Tournaments in Mutual-Fund Families

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We examine intrafirm competition in the mutual-fund industry. We test the hypothesis that fund managers within mutual-fund families compete with each other in a tournament. Our empirical study of the US equity mutual-fund market shows that they adjust the risk they take depending on the relative position within their fund family. The direction of the adjustment depends on the competitive situation in that family. Risk adjustments are particularly pronounced among managers of funds with high expense ratios, which are managed by a single manager and which belong to large families. (*JEL* G20, G23, J49)

Virtually all mutual funds belong to a multi-fund family.[1] Several recent papers study the behavior of such fund families. Mamaysky and Spiegel (2002), Siggelkow (2003), and Khorana and Servaes (2006) look at their product policies, and Gallaher, Kaniel, and Starks (2006) examine their advertising decisions. Guedj and Papastaikoudi (2005) and Gaspar, Massa, and Matos (2006) study how fund families shift performance between their funds. All these papers focus on the decisions of the top management of a fund family, but they ignore the decisions of the individual fund managers in the family and thus implicitly assume that fund families are coordinated entities.

This paper is the first to study the behavior of individual fund managers in the context of their fund family. It is important to analyze the behavior of fund managers in this context since the top management of the fund family sets several kinds of incentives for the family's fund managers. First, the family's top management decides which portfolio managers to promote. If a fund's portfolio manager gets promoted, the individual's salary will increase.

The authors would like to thank Matthew Spiegel (the editor) and an anonymous reviewer as well as Amanda Adkisson, Vikas Agarwal, Thomas Burkhardt, Joachim Grammig, Knut Griese, Philippe Jorion, Katja Kaufmann, Ajay Khorana, Olaf Korn, Alexandra Niessen, Martin Ruckes, Henri Servaes, Laura Starks, Jonathan Taylor, Ulf von Lilienfeld-Toal, Russ Wermers, Pradeep Yadav, Lu Zheng, and participants of the meetings of the BSI Gamma Foundation in Zuerich in 2002 and the European Finance Association (EFA) Meeting in Glasgow in 2003 for helpful comments. Financial support from the BSI Gamma Foundation is gratefully acknowledged. All remaining errors are our own. Address correspondence to Stefan Ruenzi, Department of Finance, University of Cologne, Albertus-Magnus-Platz, 50923 Koeln, Germany; e-mail: ruenzi@wiso.uni-koeln.de; telephone: (++49)+221-4706-966; fax: (++49)+221-470-3992.

[1] A fund family includes all funds managed by the same fund management company (e.g., Janus or Fidelity). According to Gasper, Massa, and Matos (2006), more than 90% of all equity funds belong to such fund families and 98% of all assets under management in all US equity funds are managed by these funds.

doi:10.1093/rfs/hhm057 Advance Access publication December 14, 2007

Second, the family's management decides which manager's funds to advertise. Marketing efforts directed to a fund also indirectly increase a manager's salary because such efforts attract higher inflows (see Jain and Wu, 2000; Gallaher, Kaniel, and Starks, 2006) and fund managers' compensation is often dependent on their assets under management (e.g., Khorana, 1996). Third, fund families can shift performance between funds, for example, by allocating attractive IPO shares to certain funds (e.g., Gaspar, Massa, and Matos, 2006). Better performance also leads to higher inflows (e.g., Sirri and Tufano, 1998) and eventually to higher compensation. Since only a selected group of managers will be promoted and the overall budget of a fund family for marketing activities as well as the possibilities for cross-fund subsidization are limited, the fund managers within a family compete with each other for these scarce resources. Hence, intrafirm competition exists between the managers of a fund family. While the competition between mutual-fund managers in the market-place (called a "segment" tournament[2]) has attracted considerable attention in the literature (e.g., Brown, Harlow, and Starks, 1996), this paper is the first attempt to understand the competition among fund managers within fund families.

There tend to be fixed points in time at which the fund family makes family decisions on advertising, compensation, and promotions. A likely date for such decisions is the end of the year.[3] Therefore, fund managers would be expected to try to enhance their performance by year end in order to achieve one of the top positions within the fund family. If they succeed, their funds could be advertised or supported by cross-fund subsidization and they will possibly be promoted. If they do not succeed, they may not receive these extra benefits.[4] It then may not be as important whether the fund manager reaches any mid-level or a bad position.[5] Thus, they face a convex reward scheme. This is a typical tournament situation: the winners get a large prize and the losers end up with much less. In such a tournament, the optimal response of a fund manager to its interim performance is an adjustment of risk taking (e.g., Taylor, 2003; Makarov, 2005; Acker and Duck, 2006). Thereby, the manager can maximize the probability of reaching a top position at the end of the year. In this paper we empirically examine whether fund managers engage in such a *family tournament*. This is important because the tournament behavior of fund managers can lead to suboptimal portfolios from the fund investors' point of view (see Bagnoli and

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[2] A segment is defined as the entirety of funds having comparable investment objectives, e.g., growth and income or small company growth.

[3] For example, Gallaher, Kaniel, and Starks (2006) report that advertising budgets are decided upon on a yearly basis.

[4] Kempf and Ruenzi (2006) show that the best funds within a family receive economically significant additional inflows. This agrees with our argument that only the best funds in a family will be advertised and eventually enjoy higher inflows.

[5] A notable exception is the case of an extremely bad position. Then the fund manager does care about her position, as such a bad performance entails the threat of dismissal (e.g., Khorana, 1996; Chevalier and Ellison, 1999). For a model in which employment risk drives the behavior of fund managers, see Hu, Kale, and Subramaniam (2006).

Watts, 2000) and to irrational price formation in asset markets (see James and Isaac, 2000).

Our analysis of the family tournament and the influence of the competitive situation within fund families delivers two main testable implications: in large families, fund managers lagging behind after the first part of the year (midyear losers) should increase portfolio risk relative to the midyear winners. In small families, midyear winners should increase risk more than midyear losers.

Testing these conjectures with data on well-diversified US equity mutual funds for the period 1993–2001, we obtain the following main results: fund managers adjust the risk of their funds in the course of a year dependent on their interim position within the family. This suggests that a family tournament exists. We find that fund managers in large and small families behave differently from each other in the family tournament as hypothesized.

Our findings on the behavior of fund managers in the family tournament are very robust over time and hold after controlling for the influence of the Brown, Harlow, and Starks (1996) segment tournament. The results on differences between large and small families are not driven by individual fund characteristics such as age, size, fee structures, trading activity, segment affiliation, or management structure. They also hold after controlling for segment- and family-fixed effects.

We document some interesting differences with respect to the extent of risk adjustment in the family tournament. First, fund managers belonging to large families generally engage more heavily in the family tournament. This finding is in line with the results of Almazan et al. (2004), who find that fund managers in large families face fewer restrictions than managers in small families. It is also in line with Guedj and Papastaikoudi (2005), who show that cross-fund subsidization is more likely in large families. Second, risk adjustment in large families is stronger for managers of funds with high-expense ratios than for funds with low-expense ratios. This can be explained by the finding of Gaspar, Massa, and Matos (2006) that funds with high expense ratios are more likely to be supported by cross-fund subsidization. Third, we find more pronounced risk adjustment for single-managed funds than for team-managed funds in large families. This agrees with findings that Qiu (2003) reports for the segment tournament and could be due to competing incentives different managers in a team might have.

This paper is organized as follows: The following section analyzes the decision problem of fund managers in the family tournament, derives testable implications, and reviews the related literature. Section 2 describes the data and introduces the empirical model. Section 3 details the results of our empirical investigation, and section 4 examines the impact of fund characteristics on the behavior of fund managers in the family tournament. Section 5 confirms the temporal stability of the results. The final section summarizes the results and describes some implications of the findings.

1. Competition in the Fund Industry and Family Tournaments

1.1 Family tournaments: Intuition and testable hypotheses

The convex incentive structure within mutual-fund families gives rise to a family tournament. However, it is not obvious how managers behave in this tournament.

Taylor (2003) shows in a game theoretical setting that the optimal behavior of fund managers who take the behavior of other managers into account is exactly opposite to the optimal behavior of fund managers who do not consider the behavior of other managers. The intuition for these results is as follows. If there are no strategic interactions, midyear losers have not much to lose from increasing risk. Due to the convex reward scheme, a further deterioration of their performance is not going to hurt them much. However, by increasing risk they enhance their chances of catching up and still reaching a top position. In contrast, midyear winners have a lot to lose if their position deteriorates. Thus, they will decrease risk, thereby trying to lock in their winning position. Consequently, losers increase risk more than winners do. In contrast, if there are strategic interactions, winners try to lock in their position by mimicking the strategy of the losers. This allows them to retain their lead. As winners expect losers to buy more risky assets in order to catch up, they will also tend to buy more risky assets. However, buying more risky assets is not going to help the losers, if winners also invest in these assets. They have to follow a strategy that is different from the winners' strategy. Otherwise, they have no chance to close the performance gap between them and the midyear winners. Thus, they have to choose the opposite behavior, i.e., not increasing their risk.[6]

Based on this reasoning, we expect crucial differences to exist between large and small families in the family tournament. The rationale is that strategic interactions are generally assumed to be crucial if there are only a small number of individuals interacting (e.g., Mas-Colell, Whinston, and Green, 1995). Only in these cases do the players involved take the actions of the other players into account. This setting is given, for example, in an oligopolistic market. Similarly, the number of players in the family tournament is small in small-fund families but not in large-fund families. As the number of players involved increases, strategic interactions become less important. In the extreme case of perfect competition, where all players are atomistic, strategic interactions are irrelevant. The same holds for the family tournament in large families.

This leads to two testable hypotheses. (1) In large families, midyear losers increase risk more than midyear winners. (2) In small families, midyear winners increase risk more than midyear losers.

Brown, Harlow, and Starks (1996) and Busse (2001) show that fund managers also adjust risk in the segment tournament. However, with the assumption that fund managers adjust risk as the response to either a family or segment

[6] A similar result is derived in a theoretical model with strategic interactions by Makarov (2005).

tournament, they only have one decision variable. Thus, the two tournaments are interrelated. Therefore, the hypotheses developed above have to be understood in a ceteris paribus sense, i.e., they hold after taking into account the risk-taking incentives from the segment tournament. In our empirical examination of the family tournament, we have to take into account this ceteris paribus assumption by controlling for the influence of the segment rank. We do so by applying a multivariate setting, which allows us to analyze the behavior in both tournaments simultaneously.

1.2 Related literature

Our research is related to four strands of literature. First, we extend the literature on tournaments in the mutual-fund market (e.g., Brown, Harlow, and Starks, 1996; Orphanides, 1996; Koski and Pontiff, 1999; Busse, 2001; Elton, Gruber, and Blake, 2003) by showing that fund managers not only engage in the well-documented segment tournament but also in a family tournament.

Second, our paper relates to the traditional corporate tournaments literature (e.g., Lazear and Rosen, 1981; Nalebuff and Stiglitz, 1983; Green and Stokey, 1983; Rosen, 1986; Bognanno, 2001; as well as the overview in Prendergast, 1999). The main difference between our paper and the literature on corporate tournaments is that we focus on risk taking, while these papers concentrate on the effort choices of the contestants.[7] Furthermore, most theoretical papers on corporate tournaments examine a competition for one top prize.[8] However, with the exception of the competition for the CEO position, real-world corporate tournaments are often characterized by the fact that there are multiple prizes. There are regularly multiple positions to be filled at various levels within the firm. A similar situation exists in the mutual-fund industry. In the family tournament as well as in the segment tournament there can be multiple prizes. For example, within a fund family, various funds will be advertised. There often exist multiple larger funds within a fund family that a specific fund manager might be promoted to. It is also not unlikely that more than one fund will be supported by means of intrafamily cross-fund subsidization. Similarly, the segment tournament also has multiple prizes. Although it is clearly defined through performance rankings, the very best fund is not the only winner in the segment tournament. Sirri and Tufano (1998) show that at least the best 20% of all fund managers within a segment experience large inflows. Thus, the classical corporate tournament, the segment tournament, and the family tournament are comparable in the sense that they can all have multiple winners. The results of combining both external and internal tournaments contribute to the corporate tournaments literature.

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[7] Hvide (2002) examines theoretically the interaction between effort and risk-level choices of corporate managers in a tournament situation.

[8] Multiple prizes in corporate tournaments are studied in Clark and Riis (1998) for the case of homogeneous prizes and Moldovanu and Sela (2001) for the case of heterogeneous prizes. Many of the results derived in models with only one prize also hold in the case of multiple prizes.

Third, we extend the recent literature on fund families (e.g., Mamaysky and Spiegel, 2002; Siggelkow, 2003; Nanda, Wang, and Zheng, 2004; Guedj and Papastaikoudi, 2005; Khorana and Servaes, 2006; Gallaher, Kaniel, and Starks, 2006; Gaspar, Massa, and Matos, 2006) by examining how fund managers behave *within* the organizational setting of their family rather than viewing fund families as coordinated entities.

Fourth, we contribute to the literature on intrafirm competition. While there are some theoretical papers examining intrafirm competition (e.g., Polasky, 1992; Fauli-Oller and Giralt, 1995; Baye, Crocker, and Ju, 1996; Ziss, 1998; Corchon and Gonzalez-Maestre, 2000), there is scarce empirical evidence on this issue.[9]

2. Empirical Investigation

2.1 Data and methodology

The sample consists of data on US equity funds from the CRSP Survivor Bias Free US Mutual Fund Database.[10] The database contains data on monthly total returns, the fund management company, and other characteristics of the fund. We use the strategic insight objectives (SI) of funds to define the market segments in which they operate. We focus exclusively on equity mutual-fund managers. It seems unlikely that equity fund managers directly compete with the bond or money market managers in their family.[11] Their performances cannot be easily compared, and there is not much fungibility among bond, money market, and equity fund managers. As the SI classification is available beginning in 1993, our data sample starts in 1993. It ends in 2001, giving us nine years of data.

In the observations, we eliminate those years of a fund for which some of the data are missing. All examinations are done for fund families and segments including more than two funds. The CRSP database lists every single share class of a fund as an individual entry. These share classes only differ with respect to their fee structure or their minimum investment requirements, but are backed by the same portfolio of assets. Thus, returns are highly correlated across the different share classes in the same fund. Since they cannot be managed independently, we omit all classes of multiple-class funds except for the first class of these funds in our dataset. The first class in the dataset is usually the oldest and largest share class of the fund and is representative of the fund. Furthermore, the choice of the share class is often determined by the distribution

[9] Ruebeck (2002) examines intrafirm competition in the PC hard drive market in the US by looking at pricing strategies of different subsidies of firms in the early 1990s.

[10] 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).

[11] This does not preclude the possibility that there might be another family tournament going on among the bond fund managers or the money market fund managers within the family.

channel investors use. For example, investors turning to brokers will have to choose a load class, while other investors might only compare the no-load share class of multiple-class funds. Thus, for flow-induced incentives, only the relative position of the fund in the group that is relevant for the specific investor is important. Therefore, we usually stick with the A-Class (or its equivalent) of multiple-class funds, which is typically characterized by a front-end load fee in addition to an annual management fee.[12] Nanda, Wang, and Zheng (2005) report that the A-Class of multiple-class funds clearly dominates all other classes in terms of assets under management. These exclusions reduce our initial number of yearly fund observations from 41,367 to 22,756.

The basic structure of the family tournament is as follows: fund managers observe their position relative to the other funds in the family (family rank) when the midyear returns are released. Based on this family rank they decide on the risk to take in the second half of the year. Although some mutual-fund investors' investment decisions and decisions of families to advertise or promote managers might depend on longer period horizons, the one-year horizon is the most natural choice. Most managers are compensated based on calendar year performance. Further, for the mutual-fund investors, evidence indicates that prior year performance is the most important decision criterion (e.g., Sirri and Tufano, 1998). Thus, trying to reach a top position by the end of the year based on the performance within this year seems a natural goal of fund managers.

We use the return data from our dataset to calculate two rankings of a fund i at the end of the first part of year t. The *segment rank* of a fund, R_{it}^S, is determined by its total return relative to the total returns of the competing fund managers in the same segment:[13] the rank is calculated by ordering the funds in a segment according to their total returns.[14] We then calculate the fractional segment rank for each fund. Segment ranks, R_{it}^S, are distributed evenly between 0 and 1. A higher R_{it}^S denotes a better performance within a segment.

To measure the *family rank* of a fund, R_{it}^F, we arrange all equity funds of a family according to their segment ranks, R_{it}^S. Based on this ordering of the segment ranks, we then assign a family rank number to each fund. This "rank-of-ranks" method ensures that the performance of funds from different segments can easily be compared. Similar to above, we then calculate fractional ranks in order to make ranks from families of different size comparable. Thus, R_{it}^F is also evenly distributed between 0 and 1. A higher R_{it}^F denotes a better performance within a family. For example, consider a hypothetical family that only has three funds, $i = 1, 2, 3$. Two funds are from the *Growth and Income* segment and achieve a segment rank of $R_{1t}^S = 0.5$ and $R_{2t}^S = 0.7$, respectively,

[12] Alternatively, we also aggregate all share classes of one fund. While calculating returns, we weighted the return of the respective share class by its total net asset value (TNA). The results (not reported) are virtually identical.

[13] Patel, Zeckhauser, and Hendricks (1994) show that investors care more about raw returns than risk-adjusted measures and more about rankings than absolute performance.

[14] Segment ranks are calculated separately for each segment. This also controls for risk differences across various segments.

Table 1
Summary statistics

Year	Number of funds	Number of families	Mean family TNA
1993	1175	238	3,049
1994	1439	260	3,267
1995	1821	270	4,487
1996	2122	278	5,856
1997	2598	297	7,429
1998	2975	319	8,620
1999	3302	336	10,844
2000	3459	381	9,178
2001	3865	383	8,271

This table presents summary statistics on US equity mutual funds. Column 2 presents the total number of funds in the sample. In column 3, the number of families is shown, and column 4 presents the mean sum of the total net asset values (TNA) of all funds in a family. TNAs are in million USD.

while the third fund belongs to the *Aggressive Growth* segment and achieves a segment rank of $R^S_{3t} = 0.4$ in year t. The fund with the best segment rank of all funds in the family, i.e., fund 2, gets assigned the top family rank, $R^F_{2t} = 1$. The other two funds get assigned the family ranks $R^F_{1t} = 0.5$ and $R^F_{3t} = 0$, respectively. Note that this does not preclude the possibility that fund 3 has a higher absolute return than the other funds in year t.

The correlation between R^S_{it} and R^F_{it} is positive by construction. For the whole sample, the correlation coefficient between these two variables is 0.78, indicating that multicollinearity might be a problem. Even in this case one still gets consistent and unbiased estimators (e.g., Greene, 2000, chapter 6.7). However, standard errors will be high and it is therefore harder to get significant results.

Table 1 documents the rapid growth of the mutual-fund industry. The number of mutual funds in the sample increases from 1,175 funds in 1993 to 3,865 funds in 2001. The number of fund families rises from 238 to 383. The average amount of assets under management in a family increases from about 3 billion USD to more than 8 billion USD.

In the remainder of this paper, we concentrate on funds belonging to the three largest segments (Growth, Growth and Income, Small Company Growth), leaving us with 10,321 yearly fund observations.[15] We concentrate on these segments for three reasons. First, we want to make the sample homogeneous with respect to the competitive situation in the market segment. A large number of funds belong to each of our three segments in every year. We can safely assume that the competition within these segments is atomistic. Hence, concentration on large segments allows us to examine the effect of the competitive situation within the family in isolation. Second, we want to make the sample homogeneous with respect to the ease of risk adjustment. All funds in the sample

[15] We calculate segment ranks for each of these segments separately as described above, thereby measuring the segment tournament separately within each segment. We do not group them together, because we want to allow for differences in risk and risk adjustment between the three segments. For robustness, instead of concentrating on the three largest segments, we also do an analysis using observations from the very largest segment only and the five largest segments, respectively. The results (not reported) are not affected by this.

are well diversified and have similar opportunities to adjust risk.[16] Third, we want to compare the results on the family tournament with earlier papers on the segment tournament (e.g., Brown, Harlow, and Starks, 1996) that focus on large market segments.

2.2 Empirical model

We assume that managers engage in yearly tournaments.[17] We examine how they change risk depending on their family rank, R_{it}^F. As we expect a difference in behavior between large and small families, we interact the family rank with dummies that indicate whether the fund belongs to a large or a small family. Our empirical model reads

$$\begin{aligned}\Delta\sigma_{it} = {} & b_l^F R_{it}^F \cdot D_l + b_s^F R_{it}^F \cdot D_s + b_l^S R_{it}^S \cdot D_l + b_s^S R_{it}^S \cdot D_s \\ & + b_1 \Delta\sigma_{it}^m + b_2 \sigma_{it}^{(1)} + e_{it}. \end{aligned} \tag{1}$$

The dependent variable, $\Delta\sigma_{it} := \sigma_{it}^{(2)} - \sigma_{it}^{(1)}$, is the change in standard deviations of fund returns from the first to the second part of the year,[18] where $\sigma_{it}^{(1)}$ ($\sigma_{it}^{(2)}$) denotes the estimated annualized standard deviation of monthly returns of fund i in the first part (second part) of year t. The position of fund i within its family (segment), i.e., its family rank (segment rank), after the first part of year t is denoted by R_{it}^F (R_{it}^S). The dummy variable D_l (D_s) takes on the value 1 if the fund belongs to a large (small) family, and 0 otherwise. The difference between the median standard deviation in the second part of the year, $\sigma_{it}^{m(2)}$, and in the first part of the year, $\sigma_{it}^{m(1)}$, is denoted by $\Delta\sigma_{it}^m := \sigma_{it}^{m(2)} - \sigma_{it}^{m(1)}$.[19]

In line with the literature on segment tournaments (e.g., Brown, Harlow, and Starks, 1996) we choose a length of seven months as the first part of the year. During the following five months, fund managers can adjust the risk of their portfolio. The (7,5)-partitioning is reasonable because many interim rankings are set up roughly at the middle of the year and it takes some time for fund managers to adjust their portfolio afterwards.[20]

The main explanatory variable of interest in model (1) is the family rank, R_{it}^F. Significant coefficients b^F suggest that fund managers change risk depending

[16] There are still some differences between the large cap-oriented segments: growth and growth and income and the small company growth segment; however, the results do not depend on this (see section 4.3).

[17] We argue that these yearly tournaments are independent over time. It is also possible that tournament behavior is influenced not only by the performance in the first part of the year, but also by prior performance. Brown, Harlow, and Starks (1996) report some influence of prior performance in the segment tournament. The results for the family tournament (not reported) are not qualitatively affected if we distinguish between previous year winners and previous year losers. This suggests that managers mainly care about their position in one-year family tournaments rather than multi-period tournaments.

[18] We also use the difference of the risk ratios $(\sigma_{it}^{(2)}/\sigma_{it}^{m(2)}) - (\sigma_{it}^{(1)}/\sigma_{it}^{m(1)})$ as a dependent variable. The results are very similar to those reported.

[19] We also use the respective mean fund instead of the median to calculate the proxies for the change in segment risk. The results are not affected by this.

[20] We also run our regressions taking six months instead of seven months as the first part of the year. The general results are unchanged, but the effects show up more clearly in the (7,5) specification than in the (6,6) specification.

on their family rank, which would be a strong indication of the existence of a family tournament. If midyear losers increase risk more than midyear winners do, b^F is negative. This behavior is expected in large families. In small families, we expect the opposite behavior, $b_s^F > 0$.[21]

Model (1) allows us to simultaneously examine whether a family tournament exists and whether the tournament behavior differs between large and small families. We use the mean number of competitors of a fund within its family as a cutoff for large families. Families with at least 26 funds are classified as large families, all others as small ones. Using this cutoff, 50.13% of the funds are categorized as belonging to large families. However, we will show later (section 3.3) that the results are not sensitive to a variation of this cutoff.

We control for other effects that might influence the risk-taking behavior of fund managers. Most importantly, based on the literature, we expect an influence of the segment rank of a fund, R_{it}^S (e.g., Brown, Harlow, and Starks, 1996). We allow this influence to vary between large and small families also by interacting the segment rank with the dummies D_l and D_s, respectively. As we only examine funds from large segments, we expect nonstrategic behavior of fund managers in the segment tournament ($b_l^S < 0$ and $b_s^S < 0$), irrespective of whether they belong to large or small families.

The assumption that fund managers respond to tournaments by adjusting risk implies that they only have one decision variable for both tournaments. To capture the conditional nature of the family ranks as well as the influence of both tournaments, we employ the multivariate model presented above. It simultaneously captures the marginal influence of the family rank and the segment rank. The estimates from the multivariate model give us the marginal influence of the family rank conditional on the influence of the other variables, especially given the influence of the segment tournament (and vice versa).

Adding $\Delta\sigma_{it}^m$ controls for changes in the segment volatility. If the volatility of the segment the fund belongs to changes for some exogenous reasons, this will also influence the risk of the fund. Furthermore, we expect mean reversion in funds' volatility (e.g., Koski and Pontiff, 1999; Daniel and Wermers, 2000). Therefore, the standard deviation in the first part of the year, $\sigma_{it}^{(1)}$, is included as a control variable in the regression.

Finally, we include time-fixed effects, which control for factors such as temporal changes in the overall risk characteristics of the equity markets over time, which might affect changes in individual fund risk.

[21] Our hypotheses are that the coefficients are either greater than zero (in those cases where we expect strategic behavior) or smaller than zero (when we expect nonstrategic behavior) rather than just different from zero. Therefore, we conduct one-sided t-tests to determine significance levels.

Table 2
Risk taking in large and small fund families

Independent variable	Description of independent variable	(A)	(B)	(C)
$R_{it}^F \cdot D_l$	Family rank in large families	-0.0183^{***}	-0.0181^{***}	-0.0174^{**}
		(-2.5512)	(-2.5278)	(-2.2933)
$R_{it}^F \cdot D_s$	Family rank in small families	0.0092^{***}	0.0103^{***}	0.0062^{**}
		(3.5422)	(4.0704)	(2.3134)
$R_{it}^S \cdot D_l$	Segment rank in large families	0.0332^{***}	0.0326^{***}	0.0291^{***}
		(4.3561)	(4.3537)	(3.5903)
$R_{it}^S \cdot D_s$	Segment rank in small families	0.0089^{***}	0.0058^{**}	0.0105^{***}
		(3.1337)	(2.0703)	(3.4567)
$\Delta\sigma_{it}^m$	Change in segment volatility	0.8363^{***}	0.8529^{***}	0.8469^{***}
		(30.0690)	(31.1979)	(31.2495)
$\sigma_{it}^{(1)}$	Fund's risk in first part of year	-1.1837^{***}	-1.3543^{***}	-1.5098^{***}
		(-55.5036)	(-59.4609)	(-62.5860)
Time-Fixed Effects		Yes	Yes	Yes
Segment-Fixed Effects		No	Yes	Yes
Family-Fixed Effects		No	No	Yes
R^2		72.22%	73.20%	75.31%

This table contains estimates from pooled regressions. We estimate model (1) from the main text with time-fixed effects (column A), with time- and segment-fixed effects (column B), and with time-, segment- and family-fixed effects (column C), respectively. Funds from the segments growth, growth and income, and small company growth are examined for the years 1993 to 2001. The dependent variable is the fund's change of risk between the first and second part of a year. The independent variables are the rank of this fund in its family, R_{it}^F, and in its segment, R_{it}^S, the change in segment volatility, $\Delta\sigma_{it}^m$, and the risk of the fund in the first part of the year, $\sigma_{it}^{(1)}$. R_{it}^F and R_{it}^S are interacted with D_l or D_s, respectively. D_l (D_s) equals one if a fund belongs to a large (small) family, and zero otherwise. A family is classified as large if the number of funds in the family is not smaller than the mean number (i.e., 26). t-values are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level (one-tailed tests), respectively. The number of observations is 10,321.

3. Empirical Results

3.1 Risk taking in the family tournament

The estimation results of model (1) are presented in column (A) of Table 2. Our main focus is on the coefficients of the family tournament, b_l^F and b_s^F. The null hypothesis that the family rank has no impact on risk taking can be rejected at the 1% level (F-statistic = 9.44): a family tournament does exist. Fund managers change risk depending on their midyear family rank.

The way in which managers change their risk crucially depends on the size of their family. The coefficient for large families, b_l^F, is negative, i.e., midyear losers in large families increase risk more than midyear winners do. The opposite is true for fund managers in small families ($b_s^F > 0$). This supports our prediction of nonstrategic behavior in large families and strategic behavior in small families. The effects we find are not only statistically highly significant, but also economically meaningful. For example, the worst fund managers from large families increase risk by 1.83% points more than the best fund managers. This is more than 10% of the average risk fund managers take, which is 17.7%. Thus, both of our hypotheses on the behavior of fund managers from large and small families in the family tournament are supported.

We also find an influence of the segment rank. The null hypothesis that there is no influence of the segment rank on risk-taking behavior is rejected at the 1% level (F-statistic = 13.61). The signs of the coefficients b_l^S and b_s^S are both positive and significant. Fund managers behave strategically in the segment tournament. Given that we only look at fund managers from large segments, we would expect negative signs. Furthermore, this result contradicts empirical evidence presented by Brown, Harlow, and Starks (1996), Koski and Pontiff (1999), and Elton, Gruber, and Blake (2003), who all find nonstrategic behavior in the segment tournament. However, some recent studies find results similar to ours for the segment tournament (e.g., Busse, 2001). We will discuss this issue further in section 5, where we show that the impact of the segment rank is sample specific and not stable over time.

It is interesting to note that risk adjustment is generally stronger in large families than in small families, i.e., $|b_l^F| > |b_s^F|$ and $|b_l^S| > |b_s^S|$. The latter difference is significant at the 1% level. This result suggests that fund managers in large families can adjust risk more freely than fund managers in small families. This is consistent with evidence that managers in large families face fewer restrictions than managers in small families (Almazan et al., 2004) and have stronger incentives due to cross-fund subsidization, which is more common in large families than in small families (Guedj and Papastaikoudi, 2005).

The coefficients b_1 and b_2 of our control variables have the expected sign. The positive coefficient b_1 indicates that the risk changing of a fund manager depends positively on the change in segment volatility. The significantly negative coefficient b_2 indicates mean reversion in the standard deviation. It suggests that fund managers have a target level of risk (see Daniel and Wermers, 2000). Therefore, fund managers with relatively high risk in the first period will tend to decrease their risk and vice versa.

3.2 Segment-fixed and family-fixed effects

Although we concentrate on well-diversified equity funds, it is possible that the behavior of fund managers differs among the three segments we examine. Thus, we redo our analysis including segment-fixed effects. The results are presented in column B of Table 2. They are virtually identical to those without segment-fixed effects in column A.

Fund families also differ with respect to various characteristics that might influence the risk-taking behavior of fund managers. Estimating our model using family-fixed effects captures the influence of such characteristics.

One such potential characteristic is the fund family's monitoring ability. It is possible that some fund families are better at monitoring than others. While large families have greater resources for monitoring managers than small families, small families have a smaller number of managers to monitor. Consequently, it is not obvious whether large or small families are better at monitoring.

Another characteristic that might influence risk-taking incentives is the proportion of the family's funds being managed by a specific manager. So far, we implicitly assume that each fund manager only manages one fund. In reality, many fund managers manage more than one fund or are part of different management teams. Strategies of managers with multiple funds might thus not be independent. However, fund managers can still adjust the risk of each of the funds they are responsible for independently. Thus, our observations are not necessarily dependent upon each other. Nevertheless, especially in small families, the multiple funds managed by one manager can be a large proportion of the family's overall number of funds. In such families, the manager concentration is higher and fund managers might face different incentives, because they actually compete with themselves in the family tournament. Unfortunately, we cannot compute the number of funds under management for each manager, because many fund companies do not provide fund managers' names, only indicating that the fund is team managed (e.g., Massa, Reuter, and Zitzewitz, 2006; Bär, Kempf, and Ruenzi, 2006). However, family-fixed effects offer a way to capture the influence of various degrees of fund manager concentration between families.

Finally, some fund families might have similarities in risk attitudes among their managers so that they are more conservative or more aggressive. Such effects can also be captured by including family-fixed effects.

Estimation results including segment-fixed and family-fixed effects are presented in column C of Table 2. Even after controlling for fixed effects, our estimation results still suggest strategic behavior in small families and nonstrategic behavior in large families in the family tournament. The results for the segment tournament and the control variables also remain unchanged. This indicates that differences between families such as differences in monitoring abilities, in the shares of the family's funds being managed by one manager, and in risk attitudes do not drive our results on differences in behavior between large and small families.

3.3 Variations of the cutoff between small and large families

We chose the mean number of competitors a fund manager has within its family as the cutoff for large families. In the following, we examine whether the results are sensitive to this choice in two ways. First, we use several alternative cutoffs by adding and subtracting 5 and 10, respectively, from the initial cutoff of 26. These cutoffs (16, 21, 31, and 36 funds) classify between 63.43% and 41.37% of the yearly fund observations as coming from large families. Estimation results for the coefficients b_l^F and b_s^F from model (1) for these cutoffs are presented in panels A to D of Table 3. We do not report results for the segment tournament and the other control variables here and in the following tables for the sake of brevity. Coefficients are always positive and usually significant at the 1% or 5% level. The influence of the other control variables also does not change.

Table 3
Different cutoffs for large/small families

Independent variable	Description of independent variable	(A)	(B)	(C)	Number of observations
		Panel A: Cutoff = 16			
$R_{it}^F \cdot D_l$	Family rank in families with ≥16 funds	−0.0017 (−0.3156)	−0.0011 (−0.2033)	0.0003 (0.0492)	6,443
$R_{it}^F \cdot D_s$	Family rank in families with <16 funds	0.0075*** (2.7633)	0.0087*** (3.2468)	0.0038* (1.3378)	3,878
Time-fixed effects		Yes	Yes	Yes	
Segment-fixed effects		No	Yes	Yes	
Family-fixed effects		No	No	Yes	
R^2		72.18%	73.18%	75.28%	
		Panel B: Cutoff = 21			
$R_{it}^F \cdot D_l$	Family rank in families with ≥21 funds	−0.0121** (−1.8428)	−0.0117** (−1.8183)	−0.0104* (−1.5194)	5,730
$R_{it}^F \cdot D_s$	Family rank in families with <21 funds	0.0087*** (3.3435)	0.0100*** (3.5871)	0.0053** (1.9738)	4,591
Time-fixed effects		Yes	Yes	Yes	
Segment-fixed effects		No	Yes	Yes	
Family-fixed effects		No	No	Yes	
R^2		72.20%	73.18%	75.29%	
		Panel C: Cutoff = 31			
$R_{it}^F \cdot D_l$	Family rank in families with ≥31 funds	−0.0195** (−2.2713)	−0.0192** (−2.2753)	−0.0119* (−1.3118)	4,708
$R_{it}^F \cdot D_s$	Family rank in families with <31 funds	0.0084*** (3.2977)	0.0095*** (3.8186)	0.0052** (1.9675)	5,613
Time-fixed effects		Yes	Yes	Yes	
Segment-fixed effects		No	Yes	Yes	
Family-fixed effects		No	No	Yes	
R^2		72.21%	73.19%	75.31%	
		Panel D: Cutoff = 36			
$R_{it}^F \cdot D_l$	Family rank in families with ≥36 funds	−0.0251*** (−2.5883)	−0.0263*** (−2.7566)	−0.0171** (−1.7294)	4,270
$R_{it}^F \cdot D_s$	Family rank in families with <36 funds	0.0081*** (3.2022)	0.0093*** (3.7567)	0.0046** (1.7718)	6,051
Time-fixed effects		Yes	Yes	Yes	
Segment-fixed effects		No	Yes	Yes	
Family-fixed effects		No	No	Yes	
R^2		72.21%	73.18%	75.29%	

This table contains estimates of b_l^F and b_s^F from model (1) as shown in the main text for different cutoffs for large families. The model is estimated with time-fixed effects (column A), with time- and segment-fixed effects (column B), and with time-, segment-, and family-fixed effects (column C), respectively. Funds from the segments growth, growth and income, and small company growth are examined for the years 1993 to 2001. The dependent variable in all regressions is the fund's change of risk between the first and second part of a year. The independent variables are the rank of this fund in its family, R_{it}^F, and in its segment, R_{it}^S, the change in segment volatility, $\Delta\sigma_{it}^m$, and the risk of the fund in the first part of the year, $\sigma_{it}^{(1)}$. R_{it}^F and R_{it}^S are interacted with D_l or D_s, respectively. D_l (D_s) equals one if a fund belongs to a large (small) family, and zero otherwise. A family is classified as large if the number of funds in the family is not smaller than 16 (panel A), 21 (panel B), 31 (panel C), or 36 (panel D), respectively. For the sake of brevity we only report the estimates for the influence of the family rank. The last column presents the number of observations in each group. The number of observations in all regressions is 10,321. t-values are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level (one-tailed tests), respectively.

Looking at column A of Table 3, we observe a negative estimate for b_l^F and a positive estimate for b_s^F for all cutoffs. All but one estimate are significantly different from zero. Thus, our main result is stable with respect to a variation of this cutoff. The coefficient b_l^F becomes larger (in absolute value) when the cutoff increases. This suggests that some small families are misclassified as large families if a very low cutoff is chosen. Similarly, b_s^F is decreasing for cutoffs larger than 26. In these cases, the results become weaker because some large families are misclassified as small families. Results in columns B and C in panels A to D show that the results also hold if we include segment-fixed effects and family-fixed effects.

As a second robustness test, we define three groups of funds according to the number of competitors in the fund's family. We estimate a regression similar to model (1), but interact family ranks with three dummies (D_{small}, D_{medium}, and D_{large}) instead of just two. The first group consists of funds with fewer than 21 competitors in the family (small), the second group of funds with 21–31 competitors (medium), and the third group of funds with more than 31 competitors (large). The results are shown in Table 4.

The findings in column A of Table 4 support our earlier findings. The influence of the family rank for the small-family group is significantly positive, while it is significantly negative for the large-family group. Both coefficients are statistically significant at the 1% level. In the middle group, we find no significant influence, because here large and small families are mixed together. Therefore, in this group some managers behave strategically, while others do not. Again, the results also hold if segment-fixed effects and family-fixed effects are included (columns B and C).

4. Influence of Fund Characteristics

We now examine the influence of individual fund characteristics on the behavior of fund managers in the family tournament. We use a dummy approach to study the influence on tournament behavior. We use two dummies to indicate to which of two groups a manager's fund belongs. If a fund belongs to group 1 (e.g., single-managed funds), D_1 equals 1. Accordingly, if the fund belongs to group 2 (e.g., team-managed funds), D_2 equals 1. The dummies equal zero, if the fund does not belong to the respective group. Our model then reads

$$\begin{aligned}\Delta\sigma_{it} = {} & b_{l,1}^F R_{it}^F \cdot D_l \cdot D_1 + b_{l,2}^F R_{it}^F \cdot D_l \cdot D_2 \\ & + b_{s,1}^F R_{it}^F \cdot D_s \cdot D_1 + b_{s,2}^F R_{it}^F \cdot D_s \cdot D_2 \\ & + b_{l,1}^S R_{it}^S \cdot D_l \cdot D_1 + b_{l,2}^S R_{it}^S \cdot D_l \cdot D_2 \\ & + b_{s,1}^S R_{it}^S \cdot D_s \cdot D_1 + b_{s,2}^S R_{it}^S \cdot D_s \cdot D_2 \\ & + b_1 \Delta\sigma_{it}^m + b_2 \sigma_{it}^{(1)} + e_{it}. \end{aligned} \tag{2}$$

Table 4
Three family-size groups

Independent variable	Description of independent variable	(A)	(B)	(C)	Number of observations
$R_{it}^F \cdot D_{\text{large}}$	Family rank in families with ≥31 funds	−0.0194*** (−3.3421)	−0.0191*** (−3.3361)	−0.0177*** (−2.0072)	4,708
$R_{it}^F \cdot D_{\text{medium}}$	Family rank in families with ≥21 and < 31 funds	0.0005 (0.9585)	0.0009 (0.0886)	0.0009 (0.0938)	1,022
$R_{it}^F \cdot D_{\text{small}}$	Family rank in families with <21 funds	0.0088*** (3.3420)	0.0099*** (3.8552)	0.0056** (2.0432)	4,591
Time-fixed effects		Yes	Yes	Yes	
Segment-fixed effects		No	Yes	Yes	
Family-fixed effects		No	No	Yes	
R^2		72.21%	73.20%	75.31%	

This table contains estimates of b_l^F and b_s^F from model (1) as shown in the main text for three groups of funds according to family size. The model is estimated with time-fixed effects (column A), with time- and segment-fixed effects (column B), and with time-, segment-, and family-fixed effects (column C), respectively. Funds from the segments growth, growth and income, and small company growth are examined for the years 1993 to 2001. The dependent variable in all regressions is the fund's change of risk between the first and second part of a year. The independent variables are the rank of this fund in its family, R_{it}^F, and in its segment, R_{it}^S, the change in segment volatility, $\Delta\sigma_{it}^m$, and the risk of the fund in the first part of the year, $\sigma_{it}^{(1)}$. R_{it}^F and R_{it}^S are multiplied with either D_{small}, D_{medium}, or D_{large}, which take on the value one if a fund has less than 21, between 21 and 30, or more than 30 competitors within its family, respectively. For the sake of brevity we only report the estimates for the influence of the family rank. The last column presents the number of observations in each group. The number of observations is 10,321. t-values are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level (one-tailed tests), respectively.

This allows us to study whether the tournament behavior of managers of funds belonging to group 1 differs from the behavior of managers of funds belonging to group 2.[22] In the remainder of this section, we show that the main results generally hold for all groups of fund managers: They engage in the family tournament and fund managers in small families behave strategically ($b_{l,1}^F > 0$, $b_{l,2}^F > 0$), while fund managers in large families behave nonstrategically ($b_{s,1}^F < 0$, $b_{s,2}^F < 0$).

4.1 Single-managed versus team-managed funds

We start by analyzing the impact of the management structure on the behavior of fund managers in the family tournament. As mentioned above, managers might partly compete against themselves, if they manage multiple funds. Unfortunately, our data do not allow us to identify all funds managed by each manager. However, it is likely that team members of funds are at the same time members of many different teams, because they often specialize in specific tasks they can fulfill in many different funds. Thus, because team members are usually part of several funds, the probability that they compete against themselves in the family tournament is higher than for single-managed funds. Such

[22] Alternatively, we also run our base model (1) for subsamples consisting of group 1 and 2, respectively, according to the various characteristics we examine. The results (not reported) agree with those using the dummy interaction approach.

Table 5
Management structure: single versus team-managed funds

Independent variable	Description of independent variable	Model (2)	Number of observations
$R_{it}^F \cdot D_l \cdot D_1$	Family rank in large families for single-managed funds	−0.0210*** (−2.6002)	2,962
$R_{it}^F \cdot D_l \cdot D_2$	Family rank in large families for team-managed funds	−0.0060 (−0.3566)	521
$R_{it}^F \cdot D_s \cdot D_1$	Family rank in small families for single-managed funds	0.0070*** (2.5791)	6,053
$R_{it}^F \cdot D_s \cdot D_2$	Family rank in small families for team-managed funds	0.0279*** (3.4895)	785

This table contains estimation results from model (2) as shown in the main text. Results for an estimation including time-fixed effects are presented. Funds from the segments growth, growth and income, and small company growth are examined. The dependent variable in all regressions is the fund's change of risk between the first and second part of a year. The independent variables are the rank of this fund in its family, R_{it}^F, and in its segment, R_{it}^S, the change in segment volatility, $\Delta\sigma_{it}^m$, and the risk of the fund in the first part of the year, $\sigma_{it}^{(1)}$. R_{it}^F and R_{it}^S are interacted with D_l or D_s, respectively. D_l (D_s) equals one if a fund belongs to a large (small) family, and zero otherwise. A family is classified as large if the number of funds in the family is not smaller than the mean number (i.e., 26). These variables are additionally interacted with D_1 or D_2, respectively. The dummy variable D_1 (D_2) equals one if a fund is single managed (team managed), and zero otherwise. For the sake of brevity we only report the estimates for the influence of the family rank. The number of observations is 10,321. The last column contains the number of observations for the different combinations of large/small families and single-managed/team-managed funds. t-values are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level (one-tailed tests), respectively.

competing incentives could lead to less pronounced risk taking of teams than of single managers in the family tournament.

To test this, we set the dummy D_1 (D_2) in model (2) equal to 1 if the fund is managed by a single manager (team), and equal to 0 otherwise. The results are presented in Table 5.[23]

We find a negative (positive) estimate for the influence of the family rank in large (small) families for single-managed funds as well as for team-managed funds. The influence of the family rank for single-managed funds is stronger than for team-managed funds in large families.[24]

4.2 Influence of the expense ratio

Gaspar, Massa, and Matos (2006) show that funds with high expense ratios are more likely to benefit from cross-fund subsidization than other funds, because the fund company earns the highest fee income from these funds. Thus, family tournament incentives for the first should be stronger than for the latter. Since large families are more likely to engage in cross-fund subsidization than small families (Guedj and Papastaikoudi (2005)), we expect the stronger incentives

[23] The results (not reported) additionally including segment-fixed and family-fixed effects are very similar.

[24] The results for the segment tournament (not reported) also suggest much weaker risk adjustment among teams than among single managers. For team-managed funds, only the coefficient for the influence of the segment rank in large families is significant at the 10% level, while the coefficient for small families is insignificant. For single-managed funds, both coefficients are positive and statistically significant at the 1% level.

Table 6
Fee structure: single versus multiple-class funds and high versus low expenses

Independent variable	Description of independent variable	Model (2)	Number of observations
	Panel A: Single-class versus multiple-class funds		
$R_{it}^F \cdot D_l \cdot D_1$	Family rank in large families for single-class funds	−0.0232* (−1.6250)	1,075
$R_{it}^F \cdot D_l \cdot D_2$	Family rank in large families for multiple-class funds	−0.0172** (−2.0141)	2,408
$R_{it}^F \cdot D_s \cdot D_1$	Family rank in small families for single-class funds	0.0119*** (3.5001)	3,212
$R_{it}^F \cdot D_s \cdot D_2$	Family rank in small families for multiple-class funds	0.0054* (1.3669)	3,626
	Panel B: High-expense versus low-expense funds		
$R_{it}^F \cdot D_l \cdot D_1$	Family rank in large families for high-expense funds	−0.0395* (−1.5884)	335
$R_{it}^F \cdot D_l \cdot D_2$	Family rank in large families for low-expense funds	−0.0164 (−0.9425)	740
$R_{it}^F \cdot D_s \cdot D_1$	Family rank in small families for high-expense funds	0.0059* (1.3864)	1,786
$R_{it}^F \cdot D_s \cdot D_2$	Family rank in small families for low-expense funds	0.0227*** (4.0561)	1,426

This table contains estimation results from model (2) as shown in the main text. Results for an estimation including time-fixed effects are presented. Funds from the segments growth, growth and income, and small company growth are examined. The dependent variable in all regressions is the fund's change of risk between the first and second part of a year. The independent variables are the rank of this fund in its family, R_{it}^F, and in its segment, R_{it}^S, the change in segment volatility, $\Delta\sigma_{it}^m$, and the risk of the fund in the first part of the year, $\sigma_{it}^{(1)}$. R_{it}^F and R_{it}^S are interacted with D_l or D_s, respectively. D_l (D_s) equals one if a fund belongs to a large (small) family, and zero otherwise. A family is classified as large if the number of funds in the family is not smaller than the mean number (i.e., 26). These variables are additionally interacted with D_1 or D_2, respectively. In panel A, the dummy variable D_1 (D_2) equals one if a fund is a single-class fund (multiple-class fund), and zero otherwise. In panel B, D_1 (D_2) equals one if a fund's expense ratio is above (not above) the median expense ratio, and zero otherwise. For the sake of brevity we only report the estimates for the influence of the family rank. The regression in panel B is run on a subsample that consists only of single share class funds. The number of observations is 10,321 in panel A and 4,287 in panel B. The last column contains the number of observations for the different combinations of large/small families and single/multiple class (high/low expense ratio) funds. t-values are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level (one-tailed tests), respectively.

due to cross-fund subsidization in favor of high-expense funds to mainly play a role in large families.

To analyze the influence of the expense ratio in isolation, we concentrate on single-class funds. This reduces the number of fund-year observations to 4,287. To examine whether this limitation of the sample influences the results, we start by comparing the risk-taking behavior of managers of single-class and multiple-class funds. We set D_1 (D_2) equal to 1 if the fund is a single-class (multiple-class) fund, and 0 otherwise. Estimation results are presented in panel A of Table 6.

The results show that there is no notable difference in the behavior of managers of single- and multiple-class funds. We now examine differences between those managers who run single-class funds with above-median expense ratios ($D_1 = 1$) and those managers who run single-class funds with below-median

expense ratios ($D_2 = 1$). Estimation results are presented in panel B of Table 6. In large families, risk adjustment for low-expense funds is less pronounced than risk adjustment for high-expense funds. This supports our argument above. However, in small families risk adjustment for low-expense funds is more pronounced than risk adjustment for high-expense funds. Thus, the expense ratio has no clear impact on the behavior of the fund managers in the family tournament.

4.3 Further characteristics: Market segment, age, size, and trading activity

In unreported tests, we also examine the impact of further fund characteristics such as the market segment a fund belongs to, its size, its age, whether it levies a load or not, and its trading activity on fund managers' behavior in the family tournament. We find that the difference in the behavior of fund managers from large and small families is not driven by these fund characteristics. However, there is some evidence that the extent of risk adjustment is larger among large-cap funds than among small-cap funds.

5. Temporal Stability

We now explore the temporal stability of the results. We run yearly regressions, and we also conduct rolling three-year regressions to get less noisy estimates. Results of the yearly regressions are presented in panel A of Table 7.

Despite the large amount of noise in the yearly regressions, we find at least one significant coefficient with the correct sign for the family tournament in each year. We conduct a test based on Fisher's method, which allows us to combine the results from l different years into one test statistic (see Fisher, 1948).[25] Under the null hypothesis, the p-values from the individual tests are equally distributed on the (0,1) interval. Then, $\lambda = -2 \cdot \sum_{l=1}^{l} \ln p_l$ has a χ^2 distribution with $2l$ degrees of freedom, where l is the number of individual tests.[26] This statistic can be used for an overall evaluation of the null hypothesis based on the l yearly tests. The null that the coefficient in column 1 of Table 7 is greater than zero can be rejected at the 5% significance level, and the null that the coefficient in column 2 is smaller than zero can be rejected at the 1% significance level.

Results for the rolling three-year regressions are presented in panel B of Table 7. For the family tournament, all coefficients of the subperiods are of the expected signs and most of them are significant. These results indicate that the behavior of fund managers in the family tournament is very stable over time.

Turning to the coefficients from the segment tournament in panels A and B of Table 7, we find different coefficients. Whereas the results from the earlier

[25] We thank an anonymous referee for suggesting this additional test to assess the temporal stability of the results.

[26] This test is often called Pearson's p_λ test (e.g., Rao, 1952, p. 44). Strictly speaking, it can only be applied for independent tests. The results mentioned in Note 17 suggest that this is a reasonable assumption.

Table 7
Temporal stability of results

Year	$R_{it}^F \cdot D_l$	$R_{it}^F \cdot D_s$	$R_{it}^S \cdot D_l$	$R_{it}^S \cdot D_s$	N
		Panel A: Yearly regressions			
1993	−0.0451**	0.0045	0.0685***	0.0272***	604
	(−1.9241)	(0.8967)	(3.0138)	(4.6015)	
1994	−0.0119	0.0079**	−0.0031	−0.0229***	707
	(−0.4177)	(2.3023)	(−0.1076)	(−5.5636)	
1995	0.0122	0.0057*	−0.0187	−0.0058*	842
	(0.6384)	(1.4671)	(−0.9638)	(−1.2861)	
1996	−0.0164	0.0075*	0.0138	−0.0122**	933
	(−0.6321)	(1.4205)	(0.5272)	(2.0376)	
1997	−0.0181*	−0.0054	0.0401***	0.0203***	1,137
	(−1.4715)	(−1.1494)	(3.0990)	(3.9185)	
1998	−0.0021	0.0135**	0.0598***	0.0403***	1,316
	(−0.0954)	(1.7198)	(2.5748)	(4.6363)	
1999	−0.0476**	0.0126*	0.0582***	0.0071	1,479
	(−2.1496)	(1.3357)	(2.4755)	(0.6880)	
2000	−0.0321*	0.0193**	0.0438**	−0.0009	1,564
	(−1.4432)	(1.9434)	(1.8976)	(−0.0920)	
2001	0.0051	0.0125**	0.0393***	0.0339***	1,739
	(0.4148)	(2.0098)	(2.8744)	(4.6132)	
		Panel B: Rolling three-year regressions			
1993–1995	−0.0278**	0.0072***	0.0200*	−0.0098***	2,153
	(−2.0172)	(2.8709)	(1.4478)	(3.4060)	
1994–1996	−0.0112	0.0077***	−0.0016	−0.0200***	2,482
	(−0.7757)	(2.9563)	(−0.1112)	(−6.7269)	
1995–1997	−0.0131*	0.0042*	0.0157*	−0.0035	2,912
	(−1.2874)	(1.5141)	(1.4869)	(−1.1197)	
1996–1998	−0.0006	0.0067*	0.0262**	0.0170***	3,386
	(−0.0500)	(1.6136)	(1.9647)	(3.6905)	
1997–1999	−0.0155	0.0074*	0.0420***	0.0216***	3,932
	(−1.2438)	(1.5248)	(3.1958)	(4.0825)	
1998–2000	−0.0314***	0.0163***	0.0548***	0.0133**	4,359
	(−2.3761)	(3.0098)	(3.9590)	(2.2605)	
1999–2001	−0.0211**	0.0150***	0.0395***	0.0093**	4,782
	(−1.9752)	(3.0428)	(3.4791)	(1.7494)	

This table contains estimates from regressions for yearly subsamples for each year 1993–2001 (panel A) as well as rolling three-year pooled regressions including time-fixed effects (panel B). Funds from the segments growth, growth and income, and small company growth are examined. The dependent variable in all regressions is the individual fund's change of risk between the first and second part of a year measured as the annualized standard deviation of a fund's monthly returns in the second part of the year less that of the first part of the year. The independent variables are the rank of this fund in its family, R_{it}^F, and in its segment, R_{it}^S, the change in segment volatility, $\Delta\sigma_{it}^m$, and the risk of the fund in the first part of the year, $\sigma_{it}^{(1)}$. R_{it}^F and R_{it}^S are interacted with D_l or D_s, respectively. D_l (D_s) equals one if a fund belongs to a large (small) family, and zero otherwise. A family is classified as large if the number of funds in the family is not smaller than the mean number (i.e., 26). For the sake of brevity, we only report the estimates for the influence of the family rank and the segment rank. t-values are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% level (one-tailed tests), respectively. The last column contains the number of observations N.

years of the sample indicate nonstrategic behavior in many cases, we find strong evidence for strategic behavior in the later years. If we restrict our analysis to the first half of our sample (1993 to 1996), the overall influence of the segment rank is negative (results not reported). This confirms the results of earlier studies (e.g., Brown, Harlow, and Starks, 1996; Elton, Gruber, and Blake, 2001). In the later years (1997–2001), the coefficient becomes significantly positive. These later years also drive the results for the whole sample in Table 2. There is

a clear change in the behavior of fund managers in the segment tournament. This suggests that the behavior of fund managers in the segment tournament is sample specific, while the behavior in the family tournament is more stable over time.

The finding of time-variant behavior of fund managers in the segment tournament is consistent with the results in Kempf, Ruenzi, and Thiele (2007). These authors examine temporal changes in the behavior of fund managers in the segment tournament and argue that midyear losers in their segment should only increase risk more than winners if employment risk is low. In contrast, if employment risk is high, midyear losers should not increase risk in order to minimize the probability of a further deterioration of their position and eventually of being dismissed. The first half of the sample is dominated by bull markets, where employment risk for fund managers is low, because aggregate inflows are high and many new funds are started. Thus, fund managers face a low risk of losing their job (and would have little trouble finding a new job as fund manager). In the second half of the sample, there are several bear market years, and employment risk for fund managers should thus be higher in this period.

6. Conclusion

In this paper, we study the intrafirm competition of fund managers. Our main contribution is to show that fund managers compete with the other fund managers of their own company for the best rank in the fund family. This offers a novel view on fund families. Funds of a family should not be viewed as coordinated entities as implicitly assumed in the literature so far. They should rather be seen as competitors in an intense intrafirm competition.

We show that fund managers engage in two tournaments. Besides the well-known Brown, Harlow, and Starks (1996) segment tournament, they also compete in a family tournament. They do so by adapting fund risk dependent on their midyear rank within their family. We also show that the risk-taking behavior of fund managers depends on the competitive situation they face. Midyear losers from large families increase risk more than winners do. In small families, the opposite behavior is observed: midyear winners increase risk more than losers do. This suggests that strategic interaction takes place in small-fund families, but not in large ones. The results are not driven by differences in individual fund characteristics, and they are stable over time. Furthermore, risk adjustment in the family tournament is more pronounced in large families than in small families, possibly due to less severe restrictions managers face in large families. Risk adjustment is also more pronounced among managers of single-managed funds and managers of funds with high-expense ratios in large families, which is consistent with the stronger risk adjustment incentives these managers face.

The results have implications for fund investors, fund families, and regulatory authorities. The risk adjustments in the family tournament are not carried out to

realize an optimal portfolio from the fund investors' point of view. Furthermore, they can cause considerable rebalancing costs. Thus, such behavior is likely not to be in the best interest of fund investors. Furthermore, engagement in the family tournament can not only adversely affect investors, but also the fund family itself. While managers mainly compete for inflows with managers from other families in the segment tournament, they compete with the other fund managers in the same family in the family tournament. Due to the uncoordinated behavior of individual fund managers within their family considerable agency costs might arise, which would not be in the best interest of the fund family. The results indicate that teams in large families engage less in the family tournament. Possibly fund families are aware of this, which might explain the recent trend towards team management in the fund industry (e.g., Massa, Reuter, and Zitzewitz, 2006; Bär, Kempf, and Ruenzi, 2006). Finally, James and Isaac (2000) show that tournament behavior can lead to irrational price formation in asset markets. Therefore, regulatory authorities also should show an interest in the tournament behavior of fund managers.

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