Family Matters: The Performance Flow Relationship in the Mutual Fund Industry*

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ABSTRACT

The relationship between the performance of mutual funds and their subsequent growth is examined. The focus of our paper is on the influence of the position of a fund within its family. So far only the influence of the position of a fund within its segment on its subsequent inflows has been considered. Our empirical study of the US mutual fund market shows that fund growth depends on the relative position of a fund within its segment *and* within its family. This leads to important incentives for fund managers.

I. Introduction

There is a broad empirical literature looking at the relationship between the performance of mutual funds and subsequent inflows of new money into these funds.[1] The studies find that the performance flow relationship (PFR) is positive and convex. The best performing funds in a market segment get the lion's share of inflows, whereas bad and mediocre funds hardly differ in terms of net flows.[2]

In this paper we argue that funds not only compete for flows within their market segment, but also within their fund family.[3] We expect the position of a fund within its family to determine inflows because fund families advertise their star funds (see, e.g., Jain and Wu (2000)). If advertisement is productive, we expect top funds within a family to grow faster than other funds.

There are no studies looking at the influence of the position of a fund within its family on its subsequent growth. Ours is the first study to address this issue: Is there an influence of a fund's relative performance within its family on its inflows? And if so, how does this relationship look like?

Answering this question is relevant because of two reasons: First, it allows us to better understand the determinants of fund growth and therefore the behavior of mutual fund investors. Second, the influence of the performance within a family on fund growth creates incentives for fund managers and might therefore influence their trading strategies. The

[1] The very first papers are Spitz (1970) and Smith (1978). Recent studies include Ippolito (1992), Patel, Zeckhauser, and Hendricks (1994), Roston (1996), Chevalier and Ellison (1997), Goetzmann and Peles (1997), Sirri and Tufano (1998), Barber, Odean, and Zheng (2002), and Nanda, Wang, and Zheng (2004). DelGuercio and Tkac (2002) and Agarwal, Daniel, and Naik (2003) look at the performance flow relationship in the pension fund and hedge fund markets, respectively.

[2] A segment is defined as the entirety of all funds having comparable investment objectives, e.g., *Growth*, *Growth and Income*

[3] A fund family is defined as the entirety of all funds managed by the same mutual fund management company, e.g. *Janus* or *Fidelity*.

incentives arising from a fund's position within its segment have been studied by, e.g., Brown, Harlow, and Starks (1996), and Chevalier and Ellison (1999). The influence of the relative position within the family on fund behavior is examined in Kempf and Ruenzi (2004b).

The paper proceeds as follows: Section II describes the methodology. Section III presents the data and summary statistics. Section IV contains the results of our empirical study and stability tests. Section V concludes.

II. Methodology

We want to explain fund growth, $FLOW_{i,t}$, by the relative position of a fund within its segment and within its family in the previous year. A simplified framework to address this issue is

$$FLOW_{i,t} = f(SegPerf_{i,t-1}, FamPerf_{i,t-1}, Controls).$$

The position of a fund within its segment and within its family is denoted by $SegPerf_{i,t-1}$ and $FamPerf_{i,t-1}$, respectively. $Controls$ denotes a set of control variables that have proven to be relevant factors influencing fund growth.

We now turn to a more detailed description of our model and the variables contained therein. In Section II.A we describe how we construct the dependent variable $FLOW_{i,t}$. Section II.B describes how we construct the performance variables $SegPerf_{i,t-1}$ and $FamPerf_{i,t-1}$. Section II.C describes the control variables. The empirical model is detailed in Section II.D.

A. Dependent Variable

Due to data limitations we do not observe inflows into a fund directly. Instead, we have to use the standard procedure from the literature to construct the growth of fund i in year t:[4]

$$FLOW_{i,t} = \frac{TNA_{i,t} - TNA_{i,t-1}}{TNA_{i,t-1}} - r_{i,t}$$

$TNA_{i,t}$ is the total net asset value of fund i in year t and $r_{i,t}$ is the total rate of return of fund i in year t. $FLOW_{i,t}$ reflects the growth of the fund that is not due to the rate of return earned on the assets under management, but due to new external money. $FLOW_{i,t}$ is a conservative measure of the inflows into a fund. It implicitly assumes that flows occur at the end of the year and that all dividends are re-invested in the same fund. Sirri and Tufano (1998) show that the results of their study are not sensitive to this assumption.

B. Performance Variables

Many different performance measures are suggested in the literature to explain fund inflows.[5] We can classify performance measures as ordinal measures (ranks) and cardinal measures. Studies comparing ordinal and cardinal measures find that ordinal measures are able to explain fund growth much better than cardinal measures (see, e.g., Patel, Zeckhauser, and Hendricks (1994), Myers (2001), and Navone (2002)). These results confirm the findings of the survey studies by Capon, Fitzsimons, and Weingarten (1994) and Capon, Fitzsimons, and Prince (1996). The latter two studies find that fund rankings are the most important

[4] This procedure is used by Chevalier and Ellison (1997) and Sirri and Tufano (1998), among other.

[5] Raw and/or Excess-Returns over the risk-free rate or some broad market-index are used by Ippolito (1992), Patel, Zeckhauser, and Hendricks (1994), Roston (1996), Goetzmann and Peles (1997), Gruber (1996), Berkowitz and Kotowitz (2000) and Jain and Wu (2000) as cardinal measure and by Patel, Zeckhauser, and Hendricks (1994), Sirri and Tufano (1998), and Fant and O'Neal (2000) as ordinal measures. Risk-adjusted performance measures like Jensen's Alpha or multi-factor Alphas are used by Ippolito (1992), Patel, Zeckhauser, and Hendricks (1994), Harless and Peterson (1998), Gruber (1996), Berkowitz and Kotowitz (2000), Jain and Wu (2000), Nanda, Wang, and Zheng (2004), and Lynch and Musto (2003). Fant and O'Neal (2000) and Del Guercio and Tkac (2002) use performance ranks based on Jensen's Alpha.

information as well as selection criterion for fund investors. Therefore, in the following we only use ordinal measures, i.e. ranks based on different performance measures, to explain fund growth.

As there is no clear evidence in the literature which performance measure our ranks should be based on, we use three different measures.

First, we use the Sharpe Ratio in year t

$$SR_{i,t} = \frac{r_{i,t} - r^f_{i,t}}{STD_{i,t}}.$$

$r^f_{i,t}$ denotes the rate of return on the risk-free asset in year t and $STD_{i,t}$ denotes the annualized return standard deviation of fund i in year t.

Second, we use the Fama and French (1993) methodology to estimate three-factor alphas:

$$r_{i,m} - r^f_m = \alpha^{3F}_i + \beta_{i1} \cdot RMRF_m + \beta_{i2} \cdot SMB_m + \beta_{i3} \cdot HML_m + \varepsilon_{i,m}$$

$r_{i,m}$ is the rate of return of fund i in month m, r^f_m is the risk-free rate in month m and $RMRF_m$ is the excess-return of the market over the risk free rate in month m. SMB_m and HML_m denote the rate of return on portfolios that mimick the size-factor and the book-to-market factor, respectively. The regression is run for every fund i and every year t separately in order to get a time series of yearly observations of the three-factor alphas.

Finally, we estimate the Carhart (1997) four-factor model to generate four-factor alphas. The regression-equation is the same as for the three-factor model presented above, except that we add the momentum factor MOM_m:

$$r_{i,m} - r^f_m = \alpha^{4F}_i + \beta_{i1} \cdot RMRF_m + \beta_{i2} \cdot SMB_m + \beta_{i3} \cdot HML_m + \beta_{i4} \cdot MOM_m + \varepsilon_{i,m}.$$

We construct segment ranks by ordering all funds belonging to a specific market segment in a given year according to each of the described measures separately. We then assign a rank-number $RANK$ to them. This rank-number is normalized so that ranks are evenly distributed between 0 and 1. The best fund gets assigned the rank 1. $RANK^{PERF}_{i,t}$ denotes the rank of fund i in year t within its segment based on the performance measure $PERF$. $PERF$ can be SR, if the ranking is based on the Sharpe Ratio, and $3F$ and $4F$, if it is based on the three- and four-factor alpha, respectively.

The relative success of a fund within its family is denoted by $RoR_{i,t}^{PERF}$. This family rank can be based on one of the three segment rankings described above. To construct $RoR_{i,t}^{PERF}$, we order all funds within a family according to their rank within their respective segment, $RANK_{i,t}^{PERF}$. Based on this segment ranking we then assign a new rank number to them. Therefore it is a **R***ank*-**o***f*-**R***ank*. This method is sensible because fund families usually have funds in different segments and these segments are characterized by different risk-return characteristics. Therefore, we cannot simply compare the Sharpe Ratios or factor alphas of the funds within a family.

C. Control Variables

Funds might benefit from positive spillover effects if there are other funds in the same family that show a top performance (see, e.g., Ivkovic (2003) and Nanda, Wang, and Zheng (2004)). To control for this effect, we add the variable $STAR_{i,t}$ to our model. We calculate this ratio by first counting the number of funds in fund i's family that were among the top 5% within their segment. This number is then divided by the total number of funds in the same fund's family to provide the star ratio.[6]

Ippolito (1992) and Sirri and Tufano (1998) find a marginal influence of risk on fund flows. We follow their approach and include the annualized standard deviation of monthly returns, $STD_{i,t}$, in the model as a measure of the riskiness of the fund.

[6] We use this ratio rather than a dummy indicating the existence of another top performer in the family (as, e.g., in Ivkovic (2003)) because the families in our sample are quite large and the probability of having a star in any of the segments therefore is quite high. For example, more than 40% of all families have a top-5% fund in at least one segment. This number rises to 55% if we look at top-10% funds.

We also include the growth of the fund in the previous year, $FLOW_{i,t-1}$, to control for possible autocorrelation in fund flows (see, e.g., Zeckhauser, Patel, and Hendricks (1991)). This autocorrelation might be due to other fund-specific characteristics that we do not control for and that do not change over time. It could also be due to a status-quo bias. If investors suffer from a status-quo bias they tend to repeat an investment decision made in the past, even if this decision is not optimal any more. This kind of behavior leads to a positive dependence of current inflows on past inflows (see, e.g., Kempf and Ruenzi (2004a)).

We include the log of the fund size, $ln(TNA_{i,t})$, because it is probably more difficult for large funds to grow than for small funds (see, e.g., Chevalier and Ellison (1997), and Sirri and Tufano (1998)).

Our model also includes the log of the age of a fund, $lnAGE_{i,t}$. Chevalier and Ellison (1997) show that young funds behave differently from old funds. Differences in the investment strategy might influence investors' demand. Bergstresser and Poterba (2002) and Del Guercio and Tkac (2002) find a negative influence of a fund's age on fund growth.

To control for the influence of fees we follow the standard procedure in the literature (see, e.g., Khorana and Servaes (2003)) and assume an average holding period of 7 years for fund investors. Our measure for the total fee burden, $FEES_{i,t}$, is therefore constructed as the sum of the expense ratio and 1/7 of all loads charged by the fund.

We also add the turnover ratio of the fund, $TO_{i,t}$, to examine whether investors prefer actively managed funds. While Woerheide (1982) finds no significant influence of the trading activity on fund growth, more recent studies like Rockinger (1995) and Bergstresser and Poterba (2002) report a positive influence.

$FLOW(Seg)_{i,t}$ and $FLOW(Fam)_{i,t}$ are defined as the growth rates of fund i's segment and family, respectively. The growth of the segment and family is calculated net of the growth of the fund analyzed. By including $FLOW(Seg)_{i,t}$ we control for segment-specific effects that might influence the growth of the funds belonging to this specific segment. A positive influence of segment growth on fund growth is documented in, e.g., Sirri and Tufano (1998), and Fant and O'Neal (2000). $FLOW(Fam)_{i,t}$ is added to control for family specific factors like marketing efforts boosting the whole family. Other family specific factors are additional services offered by the fund company like, e.g., telephone hotlines or the possibility of defined contribution plans (see, e.g., Harless and Peterson (1998)).

We also include the log of the size of the family, $lnTNA(Fam)_{i,t}$. The total net assets under management (TNA) in the family are calculated net of the TNA of the fund analyzed. This variable is a proxy for the visibility of a fund family.

Finally, we also include a set of dummy variables D_j that take on the value 1 if an observation is from year j and 0 otherwise. The dummy variables control for year-specific, economy-wide effects in our pooled regression.[7]

D. Empirical Model

We know from the literature that the PFR in the market segment is convex. We therefore follow the approach suggested by, e.g., Sirri and Tufano (1998) and Fant and O'Neal (2000). They apply a piecewise-linear specification: Slope coefficients are estimated for the bottom quintile, the three middle quintiles, and the top quintile of the fractional ranked performance separately. The complete model using their technique then reads:

$$
\begin{aligned}
FLOW_{i,t} \quad = \quad & \beta_{1a} \cdot LOW(Seg)_{i,t-1} + \beta_{1b} \cdot MID(Seg)_{i,t-1} + \beta_{1c} \cdot TOP(Seg)_{i,t-1} \\
& + \beta_{2a} \cdot LOW(Fam)_{i,t-1} + \beta_{2b} \cdot MID(Fam)_{i,t-1} + \beta_{2c} \cdot TOP(Fam)_{i,t-1} \\
& + \gamma_1 \cdot STAR_{i,t-1} + \gamma_2 \cdot STD_{i,t-1} + \gamma_3 \cdot FLOW_{i,t-1} \\
& + \gamma_4 \cdot lnTNA_{i,t-1} + \gamma_5 \cdot lnAGE_{i,t-1} + \gamma_6 \cdot FEES_{i,t-1} + \gamma_7 \cdot TO_{i,t-1} \\
& + \gamma_8 \cdot FLOW(Seg)_{i,t} + \gamma_9 \cdot FLOW(Fam)_{i,t} + \gamma_{10} \cdot lnTNA(Fam)_{i,t-1}
\end{aligned}
$$

[7] Rockinger (1995) argues that in some years the aggregate liquidity in the market is higher than in others because of business cycle patterns. This might lead to higher growth rates of funds in these years.

$$+\sum_{j=1993}^{2001} \alpha_j \cdot D(j)_{i,t} + \varepsilon_{i,t}, \tag{1}$$

where

$$\begin{aligned}
LOW(Seg)_{i,t-1} &= \min(RANK^{Perf}_{i,t-1}, 0.2) \\
LOW(Fam)_{i,t-1} &= \min(RoR^{Perf}_{i,t-1}, 0.2) \\
MID(Seg)_{i,t-1} &= \min(RANK^{Perf}_{i,t-1} - LOW(Seg)_{i,t-1}, 0.6) \\
MID(Fam)_{i,t-1} &= \min(RoR^{Perf}_{i,t-1} - LOW(Fam)_{i,t-1}, 0.6) \\
TOP(Seg)_{i,t-1} &= RANK^{Perf}_{i,t-1} - (LOW(Seg)_{i,t-1} + MID(Seg)_{i,t-1}) \\
TOP(Fam)_{i,t-1} &= RoR^{Perf}_{i,t-1} - (LOW(Fam)_{i,t-1} + MID(Fam)_{i,t-1}).
\end{aligned}$$

The piecewise linear regression methodology allows us to estimate different slope coefficients for the bottom quintile, the middle quintiles, and the top quintile. For example, the estimate of the slope in the bottom quintile of the PFR in the segment is given by β_{1a}. Note that we include all controls that are relevant for investment decisions in year t, but whose values are unknown at the beginning of the year, as lagged variables.

III. Data and Summary Statistics

We use data on all US equity funds from the CRSP survivorship free mutual fund database.[8] The CRSP database contains data on monthly total returns, the fund management company, the year of origin, and other characteristics of the fund. We use the Strategic Insight Objectives (SI) of the funds to define the market segments. This provides us with 38 different segments. As the SI classification is available from 1993 on, our study starts in 1993. It ends in 2001 leaving us with nine years of data.

[8] Source: CRSP™, Center for Research in Security Prices. Graduate School of Business, The University of Chicago. Used with permission. All rights reserved. crsp.uchicago.edu. For a more detailed description of the CRSP database, see Carhart (1997) and Elton, Gruber, and Blake (2001).

To calculate the three- and four-factor alphas described in Section II.B we use the returns of the respective factor portfolios provided by Kenneth R. French.[9]

As we use previous year's performance to explain inflows, only funds that are at least 2 years old in any given year are included. We restrict our dataset by excluding outliers: We exclude funds with a growth rate of more than 500% and funds with a TNA of less than 10 Million USD.[10] Furthermore, we also exclude all families and segments with less than 20 funds. This ensures that the rank-numbers defined above are smoothly distributed. Our final sample consists of 10,068 fund year observations. Summary statistics of our resulting sample are presented in Table I.

+++ PLEASE INSERT TABLE I ABOUT HERE +++

The number of funds in our sample grows from 117 in 1993 to 2,688 in 2001. These numbers exaggerate the growth of the fund industry because the share of excluded funds belonging to segments and families with less than 20 funds is much larger in the earlier years of our sample. The average number of funds per year is 1,119. The size, $TNA_{i,t}$, of the average fund in our sample is 1,124 million USD, with a maximum of 1,829 million USD in 1995 and a minimum of about 756 million USD in 2001. The mean growth rate due to new money in our sample is 10.74 % p.a.. The age of the mean fund is 10.38 years.

[9] The factor returns are available for downloading at Kenneth R. French's Homepage `http://mba.tuck.dartmouth.edu/pages/faculty/ken.french`.

[10] We also followed Bergstresser and Poterba (2002) and only excluded fund years in which funds grew more than tenfold. Results remain virtually unchanged. We also set the growth rate of funds growing by more than 500% equal to 5. Results do not change.

IV. Empirical Results

A. Performance Flow Relationship in the Segment

In this (mainly reproductive) section, we estimate the model for the PFR in the segment. We estimate Model (1), but leave aside the influence of the position of a fund within its family for the moment. Results are presented in Table II. We do not report the estimates for the yearly dummies for sake of brevity.

+++ PLEASE INSERT TABLE II ABOUT HERE +++

We find evidence for a positive and convex influence of past performance on fund growth, irrespective of what performance measure we use for calculating ranks. Thereby, we support the results of earlier studies. Investors chase past winners, but do not sell past losers to the same extent.

The impact of the other control variables is the same as in earlier studies: We find a positive and highly significant influence of the star ratio, $STAR_{i,t-1}$, indicating that spill-over effects are very important. The influence of risk, measured by $STD_{i,t-1}$, on inflows is insignificant for the Sharpe Ratio (which already includes $STD_{i,t-1}$ in the denominator) specification. $STD_{i,t-1}$ has an statistically significant negative influence in the factor alpha specifications. This indicates that investors prefer less risky funds. The influence of previous year's fund growth, $FLOW_{i,t-1}$, is positive and highly significant. This is consistent with the existence of a status-quo bias in the mutual fund market. There is also a strong negative influence of fund size, $lnTNA_{i,t-1}$, on growth. Large funds grow slower than small funds. The influence of the fund's age, $lnAGE_{i,t-1}$, is negative, but only marginally significant. Old funds tend to grow slower than young funds. Fees, $FEES_{i,t-1}$, have a negative impact on fund growth. Investors are fee-sensitive. Turnover, $TO_{i,t-1}$, has no notable impact. Investors do not seem to strongly prefer an active management style. The growth rates of the segment and the family a fund belongs to ($FLOW(Seg)_{i,t}$ and $FLOW(Fam)_{i,t}$, respectively) have a positive and significant influence on fund growth. This indicates that further segment- and family-specific characteristics are important for fund investors. We also find a positive influence of the size of the fund's family, $lnTNA(Fam)_{i,t-1}$, on its growth. This suggests that larger families enjoy a better visibility. Overall, we confirm the results of earlier studies. We will not report estimates of the control variables in the following tables; they remain qualitatively unchanged.[11]

The R^2 using Sharpe Ratio ranks is 22.49%, while it is only below 18% for the factor alpha ranks. Ranks based on Sharpe Ratios clearly explain fund growth better than ranks based on factor alphas. Therefore, we use ranks based on Sharpe Ratios in the remainder of the paper.

B. Performance Flow Relationship in the Family and in the Segment

We now analyze the influence of a fund's position within its family on its subsequent growth. We estimate our fully specified Model (1). Results are presented in Table III.

+++ PLEASE INSERT TABLE III ABOUT HERE +++

We still find strong evidence for a convex PFR in the segment, even after controlling for the influence of a fund's position within its family. All of the piecewise linear slope coefficients for the segment PFR are positive and highly significant.

Most importantly, we find statistically significant evidence for a convex PFR in the family. The slope coefficient for the top quintile, $TOP(Fam)$, is positive and statistically significant. The other slope coefficients, $LOW(Fam)$ and $MID(Fam)$, are insignificant. This indicatefs that it matters for fund growth whether a fund belongs to the top quintile. However, it does not matter whether a fund belongs to the lowest or to the mid quintiles. This is consistent

[11] The complete tables - and also all other results that are not reported in the following - are available from the authors upon request.

with our view that mutual fund families promote their best funds. Therefore, top funds within families experience larger inflows. As only top funds will be promoted, it only matters to reach the top quintile. This suggests not to model different slope coefficients (as with the piecewise linear specification used above), but rather to look at a level effect of moving up into the top ranks. Therefore, we estimate the following modified model:

$$\begin{aligned} FLOW_{i,t} &= \beta_{1a} \cdot LOW(Seg) + \beta_{1b} \cdot MID(Seg) + \beta_{1c} \cdot TOP(Seg) \\ &\quad + \beta_{3a} \cdot D_{II}(Fam) + \beta_{3b} \cdot D_{III}(Fam) + \beta_{3c} \cdot D_{IV}(Fam) + \beta_{3d} \cdot D_{V}(Fam) \\ &\quad + \dots \end{aligned} \tag{2}$$

In (2) we replace the three slope coefficients for the family PFR by four dummy variables, $D_{II}(Fam)$-$D_V(Fam)$. We use dummies to examine the average flow to funds if a fund is not within the very bottom quintile of the performance ranking. These dummies are defined as $D_{II}(Fam) = 1$ if $RANK^{Perf}_{i,t-1} \in]0.2, 0.4]$, and 0 otherwise, $D_{III}(Fam) = 1$ if $RANK^{Perf}_{i,t-1} \in]0.4, 0.6]$, and 0 otherwise, and so on. Note, that in (2) there is no dummy D_I, because this would make the regressors linear dependent. The base inflow of the lowest quintile is reflected in the yearly dummies.

The estimates for (2) are again presented in Table III. $D_V(Fam)$ is positive and statistically significant, whereas $D_{II}(Fam)$ to $D_{IV}(Fam)$ are insignificant. There is no influence of belonging to a specific quintile except for the top one. If a fund belongs to the top quintile in its family, it grows - ceteris paribus - by nearly 7% more than other funds. Given the average growth rate of 10.74% p.a. (see Table I), this effect is economically very important. The convexity in the segment PFR still shows up strongly, as indicated by the three positive and statistically significant coefficients $LOW(Seg)$ to $TOP(Seg)$.

As a third specification we replace the piecewise linear coefficients with quintile dummies for the segment rank, too. The new segment variables are denoted by $D_{II}(Seg)$-$D_V(Seg)$ and are defined in the same way as the family dummies above. Our Model (3) reads:

$$FLOW_{i,t} = \beta_{4a} \cdot D_{II}(Seg) + \beta_{4b} \cdot D_{III}(Seg) + \beta_{4c} \cdot D_{IV}(Seg) + \beta_{4d} \cdot D_V(Seg)$$

$$+\beta_{3a} \cdot D_{II}(Fam) + \beta_{3b} \cdot D_{III}(Fam) + \beta_{3c} \cdot D_{IV}(Fam) + \beta_{3d} \cdot D_{V}(Fam)$$
$$+ \ldots \tag{3}$$

Results are presented in Table III and again confirm our earlier findings. They indicate a convex PFR in the segment and in the family. However, the R^2 in this case is slightly lower than for Model (2). Thus, a specification using piecewise linear coefficients for the segment PFR and performance dummies for the family PFR is able to explain fund growth best.

In a final step we now look at a finer breakdown of the family rank in deciles. This allows us to gain a more precise understanding on how growth depends on the position of a fund within its family. Instead of the four dummy variables indicating quintiles in Model (2), we now use nine dummies, $D_2(Fam) - D_{10}(Fam)$, indicating whether a fund belongs to a specific performance decile in its family. This extended model reads:

$$\begin{aligned} FLOW_{i,t} &= \beta_{1a} \cdot LOW(Seg) + \beta_{1b} \cdot MID(Seg) + \beta_{1c} \cdot TOP(Seg) \\ &\quad + \sum_{n=2}^{10} \delta_n \cdot D_n(Fam) + \ldots \end{aligned} \tag{4}$$

Estimation results for Model (4) are presented in Table III. There is still strong evidence for a convex PFR in the segment and in the family. In the family, the coefficients for $D_2(Fam)-D_8(Fam)$ are all insignificant. However, the coefficients for $D_9(Fam)$ and $D_{10}(Fam)$ are positive and statistically significant at the 5%- and 1%-level, respectively. A fund grows - ceteris paribus - by 7% more if it belongs to the second best decile, and even by 10% more if it belongs to the top decile.

Taken together, our results indicate that the PFR is convex in the segment as well as in the family. The convexity is very pronounced over the whole performance domain in the segment case. In contrast, in the family case it only seems to matter whether a fund happens to end up in the top quintile. This result is consistent with the view that the growth of the top funds in a family is due to advertisements for these funds.

Our result of a convex PFR in the family has important consequences. A convex relationship between performance and inflows leads to interesting incentives for fund managers. This is shown in, e.g., Brown, Harlow, and Starks (1996) and Chevalier and Ellison (1997) for the case of the segment rank, $RANK_{i,t-1}^{Perf}$. The contribution of our study is to show that this convexity also exits with respect to the family rank, $RoR_{i,t-1}^{Perf}$. This should lead to incentives depending on the position of a fund within its family (see, e.g., Kempf and Ruenzi (2004b)). Fund managers' strategies might therefore be influenced by much more complex incentives than typically assumed in the literature.

C. Stability Tests

As can be seen from Table I, the year 1993 is characterized by an extreme growth rate of the fund industry. Therefore we re-estimate the results presented in Table III, but exclude observations from 1993. Results are presented in Table IV.

+++ PLEASE INSERT TABLE IV ABOUT HERE +++

All results remain very similar. The results of Model (2) for the family PFR are even a little bit stronger. Thus, our results are not driven by the extraordinary growth of funds in 1993.

In our models we do not use the return of fund i in the year under consideration, $r_{i,t}$. One might argue to include $r_{i,t}$ as independent variable because the performance within year t might already cause external fund growth in the same year. However, there are possible endogenity problems because $r_{i,t}$ is also used to calculate our dependent variable $FLOW_{i,t}$. Despite this potential problem, we follow Sirri and Tufano (1998) and re-estimate our models with $r_{i,t}$ as additional explanatory variable. Its influence is always positive and statistically significant; the results regarding the other variables (not reported here) remain very similar.

We follow Sirri and Tufano (1998) by assuming a seven year holding period while constructing our fee measure, $FEES_{i,t-1}$. Barber, Odean, and Zheng (2002) report an average holding period of 30 months.[12] Therefore, we also do all examinations assuming a holding period of 30 months. The effect of fees is still significantly negative and the influence of the other variables also remains qualitatively unchanged (results not reported here).

Our measure for the effect of positive spillovers from other top funds within the family, $STAR_{i,t-1}$, is calculated by dividing the number of top 5%-funds in the family by the total number of funds in the family. We also use the top 2.5%-funds and the top 10%-funds to calculate this ratio instead. Results (not reported here) remain virtually unchanged.

V. Conclusion

Sirri and Tufano (1998), among others, examine the relationship between the relative performance of a fund within its segment and its subsequent growth. They find a positive and convex performance flow relationship (PFR) in the segment.

We extend their analysis and examine the question: Is there an influence of the relative position of a fund within its family on its growth? We analyze this question using a broad sample of US equity mutual funds from 1993 to 2001.

Our main result is that there is a positive and convex relationship between the family rank of a fund and its subsequent growth. The PFR in the family is convex. The top 20% funds in a family grow by an additional 6.78% as compared to the other funds in the family after controlling for their position within their segment.

Brown, Harlow, and Starks (1996) have shown that a convex relationship between the segment rank of a fund and its growth leads to interesting incentives for fund managers. Our result of a convex PFR in the family, that exists besides the convex PFR in the segment, should give rise to more complex incentives. Fund managers not only compete against the

[12] From Shrider (2003), who examines the trading accounts of load-fund investors from a large brokerage firm, an average holding period of approximately three years can be calculated.

other funds within their segment, but also against the other funds within their own family. Studying the implications stemming from this complex incentive structure offers a promising avenue for further research.

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Table I
Summary Statistics

This table presents summary statistics of our dataset covering the years 1993-2001. The numbers are based on calculations including all U.S. equity mutual funds from the CRSP database except those with a growth rate of more than 500% and those with total net assets (TNA) under management of less than 10 Million USD. Funds younger than 2 years and segments and families containing less than 20 funds are excluded.

Year	Number of funds	Mean TNA in Mio USD	Mean Growth in %	Mean Age in years
1993	117	1,664.2	40.45	11.85
1994	128	1,818.4	16.37	12.22
1995	233	1,828.5	12.75	13.91
1996	411	1,655.0	14.80	13.54
1997	863	1,346.5	17.29	11.42
1998	1,283	1,281.7	10.19	10.60
1999	2,087	1,363.3	10.45	10.01
2000	2,258	930.0	9.56	9.76
2001	2,688	756.4	7.79	9.79
Average	1,119	1,124.2	10.74	10.38

Table II
Performance Flow Relationship in the Segment

Estimation results from Model (1) as contained in the main text are presented. The influence of the family position is excluded. Dependent variable in all models is fund growth. Explanatory variables are contained in Column 1. The number of observations in all models is 10,068.

	Ranks based on		
	Sharpe Ratio ($Perf = SR$)	3-Factor Alpha ($Perf = 3F$)	4-Factor Alpha ($Perf = 4F$)
Model (1)			
$LOW(Seg)$	0.3393***	0.2234*	0.2911**
$MID(Seg)$	0.4250***	0.2902***	0.2494***
$TOP(Seg)$	1.2911***	0.7373***	0.7981***
$STAR_{i,t-1}$	0.6987***	0.6338***	0.4089***
$STD_{i,t-1}$	−0.0400	−0.1467**	−0.1416**
$FLOW_{i,t-1}$	0.2214***	0.2410***	0.2429***
$lnTNA_{i,t-1}$	−0.0706***	−0.0696***	−0.0685***
$lnAGE_{i,t-1}$	−0.0150*	−0.0082	−0.0087
$FEES_{i,t-1}$	−3.1249***	−3.2893***	−3.2626***
$TO_{i,t-1}$	0.0089	0.0109	0.0147*
$FLOW(Seg)_{i,t}$	0.0827***	0.0810***	0.0825***
$FLOW(Fam)_{i,t}$	0.0240***	0.0315***	0.0359***
$lnTNA(Fam)_{i,t-1}$	0.0254***	0.0334***	0.0332***
R^2	22.49%	17.99%	17.27%

***,**, and * denote statistical significance at the 1%, 5%, and 10%-level respectively.

Table III
Performance Flow Relationship in the Family and in the Segment

Estimation results from models (1) - (4) contained in the main text are presented. Dependent variable in all models is fund growth. Explanatory variables are contained in Column 1. Control variables not reported are the lagged star ratio, lagged standard deviation, lagged flows, lagged size and age of the fund, lagged fees, lagged turnover rate, segment- and family growth, and the size of the fund family. The performance is measured using ranks based on Sharpe Ratios. The number of observations in all models is 10,068.

	Model (1)	Model (2)	Model (3)	Model (4)
$LOW(Seg)$	0.3065**	0.5694***		0.4676***
$MID(Seg)$	0.3833***	0.3513***		0.3708***
$TOP(Seg)$	1.0205***	1.0084***		0.9060***
$LOW(Fam)$	0.0393			
$MID(Fam)$	0.0299			
$TOP(Fam)$	0.3244**			
$D_{II}(Seg)$			0.0676***	
$D_{III}(Seg)$			0.1184***	
$D_{IV}(Seg)$			0.1885***	
$D_V(Seg)$			0.2685***	
$D_{II}(Fam)$		−0.0028	0.0221	
$D_{III}(Fam)$		−0.0152	0.0223	
$D_{IV}(Fam)$		0.0151	0.0626**	
$D_V(Fam)$		0.0678**	0.1598***	
$D_2(Fam)$				0.0357
$D_3(Fam)$				0.0241
$D_4(Fam)$				0.0131
$D_5(Fam)$				0.0199
$D_6(Fam)$				−0.0126
$D_7(Fam)$				0.0395
$D_8(Fam)$				0.0268
$D_9(Fam)$				0.0727**
$D_{10}(Fam)$				0.1064***
R^2	22.49%	22.64%	22.21%	22.69%

***,**, and * denote statistical significance at the 1%, 5%, and 10%-level respectively.

Table IV
Results Excluding Observations from 1993

Estimation results from models (1) - (4) contained in the main text are presented. Dependent variable in all models is fund growth. Explanatory variables are contained in Column 1. Control variables not reported are the lagged star ratio, lagged standard deviation, lagged flows, lagged size and age of the fund, lagged fees, lagged turnover rate, segment- and family growth, and the size of the fund family. The performance is measured using ranks based on Sharpe Ratios. We exclude all observations from the year 1993. The number of observations in all models is 9,951.

	Model (1)	Model (2)	Model (3)	Model (4)
$LOW(Seg)$	0.2951*	0.5604***		0.4569***
$MID(Seg)$	0.3765***	0.3437***		0.3655***
$TOP(Seg)$	1.0205***	1.0113***		0.9061***
$LOW(Fam)$	0.0442			
$MID(Fam)$	0.0318			
$TOP(Fam)$	0.3533**			
$D_{II}(Seg)$			0.0650***	
$D_{III}(Seg)$			0.1130***	
$D_{IV}(Seg)$			0.1838***	
$D_{V}(Seg)$			0.2616***	
$D_{II}(Fam)$		0.0239	0.0221	
$D_{III}(Fam)$		0.0264	0.0223	
$D_{IV}(Fam)$		0.0638**	0.0626**	
$D_{V}(Fam)$		0.1672***	0.1598***	
$D_2(Fam)$				0.0363
$D_3(Fam)$				0.0266
$D_4(Fam)$				0.0134
$D_5(Fam)$				0.0230
$D_6(Fam)$				−0.0099
$D_7(Fam)$				0.0422
$D_8(Fam)$				0.0245
$D_9(Fam)$				0.0775**
$D_{10}(Fam)$				0.1128***
R^2	22.30%	22.42%	21.98%	22.48%

***,**, and * denote statistical significance at the 1%, 5%, and 10%-level respectively.