We next examine the level of survivorship bias using our sample. Looking at gross returns, we find that the average fund surviving until 1994 outperformed the average fund that existed between 1975 and 1994 (whether it survived or not) by 104 basis points per year. Results for subperiods show that survivorship bias has remained reasonably constant over the entire time period. However, survivorship bias measured with risk-adjusted returns averaged only 20 basis points per year from 1976 to 1994. Our results before 1985 are consistent with Grinblatt and Titman (1989a), who measured risk-adjusted returns using four different specifications of the Jensen measure (based on four different benchmarks, all of which were different from our benchmark). Again, we find that survival bias, measured in risk-adjusted terms, has remained reasonably stable over subperiods.

Next, we investigate the level of performance persistence in mutual fund gross returns. A strategy of buying an equally weighted portfolio of last year's best decile of funds (ranked by gross return) provided an average gross return that was 3 percent per year higher than the gross return of the average mutual fund.[8] In addition, the simple Jensen measure of this strategy was over 3 percent per year. Most importantly, the success of this strategy during any given year was strongly related to the presence (or absence) of a momentum effect in stock returns during that year. Buying last year's best funds worked well during 1976-1992, with the exception of 1981, 1983, 1988, and 1989, while the momentum effect in stock returns was absent in 1981, 1983, and 1988. The results differed in 1989 because the best funds in 1988 were funds that invested as contrarians, a strategy that performed very poorly in 1989 (when the momentum effect in stock returns was again very strong).

Upon further investigation, the pre-expense performance that accues to buying last year's best

results. This group achieved an average performance level of about 4 percent per year, with statistically significant positive performance during 9 out of 19 years from 1976 to 1994. There was no evidence of statistically significant negative performance during any of the years for this group. By contrast, contrarian funds showed no statistically significant performance, either positive or negative, during any year.

[6]This expense ratio estimate was provided by Carhart (1997), and was for the years 1976-1992.

[7]Carhart (1997) also estimates average fund transaction costs of 109 basis points per year, which may be higher than that incurred by an individual passively holding a basket of stocks over long periods of time. However, an individual would incur some trading costs in keeping a well-diversified portfolio of stocks over time. In addition, the individual may be well-served by buying larger mutual funds, since Grinblatt and Titman (1989a) find that the impact of transaction costs on fund returns is inversely related to the size of a fund. They estimate that the largest quintile of funds during 1975 to 1984 had transaction costs *plus* expenses totalling only about 130 basis points per year.

[8]Interestingly, the NASD has recently pressed Morningstar into including one-year performance rankings of mutual funds [7].

funds disappears when controlling for the momentum effect in stock returns. We control for the momentum effect with Carhart's (1996) four-factor model, which includes a portfolio return that represents a loading on momentum. Buying last-year's best funds amounts to a positive loading on the momentum factor during this year, while buying last-year's worst funds is a negative loading this year.

Replacing Carhart's momentum factor with a portfolio that represents this year's return difference between those funds most *actively* investing on momentum last year and those most actively investing as contrarians gives the same results. Thus, the difference in returns between active momentum investors and active contrarians fully captures the impact of the momentum effect in stock returns on the gross-returns sort strategy. Therefore, contrary to Carhart's findings for persistence in net returns, we find that *active* momentum strategies (and not merely holding on to last year's winning stocks) play a large part in explaining gross return persistence. Further, funds actively investing on momentum persist in doing so. Similar to Carhart's findings using net returns, however, we find that persistence in gross returns appears to be largely explained by the momentum effect in stock returns.

Finally, we investigate the determinants of the disappearance of funds. Survivorship bias is most problematic when non-surviving funds have different risk and return characteristics from the universe of funds. While GTW showed that funds investing on momentum tend to outperform other funds, we show that such funds run the risk of a reversal in fortune due to the absence of a momentum effect during some years.[9] In addition, investing on momentum can involve holding a portfolio that is less diversified than a buy-and-hold investment strategy. We find that last year's best funds (which generally consist of funds actively investing on momentum) suffer a rate of attrition nearly as high as that of other funds, making the pool of non-surviving funds more representative of the universe of funds. Funds investing on momentum, while outperforming other funds over the long run, run the risk of a short period of poor performance followed by fund termination (supporting the BGIR survivorship model). Contrarian investors apparently disappear because they underperform other funds over longer periods of time (supporting the GT survivorship model).

With a group of Monte Carlo simulations, we demonstrate how investing on momentum can result in holding a portfolio that is not well-diversified. We create a cross-section of mutual fund

[9] As aptly stated by a recent Wall Street Journal article [8]: "In 1991, momentum investing worked pretty well. But the technique has an erratic long-term record and is difficult to use properly."

managers with a large amount of dispersion in the extent to which they condition their portfolio choices on past returns. Some funds are strong momentum investors and others are strong contrarians, with a uniform distribution of funds between the extremes. The simulation results show that, if funds are judged on either their short-term performance (as in the BGIR model) or on their longer-term performance (as in the GT model), the extreme funds (strong momentum investors and strong contrarians) are most likely to disappear. The result is that surviving funds have average returns only slightly higher than non-surviving funds, making survivorship bias a relatively small concern under either survival model. Thus, our most important contribution to the survivorship bias literature is that we explain why this type of bias is not particularly large, as recently noted by Elton, Gruber, and Blake (1996b) and Carhart (1995). These papers find that survivorship bias amounts to only about 100 basis points per year.

The remainder of the paper is organized in four sections. The methodology that we use to characterize the investment styles of funds is presented in Section 2. Empirical findings are discussed in Section 3. Simulation examples are undertaken in Section 4. We conclude the paper in Section 5.

2 Methodology

2.1 The Mutual Fund Database

Quarterly portfolio holdings for virtually all publicly traded mutual funds with equity holdings that existed during any given quarter between December 31, 1974 and December 31, 1994 (inclusive) were purchased from CDA Investment Technologies, Inc. of Rockville, Maryland.[10] The first ten years of this dataset were used by Grinblatt and Titman (1989a, 1993) to examine the performance of the funds and by Grinblatt, Titman, and Wermers (1995) to analyze the investment strategies of the funds. The dataset lists the equity portion of each fund's holdings (i.e., the shareholdings of each CUSIP) along with the net asset value and the self-declared investment objective (beginning June 30, 1980) at the end of each calendar quarter.

Monthly prices and returns were obtained from the CRSP NYAM and NASD files.[11] As necessitated by the frequency of the fund holdings dataset, we use the beginning of calendar quarter

[10] See the Appendix for details on the procedure used by CDA to collect mutual fund data and for details about the structure of the database.

[11] Returns from the CRSP daily files are compounded into monthly returns to minimize problems arising from missing observations, since the CRSP compounding program ignores missing daily returns.

share holdings of a fund as a proxy for its holdings throughout that quarter. As such, we believe that any evidence of significant performance by a fund, either positive or negative, is probably biased toward zero.

CDA assigns fund numbers to each distinct fund. A fund number stays with the fund as long as it is in existence, including after name or investment objective changes, allowing us to continue tracking a fund until it merges with another fund or until it is liquidated.

In Table 1, we illustrate the composition of the database during each year, along with some details on the entry and exit of funds from different categories.[12] Statistics are presented for the entire universe of funds, along with funds in the five largest investment-objective categories, aggressive-growth, growth, growth-income, balanced, and international stock funds (those domestic funds specializing in international stocks).[13]

The universe of mutual funds expanded significantly during this period, from almost 400 funds at the end of 1974 to over 2,700 funds at the end of 1994. Since the vast expansion in self-directed retirement plans in the early 1980s, every year has seen a significant increase in the number of funds available. Throughout this time period, equity mutual funds declaring themselves as "growth funds" have been the most popular.

2.2 A Comparison to Databases Used by Other Researchers

Brown and Goetzmann (1995) collected data from the *Mutual Funds Panorama* published by Wiesenberger Investment Companies Service for the years 1976 through 1988.[14] Wiesenberger reports annual data for each publicly offered open-end mutual fund. BG collected data for all firms listed as common stock funds, and for specialty funds that invested in common stocks (typically sector funds). This data includes the fund name, the year of origin, the fund objective, the net asset value at the beginning and end of the year, the 12-month change in net asset value per share adjusted for capital gains distributions, the income return, the capital gains distributions, and the

[12]The columns "born" and "died" list a yearly count of the number of new funds and the number of funds liquidated or merged into another fund, respectively. For a more-detailed description of the investment-objective categories, see GTW.

[13]The smaller categories that are not shown include income funds, funds that mainly hold municipal bonds, bond and preferred stock funds, special purpose funds, venture capital/special situations funds, metals funds, and foreign mutual funds covered by CDA (foreign funds, mainly Canadian, number about 200 in 1994). We believe that CDA tracked virtually every domestic stock fund, but that categories of funds having other specialties (such as metals funds), along with foreign stock funds, may be somewhat incomplete. We are in the process of more accurately determining the completeness of each category. For more details on the construction of the CDA database, see the Appendix.

[14]Wiesenberger is actually now part of CDA/Wiesenberger.

expense ratio. BG then calculated the total return for each fund, inclusive of capital appreciation, income, and capital gains distributions.

The *Panorama* also indicates merged funds and name changes of funds. When one fund was merged into another, BG treated the acquired fund as if it disappeared. Reporting to Wiesenberger is at least in part discretionary, so the database may not be entirely free of selection bias. Also, since BG only collect annual data, they exclude from their sample the year that funds do poorly and merge or fail. Our database includes 1,381 funds at the end of 1988, while the BG database includes 829. We include many more funds in some categories, such as international funds. In addition, we include funds investing both in stocks and bonds (balanced funds), which are not included in the BG database.

Elton, Gruber, and Blake (1996a,b) collected data on the 361 funds categorized as stock funds in 1976 from Wiesenberger's *Investment Companies*. They calculated returns from 1977 to 1993 for the 188 unrestricted funds having at least a net asset value of $15 million at the end of 1976. In addition, they collected data on name changes, mergers, investment objective changes, and restrictions (such as not being available to the general public any longer) from Wiesenberger, supplemented by information from the fund companies themselves.

For funds that existed over the entire period, monthly returns were collected from Investment Company Data, Incorporated (ICDI). For funds that ceased to exist, returns were calculated from data supplied by Interactive Data Corporation (IDC), supplemented by information from the funds themselves (including the terms of mergers). Elton, Gruber, and Blake have provided the only study that tracks each merging fund's returns during and after the merger period (using the information on the acquiring firm and the terms of the merger), but their analysis is limited to the relatively small sample of funds existing at the end of 1976.

Malkiel (1995) collected quarterly net returns and expense data from Lipper Analytic Services for all publicly available equity mutual funds in existence each quarter from 1971 to 1991. Excluded were specialized funds that did not mainly hold diversified portfolios of stocks, such as sector funds or balanced funds (which invest in both stocks and bonds). In analyzing the annual return of the funds for a particular year, Malkiel dropped funds that did not survive the entire year. Malkiel's sample included 724 funds at the end of 1990, while our database included 1,750. We believe that our sample is much larger due to the fund categories that Malkiel excludes from his analysis.[15]

[15]However, it is puzzling why Malkiel's database is significantly smaller than that of BG, since both apparently

Carhart (1995, 1996) collected mutual fund data from several sources, including Wiesenberger, FundScope, Investment Company Data, Inc. (ICDI), the Investment Dealer's Digest, and United and Babson. Carhart's data cover fund attributes, including investment objective, net asset value, expense ratio, turnover, income and capital gains distributions, and load fees. Net returns are calculated from net asset value and distribution data, while transaction costs are estimated assuming that cross-sectional differences in fund returns explained by differences in fund turnover are actually due to differences in transaction costs incurred. We believe that Carhart's sample of mutual funds is as complete as ours, the difference being that our database focuses on stock holdings while Carhart's database focuses on net returns and fund characteristics.

Grinblatt and Titman (1989a, 1993) used CDA quarterly holdings data from 1975 to 1984 in their analysis of fund performance and survivorship bias. They supplemented this data with net returns purchased from CDA (also 1975 to 1984), for those funds surviving until December 31, 1984.

2.3 Measuring Risk-Adjusted Performance

Our portfolio holdings allow us to adjust returns for risk without choosing an arbitrary market-based index, in contrast to almost all other papers studying the risk-adjusted performance of mutual funds. The problems with choosing an appropriate market benchmark portfolio are well-documented [see, for example, Roll (1978)]. Grinblatt and Titman (1989b), for example, show that the commonly used Jensen measure biases the performance measure downward for funds with market-timing information.

Our measure, developed by Grinblatt and Titman (1993), uses the past portfolio weights of a given mutual fund to calculate a benchmark return for the evaluation period. Since the resulting performance measure is the difference between the current period return of two portfolios (chosen at slightly different times) by the same manager, the bias in the measure is of the order of the factor risk premia times the *change* in factor loadings over time, which is likely to be small when looking only at the equity portions of fund portfolios. By contrast, performance measures using a market-based index as a benchmark exhibit biases of the order of the factor risk premium times the priced factor loadings that are not spanned by the market benchmark.[16]

follow the same categories of funds. For example, Malkiel reports a universe of 686 funds in 1988, while BG report 829.

[16] See Grinblatt and Titman (1989b, 1993) for an excellent discussion of these issues.

Specifically, this performance measure (α) subtracts the current month's return earned by the portfolio held four quarters ago from the return earned by the current portfolio to adjust for risk:[17]

$$\alpha = \frac{1}{T}\sum_{t=1}^{T}\sum_{j=1}^{N}(\tilde{w}_{j,t} - \tilde{w}_{j,t-4})\tilde{R}_{j,t+1} \quad , \tag{1}$$

where $\tilde{w}_{j,t}$ is the portfolio weight on stock j at date t, and $\tilde{R}_{j,t+1}$ is the return of security j ($j = 1...N$) from date t to date $t+1$, the evaluation period. Note that α represents the mean return of a zero-investment portfolio. If the systematic risk of the current and benchmark portfolios are the same from the point-of-view of an investor with no selectivity or timing abilities [as defined by Grinblatt and Titman (1989b)], the performance represented by α should be insignificant from the point-of-view of that investor.[18]

2.4 Measuring "Momentum Investing" Behavior

We use the "lagged zero measure" ($L0M$) developed in GTW to determine the degree to which a fund *actively* uses a momentum investing strategy to choose stocks:[19]

$$L0M = \frac{1}{T}\sum_{t=1}^{T}\sum_{j=1}^{N}(\tilde{w}_{j,t} - \tilde{w}_{j,t-1})\tilde{R}_{j,t} \quad . \tag{2}$$

Equation (2) measures the degree to which a fund manager moves his portfolio into stocks that have experienced high returns and away from stocks that have experienced low returns during the prior quarter. Since this measure equals the difference between two portfolio returns during a benchmark period, a positive measure means that a fund's current portfolio would have had a higher return during the historical period than the portfolio that the fund would have held, had no

[17] Since portfolio weights are only observed quarterly, while CRSP returns are available monthly, we actually use a slightly modified version of this equation:

$$\alpha = \frac{1}{3T}\sum_{t=1}^{T}\sum_{i=1}^{3}\sum_{j=1}^{N}(\tilde{w}_{j,3t+9} - \tilde{w}_{j,3t-3})\tilde{R}_{j,3t+9+i}.$$

[18] Grinblatt and Titman (1989a) provide evidence that the two portfolios have the same market betas.

[19] Again, we use a slightly modified version of this equation that uses monthly returns:

$$L0M = \frac{1}{120}\sum_{t=1}^{40}\sum_{i=1}^{3}\sum_{j=1}^{N}(\tilde{w}_{j,3t} - \tilde{w}_{j,3t-3})\tilde{R}_{j,3t-3+i}.$$

portfolio revisions been made.

The portfolio weights of high (low) return stocks increase (decrease) even if the number of shares held stays constant. Without modification, $L0M$ would indicate momentum investing for buy-and-hold investment strategies. To focus on *active* momentum strategies, we calculate the beginning and ending weights for a stock during a given quarter using the average of the beginning and ending share prices.[20]

3 Results

3.1 An Examination of 20 Years of Mutual Fund Returns

Malkiel (1995) used returns net of expenses and transaction costs to conclude that mutual funds, as a group, have not been able to beat the S&P 500 market index. Malkiel found that, during 1982-1991, the average mutual fund underperformed the S&P 500 by almost 200 basis points per year.[21]

Our first test investigates how the average mutual fund has compared to market index, gross of *all* expenses and transaction costs. Table 2 compares the average monthly returns accruing to a portfolio equally weighted in all funds (rebalanced monthly) with two CRSP NYSE/AMEX indexes (also rebalanced monthly). For each month, this portfolio of funds includes all funds existing at the beginning of the calendar quarter containing the month, whether or not the fund survived past that quarter. Therefore, our results are essentially free of any survivorship biases.[22]

For every year during the period 1975-1982, we find that the equally weighted fund portfolio outperformed the CRSP value-weighted index (we also present these results in Figure 1). However, the evidence since 1983 shows the reverse result, with the CRSP value-weighted index outperforming the average mutual fund during most years. In fact, our results during 1983-1994 show an average underperformance of about 53 basis points (before fund expenses and transaction costs are subtracted), which agrees very closely with Malkiel (1995).[23]

[20] Appropriate adjustments are made to undo the effect of stock splits and stock distributions on the shareholdings and prices.

[21] In fact, Malkiel adds back fund expenses to find that the average fund underperformed the index by about 80 basis points per year, even before expenses (but after transactions costs) were subtracted.

[22] A fund entering the sample sometime during the calendar quarter was not included in the calculations. Note that the method used by CDA to construct the database may not be entirely free from selectivity bias (see the Appendix for details), although we believe that such biases are extremely small and are not based on a survival requirement.

[23] Three differences between the Malkiel (1995) study and this study should be noted. First, Malkiel uses total net asset weighted portfolios of mutual funds, while we use equally weighted portfolios of funds. Second, Malkiel's results

During 15 out of the 20 years between 1975 and 1994, the mutual fund universe (equally weighted) outperformed the CRSP value-weighted index whenever the CRSP equal-weighted index outperformed the value-weighted index. This indicates that the funds were more heavily invested in small stocks than the value-weighted portfolio.[24]

To summarize, mutual funds outperformed the value-weighted market index during the 1970s, and underperformed the index during the 1980s, even before transactions costs and fund expenses were subtracted. Performance above market indexes by the average fund before 1983 and below market indexes thereafter appears to be largely due to the relative performance of large and small stock portfolios during these periods.

In order to estimate the magnitude of survivorship bias, we compare the returns of mutual funds that survived until the end of 1994 with those funds that did not survive in the next section. In addition, we look again at the performance of the mutual fund universe over the 20-year period, on a risk-adjusted basis.

Figures 1 and 2. Mutual Fund Gross Returns

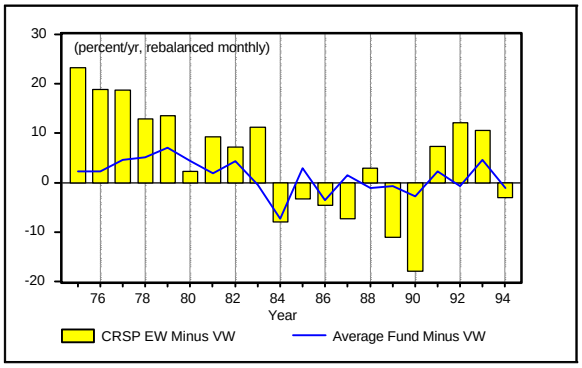

Figure 1: Average Fund Return vs. Market Indexes

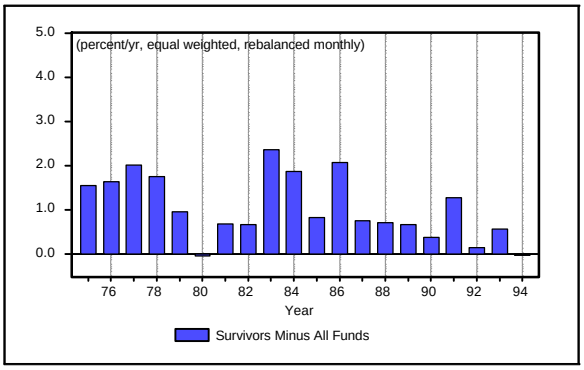

Figure 2: Survivorship Bias

are after transactions costs are subtracted, while our results are gross of transactions costs. And, third, our dataset contains the (United States) equity portion of some funds not covered by Malkiel, such as international funds, sector funds, and funds that invest both in equities and in bonds.

[24]This result was also noted by BG for mutual funds from 1977-1988, and by Lakonishok, Shleifer, and Vishny (1992b) for pension funds. Our method of equally weighting the funds exacerbates this effect, since smaller funds tend to buy smaller stocks.

3.2 The Effect of a Survivorship Requirement on Gross Returns

Having found that the average mutual fund has not been able to consistently outperform the market in terms of gross returns, we now turn our attention to estimating the magnitude of a survivorship requirement on fund returns. Some past researchers have found this effect to be large [e.g., Malkiel (1995)], while others have found it to be relatively small [e.g., Grinblatt and Titman (1989a)].

Table 1 shows that roughly one-tenth of existing funds are either merged into another fund or are liquidated in an average year (see the "all funds" category). We might expect that survivorship would be related to the fund objective, with riskier funds (e.g., aggressive-growth funds) having larger mortality rates than safer funds (e.g., balanced funds). However, we do not find significant differences between the categories that can be explained by differences in risk.[25]

Table 3 shows yearly returns to equally weighted portfolios of three groups: funds surviving until the end of 1994, funds disappearing by 1994, and funds surviving until 1994 with at least a 20-year track record. Comparing the yearly returns of the two groups of survivors, we find that, at the end of 1994, looking only at funds with a long track-record is surprisingly similar to looking at all existing funds. Comparing the gross return of the average mutual fund from each group, we find a difference of only one percent during most years, with almost identical average 20-year returns. Therefore, the concern raised by some researchers of the impact of a minimum track-record requirement does not seem warranted, at least in looking at gross returns.

The difference in returns earned by survivors and non-survivors has remained reasonably constant during the 20-year period. Although the yearly difference has ranged from about 0 to almost 4 percent, most years exhibit a difference of about 1 to 3 percent, with an average of 172 basis points for the entire 20-year period examined.

A comparison of Tables 2 and 3 shows that, from 1975 to 1994, an average return difference of 104 basis points per year existed between the equally weighted portfolio formed of all funds existing during each quarter and a portfolio formed only of funds that survived until December 31, 1994.[26] Figure 2 also presents these results. The average difference for 1975-1984 was 135 basis points, while the average difference for 1985-1994 was 74 basis points.

By comparison, Grinblatt and Titman (1989a) reported a difference of, at most, 50 basis points between the yearly gross returns of an equally weighted portfolio of all funds existing during each

[25] Elton, Gruber, and Blake (1996b) also reached this conclusion.

[26] This difference is the usual definition of "survivorship bias".

quarter between January 1, 1975 and December 31, 1984, and a similar portfolio holding only those funds existing on January 1, 1975 that survived until December 31, 1984. Our somewhat higher estimate of survivorship bias is certainly due, in part, to our more stringent requirement of fund survivorship until the end of 1994.[27] Still, the results of both studies are in agreement that examining only surviving funds results in a relatively small bias, on the order of 50 to 100 basis points per year in gross returns.

A comparison of our results for survivors and non-survivors with those of Malkiel (1995) is also somewhat illuminating. Malkiel finds an average yearly return difference (between non-survivors and survivors to 1992) of about 6.2 percent per year during the period 1982 to 1990, while we find an average difference (between non-survivors and survivors to 1994) of about 1.8 percent per year during the same time period. Most of the difference in results appears to be attributable to differences in the returns of non-survivors.[28] However, our estimate of survivorship bias in gross returns roughly agrees with that of Malkiel in net returns, about 100 basis points per year. Elton, Gruber, and Blake (1996b) and Carhart (1995) provide similar findings.

[27]This is probably why the first 10-year period exhibits a higher difference between survivors and all funds than the second 10 years. For example, it is much more difficult for a fund that exists in 1975 to survive until 1994 than for a fund that exists in 1985.

[28]Since Malkiel measures returns net of expenses and transaction costs, while ours are gross of both, it appears that a major factor in survivorship bias in net returns is the presence of higher fund expenses and transaction costs among non-survivors than among survivors. Some support for this view is offered by BG and by Carhart (1997). BG find that funds with higher expense ratios have a higher probability of disappearance. This is consistent with the presence of significant fixed operating costs for mutual funds, since BG also find that smaller funds are less likely to survive, all else equal.

Carhart estimates that the difference in expense ratios between survivors and non-survivors was about 37 basis points per year, and that the difference in transaction costs was about 70-80 basis points per year over the 1961-1992 period. In addition, small funds (which disappear more frequently than large funds) have higher portfolio turnover and buy smaller stocks, thus incurring higher transaction costs than large funds. Therefore, disappearing funds likely have significantly higher fund expenses and direct trading costs than surviving funds, per dollar invested.

A tabulation of the average returns (in percent per year over the 1982 to 1990 period) found by Malkiel and by this study is as follows:

Author	All Funds	Survivors	Non-Survivors
This study	14.8	15.9	14.1
Malkiel (1995)	12.9	13.8	7.6
Difference	1.9	2.1	6.5

Since Malkiel states that fund expenses average about 100 basis points per year, we can attribute the remaining 110 basis point difference between survivors to transaction costs and to differences in the databases and the weighting schemes (Malkiel uses total net asset weighted portfolios of funds, while we use equally weighted portfolios). The unexplained difference between non-survivors is more difficult to justify without resorting to much higher expenses and transaction costs.

3.3 Mutual Fund Performance and Survivorship Bias Using Risk-Adjusted Returns

Our results of the prior section indicated that mutual funds outperformed a simple value-weighted market index during the 1970s, but underperformed the index during the 1980s. We next explore how the funds performed on a risk-adjusted basis during these two periods.

Table 4 presents average yearly risk-adjusted performance results for the universe of funds, for the group of funds that survived until 1994, for the group that did not survive, and for the 118 funds that existed during the entire 20-year period. As discussed in Section 2, we used the four-quarter performance measure (α) developed by Grinblatt and Titman (1993), which does not require the choice of an arbitrary market-based benchmark portfolio.

Here, the results are more stable over the 20-year period for the universe of mutual funds (shown in the first column) than for our previous comparison of gross returns to the CRSP index (Figure 3 also presents these results). For example, the average performance from 1976 to 1984 was 195 basis points per year, while the average from 1985 to 1994 was 146 basis points per year. The 19-year average was 169 basis points per year. Therefore, Malkiel's finding that the universe of mutual funds performed well in the 1970s, but did not in the 1980s, is not robust to the choice of a benchmark portfolio that is more appropriate than the S&P 500 index. The average mutual fund, at least before transaction costs and expenses, has provided a reasonably consistent positive performance, although it has been small.

Figures 3 and 4. Mutual Fund Risk-Adjusted Performance

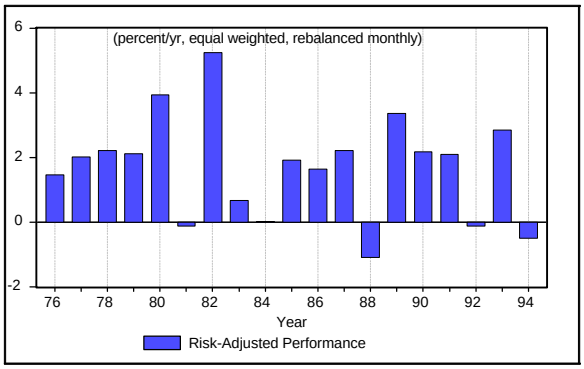

Figure 3: Average Fund Performance

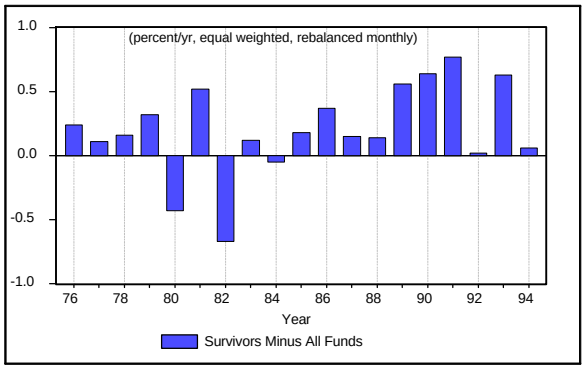

Figure 4: Survivorship Bias

Survivorship bias (the difference between all funds and survivors, shown also in Figure 4) using

risk-adjusted returns averaged 20 basis points per year, which compares closely with the findings of Grinblatt and Titman (1989a). They estimated, based on the Jensen measure, that survivorship bias in risk-adjusted returns was less than 50 basis points per year from 1975 to 1984.[29]

Consistent with our previous results for gross returns, we find that examining only those funds with a 20-year track record in 1994 does not create a larger bias than looking at the historical record of all funds existing in 1994. These two groups have nearly identical performance records, both overall and for each year.

Surprisingly, even non-survivors achieved statistically significant positive performance during three years. In contrast, there were no occurrences of significant negative performance for this group. This finding is consistent with at least a portion of non-surviving funds being terminated after a short period of poor performance, even though they may have had satisfactory long-term records.

To summarize this section, we find that mutual funds, on average, provided a small, positive risk-adjusted performance from 1975 to 1994, and that the performance difference between survivors and non-survivors (before transaction costs and expenses) is much smaller than that estimated by Malkiel (after transaction costs and expenses). Therefore, differences in transaction costs and expenses appear to be a significant factor in the disappearance of funds.

3.4 Returns to Buying Last-Year's Momentum Investing Funds

A common style used by mutual funds to select stocks consisted of conditioning portfolio choices on past returns. GTW showed that funds buying past winners (momentum investors) outperformed other funds from 1975 to 1984. From a sample of 155 funds, the mean α of the 119 funds that were momentum investors was 2.6 percent per year (with a significant t-statistic), while the mean α of the 36 contrarian funds was insignificant. In addition, Brown and Goetzmann (1995) showed that the disappearance of a fund can be explained, in part, by poor performance. In the remainder of this paper, we investigate the relation between the momentum investment style, performance persistence, and survival of funds.

Table 5 shows the gross returns and performance that would have accrued to a strategy of buying funds most actively investing on momentum versus buying those most actively investing as contrarians. That is, each year, funds were ranked on their prior-year $L0M$ measure, then an

[29] Although they measured survivorship bias in four different ways (based on four different benchmarks), all of the estimates fell below 50 basis points.

equal-weighted portfolio of the top 20 percent (or bottom 20 percent) of these ranked funds was held for a year. At the end of that year, the portfolios were rebalanced. During 15 out of 19 years, the prior-year momentum-investing funds beat the prior-year contrarians, when measured on a risk-adjusted basis. Buying momentum-investing funds would have achieved a performance level averaging about 4 percent per year, beating contrarian-investing funds by about 3 percent per year.

The table also presents the $L0M$ measure during the year following the ranking year for these two groups. These results show that both momentum investors and contrarians persist in using their respective investment styles from one year to the next.

3.5 The Persistence of Mutual Fund Returns

Does past performance predict future performance among mutual funds? We investigate this question with a very simple test that is similar to tests of persistence used by Hendricks, Patel, and Zeckhauser (1993). At the end of each year, we ranked all existing mutual funds by their prior-year gross returns. Then, we formed equally weighted decile portfolios of funds and measured the return during the following year for each portfolio. For example, at the end of 1975, we ranked all funds having a minimum of a 12-month track record by their average buy-and-hold monthly return for 1975. Returns for decile portfolios of funds based on this ranking were then measured for 1976. If a fund disappeared during 1976, it was included in the appropriate decile portfolio until the end of the quarter in which it disappeared, after which the portfolio was rebalanced (equally) in all the remaining funds.

The results, shown in Table 6, illustrate the relative success of buying past winning funds. Yearly results for choosing last-year's top decile of mutual funds each year are shown in the first column, denoted as portfolio P1. P1 outperformed last-year's worst funds, portfolio P10, by almost 7 percent per year over the 17 years shown. During only 3 of those 17 years, P10 outperformed P1. In several years, P1 outperformed P10 by more than 10 percent.

Another interesting result to note is that portfolios in the middle, P2 through P9, had returns that fell between those of P1 and P10. In fact, returns were generally monotonically decreasing from P1 to P10, although sometimes this pattern reversed. This finding is suggestive of a common investment strategy used to a different degree by funds; that is, funds appear to be using differential loadings on a common factor.

The bottom section of the table presents results with a simple adjustment for risk. The time-series of returns from each portfolio (minus T-bill returns) were regressed on the excess return of a value-weighted CRSP portfolio, with the resulting intercept and slope coefficient shown in rows labelled "CAPM Alpha" and "CAPM Beta". With this simple adjustment for risk, the difference in performance between P1 and P10 is about 6 percent per year.

Finally, we compare the returns of two differenced portfolios in the last two columns of Table 6. The first return series shows the difference in returns between P1 and P10. The second series shows the return difference between an equally weighted portfolio of the 30 percent of NYSE and AMEX stocks having the highest returns during the period beginning 7 months ago and ending 1 month ago, and an equally weighted portfolio of the 30 percent having the lowest past returns.[30]

The two differenced portfolios exhibit a remarkably similar pattern of returns. Both exhibit large, positive returns during most years. In addition, the lowest return years for the P1 minus P10 series were 1981, 1983, 1988, and 1989, while the lowest return years for the stock momentum series were 1981, 1983, and 1988.[31] Since the two series provide such similar results, the persistence in mutual fund gross returns appears to be largely driven by the momentum effect in stock returns. We explore this further in the next section.

3.6 The Role of Investment Style in Performance Persistence

Our results so far demonstrate that funds investing on momentum outperform other funds (Table 5), and that some funds are able to consistently outperform others (Table 6). This section ties these two findings together by showing that persistence in fund performance is strongly related to *active* momentum investing by funds.

In Table 7, we present results for several time-series regressions. In Panel A, we present results for the 10 portfolios formed as described in Table 6, where the excess returns for these portfolios were regressed on the returns of the three Fama and French (1993) factor portfolios.[32] These three factor portfolios include the time series of monthly returns associated with (1) a value-weighted

[30]Stocks are ranked (and new portfolios are formed) every month.We thank Louis Chan for providing this data series.

[31]During 1989, the two strategies had very different results. However, this was the year following the worst year (1988) for buying past winning stocks and shorting past losers. Therefore, the best funds of 1988 were contrarians, while the worst funds were those investing on momentum. Buying the best funds of 1988, and selling the worst, amounted to buying past losing stocks and selling past winners, which had a disastrous outcome during 1989.

[32]Our thanks to Mark Carhart for providing the Fama and French factor portfolio returns, along with the returns for his own four-factor model, which we also use in this section.

market proxy portfolio minus T-bills (RMRF), (2) the difference in returns between small- and large-capitalization stocks (SMB), and (3) the difference in returns between high and low book-to-market stocks (HML).[33]

While P1 through P10 have roughly the same loading on the market portfolio, P1 through P3 have a higher loading on the SMB regressor, indicating that last-year's best funds hold smaller stocks than other funds. F-tests strongly reject the equality of these SMB coefficients across portfolios. In addition, there appear to be slight differences in the HML coefficients. After controlling for these differences in factor loadings, however, we find that the intercepts from these regressions remain significantly different. For example, the difference in performance between P1 and P10 is still about six percent.

Panel B provides further insight by adding Carhart's (1997) fourth portfolio return as a regressor (PR1YR), which represents the difference in returns between stocks having high and low prior-year returns. While the coefficients for RMRF, SMB, and HML remain roughly the same, all intercepts are now insignificant. In addition, loadings on the PR1YR regressor monotonically decrease in value from P1 to P10. Buying last-year's best funds results in a positive loading this year on the momentum factor, while buying last-year's worst funds represents a negative loading on momentum, equal but opposite in value to the coefficient for P1. In turn, last year's best funds appear to outperform (this year) the average fund only because the best funds disproportionately hold last year's winning stocks in their portfolios (this year). Conversely, last year's worst funds underperform only because they hold last year's losers.

Carhart (1997) argues that it is not the use of *active* momentum strategies that is responsible for persistence in net mutual fund returns, but that it is more likely *passive* strategies. Funds merely holding on to last year's shares will, by default, hold a portfolio more heavily weighted in winners, with the added advantage of avoiding transaction costs of active strategies.

We now present evidence that suggests, at least for pre-expense fund returns, that the persistent use of active momentum strategies is a large factor in explaining performance persistence. Panel C compares two regressions. In the first, we regressed the difference in returns between last year's best and worst funds, equally weighted, on Carhart's four factors. In the second regression, we replaced Carhart's PR1YR regressor (which captures the momentum factor) with the difference in returns, this year, between funds most actively investing on momentum last year and those

[33] See Fama and French (1993) and Carhart (1997) for a more detailed description of the formation of these portfolios and of the Carhart four-factor portfolios used later in this section.

funds most actively investing as contrarians last year (labelled L0M). In ranking funds to create these returns, we used the $L0M$ measure of momentum investing described in an earlier section. This measure captures only active momentum investing, and would assign a value of zero to a buy-and-hold strategy (i.e., passive momentum investing).

The L0M regressor explains fund performance as well as the PR1YR regressor; an F-test cannot reject the equality of the intercepts from these two regressions, nor can another F-test reject that both intercepts equal zero. The L0M regressor is formed using a lagged ranking of funds by their tendency to invest on momentum, so the equivalence of this regressor to the PR1YR regressor indicates that last-year's active momentum funds continue with a strong momentum loading this year. This persistence in momentum loading may be partly due to holding on to winners purchased last year, but certainly is largely due to funds persisting in actively investing on momentum from year to year, as indicated previously in Section 3.4. In any case, the entire persistence in mutual fund returns may be captured by sorting mutual funds by their tendency to actively invest on momentum.

3.7 The Role of Investment Style in Survivorship Bias

BGIR demonstrated that the total portfolio risk of a mutual fund is relevant in the study of performance persistence if funds are judged by investors on their short-term track records. Even in the absence of superior information, some funds taking big risks will succeed. Funds that do not survive are funds that took big risks and failed. In this scenario, ranking funds by their short-term records is nothing more than ranking them on total portfolio risk.

However, if superior funds exist, then, in certain cases, survivorship bias of the type described by BGIR may be mitigated. If funds with the highest total portfolio risk also tend to be superior funds, then a ranking of funds based on their short-term track records may indirectly rank them by their longer-term track records.

Evidence supporting this view is provided in Table 6. The standard deviation of the yearly returns to each portfolio (shown near the bottom of the table) clearly show that choosing past winning mutual funds, while providing higher average returns, is a much higher (total) risk strategy than choosing past losing funds.[34] As noted by BG, chasing winners is a volatile strategy.

Ranking mutual funds by past returns results not only in a ranking by risk, but also in a ranking

[34]However, the differences in market risk of these two strategies is not appreciably different.

by the tendency of funds to invest on momentum. The average $L0M$ measure of each portfolio is presented near the bottom of Table 6. Note that portfolios P1, P2, P9, and P10 consist of funds more actively investing on momentum than the middle portfolios. P1 and P2 have high $L0M$ measures because last year's best funds tend to continue to invest on momentum, while P9 and P10 have high measures because last year's worst funds sometimes consist of momentum investors (who continue to invest on momentum).

In Table 8, we further investigate the relation between risk, performance, and momentum investing. Table 8A shows the average characteristics of the universe of mutual funds, survivors until 1994, and non-survivors. Survivors consist of funds that invest on momentum to a greater degree than non-survivors (as illustrated by the average $L0M$ measure of each group), and the average risk-adjusted performance of survivors is more than twice that of non-survivors. This is not surprising, given our prior finding that momentum investors outperform other funds, and given the findings of BG that survival depends on performance. A more surprising finding is that the total risk of non-survivors is not much higher than that of survivors, suggesting a more complex picture of survival than that presented by BGIR. In the rest of this paper, we present evidence supportive of a large role for momentum investment strategies in explaining the survival of funds.

Cross-sectional regressions (across funds) of fund performance on fund total portfolio risk (measured by the time-series standard deviation of monthly returns for a each fund) are presented in Table 8B. Both survivors and non-survivors show a statistically significant correlation between performance and total portfolio risk, although the relation is much stronger for survivors. This finding at first seems surprising, since the performance measure is already risk-adjusted and should not be related to any measure of risk. However, we next show that this result is due to the correlation between performance, the tendency to invest on momentum, and portfolio risk.

Table 8C presents cross-sectional multiple regressions of fund performance on fund total portfolio risk and on $L0M$, our measure of momentum investing. For both the total sample and for survivors, $L0M$ does not show significant power in explaining performance after controlling for portfolio risk. These two explanatory variables are highly correlated, as we found when we regressed $L0M$ on the total portfolio risk. This cross-sectional regression, which is unreported, resulted in a coefficient of 0.41, which was statistically significant with a p-level well below 1 percent.

Thus, funds investing on momentum tend to hold higher total risk portfolios, and they tend to outperform other funds on a risk-adjusted basis. According to the BGIR survival model, momentum

investors, though outperforming other funds, are at risk of a short period of very poor performance followed by termination. We provide some evidence supportive of this in our next section.

3.8 The Mortality of Momentum Investors and Contrarians

If, according to the BGIR survival model, short periods of poor performance result in the termination of a fund, then we would expect that momentum investors might disappear with some frequency due to occasional reversals in the momentum effect in stocks and to the higher level of total portfolio risk carried by these funds. Table 6 presents some support for this idea. At the bottom of the table, a total count of funds that disappeared from each portfolio formed in that table is presented. Members of portfolio P1, last year's best funds, disappear with a lower frequency than members of P10, last year's worst funds. However, the number disappearing is relatively flat over portfolios P1 to P8 and is not that dramatically different across all portfolios. Although it is not clear whether funds disappeared due to liquidation or due to a merger with another fund, it seems clear that this survivorship pattern presents a picture more complex than that suggested by prior research. In Section 4, we provide a simulation example that illustrates how momentum investors may disappear from a sample due to the higher levels of total portfolio risk that they carry, even though they outperform other funds over the long run.

4 Simulations of Survivorship Bias Patterns

4.1 The Return-Generating Process for Stocks

To illustrate the way in which survivorship bias, in the presence of a momentum effect in stock returns, affects inferences about performance persistence, we constructed an example using Monte Carlo simulations. In this example, we generated the return for stock i during year t with the AR(1) model,

$$R_{i,t} = \alpha + \rho R_{i,t-1} + \epsilon_{i,t} \ , \tag{3}$$

where α and ρ are constant, and $\epsilon_{i,t} \sim N(0, \sigma^2)$ is iid across i and t. A positive value of ρ introduces positive serial correlation in the return-generating process for each stock to approximate the serial correlation observed at one-year time horizons by Jegadeesh and Titman (1993). We chose values of $\rho = 0.1$, $\alpha = 0.108$ (giving a mean return of 12 percent per year), and $\sigma = 0.15$.

We can rewrite Equation (3) as

$$R_{i,t} = \frac{\alpha}{1-\rho} + \sum_{k=0}^{\infty} \rho^k \epsilon_{i,t-k},$$

which shows that each stock return follows an infinite-order moving average process in past disturbance terms, and that the unconditional expected return of each stock,

$$E[R_{i,t}] = \frac{\alpha}{1-\rho},$$

is constant through time.

4.2 The Portfolio-Selection Rule for Fund Managers

Next, we add a portfolio selection rule for each fund manager. The selection rule for manager m is

$$w_{i,t}^m = w_{i,t-1}^m + k^m(R_{i,t-1} - \overline{R}_{t-1}), \tag{4}$$

where $w_{i,t}^m$ is the portfolio weight corresponding to stock i during year t, k^m is the "feedback coefficient" for manager m, and $\overline{R}_{t-1}$ is the average return across stocks during year $t-1$ (the equally weighted market return).[35] A positive value for k^m corresponds to manager m being a momentum investor, while a negative value corresponds to a contrarian. The larger the (absolute) value of k^m, the more strongly the manager uses past returns as a determinant of portfolio choice. Note that the weights described by Equation (4) always add to one for manager m during any year. We randomly drew a value for k^m for each manager, m, from a uniform distribution between -0.125 and +0.125, $U(-0.125, +0.125)$ to simulate a diverse set of stock selection strategies.

An important observation to note (for our later results) is that a larger value of k^m, in absolute value, corresponding to a strong momentum or contrarian investor, results in a less well-diversified portfolio than a k^m close to zero. Indeed, a manager using a k^m exactly equal to zero passively holds the equal weighted market portfolio (an indexer), the minimum variance portfolio.

[35] The first difference in portfolio weights, $w_{i,t}^m - w_{i,t-1}^m = k^m(R_{i,t-1} - \overline{R}_{t-1})$, is similar to the arbitrage portfolio weights used by Lo and MacKinlay (1990) in their analysis of the positive autocorrelation in weekly portfolio returns, which were $w_{i,t} = -\frac{1}{N}(R_{i,t-1} - \overline{R}_{t-1})$. Lo and MacKinlay's weights correspond to a contrarian strategy with a feedback coefficient of $k^m = -\frac{1}{N}$ in our framework.

4.3 The Simulation Procedure

The simulations proceeded as follows. First, a time-series of stock returns was generated using Equation (3) for each of 100 stocks. We chose a time period of 20 years to match the sample period for the actual funds. Next, each fund manager was randomly assigned a subset of 25 stocks from the universe of 100, in order to allow different funds to be restricted to different groups of stocks (as with actual funds). The initial portfolio assigned to a manager was equally weighted in the 25 stocks chosen randomly for that manager. Successive portfolio weights (through time) were generated for the manager, according to his value of k^m, by the portfolio-revision rule given by Equation (4).[36]

For each evaluation period, the portfolio return was calculated for each manager, and managers were then ranked by their evaluation-period return. Then, a survival cut was made based on the ranking, so that, for example, the bottom five percent of all existing funds during that period were truncated from the sample. For truncated funds, the return from the evaluation period responsible for their truncation was included as the last return data for that fund. No more returns were generated for those funds.

This process was repeated for the next evaluation period. Portfolio returns were generated for survivors from the prior period, and another cut was made after repeating the ranking procedure. This process of calculating portfolio returns, ranking, and truncating was repeated over the remainder of the 20-year period to complete the first iteration of the simulation. Finally, the entire simulation was repeated 100 times, and average portfolio returns were calculated for all managers.

Two very different versions of the survival rule were used, corresponding to the longer-term ranking discussed by GT and to the short-term ranking discussed by BGIR. In our first group of simulations, we used an evaluation period of five years; in our second group, we used an evaluation period of only one year.

4.4 Simulation Results

The results for three different versions of the five-year evaluation period are presented in Table 9. In the first version, we truncated the bottom 10 percent of funds at each evaluation period. These

[36] Actually, the equally weighted index of the 25 stocks in the manager's restricted opportunity set was used as his proxy for the market index so that portfolio weights always summed to 1 [see Equation (4)]. Using this slightly modified rule, each manager buys and sells stocks already held in his portfolio according to the relative performance of the stocks.

results are given in Panel A. We found that momentum investors, while disappearing from the sample about half as frequently as contrarians, were not the group least likely to leave even though they experienced the highest average returns. Some of these managers left the sample because of an unlucky five-year return sequence in the stocks they held, exascerbated by a relatively undiversified portfolio.

Panels B and C present the results of the other two versions of the simulation, which introduce more stringent truncation rules. In Panel B, we truncate the worst 15 percent of managers each period, while in Panel C, we truncate the worst 20 percent. The results are qualitatively similar to those of Panel A, only somewhat magnified. Non-surviving funds from the momentum investing group (P6) had higher average returns than all other non-survivors. This group increased the average return of non-survivors, which decreased the level of survivorship bias.

In Table 10, we repeat the simulations using a one-year evaluation period. Panel A truncates the worst two percent of managers each year. Here, momentum investors suffer a mortality rate almost equal to that of contrarians due to the greater probability of a single bad portfolio return than a five-year run of bad luck. Even though these managers had short periods of poor performance, their long-term performance was good. In fact, non-surviving momentum investors outperformed the average surviving fund, suggesting a very perverse survival rule. The disappearance of some superior managers had the effect of substantially reducing the survivorship bias in the total sample.

Panels B and C repeat the one-year truncation by eliminating three and five percent of managers, respectively, each year. Again, the results are qualitatively similar to, although more extreme than, the results of Panel A. To summarize our results for both tables, we find that the presence of momentum investors reduces survival bias because non-surviving funds are more representative of the universe of funds than envisioned by BGIR and by some other studies. This result persists both with a very short-term evaluation period and with a longer period. Interestingly, the pattern of disappearance in our simulations was similar to the actual pattern found among the universe of funds, shown in Table 6.

5 Conclusion

We have analyzed the most detailed survivorship-bias free mutual fund holdings database to date in order to determine whether mutual funds have provided a fair return over the long term. In addition, we have provided an estimate of the survivorship bias introduced by analyzing only funds

that have survived a past test period.

We provide evidence supportive of four conclusions. First, the average mutual fund has earned a reasonably steady pre-expense performance of 75 basis points per year between 1975 and 1994. Second, an investor choosing last-year's best decile of funds would have achieved a pre-expense return three percent per year higher than an investor choosing last-year's average fund. However, the difference in returns disappears after controlling for the momentum effect in stock returns. In general, the strategy of buying last year's best funds works well except for years when stocks with high past returns underperform stocks with low past returns.

Third, we find evidence that this performance persistence is, to a large extent, driven by the persistent use of *active* momentum investment strategies (and not simply by funds passively holding on to past winner stocks). Finally, we find that survivorship bias has consistently had a minimal impact on the average pre-expense performance of mutual funds. Funds surviving until 1994 exhibited an average performance only 23 basis points per year above that of all funds (surviving or not). The larger survivorship bias in net returns found by other researchers appears to be at least in part due to significantly higher transaction costs and fund expenses among non-survivors than among survivors.

A further path of research is suggested by our results. An analysis of net returns, along with fund expenses, is clearly warranted. Although Carhart (1996) makes a significant contribution along these lines, further progress may be made by an accurate fund-by-fund matching of expenses and net returns with the holdings data that we used in this study. This matching would make possible more accurate and detailed cross-sectional studies of the relative importance of investment style and expenses in the observed levels of performance persistence and survivorship bias. Perhaps fixed costs provide too high of a hurdle for "fallen angel" funds to overcome, as supported by the significant negative impact of higher expense ratios on survival probability reported by Brown and Goetzmann (1995) and by the large difference in expense ratios between the best and worst funds reported by Carhart (1997).

There is one additional puzzle that our findings may solve. Since mutual funds practicing momentum investment strategies have outperformed other funds over long time periods, one may ask why this group of funds has not, over time, come to dominate the marketplace. We suggest that perhaps it is the additional riskiness inherent in investing on momentum that partially answers this question, although our findings, combined with those of Carhart, also suggest a major role for

transaction-cost explanations. Large groups of such funds may, on average, outperform other groups, but some individual funds may suffer short bouts of very poor performance and may be culled from the group. Having large fixed costs, mutual funds, unlike most liquid assets, have large economies-of-scale. The market for mutual funds may not tolerate under-achievers for long.

Appendix: Description of CDA Database and Data-Collection Procedures

In this section, we describe the structure of the CDA database, and the collection procedure used by CDA Investment Technologies, Inc., of Rockville, Maryland in building this database.[37] The first ten years of data, which included mutual fund data starting on December 31, 1974 and ending on December 31, 1984 (inclusive), was purchased during 1985. The second ten years of data, which included the range January 1, 1985 to December 31, 1994 (inclusive) was purchased during early 1995. We believe that the content and accuracy of the data in the two databases are very similar, although it is likely that the data during the early years (e.g., 1975 and 1976) is slightly less accurate than the data in ensuing years. However, CDA exerts a substantial and ongoing effort in correcting errors found in past data. From the client's point-of-view, this error-detection procedure ends only when the database is finally delivered.

The database consists of the following information:

1. Fund name and management company name
2. Date of mutual fund report from which data was collected (since June 30, 1979; see discussion below)
3. Net asset value
4. Self-declared investment objective (since June 30, 1980)
5. Shares held of each equity CUSIP by each fund

One source of these data are reports filed by the funds with the SEC. As required by N30-D regulations, mutual funds must file their portfolio holdings with the SEC twice per year. The semi-annual reporting dates are determined by the fiscal year chosen by a given mutual fund, with the filing required within 60 days of each fiscal 6-month period. For example, one fund may choose a semi-annual cycle of February to August, while another may choose June to December.

Another source are voluntary reports by the mutual funds, whether they are quarterly reports normally made to fund shareholders or informal reports made only to CDA. On an ongoing basis, CDA maintains and updates a database of fund names, and the company formally requests to subscribe to any such reports from each fund that is listed in its database. The database of fund

[37] This information was derived from conversations with Mr. Chris Spillan and Mr. Dan Maxwell, who are former and current employees, respectively, in the technical support department of CDA Investment Technologies, Inc. We are in the process of determining even more accurately the exact procedures used by CDA and the possible biases and errors that may be present.

names is compiled from several sources, including the Wall Street Journal. CDA makes an effort to ensure that its database is as complete as possible; the company attempts to contact fund companies that are delinquent in sending quarterly information, if the company normally sends information at that frequency. These reports are generally available with 60-90 days after the end of the calendar quarter. This source of reporting allows CDA to update holdings quarterly for about 40 percent of domestic funds (the percentage of foreign funds that are updated quarterly is much smaller).

No matter what the source of data, CDA provides quarterly holdings for every fund. For those funds not filing every quarter, CDA fills in "missing quarters" by carrying forward the holdings of the prior-quarter. CDA makes appropriate adjustments for CUSIP changes, stock splits, and other stock distributions to any such holdings that are carried forward from prior quarters.

Beginning June 30, 1979, CDA documented the date of the report publication from which a given quarter's data was derived. For example, if a particular fund did not supply a quarterly report for its fiscal quarter ending on June 30, 1985, then CDA carried forward the holdings (and other data) for June 30 for the fund as provided by its March 31, 1985 quarterly report (with appropriate adjustments to holdings data), assuming that the March 31 quarterly report was available (if not, the most recent report was carried forward). CDA then entered the date "March 31, 1985" as the report date from which the June 30 data was derived. This date-of-update reporting by CDA is also useful to determine the number of funds using a fiscal quarter that does not coincide with calendar quarters. For example, a fund that reports on May 31, 1985 is recorded as such, even though its holdings are included with funds that report on June 30, 1985. The vast majority of mutual funds use a fiscal quarter that coincides with calendar quarters; therefore, for this study, we use the approximation that all holdings reported within a given calendar quarter were also valid for the end of that calendar quarter.

Although CDA believes that it tracks virtually all publicly-offered mutual funds in existence during each quarter, it is possible that some small biases may be inherent in the database. For example, CDA states that holdings information for very small funds is the most difficult to obtain, so most missing funds are very small funds. However, we do not believe that such biases materially affect this study.

Bibliography

[1] Brown, Stephen J. and William N. Goetzmann, 1995, "Performance Persistence," Journal of Finance, Volume 50 (2), pp. 679-698.

[2] Brown, Stephen J., William N. Goetzmann, Roger G. Ibbotson, and Stephen A. Ross, 1992, "Survivorship Bias in Performance Studies," Review of Financial Studies, Volume 5 (4), pp. 553-580.

[3] Brown, Stephen J.., William N. Goetzmann, and Stephen A. Ross, 1995, "Survival," Journal of Finance, Volume 50 (3), pp. 853-873.

[4] Carhart, Mark, 1995, "Survivor Bias and Mutual Fund Performance," University of Southern California working paper.

[5] Carhart, Mark, 1997, "On Persistence in Mutual Fund Performance," Journal of Finance, forthcoming.

[6] Chan, Louis K.C., Narasimhan Jegadeesh, and Josef Lakonishok, 1996, "Momentum Strategies," Journal of Finance, Volume 51 (5), pp. 1681-1714.

[7] Damato, Karen, "Morningstar Edges Toward One-Year Ratings," The Wall Street Journal, April 5, 1996, p. C1.

[8] Dorfman, John R., "Cyclical Stocks May Have Replaced Appeal of 'Momentum' Investing," The Wall Street Journal, February 24, 1992, p. C1.

[9] Elton, Edwin, Martin J. Gruber, and Christopher R. Blake, 1996a, "The Persistence of Risk-Adjusted Mutual Fund Performance," Journal of Business, Volume 69(2), pp. 133-157.

[10] Elton, Edwin, Martin J. Gruber, and Christopher R. Blake, 1996b, "Survivorship Bias and Mutual Fund Performance," Review of Financial Studies, forthcoming.

[11] Fama, Eugene F. and Kenneth R. French, 1993, "Common Risk Factors in the Returns on Bonds and Stocks," Journal of Financial Economics, 33, pp. 3-53.

[12] Grinblatt, Mark and Sheridan Titman, 1989a, "Mutual Fund Performance: An Analysis of Quarterly Portfolio Holdings," Journal of Business, 62, pp. 394-415.

[13] Grinblatt, Mark and Sheridan Titman, 1989b, "Portfolio Performance Evaluation: Old Issues and New Insights," Review of Financial Studies, Volume 2 (3), pp. 393-421.

[14] Grinblatt, Mark and Sheridan Titman, 1992, "The Persistence of Mutual Fund Performance," Journal of Finance, Volume 47 (5), pp. 1977-1984.

[15] Grinblatt, Mark and Sheridan Titman, 1993, "Performance Measurement without Benchmarks: An Examination of Mutual Fund Returns," Journal of Business, 66, pp. 47-68.

[16] Grinblatt, Mark, Sheridan Titman, and Russ Wermers, 1995, "Momentum Investment Strategies, Portfolio Performance, and Herding: A Study of Mutual Fund Behavior," American Economic Review, Volume 85 (5), pp. 1088-1105.

[17] Hendricks, Darryll, Jayendu Patel, and Richard Zeckhauser, 1993, "Hot Hands in Mutual Funds: The Persistence of Performance, 1974-88," Journal of Finance, Volume 48 (1), pp. 93-130.

[18] Hendricks, Darryll, Jayendu Patel, and Richard Zeckhauser, 1995, "The J-Shape of Performance Persistence Given Survivorship Bias," John F. Kennedy School of Government at Harvard University working paper.

[19] Jegadeesh, Narasimhan and Sheridan Titman, 1993, "Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency," Journal of Finance, Volume 48 (1), pp. 65-92.

[20] Lakonishok, Josef, Andrei Shleifer, and Robert W. Vishny, 1992a, "The Impact of Institutional Trading on Stock Prices," Journal of Financial Economics, Volume 32 (1), pp. 23- 43.

[21] Lakonishok, Josef, Andrei Shleifer, and Robert W. Vishny, 1992b, "The Structure and Performance of the Money Management Industry," Brookings Papers on Economic Activity: Microeconomics, pp. 339-391.

[22] Lo, Andrew W. and Craig MacKinlay, 1990, "When Are Contrarian Profits Due to Stock Mark Overreaction?," Review of Financial Studies, Volume 3 (2), pp. 175-205.

[23] Malkiel, Burton G., 1995, "Returns from Investing in Equity Mutual Funds, 1971-1991," Journal of Finance, Volume 50 (2), pp. 549-572.

[24] Roll, Richard W., 1978, "Ambiguity when Performance is Measured by the Securities Market Line," Journal of Finance, Volume 33 (4), pp. 1051-1069.

[25] Wermers, Russ, 1997, "Herding, Trade Reversals, and Cascading by Institutional Investors," University of Colorado working paper.

Table 1. Summary Statistics for Mutual Fund Universe

An end-of-year fund census, and a fund balance during the year, is provided for the universe of mutual funds existing during each year, and for all funds existing in each of the five major fund investment-objective categories. The columns "born" and "died" refer to new funds and to disappearing funds (due to a merger with another fund or to a fund liquidation), respectively. The columns "in" and "out" refer to funds that entered the category by changing from another category, and that left the category by changing to another category, respectively.

END OF YEAR	ALL FUNDS			AGGRESSIVE GROWTH					GROWTH					GROWTH-INCOME					BALANCED					INTERNATIONAL				
	COUNT	BORN	DIED	COUNT	BORN	DIED	IN	OUT	COUNT	BORN	DIED	IN	OUT	COUNT	BORN	DIED	IN	OUT	COUNT	BORN	DIED	IN	OUT	COUNT	BORN	DIED	IN	OUT
1974	393	---	---																									
1975	466	78	5																									
1976	408	18	76																									
1977	613	233	28																									
1978	579	11	45																									
1979	554	18	43																									
1980	548	21	27	89	---	---	---	---	198	---	---	---	---	102	---	---	---	---	29	---	---	---	---	0	---	---	---	---
1981	539	30	39	85	2	3	3	6	196	13	22	10	3	96	3	4	0	5	30	3	2	1	1	0	0	0	0	0
1982	676	202	65	62	2	5	22	42	200	16	24	66	54	111	6	11	48	28	37	4	8	17	6	0	0	0	0	0
1983	938	324	62	72	12	5	10	7	204	33	26	20	23	111	10	10	18	18	43	8	6	7	3	0	0	0	0	0
1984	989	151	100	86	8	2	25	17	207	22	14	37	42	118	8	4	29	26	38	1	2	4	8	0	0	0	0	0
1985	1066	137	60	87	10	3	13	19	229	22	7	28	21	124	11	5	24	24	64	3	3	30	4	11	2	0	15	6
1986	1234	216	48	101	14	0	17	17	278	51	14	43	31	129	14	6	22	25	58	4	1	4	13	13	5	1	1	3

Table 1 (Continued)

END OF YEAR	ALL FUNDS			AGGRESSIVE GROWTH					GROWTH					GROWTH-INCOME					BALANCED					INTERNATIONAL				
	COUNT	BORN	DIED	COUNT	BORN	DIED	IN	OUT	COUNT	BORN	DIED	IN	OUT	COUNT	BORN	DIED	IN	OUT	COUNT	BORN	DIED	IN	OUT	COUNT	BORN	DIED	IN	OUT
1987	1324	195	105	109	11	3	9	9	314	56	21	25	24	143	26	4	13	21	71	11	3	8	3	20	5	0	3	1
1988	1381	202	145	126	17	6	20	14	335	36	11	31	35	158	19	4	19	19	76	14	2	2	9	24	5	2	1	0
1989	1457	173	97	138	18	12	22	16	352	48	21	23	33	162	17	6	13	20	92	14	6	11	3	31	8	2	2	1
1990	1750	511	218	148	16	15	22	13	373	59	27	30	41	175	37	19	21	26	96	10	3	6	9	43	13	1	1	1
1991	2065	523	208	176	28	9	26	17	439	94	20	32	40	197	39	11	22	28	113	20	6	11	8	67	23	5	6	0
1992	2204	402	263	184	20	12	4	4	530	127	30	7	13	230	30	13	20	4	110	19	10	1	13	79	13	8	7	0
1993	2632	738	310	202	27	21	22	10	848	393	63	26	38	301	87	19	21	18	154	60	10	3	9	113	38	7	5	2
1994	2739	663	556	204	15	7	16	22	1246	299	76	205	30	363	75	28	22	7	195	33	16	28	4	212	108	12	5	2

Table 2. Comparison of Mutual Fund Returns to the Market Index

For each year (row) below, the average buy-and-hold monthly return (annualized to percent per year) is presented for the CRSP VW (NYSE/AMEX value-weighted portfolio), CRSP EW (NYSE/AMEX equally weighted portfolio), the equally weighted portfolio of all funds existing during the year, and the differenced portfolio, which holds the equally weighted fund portfolio long and the CRSP value-weighted portfolio short in equal amounts (the time-series t-statistic is given in parentheses below the return). All portfolios are rebalanced monthly. In addition, the number of funds existing at the end of each year is shown.

Year	CRSP VW w/DIVIDENDS	CRSP EW w/DIVIDENDS	EW PORTFOLIO OF FUNDS Number	EW PORTFOLIO OF FUNDS Return	DIFFERENCED PORTFOLIO EW FUND PORTFOLIO MINUS CRSP VW
1975	34.00	57.23	466	36.26	2.26
					(0.90)
1976	24.64	43.53	408	26.97	2.32
					(0.90)
1977	-3.81	14.90	613	0.81	4.62 ***
					(3.24)
1978	9.00	21.90	579	14.17	5.16
					(1.29)
1979	22.33	35.84	554	29.45	7.12 ***
					(2.87)
1980	30.50	32.73	548	34.86	4.35
					(1.37)
1981	-3.48	5.73	539	-1.53	1.95
					(0.61)
1982	20.21	27.40	676	24.56	4.34
					(1.52)
1983	21.37	32.54	938	20.90	-0.47
					(-0.14)
1984	5.86	-2.07	989	-1.42	-7.28 **
					(-2.16)
1985	28.11	24.85	1,066	31.07	2.96
					(0.65)
1986	17.07	12.46	1,234	13.58	-3.49
					(-1.42)
1987	7.29	0.05	1,324	8.79	1.50
					(0.28)
1988	16.66	19.59	1,381	15.57	-1.09
					(-0.29)
1989	26.61	15.53	1,457	25.94	-0.67
					(-0.32)
1990	-3.49	-21.35	1,750	-6.28	-2.80
					(-0.66)
1991	27.95	35.27	2,065	30.20	2.25
					(0.88)
1992	7.94	20.10	2,204	7.22	-0.72
					(-0.19)
1993	10.61	21.16	2,632	15.23	4.62
					(1.59)
1994	0.14	-2.87	2,739	-1.00	-1.14
					(-0.40)
1975-1994	14.98	19.73	5,239 (a)	16.27	1.29 *
					(1.74)

**Significant at the 10 percent significance level.*
***Significant at the 5 percent significance level.*
****Significant at the 1 percent significance level.*
(a)Total number of distinct funds from 1975-1994.

Table 3. Comparison of Survivors to Non-Survivors: Gross Returns

For each year (row) below, the average buy-and-hold monthly return (annualized to percent per year) is presented for the CRSP VW (NYSE/AMEX value-weighted portfolio), the equally weighted portfolio of all funds surviving until December 31, 1994, the equally weighted portfolio of all funds not surviving until December 31, 1994, and the differenced portfolio, which holds the equally weighted survivor portfolio long and the equally weighted non-survivor portfolio short in equal amounts (the time-series t-statistic is given in parentheses below the return). For survivors and non-survivors, the number of funds existing at the end of each year is shown. Finally, the average monthly return is presented for the equally weighted portfolio of the 118 funds that existed on January 1, 1975 and survived until December 31, 1994. All portfolios are rebalanced monthly.

Year	CRSP VW w/DIVIDENDS	Survivors Number	Survivors Return	Non-Survivors Number	Non-Survivors Return	Survivors Minus Non-Survivors	Funds Existing From 1975-1994 (118 Funds)
1975	34.00	130	37.82	336	35.59	2.23	37.59
						(1.28)	
1976	24.64	140	28.61	268	26.26	2.35 *	27.50
						(2.12)	
1977	-3.81	188	2.82	425	-0.08	2.90 **	0.91
						(2.47)	
1978	9.00	192	15.92	387	13.34	2.57 *	15.08
						(2.04)	
1979	22.33	199	30.41	355	28.94	1.47	30.25
						(1.68)	
1980	30.50	207	34.81	341	34.88	-0.07	35.43
						(-0.07)	
1981	-3.48	222	-0.85	317	-1.95	1.10	-2.37
						(1.14)	
1982	20.21	263	25.21	413	24.09	1.13	23.81
						(1.63)	
1983	21.37	318	23.27	620	19.68	3.59 *	22.70
						(1.91)	
1984	5.86	357	0.45	632	-2.42	2.87	1.43
						(1.75)	
1985	28.11	389	31.89	677	30.68	1.21	31.74
						(0.74)	
1986	17.07	454	15.65	780	12.40	3.25 **	16.58
						(2.82)	
1987	7.29	538	9.54	786	8.33	1.21	11.05
						(0.88)	
1988	16.66	619	16.28	762	15.08	1.20	15.35
						(1.28)	
1989	26.61	702	26.61	755	25.39	1.22	27.12
						(1.34)	
1990	-3.49	894	-5.91	856	-6.70	0.79	-5.07
						(0.62)	
1991	27.95	1,201	31.47	864	28.51	2.96 **	33.14
						(2.80)	
1992	7.94	1,460	7.38	744	6.93	0.45	9.53
						(0.47)	
1993	10.61	2,110	15.80	522	14.06	1.74	13.16
						(1.31)	
1994	0.14	2,739	-1.03	0	-1.33	0.30	-0.19
						(0.26)	
1975-1994	14.98	2,739 (a)	17.31	2,500 (b)	15.58	1.72 ***	17.24
						(6.26)	

**Significant at the 10 percent significance level.*
***Significant at the 5 percent significance level.*
****Significant at the 1 percent significance level.*
(a)Total number of funds surviving until 1994
(b)Total number of funds not surviving until 1994

Table 4. Comparison of Survivors to Non-Survivors: Performance

For each year (row) below, the average monthly performance (buy-and-hold, annualized to percent per year) is presented for the equally weighted portfolio of all funds existing during each quarter, the equally weighted portfolio of funds surviving until December 31, 1994, the equally weighted portfolio of funds not surviving until December 31, 1994, and the differenced portfolio, which holds the equally weighted survivor portfolio long and the equally weighted non-survivor portfolio short in equal amounts. In all cases, only funds with a one-year record are included to enable the computation of performance. Time-series t-statistics are given in parentheses below returns. For survivors and non-survivors, the number of funds existing at the end of each year (and having a one-year performance record) is shown. Finally, the average monthly performance is presented for the equally weighted portfolio of the 118 funds that existed on January 1, 1975 and survived until December 31, 1994. All portfolios are rebalanced monthly.

		Survivors		Non-Survivors		Survivors Minus	Funds Existing From 1975 to 1994
Year	All Funds	Number	Perf.	Number	Perf.	Non-Survivors	(118 Funds)
1976	1.47	120	1.71	243	1.37	0.33	1.70
	(1.33)		*(1.38)*		*(1.27)*	*(0.64)*	*(1.38)*
1977	2.01 *	131	2.12	240	1.95 *	0.17	2.03
	(1.93)		*(1.76)*		*(1.97)*	*(0.35)*	*(1.61)*
1978	2.21	178	2.37	359	2.13	0.24	2.01
	(1.17)		*(1.30)*		*(1.08)*	*(0.32)*	*(1.24)*
1979	2.12	184	2.44 *	341	1.96	0.48	2.64 *
	(1.75)		*(1.97)*		*(1.54)*	*(0.67)*	*(1.95)*
1980	3.94	192	3.51	326	4.19	-0.68	4.53 *
	(1.72)		*(1.74)*		*(1.68)*	*(-0.82)*	*(1.84)*
1981	-0.12	198	0.40	300	-0.43	0.84	-0.01
	(-0.06)		*(0.22)*		*(-0.21)*	*(1.57)*	*(-0.004)*
1982	5.23 ***	214	4.56 ***	275	5.72 **	-1.16	5.01 ***
	(3.42)		*(3.69)*		*(3.05)*	*(-0.99)*	*(3.33)*
1983	0.66	229	0.78	218	0.55	0.23	0.76
	(0.38)		*(0.45)*		*(0.31)*	*(0.48)*	*(0.38)*
1984	0.01	288	-0.04	516	0.01	-0.06	0.67
	(0.02)		*(-0.04)*		*(0.02)*	*(-0.10)*	*(0.50)*
1985	1.92	332	2.10 *	532	1.81	0.28	1.70
	(1.71)		*(2.00)*		*(1.45)*	*(0.42)*	*(1.70)*
1986	1.64	359	2.01	602	1.40	0.61	2.08
	(1.03)		*(1.35)*		*(0.83)*	*(0.99)*	*(1.46)*
1987	2.21	413	2.36	673	2.13	0.23	2.29
	(1.16)		*(1.25)*		*(1.07)*	*(0.27)*	*(1.01)*
1988	-1.08	493	-0.94	668	-1.16	0.22	-1.36
	(-0.61)		*(-0.59)*		*(-0.60)*	*(0.44)*	*(-0.92)*
1989	3.36 ***	570	3.92 ***	604	2.87 ***	1.05 **	3.81 ***
	(4.47)		*(4.87)*		*(3.89)*	*(2.98)*	*(3.34)*
1990	2.17	638	2.81	460	1.34	1.47 **	1.89
	(1.28)		*(1.70)*		*(0.75)*	*(2.70)*	*(1.28)*
1991	2.10	770	2.87	554	0.94	1.93 **	3.00
	(1.08)		*(1.34)*		*(0.54)*	*(2.44)*	*(1.19)*
1992	-0.12	1,100	-0.10	532	-0.17	0.07	-0.08
	(-0.11)		*(-0.09)*		*(-0.16)*	*(0.17)*	*(-0.05)*
1993	2.84	1,267	3.47	420	1.46	2.01 **	3.50
	(1.35)		*(1.54)*		*(0.81)*	*(2.87)*	*(1.54)*
1994	-0.49	1,815	-0.43	0	-1.14	0.71	-0.47
	(-0.67)		*(-0.55)*		*(-1.64)*	*(1.50)*	*(-0.57)*
1976-1994	1.69 ***	1,815 (a)	1.89 ***	1,960 (b)	1.42 ***	0.47 **	1.88 ***
	(4.71)		*(5.35)*		*(3.83)*	*(3.10)*	*(4.86)*

**Significant at the 10 percent significance level.*
***Significant at the 5 percent significance level.*
****Significant at the 1 percent significance level.*
(a)Total number of funds surviving until 12/31/94 with at least a one-year record (required to compute performance).
(b)Total number of funds not surviving until 12/31/94 with at least a one-year record.

Table 5. Comparison of Momentum Investors to Contrarian Investors

This table presents the average monthly buy-and-hold return for each year between 1976 and 1994 (annualized to percent per year) for equally weighted portfolios of mutual funds which invested most strongly on momentum ("Momentum Investors") or invested most strongly as contrarians ("Contrarian Investors") during the prior year. To select these funds each year, all funds existing during the prior year were ranked on their average L0M measure for the prior year. Then, the top 20 percent of funds were assigned to the momentum portfolio, while the bottom 20 percent were assigned to the contrarian portfolio. Finally, the next year's average monthly returns were measured. All mutual funds existing during that year were included in the returns calculation (both survivors and non-survivors). Then, the entire process was repeated for the following year. Both gross returns and performance (computed as described in the paper) are presented. In addition, the L0M measures of the two portfolios during the year following the sort year are presented in the columns at the left. All portfolios are rebalanced monthly. T-statistics are shown in parentheses.

	L0M Measure		CRSP VW	Gross Return		Performance	
Year	Momentum Investors	Contrarian Investors	RETURN w/DIVIDENDS	Momentum Investors	Contrarian Investors	Momentum Investors	Contrarian Investors
1976	6.92 **	-1.10	24.64	25.12	31.08	2.65	0.32
	(2.36)	*(-0.64)*				*(1.58)*	*(0.35)*
1977	3.27 ***	0.24	-3.81	2.47	0.61	5.31 *	-0.26
	(5.65)	*(1.01)*				*(2.02)*	*(-0.21)*
1978	3.58 ***	-1.11 **	9.00	18.34	13.64	4.61	1.80 *
	(4.40)	*(-2.22)*				*(1.15)*	*(1.87)*
1979	3.87 ***	-1.46 **	22.33	38.65	29.20	5.28 *	1.04
	(5.02)	*(-2.76)*				*(1.92)*	*(1.26)*
1980	4.17 ***	-0.57	30.50	43.44	30.84	7.20	1.37
	(3.32)	*(-1.00)*				*(1.42)*	*(1.26)*
1981	7.96 ***	-0.86 **	-3.48	-5.03	1.61	-0.52	0.84
	(4.58)	*(-2.30)*				*(-0.13)*	*(0.72)*
1982	6.43 ***	-2.69 ***	20.21	27.54	23.13	10.12 **	1.17
	(9.52)	*(-5.07)*				*(3.03)*	*(1.73)*
1983	5.54 ***	-1.76 **	21.37	21.63	23.28	2.74	0.002
	(6.58)	*(-2.90)*				*(0.63)*	*(0.002)*
1984	3.20 **	-0.17	5.86	-4.90	-0.29	-0.09	-1.33 **
	(2.23)	*(-0.14)*				*(-0.04)*	*(-2.39)*
1985	1.18	-4.23	28.11	30.46	31.56	3.58 *	1.67
	(0.85)	*(-1.26)*				*(2.13)*	*(1.03)*
1986	3.74 ***	0.17	17.07	13.83	12.82	4.82 *	0.79
	(5.13)	*(0.39)*				*(1.81)*	*(0.49)*
1987	5.11 ***	-1.15 **	7.29	11.16	7.55	5.88	0.20
	(5.72)	*(-2.46)*				*(1.68)*	*(0.13)*
1988	4.19 ***	-1.87 ***	16.66	14.26	16.59	-1.29	0.03
	(5.41)	*(-3.12)*				*(-0.39)*	*(0.04)*
1989	4.76 ***	-0.33	26.61	27.42	24.42	6.16 ***	1.29 *
	(7.82)	*(-1.07)*				*(3.58)*	*(2.05)*
1990	7.35 ***	-0.68 **	-3.49	-5.30	-8.19	4.46 *	1.02
	(9.09)	*(-2.25)*				*(2.10)*	*(0.77)*
1991	8.02 ***	-0.96 **	27.95	40.99	30.47	7.11 *	0.93
	(8.20)	*(-2.59)*				*(1.81)*	*(0.70)*
1992	7.65 ***	-1.38 ***	7.94	6.83	9.89	-1.08	0.44
	(5.42)	*(-5.09)*				*(-0.64)*	*(0.42)*
1993	6.74 ***	-0.53	10.61	17.48	14.82	7.48 *	0.17
	(7.67)	*(-0.67)*				*(2.09)*	*(0.10)*
1994	3.13 ***	-0.93 ***	0.14	-1.51	0.42	-0.55	0.23
	(8.26)	*(-3.52)*				*(-0.33)*	*(0.37)*
1976-1994	5.10 ***	-1.12 ***	13.98	16.99	15.44	3.89 ***	0.62 **
	(17.53)	*(-4.80)*				*(5.45)*	*(2.41)*

**Significant at the 10 percent significance level.*
***Significant at the 5 percent significance level.*
****Significant at the 1 percent significance level.*

Table 6. Test of Persistence of Mutual Fund Returns: Gross Returns

This table presents the average buy-and-hold monthly return for each year between 1976 and 1992 (annualized to percent per year) for equally weighted portfolios of mutual funds which were ranked on their gross return during the prior year. To select these funds each year, all funds existing during the entire prior year were ranked on their average portfolio return of the prior year. Then, decile portfolios were formed, and the gross return for the equally weighted portfolio of funds in each decile was measured over the following year. All mutual funds existing during a given calendar quarter were included in the returns calculation (both survivors and non-survivors). Then, the entire process was repeated for the following year. The "best" portfolio is the decile with the highest prior-year returns, while "worst" is the portfolio with the lowest prior-year return. For example, the row "1976" is the return to the decile portfolios which were ranked on their 1975 returns. "Momentum minus contrarian stocks" is the average monthly return (annualized) from ranking all NYSE and AMEX stocks, each month, on their compounded return over months -7 to -1, then buying the equally weighted portfolio of the top 30 percent (highest past returns) and shorting the bottom 30 percent (we thank Louis Chan of the University of Illinois for providing this column of data). The bottom four rows show the overall mean return for each portfolio (across all years), the annual standard deviation of returns, and the intercept and slope of a regression of the portfolio excess return (gross return minus 3-month t-bill rate) on the CRSP VW excess return.

Year	Best P1	P2	P3	P4	P5	P6	P7	P8	P9	Worst P10	Difference P1 Minus P10	Momentum Minus Contrarian Stocks
1976	29.98	29.48	27.32	27.34	26.25	24.51	23.73	20.67	21.54	17.92	12.07 *	9.10
											(1.91)	
1977	7.42	1.74	2.18	1.40	-1.78	-3.59	-3.12	-2.50	-2.72	0.43	6.99	17.80
											(0.95)	
1978	23.94	15.51	16.11	13.38	10.78	13.31	11.06	11.57	9.01	10.02	13.92	6.70
											(1.35)	
1979	40.94	42.21	37.69	32.96	30.12	26.60	22.65	20.88	24.59	16.89	24.05 **	13.80
											(2.65)	
1980	49.94	45.61	40.62	36.30	34.62	32.07	29.74	28.84	27.85	20.50	29.43	24.10
											(1.35)	
1981	-10.72	-8.22	-7.25	-4.12	-3.34	-1.61	-1.80	2.11	4.37	12.84	-23.56	2.70
											(-1.62)	
1982	26.13	27.16	25.30	24.98	23.27	21.92	22.64	25.31	22.32	18.92	7.21	16.40
											(0.73)	
1983	23.76	23.89	20.97	21.43	22.32	22.54	21.92	21.59	21.75	21.88	1.88	-5.20
											(0.54)	
1984	2.41	0.15	-0.68	-2.32	3.85	2.74	-0.37	-2.87	-4.60	-4.06	6.46 *	11.20
											(2.11)	
1985	28.11	33.49	33.12	31.52	33.11	32.39	27.58	26.22	24.48	14.49	13.62	18.30
											(1.29)	
1986	17.34	16.21	13.72	15.66	16.32	15.93	14.14	12.93	10.21	8.91	8.44	11.30
											(1.18)	
1987	12.80	7.47	10.94	10.38	10.93	8.13	7.59	7.72	5.59	6.27	6.53	4.10
											(0.76)	
1988	8.33	12.08	14.22	14.59	15.83	16.43	17.62	19.23	18.28	18.86	-10.53	-12.60
											(-0.97)	
1989	23.15	23.41	25.69	25.16	27.03	26.40	26.03	25.69	25.65	26.32	-3.17	25.80
											(-0.47)	
1990	-5.41	-3.57	-4.68	-4.78	-4.46	-5.70	-6.10	-8.14	-8.32	-13.05	7.63	26.10
											(1.68)	
1991	39.55	32.79	31.27	30.67	31.61	32.81	28.85	29.55	30.90	32.97	6.59	5.30
											(1.11)	
1992	7.57	10.16	11.09	8.96	8.47	9.66	10.67	8.06	7.30	-2.53	10.10	4.40
											(0.65)	
1976-1992	19.13	18.21	17.51	16.68	16.76	16.15	14.87	14.52	14.01	12.21	6.92 ***	10.55
											(2.75)	
Std Deviation	16.50	15.89	14.56	13.57	13.13	12.82	12.04	12.04	12.28	11.86		
CAPM Alpha	3.51	2.39	1.68	1.09	1.31	0.67	-0.61	-0.94	-1.57	-2.37	5.89	
CAPM Beta	1.12	1.12	1.11	1.09	1.07	1.06	1.04	1.06	1.08	1.01	0.11	
L0M Measure	1.84	1.11	0.84	0.62	0.73	0.68	0.52	0.97	1.08	1.21		
# Disappearing	159	147	146	146	145	157	178	172	187	212		

**Significant at the 10 percent significance level.*
***Significant at the 5 percent significance level.*
****Significant at the 1 percent significance level.*

Table 7. Time-Series Regressions (1976-1992)

Panel A. Regressions of Gross-Returns Sort Strategy on Fama and French (1993) Factors

The dependent variables in these regressions are the time-series of monthly returns (minus T-bill returns) that accrue to the ten decile portfolios that result from sorting mutual funds (each year) on their gross returns from the prior year. The method of forming these portfolios is further described in the notes to Table 6. The three independent variables are (1) the time-series of monthly returns associated with a value-weighted market proxy portfolio minus T-bills (RMRF), (2) with the difference in returns between small and large capitalization stocks (SMB), and (3) with the difference in returns between high and low book-to-market stocks (HML). Please see Fama and French (1993) and Carhart (1997) for further description of these variables. The intercept has been annualized to percent per year. T-statistics are shown in parentheses below coefficient estimates.

	Independent Variables			
Dependent Variable	Intercept	RMRF	SMB	HML
P1 (Best)	2.14	1.03 ***	0.44 ***	-0.11 **
	(1.46)	(34.96)	(9.33)	(-2.11)
P2	1.50 *	1.04 ***	0.30 ***	-0.11 ***
	(1.67)	(57.80)	(10.50)	(-3.42)
P3	1.02	1.04 ***	0.23 ***	-0.10 ***
	(1.39)	(70.62)	(9.68)	(-4.04)
P4	0.60	1.03 ***	0.16 ***	-0.07 ***
	(1.06)	(90.68)	(8.97)	(-3.57)
P5	0.70	1.02 ***	0.13 ***	-0.08 ***
	(1.43)	(103.53)	(8.52)	(-4.70)
P6	0.08	1.02 ***	0.10 ***	-0.05 ***
	(0.14)	(96.04)	(5.67)	(-2.81)
P7	-1.05 *	1.01 ***	0.07 ***	-0.04 *
	(-1.85)	(89.04)	(3.79)	(-1.87)
P8	-1.40 *	1.02 ***	0.10 ***	-0.08 ***
	(-1.79)	(64.86)	(4.05)	(-2.83)
P9	-2.01 **	1.02 ***	0.14 ***	-0.07 **
	(-2.33)	(58.96)	(5.12)	(-2.39)
P10 (Worst)	-3.64 **	0.95 ***	0.20 ***	-0.04
	(-2.30)	(30.01)	(3.95)	(-0.69)
P1 Minus P10	5.79 **	0.07	0.24 ***	-0.07
	(2.26)	(1.44)	(2.89)	(-0.78)
F-1 Statistic (a)	1.65 *	1760 ***	28.5 ***	4.01 ***
F-2 Statistic (b)	1.83 *	1.54	19.3 ***	2.81 ***

* Statistically significant at the 10-percent level.
** Statistically significant at the 5-percent level.
*** Statistically significant at the 1-percent level.
(a) An F-test of the null that all intercepts (or coefficients) are equal to zero across regressions.
(b) An F-test of the null that all intercepts (or coefficients) are equal to each other across regressions.

Panel B. Regressions of Gross-Returns Sort Strategy on Carhart (1997) Factors

The dependent variables in these regressions are the time-series of monthly returns (minus T-bill returns) that accrue to the ten decile portfolios that result from sorting mutual funds (each year) on their gross returns from the prior year. The method of forming these portfolios is further described in the notes to Table 6. The four independent variables are (1) the time-series of monthly returns associated with a value-weighted market proxy portfolio minus T-bills (RMRF), (2) with the difference in returns between small and large capitalization stocks (SMB), (3) with the difference in returns between high and low book-to-market stocks (HML), and (4) with the difference in returns between stocks having high and low prior-year returns. Please see Fama and French (1993) and Carhart (1997) for further description of these variables. The intercept has been annualized to percent per year. T-statistics are shown in parentheses below coefficient estimates.

	Independent Variables				
Dependent Variable	Intercept	RMRF	SMB	HML	PR1YR
P1 (Best)	-0.38	1.00 ***	0.47 ***	-0.05	0.23 ***
	(-0.27)	(36.20)	(10.70)	(-0.98)	(5.81)
P2	-0.15	1.02 ***	0.32 ***	-0.07 **	0.15 ***
	(-0.18)	(61.13)	(12.16)	(-2.31)	(6.29)
P3	0.12	1.03 ***	0.24 ***	-0.08 ***	0.08 ***
	(0.17)	(71.47)	(10.45)	(-3.25)	(3.96)
P4	0.01	1.03 ***	0.17 ***	-0.06 ***	0.05 ***
	(0.02)	(91.09)	(9.54)	(-2.86)	(3.34)
P5	0.56	1.02 ***	0.14 ***	-0.08 ***	0.01
	(1.09)	(101.87)	(8.56)	(-4.40)	(0.92)
P6	0.50	1.03 ***	0.09 ***	-0.06 ***	-0.04 **
	(0.93)	(96.44)	(5.39)	(-3.33)	(-2.58)
P7	-0.31	1.02 ***	0.06 ***	-0.05 ***	-0.07 ***
	(-0.55)	(92.15)	(3.39)	(-2.80)	(-4.24)
P8	-0.46	1.03 ***	0.09 ***	-0.10 ***	-0.09 ***
	(-0.58)	(66.84)	(3.67)	(-3.69)	(-3.90)
P9	-0.68	1.04 ***	0.13 ***	-0.10 ***	-0.12 ***
	(-0.80)	(62.49)	(4.75)	(-3.56)	(-5.09)
P10 (Worst)	-1.15	0.98 ***	0.17 ***	-0.10 *	-0.23 ***
	(-0.74)	(32.35)	(3.53)	(-1.83)	(-5.23)
P1 Minus P10	0.77	0.02	0.30 ***	0.05	0.46 ***
	(0.32)	(0.43)	(4.01)	(0.60)	(6.77)
F-1 Statistic (a)	1.01	1702 ***	30.42 ***	3.40 ***	7.96 ***
F-2 Statistic (b)	1.12	1.38	21.77 ***	2.21 **	8.84 ***

* Statistically significant at the 10-percent level.
** Statistically significant at the 5-percent level.
*** Statistically significant at the 1-percent level.
(a) An F-test of the null that all intercepts (or coefficients) are equal to zero across regressions.
(b) An F-test of the null that all intercepts (or coefficients) are equal to each other across regressions.

Panel C. Regressions of Gross-Returns Sort Strategy on Carhart (1997) Factors and on an Alternative Four Factors

The dependent variable in these regressions is the time-series of monthly returns that would accrue to buying an equally weighted portfolio of last-year's best funds and selling an equally weighted portfolio of last-year's worst funds, where funds are ranked by last-year's gross returns. This portfolio is P1 minus P10 of Panel A. The method of forming these portfolios is further described in the notes to Table 6. In the first regression, the four independent variables are the time-series of monthly returns associated (1) with a value-weighted market proxy portfolio minus T-bills (RMRF), (2) with the difference in returns between small and large capitalization stocks (SMB), (3) with the difference in returns between high and low book-to-market stocks (HML), and (4) with the difference in returns between stocks having high and low prior-year returns (PR1YR). See Carhart (1997) for further description of these variables. In the second regression, the PR1YR regressor is replaced by the time-series of returns that would accrue to a strategy of buying an equally weighted portfolio of the decile of funds that, during the prior year, had the largest L0M measures (i.e., these are the mutual funds most actively investing on momentum during the prior year) and selling an equally weighted portfolio of those having the smallest L0M measures (L0M). The intercept has been annualized to percent per year. T-statistics are shown in parentheses below coefficient estimates.

	Independent Variables				
Dependent Variable	Intercept	RMRF	SMB	HML	PR1YR
P1 Minus P10	0.77	0.02	0.30 ***	0.05	0.46 ***
	(0.32)	(0.43)	(4.01)	(0.60)	(6.77)

	Independent Variables				
	Intercept	RMRF	SMB	HML	L0M
P1 Minus P10	1.73	-0.01	0.06	0.38 ***	1.20 ***
	(0.77)	(-0.28)	(0.76)	(4.11)	(8.45)

F-1 Statistic (a)	0.35
F-2 Statistic (b)	0.08

* Statistically significant at the 10-percent level.
** Statistically significant at the 5-percent level.
*** Statistically significant at the 1-percent level.
(a) An F-test of the null that intercepts are equal to zero across regressions.
(b) An F-test of the null that intercepts are equal to each other across regressions.

Table 8A: Mean Portfolio Statistics

For each fund in the three different categories (columns) below, the time-series measure given by the row is calculated. Then, the cross-sectional average (across funds) is presented below. The momentum-investing measure (L0M) was calculated as the difference in two portfolio returns: the return during the immediately prior period of the current portfolio minus the return during the same period of the portfolio held one-quarter lagged. The performance measure is also the difference between two portfolio returns: The return during the next period of the current portfolio minus the return during the same period of the portfolio held one year lagged. "Survivors" are those funds existing on December 31, 1994, while "Non-Survivors" are those funds that disappeared before the end of 1994.

	Total Sample (5,239 Funds)	Survivors (2,739 Funds)	Non-Survivors (2,500 Funds)
Standard Deviation of Monthly Returns (percent/month)	5.61	5.32	5.93
L0M (percent/quarter)	0.27	0.38	0.15
Performance (percent/year)	1.25	1.47	1.05

Table 8B: Cross-Sectional Regressions of Fund Performance on Total Portfolio Risk

For each category (column) below, the benchmark-free fund performance measure (in percent/year) is regressed, across funds, on the time-series standard deviation of each fund's monthly returns (in percent per month). The method of computing t-statistics is described in Grinblatt and Titman (1994). T-statistics are shown in parentheses below point estimates.

	Total Sample (5,239 Funds)	Survivors (2,739 Funds)	Non-Survivors (2,500 Funds)
Constant	-2.57 ***	-6.92 ***	-0.68
	(-4.92)	*(-7.15)*	*(-1.13)*
Coefficient for Standard Deviation	0.57 ***	1.51 ***	0.19 *
	(6.59)	*(8.70)*	*(1.96)*

Table 8C: Cross-Sectional Regressions of Fund Performance on Total Risk and Momentum-Investing Measure

For each category below, the benchmark-free fund performance measure (in percent/year) is regressed, across funds, on the fund momentum-investing measure (L0M, in percent/quarter) and on the time-series standard deviation of each fund's monthly returns (in percent per month). The method of computing t-statistics is described in Grinblatt and Titman (1994). T-statistics are shown in parentheses below point estimates.

	Total Sample (5,239 Funds)	Survivors (2,739 Funds)	Non-Survivors (2,500 Funds)
Constant	-2.29 ***	-7.07 ***	0.89
	(-4.15)	*(-7.32)*	*(1.42)*
Coefficient for Standard Deviation	0.54 ***	1.52 ***	-0.06
	(5.70)	*(8.74)*	*(-0.62)*
Coefficient for L0M	0.03	0.04	-0.01
	(1.13)	*(0.93)*	*(-0.14)*

** Significant at the 10 percent significance level*
*** Significant at the 5 percent significance level*
**** Significant at the 1 percent significance level*

Table 9. Monte Carlo Simulation of Long-Term Survival Rule

These panels present the results of a Monte Carlo simulation, using GAUSS, of 600 portfolio managers who update their portfolios solely on the basis of past-year returns. Each manager was randomly assigned a portfolio of 25 stocks (from a universe of 100 stocks), and he was restricted to buying and selling only those stocks. Stock returns were generated by an AR(1) process, and managers updated their portfolios according to their "feedback coefficient". The 100 managers with the smallest feedback coefficient were the contrarian investors, while the 100 with the largest were the momentum investors. Every five years, managers were ranked by their average portfolio return over the past five years, and the worst performers were truncated from the sample. The fraction of the funds that were truncated varied, and are shown in the Panels below. This process was repeated until 20 years of portfolio returns were generated. Finally, the entire process was repeated to give 100 simulations. The average results over the 100 simulations are shown below.

Panel A. Truncation of 10 percent lowest performers each 5-year period.
(Mean return in percent per year)

	Contrarian Investors P1	P2	P3	P4	P5	Momentum Investors P6	P1 - P6
All Funds	10.81	11.21	11.55	11.87	12.12	12.29	11.64
Surviving Funds	11.87	11.86	11.93	12.14	12.48	12.83	12.19
Non-Surviving Funds	9.76	10.00	10.02	10.10	10.48	10.77	10.19
Non-Surviving Funds Above (Below) All Funds	(1.88)	(1.64)	(1.62)	(1.54)	(1.17)	(0.87)	(1.45)
Non-Survivors (Percent)	50	35	20	13	18	26	27
						Survivorship bias	0.54

Panel B. Truncation of 15 percent lowest performers each 5-year period.
(Mean return in percent per year)

	Contrarian Investors P1	P2	P3	P4	P5	Momentum Investors P6	P1 - P6
All Funds	10.94	11.27	11.54	11.84	12.03	12.27	11.65
Surviving Funds	12.20	12.07	12.11	12.26	12.60	13.01	12.37
Non-Surviving Funds	10.16	10.40	10.39	10.51	10.70	10.89	10.51
Non-Surviving Funds Above (Below) All Funds	(1.49)	(1.24)	(1.26)	(1.13)	(0.95)	(0.76)	(1.14)
Non-Survivors (Percent)	62	48	33	24	30	35	39
						Survivorship bias	0.73

Panel C. Truncation of 20 percent lowest performers each 5-year period.
(Mean return in percent per year)

	Contrarian Investors P1	P2	P3	P4	P5	Momentum Investors P6	P1 - P6
All Funds	10.95	11.31	11.60	11.91	12.15	12.29	11.70
Surviving Funds	12.37	12.24	12.28	12.44	12.77	13.13	12.54
Non-Surviving Funds	10.43	10.70	10.84	10.98	11.05	11.06	10.84
Non-Surviving Funds Above (Below) All Funds	(1.27)	(1.00)	(0.86)	(0.72)	(0.65)	(0.64)	(0.86)
Non-Survivors (Percent)	73	60	47	36	36	40	49
						Survivorship bias	0.84

Table 10. Monte Carlo Simulation of Short-Term Survival Rule

These panels present the results of a Monte Carlo simulation, using GAUSS, of 600 portfolio managers who update their portfolios solely on the basis of past-year returns. Each manager was randomly assigned a portfolio of 25 stocks (from a universe of 100 stocks), and he was restricted to buying and selling only those stocks. Stock returns were generated by an AR(1) process, and managers updated their portfolios according to their "feedback coefficient". The 100 managers with the smallest feedback coefficient were the contrarian investors, while the 100 with the largest were the momentum investors. Each year, managers were ranked by their portfolio return, and the worst performers were truncated from the sample. The fraction of the funds that were truncated varied, and are shown in the Panels below. This process was repeated until 20 years of portfolio returns were generated. Finally, the entire process was repeated to give 100 simulations. The average results over the 100 simulations are shown below.

Panel A. Truncation of two percent lowest performers each year.
(Mean return in percent per year)

	Contrarian Investors P1	P2	P3	P4	P5	Momentum Investors P6	P1 - P6
All Funds	11.48	11.36	11.56	11.64	12.04	12.18	11.71
Surviving Funds	12.14	11.56	11.64	11.71	12.13	12.36	11.88
Non-Surviving Funds	11.02	11.02	11.17	11.21	11.70	12.01	11.37
Non-Surviving Funds Above (Below) All Funds	(0.69)	(0.69)	(0.54)	(0.50)	(0.01)	0.30	(0.34)
Non-Survivors (Percent)	59	37	17	14	21	51	33
						Survivorship bias	0.17

Panel B. Truncation of three percent lowest performers each year.
(Mean return in percent per year)

	Contrarian Investors P1	P2	P3	P4	P5	Momentum Investors P6	P1 - P6
All Funds	11.69	12.19	12.36	12.57	12.91	13.43	12.53
Surviving Funds	12.22	12.55	12.43	12.67	13.03	13.78	12.76
Non-Surviving Funds	11.58	11.84	12.08	12.11	12.64	13.26	12.24
Non-Surviving Funds Above (Below) All Funds	(0.94)	(0.68)	(0.45)	(0.41)	0.12	0.73	(0.28)
Non-Survivors (Percent)	83	51	20	18	31	67	45
						Survivorship bias	0.23

Panel C. Truncation of five percent lowest performers each year.
(Mean return in percent per year)

	Contrarian Investors P1	P2	P3	P4	P5	Momentum Investors P6	P1 - P6
All Funds	10.29	10.91	11.49	12.00	12.32	13.21	11.70
Surviving Funds	11.97	11.32	11.72	12.13	12.56	13.96	12.20
Non-Surviving Funds	10.24	10.79	11.21	11.65	12.09	13.02	11.41
Non-Surviving Funds Above (Below) All Funds	(1.46)	(0.91)	(0.49)	(0.05)	0.39	1.32	(0.29)
Non-Survivors (Percent)	97	77	46	27	52	80	63
						Survivorship bias	0.50