Persistence and Fund Flows of the Worst Performing Mutual Funds

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Abstract

We document that the observed persistence amongst the worst performing actively managed mutual funds is attributable to funds that have performed poorly both in the current and prior year. Consistent with the Berk and Green (2004) model, we demonstrate that this persistence results from an unwillingness of investors in these funds to respond to bad performance by withdrawing their capital. In contrast, funds that only performed poorly in the current year do have significant capital outflows and consequently show no evidence of persistence in their returns.

1. Introduction

Persistence in mutual fund returns is well documented in the literature. Past studies have provided statistically significant evidence of persistence in mutual fund performance ranging from 1 to 5 years and this evidence has naturally lead to the question --- is it possible to make superior returns by taking advantage of this persistence and selecting managers based on it?

For the most part, the answer to this question seems to be no. Most researchers who studied this question attribute persistence to survivorship bias and misspecification of the benchmark models of risk (Brown et al. (1992), Brown and Goetzmann (1995), and Malkiel (1995)). In what is perhaps the most influential study, Carhart (1997), demonstrates, that, subject to one caveat, there is no evidence of persistence in mutual fund returns beyond 1 year after controlling for the Fama-French factors and momentum. The one caveat is the set of worst-performing funds; even after controlling for the Fama-French factors and momentum these funds still appear to have persistently bad performance for up to 3 years following a year of bad performance. Carhart (1997) concludes that even after controlling for the Fama-French factors and momentum, fees and expenses cannot account for the persistence in these funds, leaving this regularity as an unexplained puzzle.[2]

In this paper we provide a plausible explanation for the strong and persistent underperformance of the worst performing actively managed mutual funds. Using the insights in Berk and Green (2004), we argue that this predictability in performance must result from a lack of response in fund flows from the investors in these funds. We

[2] There is evidence of superior performance for holding periods shorter than 1 year. Mamaysky et al. (2004) show that by correcting for estimation error, it possible to use historical performance to construct funds that can produce risk adjusted one-month abnormal returns. Avramov and Wermers (2004) also provide evidence of superior returns based on 1 month persistence if transaction costs are ignored.

hypothesize on theoretical grounds that this lack of response in fund flows should be concentrated in a subset of these funds --- specifically the funds that not only did badly in the current year, but also did badly in the prior year. When a fund does well, any investor in the world can take advantage of this investment opportunity. Hence there is likely to be a large inflow of new capital. When a fund performs badly only the investors in the fund can react by withdrawing capital; the most responsive investors will exit first, leaving a greater proportion of less responsive investors in the fund. Consequently, if such a fund experiences another year of poor performance, it should not experience as large a capital outflow. This is precisely what we find empirically. Funds that performed poorly two years in a row have a statistically insignificant outflow of capital. This outflow is also statistically significantly smaller than the observed outflow of capital from funds that only did poorly in the current year but not the prior year.

The logic underlying the Berk and Green (2004) model suggests that we should observe persistence whenever the flow of funds is constrained. Hence the model predicts that we should see persistence amongst funds that perform poorly two years in a row. This is exactly what we find. The persistence amongst the worst performing funds documented by Carhart (1997) is completely attributable to funds that have performed badly both in the current and prior years. Funds that have only performed poorly in the current year do not show evidence of persistence.

The remainder of the paper proceeds as follows. Section 2 reviews the literature. Section 3 explains the empirical design. Section 4 describes the data. Section 5 presents the results. Section 6 concludes.

2. Literature Review

This paper is related to two independent strands in the literature. The first strand is the research on persistence in mutual fund returns and the relation been returns and the flow of funds. The early research in this area includes Grinblatt and Titman (1989) who report persistence in mutual fund returns over 5 years and Hendricks, Patel and

Zeckhauser (1993) who find that the relative returns of the mutual funds persist from one to eight quarters and a hot-hand investment strategy can provide statistically significant abnormal returns. Elton, Gruber and Blake (1996) find persistence of short-run risk-adjusted mutual fund performance from 1 to 3 years, even after adjusting for the survival bias in the data. In a separate study, Gruber (1996) documents that in a data set relatively uncontaminated by survivorship bias, expenses, raw returns, and risk-adjusted returns can robustly predict the future performance over both one year and three year intervals. Bollen and Busse (2002) find persistence in superior performance over time periods less than a year, and Avramov and Wermers (2004) show that it is possible to use this persistence to construct a trading strategy that appears to make superior returns if transaction costs are ignored. Mamaysky et al. (2004) show that correcting for the systematic bias in the estimated alphas and betas may allow the selection of some funds that can produce risk-adjusted abnormal returns.

In what has become an influential paper, Carhart (1997) has convincingly demonstrated that much of this persistence can be explained by common factors in stock returns. With the sole exception of the worst performing funds, persistence in superior performance beyond a year can be completely attributable to persistence in the factor returns.

Thus far, no one has been able to explain persistence amongst the worst performing funds. Brown and Goetzmann (1995), who were the first to document the strong evidence of persistence amongst the worst performing funds, show that high fees alone could not account for the persistence. Carhart (1997) shows that expense ratios and turnover also cannot explain this persistence.

The evidence on persistence has sparked a host of empirical studies on the relation between fund flows and performance including Gruber (1996), Chevalier and Ellison (1997), Sirri and Tufano (1998), and Zheng (1999). These papers focus on the decision by consumers to select funds, and document that capital flows are responsive to measures of past returns. The question of why capital flows are responsive to performance when performance is largely unpredictable, is the focus of Berk and Green (2004).

The other strand of research that is related to this paper is the evidence of heterogeneity in investors' willingness to withdraw their capital when they observe a reason to do so. Perhaps the most well documented example of this behavior is the phenomenon known in the mortgage backed security market as *burnout* (e.g., Schwartz and Torous (1989), Hayre (2001), Fabozzi (2001)). When interest rates fall, different pools of mortgages experience different prepayment rates; pools that have previously experienced a drop in interest rates have lower prepayment rates than pools that have not previously experienced a drop in interest rates. This behavior is attributed to homeowners' heterogeneous responses to interest rate drops (presumably because they face different costs of refinancing their homes). Because the homeowners with the higher interest rate sensitivity prepay first, they exit the mortgage pool at the first drop in interest rates. Consequently a pool that has previously experienced a drop in interest rates has a lower proportion of sensitive borrowers and hence an overall lower prepayment --- interest rate sensitivity.

Such heterogeneity has also been documented amongst mutual fund investors. Christoffersen and Musto (2002) employ similar reasoning to explain the dispersion of mutual-fund fees: some money fails to flow from worse- to better-prospect funds, increasing the density of performance-sensitive investors in better funds and performance-insensitive investors in worse funds. Elton et al. (2004) examine the choices among index funds by investors and conclude that "some investors are clearly making bad decisions in choosing index funds (p. 282)." They argue that inferior funds can exist and prosper because there is heterogeneity in investors' willingness to move their capital.

In this paper we attribute underperformance predictability in the worst performing funds to heterogeneity amongst investors in their willingness to withdraw their capital when they observe poor performance. We do not address the reason for this heterogeneity. We implicitly presuppose the existence of some investors who are disadvantaged in mobilizing their capital. Plausible explanations for the existence of those disadvantaged investors include: tax efficiency considerations, switching costs, back-end loads and other embedded market frictions. Pontiff (1996) invokes similar arguments to explain predictability in closed end fund returns.

3. Empirical Design

In this section we first present a hypothesis for the persistent underperformance observed in mutual funds, and then present the empirical design that we use to test this hypothesis.

In Berk and Green (2004), returns are not predictable because investors make full and rational use of the information about funds' past returns to learn about managerial ability. The resulting fund flows compete away any abnormal profits thereby ensuring that all returns are unpredictable. There are two assumptions on which this argument relies. First, investors update their beliefs on future expected returns immediately and rationally. Second, investors react immediately by supplying or withdrawing funds with perfect elasticity. Neither assumption is likely to be satisfied in reality. Furthermore, the degree to which these assumptions hold is likely to vary across investors.

When a fund does well, investors who update fastest are more likely to invest. Hence, this creates a selection bias in the type of capital that flows into a successful fund --- it is likely to come from investors with the highest elasticity of supplied capital to past performance. Furthermore, since any investor in the world can choose to invest in a fund that has performed well, one would expect the supply of new capital to be large enough to ensure that there is no predictability going forward.

A similar selection bias exists when a fund does poorly. Investors with high capital to past performance elasticities exit first, implying that the remaining investors have lower elasticities. Since only investors who are currently invested in the fund can exit, following a period of poor performance, the response in the flow of funds to performance of the fund should fall. This is what Ellison and Chevalier (1997) find --- after controlling for current returns, lagged returns have additional explanatory power in explaining future fund flows. This observation suggests a test of the Berk and Green model. Because any fund that has bad performance for at least two years in a row is likely to have attenuated capital outflows, the Berk and Green model predicts that the performance of these funds should be predictable --- they should do consistently poorly.

The insight in Berk and Green (2004) is that the lack of predictability in returns results from the response in the flow of funds. So the implication of the model in that paper is that if for some reason the flow of funds response is missing, the fund's returns should be predictable. This implication of the model stands in contrast to previous work on the relation between the flow of funds and predictability. Prior research has looked for (and has been unable to find) evidence of the reverse causality. For example, Sirri and Tufano (1998) motivate their empirical work by arguing that current performance would drive flows most strongly when there was evidence that current performance was more likely to predict future performance. Under the hypothesis this prior work has relied on performance predictability should be associated with larger fund flow sensitivity while the Berk and Green model predicts that performance predictability should be associated with smaller fund flow sensitivity.

Our objective is to see whether this prediction of the Berk and Green model is observable in the data. We proceed in two stages. We first identify funds that have done poorly two years in a row and verify that these funds have attenuated capital outflows. We then test for persistance in these funds' returns.

4. Data

The mutual fund data come from the CRSP Survivorship Bias Free Mutual Fund Database constructed by Carhart (1995). It is the largest and most complete survivor-bias-free mutual fund database currently available.[3] We restrict the sample to just actively-managed domestic, well-diversified, all-equity funds in the time period January 1963-December 2003. That is, we follow what has become common practice in this literature and exclude sector funds, balanced funds, and international funds. Our sample

[3] See Carhart (1995) for a detailed description of construction of this database.

consists of 2,968 funds, or a total of 24,019 fund years, almost equally divided into three investment objectives by the Investment Company Data Institute's (ICDI)) fund objective code: long-term growth, income and growth, and aggressive growth. Unfortunately ICDI's objective code is only available beginning in 1993, so prior to that date we used Wiesenberger fund type code, which identifies the funds investment strategy from year 1962.[4] During the sample period, the average number of funds is 852, with a minimum of 147 and a maximum of 1689. The returns are defined to be what investors actually get --- they are net of transaction costs and expenses.

New fund flows are calculated as the percentage change in total assets under management, net of internal growth, under the assumption of reinvestment of dividends and other distributions, i.e.,

$$Flow_{it} = \frac{NAV_{it} - NAV_{it-1}(1+r_t)}{NAV_{it-1}(1+r_t)} \tag{1}$$

The above expression differs from what is traditionally used (see Sirri & Tifano (1998); Chevalier & Ellison (1997); and Zheng, (1999)) because it has $NAV_{it-1}(1+r_t)$ rather than NAV_{it-1} in the denominator. That is, prior researchers have measured the flow of funds as follows:

$$\frac{NAV_{it} - NAV_{it-1}(1+r_t)}{NAV_{it-1}} \tag{2}$$

Unfortunately this measure does not fully capture the percentage change in new funds because it incorrectly attributes some of this change to the change due to internal growth. For example, if the fund has a very low (negative) return that results in liquidation, (i.e., $NAV_{it} = 0$), by the definition of liquidation, the flow of funds is -100%. However, in this case (2) evaluates to a number larger than -100%.

[4] We verified that ICDI's objective code is consistent with the Wiesenberger fund type code in the period after 1993.

5. Results

We begin by first identifying a set of funds that have performed poorly for 2 straight years. Following the methodology in Carhart (1997), at the end of each year we sort stocks into deciles by their 1-year return over the year. We then divide the stocks into deciles. The funds in the worst performing decile are further subdivided into two sub-categories: those that were also in the worst performing decile in the prior year and those that were not. We label the former category (i.e., the funds that were in the worst performing decile for the last two years) as "seasoned" and the latter category as "unseasoned." So, for example, take 1995 as the formation year. At the end of 1995, we sort funds into 10 deciles based on their returns in 1995. We then divide the bottom decile into two sub-categories. The seasoned sub-category consists of the funds that were also in the bottom decile in 1994 and the unseasoned sub-category consists of the rest of the funds in the bottom decile in 1995.

If mutual fund returns were i.i.d., then, on average only 10% of funds in the lowest decile (or one in a hundred funds) would be classed as seasoned. On average, this would amount to only 8 funds. Table 1 shows the fraction of funds in two categories for the lowest decile. The persistence that has been documented in the lowest decile of funds is clearly present in our sample. On average 29.6% of funds in the bottom decile are seasoned. By comparison, 9.4% of the funds in the top decile were also in the top decile a year earlier.

Table 1:
Persistence in the Top and Bottom Decile

Of funds that are in the top (bottom) decile in the current year the average fraction of funds that were in the same decile and the bottom (top) decile is reported. At the end of each year funds are sorted into deciles based on their returns over the year and for the 10% of funds in the top decile the fraction that were also in the top (bottom) decile in the prior year is calculated. Similarly for the 10% of funds in the bottom decile, the fraction that were also in the top (bottom) decile in the prior year is calculated. The average value of these fractions over our sample period from 1964 to 2003 is reported in the table.

	Current Year	
Prior Year	**Top**	**Bottom**
Top	9.4%	8.2%
Bottom	12.9%	29.6%

We recorded the monthly flow of funds ($Flow_{it}$) and return of the bottom decile and the two sub-categories over the 12 months following decile formation. So continuing our illustrative example, we calculate the flow of funds for each month during 1996 for the funds ranked and formed into deciles by the return in 1995. Table 2 provides the average monthly flow of funds ($Flow_{it}$) and average monthly return of the bottom decile and the two sub-categories over our sample period. The *t*-statistics are calculated as this average divided by the time series standard error and are in parentheses.

Not surprisingly, the flow of capital is negative in the bottom decile. More importantly, the flow of funds is different between the two subcategories of the bottom decile. Seasoned funds have lower sensitivity; in fact, the flow of capital out of these funds is not statistically significantly different from zero. In contrast, unseasoned funds have high and statistically significant capital outflows. One might suspect that this difference might be driven by return differences across the two categories rather than differences in investor elasticities. In fact, the return of *seasoned* funds is actually *lower* than unseasoned funds --- investors withdrew significantly less of their capital from seasoned funds than from unseasoned funds, even though the average return of seasoned funds was lower.

Now that we have successfully identified a set of funds with low fund flow --- performance sensitivity, namely, seasoned funds, we can test the Berk-Green model (2004) by looking for predictability in these funds.

Table 2:
Flow and Performance Relationship in the Bottom Decile

At the end of each year stocks are sorted into deciles based on their returns over the year. The bottom decile is further subdivided into two categories: funds that were also in the bottom decile in the prior year ("seasoned funds) and ones that were not in the bottom decile in the prior year ("unseasoned funds"). The flow of funds and return over the following 12 months is then recorded. The table shows the average monthly flow of funds and average monthly return of the bottom decile, seasoned funds and unseasoned funds for the period from January 1964 to December 2003. The *t*-statistics are in parentheses and are calculated as the time series average divided by the standard error. Statistical significance at the 1% (5%) level is indicated with an ** (*).

	10^{th} Decile	Seasoned Funds	Unseasoned Funds	Difference between Seasoned and Unseasoned Funds
Flow of Funds ($Flow_{it}$) in %	-0.599 (-2.01)	-0.336 (-1.76)	-0.841 ** (-3.18)	0.504 * (2.25)
Return in %	-0.176	-0.359	-0.098	-0.261

For ease of comparison we follow the methodology used in Carhart (1997) as closely as possible. Thus, we estimate abnormal fund performance in the 12 months following decile formation using Carhart's 4-factor specification. Measuring performance relative to the 4 factor Carhart specification has become standard in this literature. However, like Carhart (1997), we do not take a stand on whether the 4-factor specification we use is a good measure of risk. Instead we simply point out that since investors can relatively costlessly mimic the strategy on which the specification is based, any managerial talent would have to at least beat this benchmark. The return of each decile (or sub-category) *i* in month *t* is given by

$$r_{i,t} = \alpha_i + \beta_i MKT_t + s_i SMB_t + h_i HML_t + m_i MOM_t + \varepsilon_{it} \quad (3)$$

MKT is the monthly excess return on the CRSP value-weighted aggregate market proxy for all NYSE, Amex, and Nasdaq stocks. HML and SMB are monthly returns to value-weighted, zero-cost positions of the Fama-French factor-mimicking portfolios. This data are obtained from Professor Ken French's website. Following Carhart (1997), we augment the Fama and French's factors with the momentum factor, which captures one year momentum in stock returns as documented by Jegadeesh and Titman (1993). MOM is constructed as monthly returns on value-weighted, zero-cost, factor-mimicking portfolio for momentum in stock returns, and is provided by Carhart.

At the end of each year, we form equally weighted portfolios of the funds in each decile. We divide the bottom decile into seasoned and unseasoned funds and form two equally weighted portfolios out of the funds in each of these sub-categories. As a control, we do the same thing for the top decile. That is, funds that are in the top decile that were also in the top decile in the prior year are put in the seasoned sub-category in the top decile and we form an equally weighted portfolio out of these funds. The unseasoned sub-category of the top deciles consists of the rest of the funds in the top decile and we again form an equally weighted portfolio of these funds. We then record the monthly excess return (the monthly return minus the 30 day T-Bill rate as reported on CRSP) of all of these portfolios over the following 12 months. If a fund drops from the sample during these 12 months, we adjust the weights accordingly.

By repeating this procedure for each year in our sample, we produce monthly returns for each decile and sub-category over the period January 1964 through December 2003. We then regress the return for each portfolio formed from decile *i* on the four Carhart factors to get an estimate of α_i. As Table 2 shows, the portfolio formed from funds in the seasoned sub-category of the bottom decile show large (negative) and statistically significant persistence (at the 1% confidence level). In contrast, the unseasoned portfolio in the bottom decile shows no persistence whatsoever --- the alpha estimate is not statistically significantly different from zero. Furthermore, as the performance of the spread position between these two portfolios shows, the difference in the alpha estimates for these two portfolios is significantly different from zero (see the 10u-10s spread position in Table1, Panel B). Perhaps even more surprising is that seasoned funds in the bottom decile appear to account for *all* the predictability within that decile. Note that the alpha estimate for unseasoned funds in the bottom decile is not significantly different from zero. Furthermore, there is no significant difference between the performance of the top decile and unseasoned funds in the bottom decile (see the 1-10u spread position in Table1, Panel B.) In contrast, the difference between the performance of the top decile and seasoned funds in the bottom decile is highly statistically significant. These results are therefore consistent with the Berk and Green model --- the set of funds in the bottom decile for which we failed to find a statistically significant outflow of funds had persistently poor performance. For the rest of the funds in the bottom decile, a significant outflow of funds was detected and hence their poor performance is not persistent.

Carhart (1997) showed that with the exception of the worst performing funds, all persistence in mutual funds that lasts longer than a year can be explained using his 4 factor specification. Here we show why persistence exists amongst the worst performing funds. In fact the majority of the worst performing funds show no evidence of persistence relative to the 4 factor specification. Persistence only exists in the worst performing *seasoned* funds. These funds have persistent returns because they have lost their highly elastic investors, and so the remaining investors do not respond to the bad performance. Not enough capital is withdrawn and as a consequence the funds exhibit persistent negative returns.

Table 3:
Post-ranking Risk Adjusted Performance of Portfolios

At the end of each year from 1964 to 2003, we form equally weighted portfolios of the funds in each decile. We divide the bottom decile (10) into seasoned (10s) and unseasoned (10u) sub-categories and form two equally weighted portfolios out of the funds in each of these sub-categories. Similarly, we divide the top decile (1) into seasoned (1s) and unseasoned (1u) sub-categories and form two equally weighted portfolios out of the funds in each of these sub-categories. The excess return of the portfolios is calculated as the monthly return of the portfolios in the 12 months following the formation year minus the 30 day T-bill rate. By repeating this procedure for each year in our sample, we produce monthly excess returns for each portfolio over the period January 1964 through December 2003. The second column in the table lists the average excess return for each portfolio over out sample period. The third column lists α_i, the estimate of the intercept from the time series regression of the portfolio excess returns on the Carhart's four factors: $r_{i,t} = \alpha_i + \beta_i MKT_t + s_i SMB_t + h_i HML_t + m_i MOM_t + \varepsilon_{it}$. The t-statistics are in parenthesis and test whether α_i is different from zero. Panel A contains the results for these portfolios. In panel B, we construct zero cost portfolios by out of the original portfolios: 1-10 is long the 1st decile and short the 10th decile; 1s-1u is long the seasoned funds in the top decile and short the unseasoned funds in the top decile; 10u-10s is long the unseasoned funds in the bottom decile and short the seasoned funds in the bottom decile; 1-10s is long the funds in the and short the seasoned funds in the bottom decile; 1-10u is long the funds in the top decile and short the unseasoned funds in the bottom decile; (10u-10s)-(1s-1u) is long the portfolio (10u-10s) and short the portfolio (1s-1u). Statistical significance at the 5% level is indicated with an *, significance at the 1% level is indicated by **.

Panel A: Risk-adjusted performance of spread-position portfolios

Portfolios	Average Monthly Excess return	α_i
Top Decile (1)	0.20%	**-0.0023** **(-1.68)**
Seasoned (1s)	0.17%	**-0.0016** **(-0.98)**
Unseasoned (1u)	0.25%	**-0.0031 *** **(-2.11)**
Bottom Decile (10)	-0.17%	**-0.0057 ***** **(-5.15)**
Seasoned (10s)	-0.36%	**-0.0079 ***** **(-6.22)**
Unseasoned (10u)	-0.09%	**-0.0021** **(-1.98)**

Panel B: Risk-adjusted performance of spread-position portfolios

Portfolios	Average Monthly Excess return	α_i
1-10	0.37%	**0.0027 ***** **(3.59)**
1u-1s	0.08%	**-0.0009** **(-1.78)**
10u-10s	0.27%	**0.0020 ***** **(3.11)**
1-10s	0.56%	**0.0029 ***** **(3.57)**
1-10u	0.29%	**0.0011** **(1.72)**
(10u-10s)-(1s-1u)	0.35%	**0.0024***** **(2.95)**

One might argue that the persistence we observe in the seasoned funds could be due to the fact that the four common factors do not measure risk correctly. If the risk of the portfolios remains relatively constant, then such misspecification could induce persistence. Since lower risk funds will on average have lower returns, they will tend to be in the lowest decile more often. So they are more likely to be in the seasoned category, rather than the unseasoned category. If the 4 factors do not capture all risk factors, a missing factor would show up as a non-zero alpha, which for the lower risk firms presumably would be negative on average. Hence we would see a negative alpha for seasoned funds in the bottom decile. However, for this argument to explain our results one would have to argue that the misspecification error is not symmetric across stocks. That is, the same argument implies that more risky funds should appear more often in the top decile. Using similar reasoning seasoned funds in the top decile presumably should have positive alphas. In fact, as Table 2 shows, the alpha of seasoned funds in the top decile is not significantly different from zero, nor is it statistically significantly different from the alpha of unseasoned fund in the same decile. So one would have to argue that the four common factors do a good job pricing the risk of risky stocks, but fail with regards to less risky stocks. This explanation does not seem particularly plausible.

6. Conclusions

In this paper we test the hypothesis that persistence in mutual fund returns is a consequence of an attenuated relationship between past returns and capital flows into and out of funds. Consistent with our hypothesis we document that the observed persistence in the returns of the worst performing funds can be attributed to funds that do not have a strong flow of funds—performance relation. Funds in the worst performing decile that do show evidence of a strong flow of funds—performance relation do not have persistent returns.

The results in this paper point toward a potentially fruitful line of research. There are other sectors where mutual fund returns appear to be predictable. For example, Mamaysky et al. (2004), and Avramov and Wermers (2004) find evidence of performance predictability in monthly returns. If we accept the notion that predictability in fund returns results from an attenuation in the flow of funds relation, then it might be fruitful to investigate the flow of funds relation for these funds. Perhaps there are particular market frictions that exist that limit the frequency with which investors' move their capital.

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