Tournaments in Mutual Fund Families*

Alexander Kempf[†]
Stefan Ruenzi[‡]

Department of Finance
University of Cologne
Albertus-Magnus-Platz
50923 Koeln
Germany
Tel.: (0049)+221-4702714
Fax: (0049)+221-4703992

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[†]kempf@wiso.uni-koeln.de
[‡]ruenzi@wiso.uni-koeln.de

Abstract

The mutual fund industry resembles a tournament situation. Funds change their risk in dependence of their midyear performance in order to reach a top rank at the end of the year. Previous studies look at the competition in fund segments. They test the hypothesis that interim losers increase risk more than winners in order to benefit from the well-documented convex performance-inflow relationship (see, e.g., Brown, Harlow, and Starks (1996) (BHS)).

We contribute to the literature in two ways: (1) Our paper is the first to analyze the question whether fund managers only engage in a segment tournament or if there is also a competition between mutual funds within their fund families. Thereby we complement to the growing literature on mutual fund families. (2) We analyze for the first time, whether the behavior of funds within their segment and within their family depends on the competitive situation they are facing. Based on the theoretical model of Taylor (2003) we argue that the intuitive behavior described in BHS should only occur in large segments/families. However, we argue that funds in small segments/families take the actions of their competitors into account and therefore show a risk-taking behavior distinct from the one observed in large segments/families.

We test our hypotheses using a comprehensive dataset of the complete US equity mutual fund universe for 1993-2001. Our main results are: (1) The midyear rank of a fund within its segment *and* within its family determines a fund's risk-taking. A family tournament does exist. (2) How a fund reacts on its midyear rank depends crucially on the number of competitors in its family and segment, respectively. (3) There is a clear break in the behavior of funds in the segment tournament before and after 1996. Overall, our results indicate that mutual funds' risk taking is determined by more complex incentives than described in previous studies.

JEL Classification: D81, G20, G23, J33

Keywords: Mutual Funds, Risk-Taking, Rank-Order Tournaments, Rank-of-Ranks Tournament, Family Tournament

1 Introduction

A substantial part of the income of mutual fund managers depends on their assets under management (see, e.g., Khorana (1996), and Brown, Harlow, and Starks (1996)). Therefore, fund managers try to increase their assets under management by generating large inflows into their fund. Since fund investors direct their money to mutual funds based on performance rankings (see, e.g., Patel, Zeckhauser, and Hendricks (1994)), fund managers have an incentive to beat their competitors. This is a typical rank-order tournament situation.

There is strong empirical evidence that the rank-inflow-relationship is convex. The best performing funds attract most of the net inflows, whereas the net inflows of funds that achieve a mediocre or bad performance hardly differ (see, e.g., Ippolito (1992), Goetzmann and Peles (1997), Chevalier and Ellison (1997), Sirri and Tufano (1998), Bergstresser and Poterba (2002), and Goriaev, Nijman, and Werker (2002)). This convexity creates incentives for fund managers to adjust the risk of their portfolio in dependence of their midyear ranking. Although this might be the optimal response of a fund manager to the respective situation she faces, there is no reason to believe that this is optimal from the mutual fund investor's perspective. Furthermore, this behavior of mutual fund managers may lead to irrational price formation in asset markets (see James and Isaac (2000)).

Brown, Harlow, and Starks (1996) (BHS) analyze the incentives for fund managers in such a rank-order tournament. They argue that it is optimal for midyear losers (i.e. funds that only reached a low rank after the first part of the evaluation period, e.g. six months) to increase their portfolio risk.[1] This enhances their chance to become a top performer by the end of the evaluation period (usually the calendar year). Losers do not have to fear any severe punishment from their increased risk taking because a further deterioration of their position will not harm them in terms of lower net inflows (and income).[2] In contrast, midyear winners want to lower their

[1]BHS and all subsequent papers (including our) focus on funds and not on fund managers. Thereby they implicitly assume that each fund is managed by a distinct fund manager. Therefore, there is no need to differentiate between funds and fund managers.

[2]This might not be true for extremely bad performances as this entails the thread of dismissal (see, e.g., Khorana (1996), Chevalier and Ellison (1999), and Hu, Kale, and Subramaniam (2002)).

risk in order to lock in their top position until the end of the year. We will term the behavior that midyear losers increase risk more than midyear winners do as *tournament behavior*.

Following Brown, Harlow, and Starks (1996) there are many studies that examine the risk taking behavior of funds (see, e.g., Orphanides (1996), Koski and Pontiff (1999), Goriaev, Nijman, and Werker (2000) and (2001), Busse (2001), Goriaev, Palomino, and Prat (2001), and Elton, Gruber, and Blake (2002)). However, all of these studies have in common that they only look at the tournament within a specific fund segment.[3]

We argue that a tournament also exists within each fund family[4], Since fund companies choose their top funds and promote them as ”star” funds. This advertisement will attract an extraordinary amount of additional inflows into these ”star” funds (see Jain and Wu (2000), Khorana and Servaes (2001), and Nanda, Wang, and Zheng (2000)). Similar as in the segment tournament, there is no severe punishment for achieving a bad rank as compared to a mediocre rank within the family.[5] Therefore, it is reasonable to assume a convex relationship between the inflows into a fund and the fund manager's rank as compared to the competing funds within her fund family. This generates incentives similar to those in the segment tournament.

We are the first paper that examines the risk taking behavior of funds within their family. Thereby we contribute to a better understanding of the complex incentive structure fund managers are facing and the resulting risk taking strategy. Furthermore, we shed some light on decisions within fund families. So far the literature has viewed a fund family as a hierarchical entity and has looked at the question, in which segments fund companies establish new funds (see, e.g., Ciccotello and Miles (1999), Massa (1998) and (2003), Khorana and Servaes (2001), Mamaysky and Spiegel (2001), Siggelkow (2002), and Zhao (2001a) and (2001b)). Our approach differs from these papers by taking as given a fund family with different funds. We complement the existing literature by examining how these funds compete with one another within their family.

[3]A fund segment includes all funds with comparable investment objectives (e.g. *Growth*, *Chinese Equity* or *Health Sector*).

[4]A fund family includes all funds managed by the same fund management company (e.g. *Janus* or *Fidelity*).

[5]Again, this might not be true for extremely bad performances.

The second main contribution of our paper is to highlight the impact of the competitive situation (within a segment and a family) on the risk strategy of fund managers. In a recent paper Taylor (2003) shows theoretically that the tournament behavior described by BHS is optimal only if fund managers do not interact strategically.[6] We argue that this is the case in large segments and in large families where many fund managers compete. In contrast, it is reasonable to assume that fund managers in small segments and small families are able to observe the behavior of their competitors and to act strategically. In such an environment winners anticipate the increased risk taking of losers and increase risk even more than losers do. Thus, midyear losers cannot increase the probability of reaching a top rank by increasing risk.[7] We will term the behavior that winners increase risk more than losers do as *strategic behavior*.[8] This behavior is expected to show up in small families and small segments.

The schedule of the paper is as follows: Section 2 presents the empirical model and Section 3 describes the data. Section 4 contains the results of the empirical study. Stability tests are presented in Section 5. Section 6 concludes.

2 Empirical Model

We want to examine how fund managers adjust the risk of their fund dependent upon their midyear performance. Fund managers are usually evaluated by their fund company and by fund investors at the end of a calendar year. Therefore they might adapt the risk of their fund in the second part of each calendar year in dependence of their performance in the first part of the same year. We label the first part of a year as *waiting period* and the second part as *adjustment period*. The two subperiods are denoted by superscripts (1) and (2), respectively.

We estimate the risk adjustment strategy using the following pooled regression:

[6] This situation is labeled type-I games in Taylor (2003). A similar result is also derived by Acker and Duck (2001).

[7] According to Attribution Theory it is possible that winners increase risk more than losers because winners might be more confident (see, e.g., Heider (1958)).

[8] This resembles the result of Taylor's type-II games.

$$\begin{aligned}\Delta\sigma_{it} &= \beta_1 RoR_{it}^{(1)}\cdot D_{ll} + \beta_2 RoR_{it}^{(1)}\cdot D_{ls} \\ &\quad +\beta_3 RoR_{it}^{(1)}\cdot D_{sl} + \beta_4 RoR_{it}^{(1)}\cdot D_{ss} \\ &\quad +\beta_5 R_{it}^{(1)}\cdot D_{ll} + \beta_6 R_{it}^{(1)}\cdot D_{ls} \\ &\quad +\beta_7 R_{it}^{(1)}\cdot D_{sl} + \beta_8 R_{it}^{(1)}\cdot D_{ss} \\ &\quad +\beta_9\Delta\sigma_{it}^{m} + \beta_{10}\sigma_{it}^{(1)} + \sum_{j=T_1}^{T_2}\alpha_j D_j + \varepsilon_{it}.\end{aligned} \tag{1}$$

Following Koski and Pontiff (1999) we use the difference of fund returns' standard deviations between the waiting and the adjustment period, $\Delta\sigma_{it} := \sigma_{it}^{(2)} - \sigma_{it}^{(1)}$, as our measure to capture a fund manager's risk changing behavior.[9] $\sigma_{it}^{(1)}$ ($\sigma_{it}^{(2)}$) denotes the estimated annualized standard deviation of monthly returns of fund i in the waiting period (adjustment period) of year t.

We assume that the risk taking behavior of a fund manager is determined by her rank within her family and within her segment at the end of the waiting period. The two main explanatory variables are denoted by $RoR_{it}^{(1)}$ (for the rank of a fund within its family) and $R_{it}^{(1)}$ (for the rank of a fund within its segment), respectively. The segment rank of a fund is determined by its total return in the waiting period relative to the total returns of the competing funds in its segment. The rank is calculated by ordering funds according to their total returns in the waiting period and assigning numbers to them in descending order (i.e. in a group of five funds the best fund gets the rank number 5 and the worst fund the rank number 1). These rank numbers are normalized by the number of funds in the segment in order to make segments of different size comparable. After this normalization the segment ranks $R_{it}^{(1)}$ are distributed evenly between 0 and 1. A higher $R_{it}^{(1)}$ denotes a better performance within a segment.

To measure the family rank of a fund we order all funds in a family according to their segment rank, $R_{it}^{(1)}$. Based on this ordering we then assign a family rank number to each fund.[10] A normalization similar as

[9] For a specification using risk-ratios similar to those in Brown, Harlow, and Starks (1996), see Section 5.

[10] This method ensures that the performance of funds from different segments can be compared. Furthermore, it is reasonable to assume that fund companies promote those

the one described above is conducted in order to make family ranks from families of different size comparable. Thus, the relative performance of fund i within its family is determined by its *Rank-of-Ranks*, $RoR_{it}^{(1)}$. A higher $RoR_{it}^{(1)}$ denotes a better performance within a family and $RoR_{it}^{(1)}$ is evenly distributed between 0 and 1.

Based on Taylor (2003) we expect that the risk taking behavior of funds depends on the competitive environment they act in. Our proxy for competition is the number of competitors in a segment and in a family. To capture this competition effect we use a dummy approach. The dummies for different combinations of large/small segments and large/small families are denoted by D_{uv}, where $u = l$ ($u = s$) stands for large (small) families and $v = l$ ($v = s$) for large (small) segments. For example, D_{sl} equals 1 if a fund belongs to a small family and a large segment in a given year and zero otherwise.

To extract the segment- and family-specific influence on fund managers' risk taking behavior, we have to control for other effects that might influence $\Delta\sigma_{it}$. It is well documented that there is mean reversion in funds' volatility.[11] To control for this effect we use $\sigma_{it}^{(1)}$ as an additional explanatory variable in our regression. Furthermore, an individual fund's risk might change due to a change in the market volatility in its segment. We control for these effects by adding the change of the market segment volatility, $\Delta\sigma_{it}^{m}$, into our regression. Since there are no appropriate indices for all segments available, we use the standard deviation difference of the median volatility fund as our proxy for segment volatility. This proxy is calculated from the median standard deviation in the waiting period, $\sigma_{it}^{m(1)}$, and in the adjustment period, $\sigma_{it}^{m(2)}$, i.e. $\Delta\sigma_{it}^{m} := \sigma_{it}^{m(2)} - \sigma_{it}^{m(1)}$. To control for effects that we have not yet captured, a dummy variable D_j is included for each year of the sample.

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funds which are the best funds within their segments since fund investors are known to care mainly about fund rankings. A rank measure based on the segment rank is therefore the natural choice for the family rank of a fund.

[11]Koski and Pontiff (1999) and Goriaev, Nijman, and Werker (2001) offer a technical interpretation for mean reversion, namely mean reversion in risk-changes caused by mismeasurement. An economic interpretation is given by Daniel and Wermers (2000): They argue that funds have a target level for their risk. Funds with relatively high risk in the first period will therefore tend to decrease their risk, and vice versa.

A negative sign of the coefficients β_1 to β_8 in model (1) indicates tournament behavior (i.e. bad funds increase risk more than good funds), whereas a positive sign indicates strategic behavior (i.e. bad funds increase risk less than good funds). In the family tournament, we expect to see strategic behavior of funds in small families (($\beta_3 > 0$, $\beta_4 > 0$)), because there are only a few other managers in these families. Each manager in a small family can therefore easily observe and take into account the actions of the other family members. The same is not true for large families. In this case managers behave as if they play against an exogenous benchmark and show tournament behavior ($\beta_1 < 0$, $\beta_2 < 0$). Similarly, for the segment tournament the hypotheses are $\beta_5 < 0$, $\beta_7 < 0$ and $\beta_6 > 0$, $\beta_8 > 0$, i.e. we expect tournament behavior in large segments and strategic behavior in small segment.

3 Data

Our data sample consists of data on US equity funds from the CRSP survivorship free mutual fund database.[12] The database contains data on monthly total returns, the fund management company, the name of the fund manager(s), 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 in which funds compete with each other. This provides us up to 38 different segments. As the SI classification is available from 1993 on, our data sample starts in 1993. It ends in 2001 leaving us with 9 years of data.

We eliminate funds for which some data is missing. All examinations are done for segments and fund families including at least two funds. Furthermore, only funds that are at least one year old at the beginning of the respective year are included. Young funds might have special life-cycle incentives (see, e.g., Chevalier and Ellison (1997)) and are therefore excluded. Less than 1% of all fund-years are deleted is this step. This leaves us with 41367 fund-years in our sample.

[12] Source: CRSP^{SM}, 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).

Table 1: Summary statistics for funds

Year	Number	Mean TNA	Max. TNA	Age	Competitors in Segment	Competitors in Family
1993	1558	468	31,705	9.8	180.7	19.2
1994	2128	399	36,442	8.0	222.1	24.6
1995	2862	424	53,702	6.9	277.5	33.3
1996	3562	457	53,989	6.5	311.9	41.7
1997	4523	488	63,766	6.1	386.3	52.9
1998	5379	511	83,552	5.9	460.6	57.8
1999	6299	578	105,939	6.0	553.9	66.0
2000	6968	502	93,067	6.2	632.7	63.0
2001	8088	392	79,515	6.6	731.8	78.9

Note: In Column 2 the total number of funds is presented. Only funds that are at least one year old in any given year are included. Funds from families and/or segments with less than two members are excluded. Columns 3 and 4 show the mean and maximum total net asset value (TNA) of all funds. TNAs are in million USD. Column 5 shows the average age of the funds. In Column 6 the average number of competitors of a fund within its segment is reported. Column 7 shows the average number of competitors a fund has within its family.

In Table 1 the rapid growth of the mutual fund industry is documented. The number of mutual funds in our sample grows from 1558 funds in 1993 to 8088 funds in 2001. In the same period the largest fund (*Fidelity Magellan*) grows from a total net asset value (TNA) of nearly 32 billion USD to nearly 80 billion USD. Although most individual funds grow rapidly over the period, the average TNA decreases from 468 million USD in 1993 to less than 400 million USD in 2001. This results from the emergence of a large number of new funds, which also causes the average fund age to decline from 9.8 years in 1993 to 6.6 years in 2001. It can also be seen that the average fund competes with 180 other funds within its segment in 1993. This number rises to over 730 in 2001. Furthermore, the average fund competes with nearly 20 other funds within its family in 1993 and with nearly 80 other funds in 2001.

Table 2: Summary Statistics - Fund Market Segments

		TNA		Number of Funds	
Year	Segments	Mean	Max.	Mean	Max.
1993	35	20,858	197,456	44.7	408
1994	37	22,985	215,573	57.7	472
1995	37	32,878	328,814	77.6	588
1996	37	42,869	425,656	94.3	673
1997	38	58,109	603,203	119.4	861
1998	37	74,345	779,853	145.5	1029
1999	34	107,199	1,075,314	186.0	1253
2000	35	99,913	1,044,709	199.4	1435
2001	35	90,548	871,972	231.1	1634

Note: In Column 2 the number of fund-segments is presented. Only funds that are at least one year old in any given year are included. Funds from families and/or segments with less than two members are excluded. Columns 3 (4) contains the mean (maximum) total net asset values (TNA) of all funds in a segment. In Column 5 the average number of funds per segment can be seen. In Column 6 the number of funds in the largest segment (according to the number of funds) is reported. All TNAs are in million USD.

The funds in our sample are classified according to the SI-Objective classification. Summary statistics on the fund segments are presented in Table 2. The number of segments in our sample ranges between 34 and 38. The average total net asset value (TNA) of a segment rises from 21 billion

USD in 1993 to 91 billion USD in 2001. The largest segments in all years in terms of number of funds as well as in terms of TNA is *Growth* followed by *Growth and Income*. The TNA of the *Growth* segment increases from 197 billion USD to 871 billion USD between 1993 and 2001. During this period the number of funds belonging to the *Growth* segment rises from 408 to 1634. The average number of funds in a segment increases from 45 to 231.

Table 3: Summary Statistics - Fund Families

		TNA		Number of Funds	
Year	Families	Mean	Max.	Mean	Max.
1993	238	3,049	126,590	6.5	84
1994	260	3,267	160,895	8.2	91
1995	270	4,487	236,733	10.6	124
1996	278	5,856	295,661	12.9	145
1997	297	7,429	382,475	15.3	159
1998	319	8,620	478,747	16.9	187
1999	336	10,844	608,080	18.8	217
2000	381	9,178	564,865	18.3	246
2001	383	8,271	492,812	21.1	289

Note: In Column 2 the number of fund families is presented. Only funds that are at least one year old in any given year are included. Funds from families and/or segments with less than two members are excluded. Column 3 and 4 report the total net asset value (TNA) of the mean and the largest fund family, respectively. In Column 5 the average number of funds per fund family can be seen. Column 6 reports the number of funds in the largest family (according to the number of funds). All TNAs are in million USD.

Table 3 presents Summary statistics on fund families. It shows that the number of fund families rises from 238 to 383 between 1993 and 2001. The average amount of assets under management in a family increases from about 3 billion USD to more than 8 billion USD. The largest family in our sample according to TNA as well as to the number of funds in all years is *Fidelity*. *Fidelity's* assets under management increase from 127 billion USD in 1993 to 493 billion USD in 2001. *Fidelity* managed 84 equity funds in 1993. This number rises constantly to 289 funds in 2001. The average number of funds per family is 7 in 1993 and rises to 21 in 2001.

4 Empirical Results

In this section we examine the existence of the family tournament introduced above. In line with the literature on segment tournaments we choose 7 months as waiting period and 5 months as adjustment period (see, e.g., Brown, Harlow, and Starks (1996)). The proposed (7,5)-segmentation is reasonable due to the fact that a lot of rankings are published around midyear and that it takes some time for fund managers to adjust their portfolios.[13] We test our hypothesis ($\beta_1 < 0$, $\beta_2 < 0$ and $\beta_3 > 0$, $\beta_4 > 0$ in the family tournament and $\beta_5 < 0$, $\beta_7 < 0$ and $\beta_6 > 0$, $\beta_8 > 0$ in the segment tournament) by estimating model (1) for the whole sample period 1993-2001. We define large families as those families with 50 or more members and large segments as those segments with 70 or more funds in a given year. The cutoff for large segments is higher than that for large families, because there is a greater number of funds in the average segment than in the average family.[14] Results are presented in Table 4.

The coefficients β_9 and β_{10} of our control variables have the expected sign. The coefficient β_9 indicates that the risk changing of a fund depends positively on the change in segment volatility. The highly significant negative coefficient β_{10} indicates mean reversion in the standard deviation. This agrees with earlier studies (see, e.g., Koski and Pontiff (1999), Daniel and Wermers (2000), and Goriaev, Nijman, and Werker (2001)).

Our main focus is on the coefficients of the family tournament, β_1 to β_4. They all are significantly different from zero.[15] Fund managers change risk in dependence of their family rank. Family tournaments do exist in the mutual fund industry. Furthermore, the results show that the response of fund managers with respect to their family rank depends on the size of their family. The coefficients for funds in large families β_1 and β_2 are negative, i.e. loser funds in large families increase risk more than winner funds do. The opposite is true for funds in small families. The respective coefficients for funds from small families β_3 and β_4 are both positive, i.e. loser funds in small families increase risk less than winners do in those families. This is evidence for tournament behavior in large families and strategic behavior in small families. These findings are in line with our predictions based on

[13] Results are stable with respect to other specifications like 6-6 months; see Section 5.

[14] For stability examinations with respect to these cutoffs see Section 5.

[15] The F-Statistic for the hypothesis that the family rank has no impact on risk taking behavior is 6.44. The hypothesis can be rejected at the 1%-level.

Table 4: Estimation of (1) for 1993-2001

Coefficient	Family	Segment	1993-2001
β_1	large	large	-0.0167^{***}
			(-4.1670)
β_2	large	small	-0.0147^{*}
			(-1.5839)
β_3	small	large	0.0044^{***}
			(2.6884)
β_4	small	small	0.0065^{*}
			(1.4732)
β_5	large	large	0.0315^{***}
			(7.5963)
β_6	large	small	0.0316^{***}
			(3.4587)
β_7	small	large	0.0072^{***}
			(4.1636)
β_8	small	small	0.0162^{***}
			(3.6230)
β_9			0.9008^{***}
			(141.8645)
β_{10}			-0.7188^{***}
			(-74.2680)
N			41367
R^2			67.78%

Note: Estimation results of (1) are presented. t-values are reported in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level (one-tailed tests), respectively. The last two rows contain the number of observations N and the centered R^2.

Taylor's (2003) model.

Results with respect to the segment tournament are somehow puzzling. β_5 to β_8 are all positive and highly significant at the 1%-level, i.e. fund managers show strategic behavior in the segment tournament in small segments as well as in large segments. This contradicts our hypothesis that $\beta_5 < 0$ and $\beta_7 < 0$. It also contradicts empirical evidence presented by Brown, Harlow, and Starks (1996), Koski and Pontiff (1999), Elton, Gruber, and Blake (2002) and Goriaev, Palomino, and Prat (2001). They do find tournament behavior (i.e. $\beta < 0$ in our setting) in the segment tournament.

There are three possible explanations for the different results: First, existing studies only looked at large segments of the mutual fund industry, whereas we examine the whole universe of funds. Second, existing studies neglect the family tournament, whereas we include it. Third, BHS and others examined data from the late 1980s to the early 1990s, whereas our sample covers the more recent years 1993-2001.

To eliminate the influence of the different sample periods and the different fund universe we now concentrate on the earlier years of our sample 1993-1996 and on funds from large segments only. This period und fund universe is also covered by many of the above-mentioned studies. We start by estimating the traditional approach

$$\Delta\sigma_{it} = \beta_{11} R_{it}^{(1)} + \beta_9 \Delta\sigma_{it}^{m} + \beta_{10}\sigma_{it}^{(1)} + \sum_{j=T_1}^{T_2} \alpha_j D_j + \varepsilon_{it}, \tag{2}$$

where we do not consider the family tournament. This approach is similar to the studies presented in the literature.[16] Results are reported in Table 5. We find $\beta_{11} < 0$, which agrees with tournament behavior in the segment tournament. This result confirms earlier studies.

In a next step we extend our analysis to large and small segments, but still leave the family tournament aside. We estimate the following modified approach:

[16] Not all studies use a regression approach. Brown, Harlow, and Starks (1996), e.g., use a contingency table approach.

Table 5: Estimation of (1), (2) and (3) for the subsample 1993-1996

Coefficient	Model (2)	Model (3)	Model (1)
β_1			-0.0103^{*}
			(-1.3085)
β_2			-0.0121
			(-1.2509)
β_3			0.0008
			(0.5516)
β_4			0.0065^{**}
			(1.8825)
β_5			0.0067
			(0.8449)
β_6			0.0188^{**}
			(1.9937)
β_7			-0.0063^{***}
			(-3.7147)
β_8			-0.0014
			(-0.4031)
β_9	0.5785^{***}	0.6791^{***}	0.6783^{***}
	(41.9607)	(68.7344)	(68.4400)
β_{10}	-1.4627^{***}	-1.1884^{***}	-1.1895^{***}
	(-56.6833)	(-55.0448)	(-55.0843)
β_{11}	-0.0042^{***}		
	(-3.9602)		
β_{12}		-0.0051^{***}	
		(-5.0058)	
β_{13}		0.0053^{***}	
		(3.8902)	
N	7955	10110	10110
R^2	58.33%	62.35%	62.39%

Note: Estimation results of models (1)-(3) for the subsample 1993-1996 are presented. Model (2) is estimated using data of funds from large segments only. t-values are reported in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level (one-tailed tests), respectively. The last two rows contain the number of observations N and the centered R^2s.

$$\Delta\sigma_{it} = \beta_{12} R_{it}^{(1)} \cdot D_l + \beta_{13} R_{it}^{(1)} \cdot D_s + \beta_9 \Delta\sigma_{it}^{m} + \beta_{10} \sigma_{it}^{(1)} + \sum_{j=T_1}^{T_2} \alpha_j D_j + \varepsilon_{it}. \quad (3)$$

Here D_l (D_s) is a dummy variable taking on the value 1 if a fund belongs to a large (small) segment, and 0 otherwise. Results are presented in Table 5. We find evidence that funds belonging to large segments show tournament behavior ($\beta_{12} < 0$). This agrees with the literature that has focused on large segments. Funds belonging to small segments show strategic behavior ($\beta_{13} > 0$). This is strong support for our hypotheses that the risk adjustment strategy of funds depends on the competitive situation of a fund.

We now turn to the estimation of our fully specified model (1) for the subsample 1993-1996. Results are presented in Table 5. All significant coefficients have the expected sign but half of them are no longer different from zero in a statistical sense.

Overall our results indicate that the puzzling results for the segment tournament (see Table 4) are not due to the inclusion of the family rank as an additional explanatory variable, nor due to the differentiation between small and large segments. Therefore, the surprising results might be caused by the fact that we used a more recent sample period than the papers in the literature. To check whether the behavior of funds in the more recent years (1997-2001) differs from their behavior in earlier years (1993-1996) we re-estimate models (1)-(3) for the later sub-sample. The results are presented in Table 6. Comparing Table 6 and Table 5 shows a clear break in the behavior of fund managers in the segment tournament. In all specifications fund managers switched from tournament to strategic behavior in the segment tournament.

The difference in the behavior in the segment tournament between 1993-1996 and 1997-2001 could be due to the large number of new funds that emerged in the late 1990s.

Table 6: Estimation of (1), (2) and (3) for the subsample 1997-2001

Coefficient	Model (2)	Model (3)	Model (1)
β_1			-0.0169^{***}
			(-3.6472)
β_2			-0.0210^{**}
			(-1.7396)
β_3			0.0064^{***}
			(2.9019)
β_4			0.0063
			(0.9212)
β_5			0.0369^{***}
			(7.7203)
β_6			0.0415^{***}
			(3.5160)
β_7			0.0115^{***}
			(4.9773)
β_8			0.0268^{***}
			(3.9563)
β_9	0.9722^{***}	0.9243^{***}	0.9239^{***}
	(96.3004)	(121.6850)	(121.5572)
β_{10}	-0.6846^{***}	-0.6933^{***}	-0.6928^{***}
	(-59.1868)	(-62.5109)	(-62.4614)
β_{11}	0.0220^{***}		
	(18.1861)		
β_{12}		0.0184^{***}	
		(15.4412)	
β_{13}		0.0263^{***}	
		(13.1977)	
N	27768	31257	31257
R^2	65.48%	66.68%	66.72%

Note: Estimation results of models (1)-(3) for the subsample 1997-2001 are presented. Model (2) is estimated using data of funds from large segments only. t-values are reported in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level (one-tailed tests), respectively. The last two rows contain the number of observations N and the centered R^2.

Table 7: Estimation of (1), (2) and (3) for funds founded before and after 1996 for the subsample 1997-2001

	Founded before 1996			Founded after 1996		
Coefficient	Model (2)	Model (3)	Model (1)	Model (2)	Model (3)	Model (1)
β_1			-0.0188^{***}			-0.0149^{**}
			(-3.2159)			(-2.0582)
β_2			-0.0304^{**}			0.0048
			(-2.2070)			(0.2203)
β_3			0.0115^{***}			0.0002
			(4.3065)			(0.0721)
β_4			-0.0005			0.0121
			(-0.0566)			(1.2058)
β_5			0.0463^{***}			0.0271^{***}
			(7.6844)			(3.6088)
β_6			0.0667^{***}			-0.0051
			(4.9709)			(-0.2399)
β_7			0.0103^{***}			0.0132^{***}
			(3.6369)			(3.5403)
β_8			0.0326^{***}			0.0218^{**}
			(3.4821)			(2.2267)
β_{11}	0.0265^{***}			0.0173^{***}		
	(17.3659)			(9.0620)		
β_{12}		0.0234^{***}			0.0130^{***}	
		(15.7051)			(6.8767)	
β_{13}		0.0348^{***}			0.0162^{***}	
		(14.3319)			(4.9652)	
N	14425	16393	16393	13343	14864	14864
R^2	72.96	73.31	73.39	56.43	58.92	59.03

Note: Estimation results of models (1)-(3) for the subsample 1997-2001 of funds founded before and after 1996 are presented. Model (2) is estimated using data of funds from large segments only. t-values are reported in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% level (one-tailed tests), respectively. The last two rows contain the number of observations N and the centered R^2.

To examine this hypothesis we re-estimate models (1)-(3) for funds founded before and after 1996 separately for the period 1997-2001. Model (2) is again estimated using funds from large segments only. Results are presented in Table 7.

Table 7 shows that the behavior of funds founded before 1996 (old funds) does not substantially differ from the behavior of funds founded after 1996 (young funds). In the 1997-2001 period all funds behave strategically in the segment tournament, no matter how old they are. This rebuts the argument that the structural break in the behavior of funds in the segment tournament is due to the emergence of new funds.

A possible explanation for this phenomenon is as follows: Above we argued that strategic interactions are relevant in situations with few competitors only, because here the actions of the other managers can be observed and can therefore be taken into account. However, strategic interactions can also be relevant in situations with many competitors if winning managers somehow know how losing managers behave on average. In this case, winning managers can take the actions of losing managers into account. We argue that this behavior is possible after 1996 because in this year Brown, Harlow, and Starks (1996) published their article about mutual fund tournaments in the *Journal of Finance*. Thus it became public knowledge that midyear losers increase risk in order to maximize their chance to become winners. This in turn enabled winning managers to anticipate this behavior and strategic interactions became relevant after 1996 in large segments, too. This argument is not valid with respect to the family tournament as this kind of tournament has not yet been studied in the literature.

5 Stability Tests

All presented results are stable with respect to different specifications. For the sake of brevity we only report qualitative results here.

As a first test we estimate the regression

$$\Delta\sigma_{it} = \beta_a R_{it}^{(1)} + \beta_b RoR_{it}^{(1)} + \beta_9 \Delta\sigma_{it}^{m} + \beta_{10}\sigma_{it}^{(1)} + \sum_{j=T_1}^{T_2} \alpha_j D_j + \varepsilon_{it} \quad (4)$$

for different subsamples of small/large families instead of using a dummy-specification as in (1). Results are very similar.

In this paper we use the difference of the standard deviations between the two parts of the evaluation period as dependent variable (see, e.g., (1)). We control for the difference of the standard deviations of the median fund in the respective segment and year. We also use the difference of the risk-ratios $(\sigma_{it}^{(2)}/\sigma_{it}^{m(2)}) - (\sigma_{it}^{(1)}/\sigma_{it}^{m(1)})$ as dependent variable. The results are very similar to those reported above.

Our results are calculated using the median fund for computing the proxies for the standard deviation of a segment. We also use the respective mean fund instead of the median. Results of the regressions remain qualitatively unchanged.

Furthermore, we change the upper limit for small segments from 70 to 100 and 150 and for small families from 50 to 100. The results remain similar.

We also run our regression taking 6 months instead of 7 months as waiting period. The general results are unchanged, but the effects show up more clearly in the (7,5) specification than in the (6,6) specification. This is consistent with the literature and an indication that it actually takes some time for fund managers to adapt the risk of their portfolios.

6 Conclusion

In this paper we study two kinds of tournaments which are relevant in the mutual fund industry: The segment tournament introduced by Brown, Harlow, and Starks (1996) (BHS) and the family tournament introduced in this paper. BHS argue that "the mutual fund market (is a) tournament in which all funds having comparable investment objectives compete with one another" and that the position of a fund within its segment determines its risk taking behavior.

In this paper we first show that it is not only the position of a fund within its segment, but also the position of a fund within its family that determines its risk taking behavior. We present empirical evidence for the risk taking behavior of funds being determined by their segment rank *and* by their family rank.

Our second contribution is to show that the optimal response of fund managers to their midyear rank depends on the competitive environment they act in. In the segment tournament (family tournament) losers from large segments (families) increase risk more than winners do. In small segments and families, the opposite is true. Midyear winners increase risk more than midyear losers. These findings support the model of Taylor (2003).

Our final finding is that the behavior of funds in the segment tournaments has changed dramatically over time. In recent years strategic behavior is observed in small and large segments. A possible explanation for this new phenomenon is that Brown, Harlow, and Starks (1996) published their work on fund managers' risk taking behavior in 1996 which therefore became known to the public. Thus, funds doing business in large segments could now take the actions of their competitors into account and therefore behave strategically. To validate this argument further research is necessary.

References

Acker, Daniella, and Nigel W. Duck, 2001, A tournament model of fund management, Working Paper.

Bergstresser, Daniel, and James Poterba, 2002, Do after-tax returns affect mutual fund inflows?, *Journal of Financial Economics* 63, 381–414.

Brown, Keith C., W.V. Harlow, and Laura T. Starks, 1996, Of tournaments and temptations: An analysis of managerial incentives in the mutual fund industry, *Journal of Finance* 51, 85–110.

Busse, Jeffery A., 2001, Another look at mutual fund tournaments, *Journal of Financial and Quantitative Analysis* 36, 53–73.

Carhart, M. M., 1997, On persistence in mutual fund performance, *Journal of Finance* 52, 57–82.

Chevalier, Judith, and Glenn Ellison, 1997, Risk taking by mutual funds as a response to incentives, *Journal of Political Economy* 105, 1167–1200.

———, 1999, Career concerns of mutual fund managers, *Quarterly Journal of Economics* 114, 389–432.

Ciccotello, Conrad S., and James A. Miles, 1999, Mutual fund families: Cafeterias or boutiques?, Working paper.

Daniel, Naveen D., and Russ Wermers, 2000, Risk-taking behavior by mutual fund managers: Do managers "walk away" from the tournament?, Working Paper.

Elton, Edwin J., Martin J. Gruber, and Christopher R. Blake, 2001, A first look at the accuracy of the CRSP mutual fund database and a comparison of the CRSP and morningstar mutual fund databases, *Journal of Finance* 56, 2415–2430.

———, 2002, Incentive fees and mutual funds, *Journal of Finance* forthcoming.

Goetzmann, William N., and Nadav Peles, 1997, Cognitive dissonance and mutual fund investors, *Journal of Financial Research* 20, 145–158.

Goriaev, Alexei, Frederic Palomino, and Andrea Prat, 2001, Mutual fund tournaments: Risk-taking incentives induced by ranking objectives, Working Paper.

Goriaev, Alexei P., Theo E. Nijman, and Bas J.M. Werker, 2000, On the empirical evidence of mutual fund strategic risk taking, Working Paper.

——— , 2001, Yet another look at mutual fund tournaments, Working Paper.

——— , 2002, The dynamics of the impact of past performance on mutual fund flows, Working Paper.

Heider, Fritz, 1958, *The Psychology of Interpersonal Relations* (John Wiley & Sons).

Hu, Ping, Jayant R. Kale, and Ajay Subramaniam, 2002, Dynamic risk shifting by fund managers in a tournament model: Theory and evidence, Working Paper.

Ippolito, Richard A., 1992, Consumer reaction to measures of poor quality: Evidence from the mutual fund industry, *Journal of Law and Economics* 35, 45–70.

Jain, Prem C., and Joanna Shuang Wu, 2000, Truth in mutual fund advertsigin: Evidence on future performance and fund flows, *Journal of Finance* 55, 937–958.

James, Duncan, and R. Mark Isaac, 2000, Asset markets: How they are affected by tournament incentives for individuals, *American Economic Review* 90, 995–1004.

Khorana, Ajay, 1996, Top management turnover: An empirical investigation of mutual fund managers, *Journal of Financial Economics* 40, 403–426.

——— , and Henri Servaes, 2001, An examination of competition and investor behavior in the mutual fund industry, Working Paper.

Koski, Jennifer Lynch, and Jeffrey Pontiff, 1999, How are derivatives used? evidence from the mutual fund industry, *Journal of Finance* 54, 791–816.

Mamaysky, Harry, and Matthew Spiegel, 2001, A theory of mutual funds: Optimal fund objectives and industry organization, Working Paper.

Massa, Massimo, 1998, Why so many mutual funds? Mutual fund families, market segmentation and financial performance, Working Paper.

——— , 2003, How do family strategies affect mutual fund flows? When performance-maximization is not the only game played in town, *Journal of Financial Economics* 67 forthcoming.

Nanda, Vikram, Z. Jay Wang, and Lu Zheng, 2000, Family values and the star phenomenon, Working Paper.

Orphanides, Athanasios, 1996, Compensation incentives and risk taking behavior: Evidence from mutual funds, Working Paper.

Patel, Jayendu, Richard J. Zeckhauser, and Darryll Hendricks, 1994, Investment flows and performance: Evidence from mutual funds, cross-border investments, and new issues, in Ryuzo Sato, Richard M. Levich, and Rama V. Ramachandran, ed.: *Japan, Europe, and International Financial Markets: Analytical and Empirical Perspectives* (Cambridge University Press: Cambridge).

Siggelkow, Nicolaj, 2002, Why focus? A study of intra-industry focus effects, Working Paper.

Sirri, Erik R., and Peter Tufano, 1998, Costly search and mutual fund flows, *Journal of Finance* 53, 1589–1622.

Taylor, Jonathan D., 2003, Risk-taking behavior in mutual fund tournaments, *Journal of Economic Behavior and Organization* 50, 373–383.

Zhao, Xinge, 2001a, Entry decisions by mutual fund families, Working Paper.

——— , 2001b, Exit decisions in the U.S. mutual fund industry, Working Paper.