Contractual and Tournament Incentives in the Mutual Fund Industry*

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ABSTRACT

I study the impact of contractual incentives on the behaviour of mutual fund managers in annual tournaments. I show that linear contracts as opposed to concave ones induce managers to make larger risk adjustments in response to their relative performance ranks. I argue that contracts with linear fee structure directly translate the convex relationship between past fund returns and fund size into a convex relationship between past performance and managerial pay, whereas concave contracts distort this relationship and make it less convex. I also demonstrate that higher fee rates encourage fund managers to engage into annual tournaments, as they strengthen the connection between fund size and managerial pay in comparison with lower fee rates. The above results are robust to controlling for funds characteristics, such as fund size, age and turnover, as well as year- and style-fixed effects.

Key words: Compensation, risk-taking
JEL classification: G11, G23, M52.

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I analyze mutual fund managers' risk taking decisions in response to the compensation and tournament incentives they face. Because new money flows into the fund are convexly related to its past performance, mutual fund managers compete against each other in annual tournaments for the largest increase in fund size. I show that the extent to which fund managers engage in annual tournaments strongly depends on the relationship between their compensation and fund size. In particular, linear relationship (as opposed to concave) between managerial pay and fund size and the higher percentage of assets under management (AUM) paid as managers' remuneration lead to the larger managerial engagement into annual tournaments.

Brown, Harlow, and Starks (1996) are the first ones to examine the risk shifting behaviour of mutual fund managers in annual tournaments and show that fund managers adjust their funds' risk exposure depending on their midyear performance rank. More specifically, by manipulating their funds' risk, managers of funds with good interim performance try to preserve their superior position and fund managers of midyear "losers" attempt to catch up with the "winners." One of the key assumptions generating this effect is that an increase in fund size results in a proportional increase in managerial pay.[1] Whereas in the majority of the US mutual funds incentive contracts are indeed based on the total assets managed by fund managers, the characteristics of those contracts substantially vary across funds, which may in turn affect the behaviour of fund managers. This study extends the previous literature, by showing that heterogeneity of incentive contracts explains the tournament behaviour of mutual funds.

I focus on actively-managed mutual funds in the United States, in which advisory/ managerial compensation is defined as a function of the total assets under management. There are two fee structures in my sample. Around 60 percent of funds have a linear fee structure. The remaining 40 percent of funds have a concave fee structure, under which the marginal advisory fee decreases with fund size. Managers of mutual funds with a concave fee structure have a lower incentive to increase the AUM than managers of funds with a linear fee structure. In addition to having a linear versus a concave fee structure, funds also differ in the % of AUM they pay their managers. Lower fee rates lead to smaller incentives to increase the fund size due to a lower increase in absolute managerial pay. Thus, I hypothesize that managers of mutual funds with a linear fee structure and higher fee rates are more likely to participate in annual tournaments and to adjust their risk trying to beat the competing funds in terms of performance.

I test the above hypotheses using the data on the advisory fee structure from the N-SAR filings for actively managed funds for the period from 2002 to 2011 and obtain the following results: First, I show that fund managers with linear contracts are significantly more likely to chase new money flows and engage in annual fund tournaments than managers with concave contracts. The risk adjustments made by fund managers under linear contracts are almost twice as high as those made by fund managers under concave contracts; I define risk adjustments as changes in fund's total

[1] I assume that the compensation contract of the fund manager tracks – at least in the contract shape that one of the investment advisor.

volatility in the second part of a year as compared to the first part of a year. I find that once the effects of both contract shape and contract slope are taken into account, in funds with linear contracts risk-shifting is 39% higher than in funds with concave contracts.

Second, I show that funds with higher fee rates tend to engage more intensively in yearly fund tournaments and alter their risk more in response to their relative performance. A one-standard deviation increase in the fee rate raises the risk change to performance rank sensitivity by 33.5%. This effect is higher in bear markets, when expected returns are negative and managers of funds with high effective rates face larger payment decrease than managers of funds with low effective rates. It is also significantly more pronounced when mutual funds with extremely high and low performance are compared, for example the top and bottom deciles in terms of style-adjusted performance.

Third, I demonstrate that the above results are robust to controlling for funds characteristics, such as fund size, age, turnover, and management style (team- vs. single-managed) as well as year- and style-fixed effects. I also show that the effect of fund size on managerial appetite for annual tournaments decreases once I control for contractual characteristics. On the contrary, turnover significantly affects risk adjustments for top- and bottom-performing funds and results in greater engagement in yearly tournaments only for midyear winners and midyear losers, not for funds, with average performance.

The rest of the paper is organized as follows. Section I presents the intuition, develops the hypotheses and describes the literature contribution. The data used in the empirical analysis are described in Section II, and the methodology is discussed in Section III. In Section IV I present and discuss the results, and Section V concludes.

I. Advisory contracts and mutual fund tournaments

A. Intuition and hypotheses

Mutual fund investors chase high returns and disproportionally invest into the top-performing funds, which results in a convex relationship between past performance and consecutive fund growth (Chevalier and Ellison (1997); Sirri and Tufano (1998); Fant and O'Neal (2000); Lynch and Musto (2003), and Huang, Wei, and Yan (2007)). Funds which earn the highest returns by the end of a calendar year experience the largest new money inflow during the subsequent year, whereas poorly performing funds does not appear to be penalized with an equivalent money outflow. This convex relationship creates tournament incentives for mutual fund managers, where the winners get the largest increase in the assets under management.

The theoretical literature shows that in such tournament context, the optimal response of a fund manager to its interim performance is an adjustment of the portfolio risk (Taylor (2003); Acker and Duck (2006); Basak and Makarov (2012)). More specifically, by manipulating their funds risk, managers of funds with good interim performance try to preserve their superior position and fund managers of midyear losers try to catch up with the winners. One of the key assumptions here is that an increase in fund size results in a considerable increase in managerial pay such that mutual fund managers have a strong incentive to attract new money flows and increase their assets under management.

I argue that managerial willingness to participate in annual tournaments strongly depends on the shape of the relationship between fund size and managerial compensation. While the previous literature implicitly assumes that fund managers are compensated with a fixed fee based on the assets under management, there is significant variation in contractual arrangements between funds and their managers/advisors in the US mutual fund industry. In particular, the Investment Advisers Act of 1940 allows two types of contracts between mutual funds and their investment advisors: (i) a linear contract with a constant marginal fee rate and (ii) a concave contract with a marginal fee rate decreasing in the fund's total net assets. A linear advisory contract directly translates the convex relationship between past fund returns and fund size into a convex relationship between past performance and managerial pay, whereas a concave contract distorts that relationship and makes it less convex. Moreover, the higher the contract concavity, the more it distorts the relationship between the past fund performance and managerial compensation and the more it restrains the tournament participation.

The strength of the relationship between the fund size and the managerial compensation directly affects managers' willingness to compete in annual tournaments. Fee rates are important incentives along with the contract shape: even under linear contracts lower fee rates result in a lower increase in absolute pay in case of growing fund size. Lower fee rates decrease managerial incentives to achieve good performance and to increase the fund size. Consequently, managers of funds with lower fee rates are less likely to participate in yearly tournaments and to adjust their risk in order to beat the competing funds in terms of performance. In the most extreme case, the compensation does not depend on the fund size. Then, managers have no reason to attract additional flows, especially in presence of diseconomies of scale, which may erode future returns (Chen, Hong, Huang, and Kubik (2004)) or if they expect only a limited number of stocks to achieve high expected returns and it is costly to scale up their portfolios without affecting security prices.

Based on the above intuition I formulate the two main hypotheses.

H1. Linear contracts, as opposed to concave contracts, encourage mutual fund managers participation in annual tournaments.

H2. Higher effective rates induce greater engagement of mutual funds into annual tournaments.

B. Related literature

My research is related to three strands of literature. First, I extend the literature on tournaments in the mutual-fund industry (Brown et al. (1996); Koski and Pontiff (1999); Busse (2001); Taylor (2003); Chen and Pennacchi (2009); Acker and Duck (2006); Basak and Makarov (2012)). The empirical literature mostly attributes the differences in tournament behaviour of mutual funds to the differences in flows to performance sensitivity, affected by fund characteristics, such as age and size (see also Chevalier and Ellison (1997)). Several papers consider employment and reputation incentives of fund managers as one of the reasons to participate in annual tournaments (Kempf, Ruenzi, and Thiele (2009); Bär, Kempf, and Ruenzi (2011)). Furthermore, theoretical papers assume that fund managers are paid a fixed percentage of the assets under management such that their pay is directly linked to the fund performance (Taylor (2003); Chen and Pennacchi (2009); Basak and Makarov (2012)). However, in the real world the relationship between mutual fund size and managerial pay is not always linear, the percentage of the assets under management paid as managerial compensation varies across funds, and managers with different contracts compete against each other in annual tournaments. Here I contribute to the literature by showing that fund managers' engagement in these tournaments depends on their compensation contracts.

Second, this study also contributes to the literature on the advisory contracts in the mutual fund industry (Coles, Suay, and Woodbury (2000); Deli (2002); Deli and Varma (2002); Kuhnen (2004); Warner and Wu (2011)) and their effects on the managerial decision making (Almazan, Brown, Carlson, and Chapman (2004); Dass, Massa, and Patgiri (2008); Massa and Patgiri (2009)). Coles et al. (2000) were the first ones to use advisory contract characteristics as a proxy for incentives in the mutual fund industry. They analyze the determinants of the premium of closed-end funds, and find that the fund premium is positively related to the advisory fee rate but not affected by the concavity of the advisory contract. Massa and Patgiri (2009) demonstrate that in comparison with concave contracts and low fee rates, linear contracts and high fee rates induce fund managers to take more risk, resulting in lower survival probability and higher risk-adjusted returns. Moreover, by analyzing funds holdings, Dass et al. (2008) show that higher incentives help mutual fund managers to overcome their tendency to herd. While the above papers suggest positive effects of high incentives contracts on the shareholder wealth, I demonstrate that these contracts can be detrimental as they aggravate fund risk shifting in annual tournaments, which harms fund performance (Huang, Sialm, and Zhang (2011)).

Third, this study contributes to the literature on incentives and risk taking. While many studies (Carpenter (2000); Rajgopal and Shevlin (2002); Ross (2004); Coles, Daniel, and Naveen (2006); Chen, Steiner, and Whyte (2006); Kadan and Swinkels (2008)) investigate whether different incentive schedules (linear vs. non-linear) induce agents to take more or less risk, only few focus on the effect of incentives on risk changes (Eisdorfer (2008); Low (2009)). Low (2009) studies the decrease in firm risk after an increase in takeover protection and finds that managers with low share of equity-based compensation are more likely to decrease firm risk and harm shareholders value than managers with high share of equity-based compensation. Eisdorfer (2008) studies the risk shifting in financially distressed firms and shows that higher ownership induces managers to invest in risk-increasing negative-NPV projects beneficial for shareholders due to limited liability. These papers consider the effect of rare and pronounced events on risk shifting in corporations, while I study the routine annual behaviour of mutual funds. Moreover, while the previous literature mostly shows that tighter alignment of managerial incentives to those of shareholders increases shareholder wealth, my results suggest that it is not always the case for mutual funds.

II. Data

The data come from two main sources: the fund advisory contract data are from the US Securities and Exchange Commission (SEC) Electronic Data Gathering, Analysis, and Retrieval (EDGAR) database, whereas the fund characteristics and performance data are from the Center for Research in Security Prices (CRSP) Survivor Bias Free US Mutual Fund database. The latter includes information on funds' monthly net returns, total net assets under management, investment objectives, and fund name (which is used to match the two databases as there is no common indicator variable). Only funds mostly investing in US equity and funds with investment styles "Growth", "Growth and Income", and "Small Cap" (following the CRSP Style code for funds' investment objectives) are included in this analysis. As CRSP separately reports data for each share class within a single fund, the total net assets of a fund are computed by summing the total net assets in each share class. The value-weighted averages across all the share classes are calculated for the net returns and turnover.

Fund advisory contract data are from the NSAR forms, which provide detailed information on contractual arrangements between the regulated investment companies and their advisors. As all regulated investment companies, mutual funds are required to file two NSAR forms annually: NSAR-A, which covers the first six months of a fund's fiscal year and NSAR-B, covering the whole fiscal year. To minimize loss of information due to incomplete or erroneous filing, I have downloaded both the NSAR-A and B filings,[2] filled in by mutual funds over the period 2002 to 2011. This yields a total of 232,272 filings. Then, the detailed information on advisory compensation contracts is combined into one database.[3]

I consider only those advisory contracts in which advisory compensation is based on total net assets of a fund. As not all investment companies have an advisory contract and some contracts contain mistakes and missing values, the number of contracts for which adviser compensation can be identified is 145,532 (which is much smaller than the total number of filings that can be downloaded). Finally, the advisory database is matched by fund name with the Survivor Bias Free US Mutual

[2]Previous literature uses only NSAR-B forms (Coles et al. (2000); Deli (2002); Deli and Varma (2002); Almazan et al. (2004); Kuhnen (2004); Warner and Wu (2011); Dass et al. (2008); Massa and Patgiri (2009))

[3]More specifically, I wrote two Python scripts: one to download the data from the EDGAR website and another one to extract and combine the information from separate files into the final database.

Fund database.[4] For the investment styles "Growth", "Growth and Income", "Income", "Medium Cap", and "Small Cap"[5], 68.3 percent of the funds are matched with their advisory contracts. The total number of exact matches obtained amounts to 26,055, which in many cases includes two matches per year for both NSAR-A and NSAR-B forms. Due to absence of return data for some funds, the final sample contains 15,305 yearly observations of mutual fund data (or 2,824 distinct funds) starting in 2002. Table I exhibits the summary statistics of the sample.

The total number of funds increases from 1,517 in 2002 to 1,658 in 2007 and then decreases to 1,246 in 2011. The drop in the number of funds is largely due to the crisis period when many funds disappeared or changed their names as a result of a merger. As the name changes are reported at different times and in different forms in the CRSP database and the NSAR forms, the number of fund name-based matches between the two databases slightly decreases as of 2008. It should be noted that my main results do not change if I exclude the period 2008-2011 from the analysis.

The average age of the funds gradually increases over the sample period, probably because young funds are more likely to close down during the crisis. From 2002 to 2007, the mean TNA per fund rises from $648.2 to $1,293.4 million and then decreases to $1,049.2 million in 2011. The average turnover is slightly lower in recent years of my sample period than in earlier years. The last two columns of Table I document that there is significant cross-year variation in the median fund's cumulative annual return and volatility, measured as the annualized standard deviation of monthly returns.

A. Advisory contracts

Typical contracts for fund advisors define advisory fee as a percentage of the market value of the fund's total net assets. Depending on the relation between the fund's total net asset and the fee rate paid as advisory compensation, two main types of advisory contracts are defined: linear and concave in funds assets. Under a linear contract the marginal fee rate stays constant, whereas under a concave contract the marginal fee rate decreases with fund size. A typical description of a concave advisory contract is provided in the *American Mutual Fund annual report for the year that ended on October 31, 2012*:

"CRMC, the fund's investment advisor, is the parent company of American Funds Distributors,® Inc. ("AFD"), the principal underwriter of the fund's shares, and American Funds Service Company® ("AFS"), the fund's transfer agent.

Investment advisory services – The fund has an investment advisory and service agreement with CRMC that provides for monthly fees accrued daily. These fees are based on a series of decreasing annual rates beginning with 0.384% on the first $1 billion of daily net assets and decreasing to 0.225% on such assets

[4] As in the CRSP database fund names consist of two parts: actual fund name and share class names which precedes it. Share class names are removed before matching.

[5] I consider only actively-managed funds and use Strategic Insight Objective Code (si_obj_cd) objective classification from CRSP to form investment styles.

in excess of $21 billion. For the year ended October 31, 2012, the investment advisory services fee was $53,283,000, which was equivalent to an annualized rate of 0.254% of average daily net assets."

Many funds do not provide any information in their annual reports or prospectuses about the contractual arrangements between the fund and its advisor. However, even the above example conceals many details. For example, the American Mutual Fund's NSAR filings for 2012 show that this advisor's contract had seven thresholds and eight matching marginal fee rates, as illustrated in Figure 1.

Table II describes the characteristics of advisory contracts. In the final sample 60% of all funds have linear contracts, which is somewhat smaller than the percentage reported in the literature (Warner and Wu (2011)). But apparently this lower number reflects the situation in a later time period: I show that the proportion of funds with linear contract has decreased over time: from 68.5% in 2002 to 56.5% in 2011. The effective rate, or the applicable marginal fee rate paid by funds to their advisors, is higher under linear contracts than under concave contracts: on average advisors receive 0.723% of AUM under a linear contract and 0.700% under a concave one. This difference is most profound in the early years but almost disappears in the later years of the sample period. The mean number of thresholds specified under concave contracts is close to 3 (the median number of thresholds is 2), so the majority of the funds with concave contracts have 3 or less thresholds.

While the difference in the average effective fee rates between funds with linear and concave contracts is only 2.27pb, it is significant (t-statistic = 5.02, p-value = 0.0000). Moreover, this difference is comparable to the average changes in fee rates under concave contracts. Under concave contracts, the average decrease in fee rate is 4.74bp when a fund reaches its next threshold in terms of AUM (on average, the fee rate drops from 70.04bp to 65.30bp). Given the median distance between thresholds of $500 million, this fee reduction results in $3.3 million loss in compensation. In my sample, I observe that funds with concave contracts beat a threshold in about 5% of all the observations. So on average, as their assets under management grow, mutual fund managers may expect their compensation to grow by $165,000 less under concave contracts than under linear contracts.

III. Methodology

To define a fund i as a midyear loser or winner, the rank R^1_{it} of its performance in the first half of year t is calculated as compared to the other funds with the same investment style. The performance ranks are based on the fund's net cumulative fund returns achieved by funds by the end of the first half of the year. The ranks are calculated for each investment style and each year separately to control for different incentives and market conditions faced by mutual funds within investment styles and at different points in time. The ranks are normalized to be equally distributed between 0 and 1, and the best-performing fund within its investment style is assigned the rank number one. Funds with a R^1_{it} below 0.5 are classified as midyear losers, while funds whose R^1_{it} is equal to or above 0.5 are classified as midyear winners.

Mutual funds are assumed to engage in yearly tournaments and to adjust their risk taking depending on their performance rank R^1_{it} within their investment style. According to hypothesis 1, funds with linear contracts are expected to exhibit a higher sensitivity to their performance rank than funds with concave contracts. To test this hypothesis the fund's rank is interacted with a dummy, which equals one if the fund has a linear advisory contract and zero otherwise. The empirical model is specified the following way:

$$\Delta\sigma_{it} = a + b \cdot R^1_{it} + c_1 \cdot D^{Lin}_{it} + c_2 \cdot D^{Lin}_{it} \cdot R^1_{it} + h_1 \cdot \sigma^1_{it} + h_2 \cdot \Delta\sigma^m_{it} + \epsilon_{it} \tag{1}$$

The dependent variable, $\Delta\sigma_{it} := \sigma^2_{it} - \sigma^1_{it}$, is the change in volatility of the fund's return from the first to the second part of the year, where σ^1_{it} (σ^2_{it}) is the annualized standard deviation of monthly returns of fund i in the first (second) part of year t. The same measure of the fund risk adjustment was previously used in the literature (see Koski and Pontiff (1999); Kempf and Ruenzi (2008); Kempf et al. (2009)). R^1_{it} is the rank of fund i in its investment style based on the fund's net cumulative returns in the first half of year t. The dummy variable D^{Lin}_{it} takes the value one if fund i has a linear advisory contract in year t, and 0 otherwise. σ^1_{it} is the risk of fund i in the first part of year t. The median change in the standard deviation is calculated for each investment style and each year separately and is denoted by $\Delta\sigma^m_{it} := (\sigma^2_{it} - \sigma^1_{it})^m$.[6]

While my main measure of contract linearity is a dummy for a linear contract vs. a concave contract, I also employ two other measures: Coles' linearity measure and conditional linearity. Coles' linearity measure, CLM_{it}, is taken from the study by Coles et al. (2000) and it is equal to the difference between the last (lowest) and the first (highest) marginal fee rates divided by the effective marginal fee rate. CLM_{it} is zero for linear contracts and negative for concave contracts, increasing in absolute value as the difference between the last and the first marginal fee rates increases. Conditional linearity, CL_{it}, is equal to the ratio of the last (lowest) marginal fee rate and the effective marginal fee rate; CL_{it} is equal to one for funds with linear contracts or for funds with concave contracts and fund size above the last threshold, when the effective rate is equal to the last marginal fee rate; CL_{it} is between zero and one otherwise. It captures the expected decrease in managerial compensation conditional on fund growth, whereas the Coles' linearity measure characterizes the shape of the contract in general. When the above two measures are employed, as well as their interaction terms with the performance rank, equation 1 becomes:

$$\Delta\sigma_{it} = a + b \cdot R^1_{it} + c_1 \cdot CLM_{it} + c_2 \cdot CLM_{it} \cdot R^1_{it} + h_1 \cdot \sigma^1_{it} + h_2 \cdot \Delta\sigma^m_{it} + \epsilon_{it} \tag{2a}$$

$$\Delta\sigma_{it} = a + b \cdot R^1_{it} + c_1 \cdot CL_{it} + c_2 \cdot CL_{it} \cdot R^1_{it} + h_1 \cdot \sigma^1_{it} + h_2 \cdot \Delta\sigma^m_{it} + \epsilon_{it} \tag{2b}$$

[6] Alternatively, the respective mean in the changes in the investment style risk can be calculated (instead of the median), but the results are not affected by this substitution.

To test whether funds with a higher fee rate are more sensitive to their performance rank (hypothesis 2), the fund's rank is interacted with fund's effective rate. The effective rate is equal to the applicable marginal fee rate at the end of the first half of the year; it is constant for linear contracts and decreases with the fund size for concave contracts. The empirical model 3 is then:

$$\Delta\sigma_{it} = a + b \cdot R^1_{it} + c_1 \cdot D^{Lin}_{it} + c_2 \cdot D^{Lin}_{it} \cdot R^1_{it} + d_1 \cdot ER^1_{it} + d_2 \cdot ER^1_{it} \cdot R^1_{it} + h_1 \cdot \sigma^1_{it} + h_2 \cdot \Delta\sigma^m_{it} + \epsilon_{it} \tag{3}$$

The dependent variable, $\Delta\sigma_{it}$, and control variables R^1_{it}, D^{Lin}_{it}, σ^1_{it}, and $\Delta\sigma^m_{it}$ are the same as in model 1. ER^1_{it} is fund's i effective rate at the end of the first half of year t.

The main explanatory variable of interest in models 1 and 3 is the fund's performance rank R^1_{it}. Significant coefficients b would suggest (in both models 1 and 3) that funds engage in yearly tournaments and subsequently adjust their risk taking. If midyear losers increase risk more than midyear winners, then both coefficients are expected to be negative. This behaviour is expected to be more pronounced in (i) funds with linear advisory contracts than in funds with concave advisory contracts and (ii) in funds with a high effective rate than in funds with low effective rate, so $c_2 < 0$ and $d_2 < 0$.

Adding $\Delta\sigma^m_{it}$ controls for the changes in the volatility within different investment styles. If the volatility of the fund's investment style changes for some exogenous reason, this will also affect the fund's risk taking. To control for potential mean reversion in funds' risk taking (Koski and Pontiff (1999); Kempf and Ruenzi (2008)) and implicit risk restrictions (Almazan et al. (2004)), the standard deviation in the first part of the year, σ^1_{it}, is included as a control variable into the regressions.

IV. Results

The central question of this paper is whether funds with different advisory contracts respond differently to their midyear performance rank. Table III compares funds with linear and concave advisory contracts in terms of their midyear cumulative net returns, midyear performance ranks, effective rates, fund size, age, turnover, and management style. All variables are measured at the end of the first half of the year, i.e. at the same time when performance ranks are calculated. The first two lines of Table III demonstrate that funds with linear and concave contracts are not significantly different in terms of midyear cumulative net returns and in terms of performance ranks.[7] So unlike Massa and Patgiri (2009), in my sample I do not find consistent evidence that the funds with linear contracts deliver superior performance in comparison with the funds with concave advisory contracts. Note that in contrast with net returns, return ranks provide better

[7] Note that the difference in mid-year performance rank medians is only slightly significant; see the second line of Table III.

grounds for comparing fund performance. When return ranks are employed, the comparison results are more precise, because return ranks are calculated within the same investment styles and for the same market conditions and they are less affected by outliers.

Whereas funds with linear advisory contracts do not achieve a higher performance, they are still very different from those with concave advisory contracts. According to Table III, funds with linear contracts tend to have higher effective rates, be smaller and younger, and have higher turnover in comparison with funds with concave advisory contracts. These observations are in line with the previous literature (Deli (2002); Massa and Patgiri (2009); Warner and Wu (2011)). Funds with linear contracts are also less likely to be team-managed than funds with concave contracts. As a fund's age, size, turnover, and management style are likely to affect its risk-taking behaviour in yearly tournaments (Chevalier and Ellison (1997); Kempf et al. (2009)), it is important to include these control variables.

A. *The impact of contract shape*

The estimation results of equation 1 are presented in Table IV. In Panel A, I consider the first six months as the first part of the year, whereas in Panel B I take the first seven months. As it may take some time for fund managers to learn their interim rankings and to adjust their portfolios subsequently, I employ the 7-5 months-specification as a robustness check. During the second part of the year (six or five months respectively), fund managers can then adjust the riskiness of their portfolios. The (6, 6 months) and (7, 5 months)-partitions are the most commonly used in the literature since Brown et al. (1996).

To isolate the effect of the fund performance rank on the changes in the fund's risk, I first estimate equation 1 while excluding the D_{it}^{Lin} and $R_{it}^{1} \cdot D_{it}^{Lin}$ terms and using a pooled regression approach. The results are reported in Table IV, Panel A, column (1): I find that the coefficient b is negative and significant which confirms that mutual funds engage in annual tournaments and that midyear winners increase in the second part of the year their risk to a lesser extent than midyear losers. The coefficient is also economically meaningful: the best fund managers increase risk by 0.22% points less than the worst fund managers. Given that the average risk change, $\Delta\sigma_{it}$, is equal to 0.49%, the best fund managers increase risk by 45% less than the worst fund managers. So the difference in risk shifting between the best- and worst-performing funds is significant in both statistical and economical terms.

The coefficients for the control variables, h_1 and h_2, have the expected signs. The significantly negative coefficient h_1 indicates that mean reversion occurs in the funds' volatility and that funds with relatively high (low) risk in the first part a year tend to decreases (increase) their risk in the second part of the year. The positive coefficient h_2 indicates that the individual risk change of a fund positively depends on the risk change of all the funds in the same investment style. These results are in line with those of Koski and Pontiff (1999) and Kempf and Ruenzi (2008).

Column (2) presents the estimation results of equation 1 which includes a dummy for linear advisory contract, D_{it}^{Lin}, and the interaction term $R_{it}^{1} \cdot D_{it}^{Lin}$. The coefficient c_1 is not different from zero, which implies that linear contracts *per se* do not force fund managers to take more or less risk in the second half of the year. In contrast, the interaction term's coefficient, c_2, is statistically significant at the 1% level and equals -0.11% points. Moreover, the coefficient for the performance rank, b, decreases in absolute value, down to -0.0016. I find that in funds with linear contracts risk-shifting is almost 70% higher than in funds with concave contracts.[8] Thus, linear advisory contracts encourage fund managers to participate in yearly tournaments and change their risk to a greater extent in response to the fund's midyear relative performance.

In columns (3) and (4), time and investment style fixed effects are added to the model, which slightly increases coefficient c_2 in absolute value, but does not affect the main findings. Column (5) presents the results for the panel regressions with random effects and column (6) shows the estimation results of equation 1 for the panel regression with fixed effects. In both models the error term ϵ_{it} is decomposed into two parts: an unobservable individual fund effect, α_i and a random part, u_{it}, uncorrelated with explanatory variables. Under the null hypothesis of the Hausman test, the unobservable individual fund effects, α_i, are not correlated with the explanatory variables. Then, both fixed- and random-effects models are consistent, but the random-effects model is asymptotically more efficient. When individual effects, α_i, are correlated with the explanatory variables, then only the fixed-effects model is consistent. The Hausman's χ^2-statistic equals 2090.2, which confidently rejects the null hypothesis at 1% level (p-value = 0.0000) and indicates that the preferred model is fixed-effects model.[9]

In the fixed-effects panel model presented in column (6), the coefficient c_2 is negative and significant. Though the coefficient c_2 is larger in absolute value than that the one in the pooled regression model presented in column (4), the economic effect slightly decreases due to the coefficient b inflation. In funds with linear contracts risk-shifting is almost 58% higher than in funds with concave contracts.[10] Thus, the risk change to performance rank sensitivity of funds with linear advisory contracts is significantly higher than that of funds with concave advisory contracts.

Columns (7) and (8) present estimation results of equations 2a and 2b, where alternative measures of contract linearity, Coles' linearity measure, CLM_{it}^{1}, and conditional linearity, CL_{it}^{1}, are used. Both equations are estimated using a fixed-effects panel regression model (in both cases, the fixed-effects model is preferred by Hausman test to a random-effects model). The interaction terms in both models are negative and significant, suggesting that as contract linearity increases, fund managers' participation in annual tournaments also increases.

[8] In funds with concave contracts, the best fund managers ($R_{it}^{1} = 1$) increase their funds' risk by 0.16 percentage points less than the worst fund managers ($R_{it}^{1} = 0$). In contrast, in funds with linear contracts, the best fund managers increase their funds' risk by 0.27 percentage points less than the worst fund managers.

[9] Fixed-effects model also allows us to address potential omitted variable bias.

[10] In funds with linear advisory contracts, the best fund managers ($R_{it}^{1} = 1$) increase risk by 0.52 percentage points less than the worst fund managers ($R_{it}^{1} = 0$), whereas in funds with concave advisory contracts, the best fund managers increase risk by 0.33 percentage points less than the worst fund managers.

I repeat the above analysis using the (7, 5 months) specification, where the first seven months are chosen as the first part of the year and during the last five months fund managers can adjust their risk. It may take fund managers/advisors some time to learn their relative ratings and to react accordingly. Performance ranks are still calculated in the middle of the year to mimic the ranks calculated by the rating agencies and available to the public and fund managers/advisors.

Panel B of Table IV presents the estimation results of equations 1 in (7, 5 months) specification, where σ^1_{it} (σ^2_{it}) is the annualized standard deviation of monthly returns of fund i in the first seven (last five) months of year t. The main results stay virtually the same as in the (6, 6 month) specification. The coefficient c_2 is negative and significant in columns (2)-(6), which indicates a higher risk change to performance rank sensitivity of funds with linear advisory contracts. Inclusion of time- and investment style-fixed effects does not affect the coefficients of interest (see columns (3) and (4)). Finally, columns (5) and (6) present the results for the panel regressions with random and fixed effects, respectively. Hausman test gives χ^2-statistic equal to 1555.36 (p-value = 0.0000), which indicates that a fixed-effects model ought to be used. So, according to the final model for the (7, 5 months) specification (see column (6)) in funds with linear contracts, risk-shifting is 2.5 times higher than in funds with concave contracts.[11] Columns (7) and (8) present the estimation results for equations 2a and 2b with alternative measures of contract linearity. In general, the results are similar to those for the (6, 6 months) specification.

B. The impact of contract slope

The estimation results of equation 3 are presented in Table V; Panels A and B show the results for the (6, 6 months) and (7, 5 months) specifications respectively. The main explanatory variables are fund's i effective rate at the end of the first half of year t, ER^1_{it}, and the interaction term $R^1_{it} \cdot ER^1_{it}$. In column (1) only R^1_{it}, ER^1_{it}, and $R^1_{it} \cdot ER^1_{it}$ are included in the estimation model. The coefficient for the interaction term $R^1_{it} \cdot ER^1_{it}$ is negative and significant at 1% level in both (6, 6 months) and (7, 5 months) specifications, indicating that funds with different effective rates exhibit a different risk change to performance rank sensitivity. More specifically, one standard deviation increase in effective rate increases risk shifting by 40%.[12]

In columns (2)-(4) different measures of contract linearity are added to the regression: the dummy for the linear contract, the Coles' linearity measure, and the conditional linearity, and their interaction terms with the performance rank. I find that the coefficient for the effective rate stays almost the same. Moreover, the effect of contract linearity on fund managers risk shifting is similar to the one found above. To calculate the marginal effect of the performance rank, R^1_{it}, for funds

[11] In funds with linear contracts, the best fund managers increase risk by 0.45 percentage points less than the worst fund managers, in contrast with 0.18 percentage points in funds with concave contracts.

[12] Given the average effective rate of 0.71%, the average risk shifting equals 0.43 percentage points. If the effective rate increases by one standard deviation to 0.99%, then risk shifting becomes 0.60 percentage points which implies a 39.5% increase.

with linear and concave advisory contracts, I take into account the difference in average effective rates between the two groups of funds (see column (2), Panel A). I find that once the effects of both contract shape and contract slope are taken into account, in funds with linear contracts risk-shifting is 39% higher than in funds with concave contracts.[13] A one standard deviation increase in effective rate raises the risk change to performance rank sensitivity by 33.5% for all funds. Thus, a one standard deviation increase in effective rate and switch from a concave contract to a linear one cause approximately the same shift in risk change to performance rank sensitivity, both in terms of the direction and magnitude.

If in some investment style groups, all funds have higher effective rates and at the same time exhibit higher risk change to performance rank sensitivity, then the above analysis may reflect spurious correlation between effective rate and risk sensitivity. To address this potential problem, I repeat the above analysis using the effective rate rank as the main explanatory variable instead of mere effective rate. The results are reported in columns (5)-(8) of Table V, where ER^1_{it} is the rank of fund i in its investment style based on the fund's effective rate at the end of the first half of year t. The main findings are not affected by this substitution: the coefficient for the interaction term between the performance rank and the effective rate rank is negative and significant. So higher effective rates induce fund managers to engage into annual tournaments to a greater extent.

C. *The impact of fund characteristics*

As I demonstrated in Table III that funds with linear and concave advisory contracts are different, I control for those differences in order to test the robustness of the above findings. I conduct a multivariate analysis of fund manager risk-shifting behaviour and extend equation 3 by adding several potentially relevant fund characteristics and their interaction terms with the fund performance rank:

$$\begin{aligned}\Delta\sigma_{it} = a + b \cdot R^1_{it} + c_1 \cdot D^{Lin}_{it} + c_2 \cdot D^{Lin}_{it} \cdot R^1_{it} + d_1 \cdot ER^1_{it} + d_2 \cdot ER^1_{it} \cdot R^1_{it} \\ + e_1 \cdot \ln(tna)_{it} + e_2 \cdot ln(tna)_{it} \cdot R^1_{it} \\ + f_1 \cdot age_{it} + f_2 \cdot age_{it} \cdot R^1_{it} \\ + g_1 \cdot turnover_{it} + g_2 \cdot turnover_{it} \cdot R^1_{it} \\ + k_1 \cdot single_{it} + k_2 \cdot single_{it} \cdot R^1_{it} \\ + h_1 \cdot \sigma^1_{it} + h_2 \cdot \Delta\sigma^m_{it} + \epsilon_{it}\end{aligned} \tag{4}$$

where $\ln(tna)_{it}$ is the natural logarithm of fund i total net assets; age_{it} and $turnover_{it}$ are the age

[13] In funds with concave contracts, midyear winners increase their risk by 0.40 percentage points less than midyear losers, because the marginal effect is calculated at the mean value of effective rate for funds with concave advisory contracts: $c_2 \times D^{Lin}_{it} + d_2 \times ER^{Mean}_{it} = -0.15 \times 0 - 0.58 \times 0.700 = -0.40$. In funds with linear advisory contracts, midyear winners increase their risk by 0.57 percentage points less than midyear losers, because the marginal effect is calculated at the mean value of effective rate for funds with concave advisory contracts: $c_2 \times D^{Lin}_{it} + d_2 \times ER^{Mean}_{it} = -0.15 \times 1 - 0.58 \times 0.723 = -0.57$.

and turnover of fund i; $single_{it}$ is a dummy variable, which equals 1 for single-managed funds and 0 for team-managed funds. I include interaction terms of the funds' features with their performance ranks in order to control for a potential possibility that funds with different characteristics exhibit different risk changes to performance rank sensitivity. The estimation results of model 4 are summarized in Table VI.

Small funds may be more responsive to their performance ranks because the market costs of risk adjustments are lower: they can rebalance their portfolios with a lower price impact in comparison with large funds (Chen et al. (2004), Pollet and Wilson (2008)). Chevalier and Ellison (1997) find that younger funds benefit more from their recent superior performance in terms of new money inflow than older funds. Moreover, Almazan et al. (2004) show that younger funds are less likely to be constrained in their investment practices, such as borrowing of money, short selling, investing in derivatives, etc. In this way, young funds have higher incentives and broader possibilities to participate in annual tournaments in comparison with older funds. Bär et al. (2011) find that teams of fund manager are less likely deviate from their funds investment style and to have high industry concentration within their portfolios than single managers. In other words, management teams follow less extreme investment strategies than single managers do. So I expect funds with a single manager to engage in annual tournaments to a greater extent than funds with a team of managers. Finally, fund managers who revise and rebalance their portfolios more frequently may find it easier to change their risk exposure, than fund managers who follow a relatively passive strategy. Moreover, active changes in risk unavoidably trigger an increase in turnover, which would be easier to hide when the initial turnover level is already high. So funds with higher turnover, signle-managed funds, smaller, and younger funds are more likely to adjust their risk in response to their performance rank.

To test the above predictions, I first estimate a curtailed version of equation 4 with the natural logarithm of fund's TNA, fund age, fund turnover, the *single* dummy and their interaction terms with the performance rank and no controls for contractual characteristics. The estimation results are reported column (1), where I do not control for the contractual characteristics. I find that in accordance with the results of (Brown et al. (1996); Goriaev, Palomino, and Prat (2001); Chen and Pennacchi (2009)), smaller funds and funds with higher turnover tend to engage more in yearly tournaments: coefficient e_2 is positive and significant, and coefficient g_2 is negative and significant. However, I do not find support for the above-mentioned hypotheses that younger funds and single-managed funds tend to risk shift more than older and team-managed funds.

The estimation results of a full version of equation 4 are presented in columns (2)-(7). The effects of advisory contract shape and slope stay essentially the same and their economical significance is close to that one found above. Panel B of Table VI presents the estimation results of equation 4 in the (7, 5 months) specification. The main findings stay virtually the same. Thus, the difference in risk change to performance rank sensitivity between funds with linear and concave contracts remains significant even in the presence of control variables capturing the funds' characteristics.

When contractual characteristics are accounted for, the effect of fund size on risk shifting behaviour decreases: the coefficient e_2 is smaller in models (2)-(7) than that one in model (1) with no controls for contractual characteristics. However, the effect of fund turnover does not change when I control for contractual characteristics. Both coefficients for turnover, g_1 and the interaction term, g_2 are significant, but have different signs: g_1 is positive and g_2 is negative. Moreover, the coefficient for the interaction term is about twice as large in absolute value as the coefficient for the turnover itself, which indicates that for the funds with an average midyear performance, there is almost no effect of turnover on the risk change. However, for midyear losers and midyear winners the effect of turnover is much more pronounced and has opposite signs. For midyear losers higher turnover results in higher risk, whereas for midyear winners higher turnover leads to a risk decrease in the second half of the year. In other words, turnover significantly affects risk adjustments only in cases of remarkably high or low fund midyear performance and results in greater engagement in yearly tournaments only for midyear winners and midyear losers, not for average performing funds.

D. Temporal stability of the results

I run yearly regressions as well as two-year subsample regressions (in order to reduce the noise in the estimates). Panel A of Table VII report the estimation results of two-year subsample regressions. The coefficients c_2 and d_2 of the interaction terms between fund advisory contracts shape and slope and fund's performance rank, $D_{it}^{Lin} \cdot R_{it}^1$ and $ER_{it} \cdot R_{it}^1$, are almost always negative and significant (see Panel A). In the individual year regressions (see Panel B), the coefficients c_2 and d_2 mostly stay negative but become insignificant in some cases. To test the simultaneous significance of the coefficients, I use a test from Fisher (1925) and combine the results from N=10 different t-tests into one test statistic. Under the null hypothesis, the p-values from the individual tests are equally distributed on the (0,1) interval. Then, the test statistic $-2 \cdot \sum_{n=1}^{N} \ln(p_n)$ has a χ^2 distribution with $2N$ degrees of freedom. The null that the coefficient c_2 in column (4) is greater than zero can be rejected at the 5% significance level ($\chi^2_{(df=20)} = 33.30$; p-value = 0.0313) and the null the coefficient d_2 in column 6 is greater than zero can be rejected at the 1% significance level ($\chi^2_{(df=20)} = 72.73$; p-value = 0.0000). I run the same analysis for the effective rate rank, Coles' linearity measure, and conditional linearity as explanatory variables and also for the (7, 5 months) specification and obtain very similar results (not reported here for the sake of brevity).

E. Contractual incentives over business cycles

The effect of contractual incentives on manager risk-taking behaviour is likely to depend on the market conditions and available investment opportunities. During bull markets, the aggregate flows into the mutual fund industry are high (Karceski (2002)) and mutual fund managers can expect a substantial increase in their pay if they reach top performance and subsequently attract a large portion of the new aggregate flows. This potential increase in compensation is larger for managers of funds with linear contracts and high effective rates, so in up markets they are more likely to engage in annual tournaments than managers of funds with concave contracts and low effective rates.

During bear markets, the aggregate flows into the mutual fund market are low[14]; therefore even for top-performing funds, the increase in fund manager compensation is likely to be low. Moreover, on average managers can expect to have negative returns, which directly reduce fund size and diminish their compensation. When fund size shrinks, fund manager compensation decreases faster for funds with concave contracts than for funds with linear ones, given the same effective rate. In other words, while under linear contracts, fund managers face a constant rate of payment reduction in case of money outflow and/or negative returns, under concave contracts, they are punished by an increasing rate of payment reduction. Moreover, higher effective rates also lead to larger managerial compensation decreases in case of negative returns or money outflows. Therefore, linear contracts and high effective rates are more likely to induce midyear winners to decrease their risk in down markets than in up markets.

To test the above-mentioned predictions, I use the same definitions of bull and bear markets as Kempf et al. (2009). The proxy for the stock market return is the value-weighted index of all securities traded at the NYSE, Amex, and Nasdaq stock exchanges. If the midyear cumulative market return is positive, then the market state is defined as a bull market; if the midyear market return is negative, the market state is defined as a bear market. According to this definition, my sample years 2005, 2008, and 2010 are years with bear market performance, for which $D_t^{Bear} = 1$, and 2002-2004, 2006, 2007, 2009, and 2011 are years with bull market performance, $D_t^{Bull} = 1$. To examine how advisory contract characteristics affect fund risk-shifting behaviour over business cycles, I take the interaction of funds' rank performance during bear and bull markets with dummies for a linear contract and with effective rate. The equation 1 then becomes:

$$\begin{aligned}\Delta\sigma_{it} = a &+ b_1 \cdot R_{it}^1 \cdot D_t^{Bull} + b_2 \cdot R_{it}^1 \cdot D_t^{Bear} \\ &+ c_1 \cdot D_{it}^{Lin} + c_2 \cdot D_{it}^{Lin} \cdot R_{it}^1 \cdot D_t^{Bull} + c_3 \cdot D_{it}^{Lin} \cdot R_{it}^1 \cdot D_t^{Bear} \\ &+ d_1 \cdot ER_{it}^1 + d_2 \cdot ER_{it}^1 \cdot R_{it}^1 \cdot D_t^{Bull} + d_3 \cdot ER_{it}^1 \cdot R_{it}^1 \cdot D_t^{Bear} \\ &+ h_1 \cdot \sigma_{it}^1 + h_2 \cdot \Delta\sigma_{it}^m + \epsilon_{it}\end{aligned} \tag{5}$$

The estimation results are presented in Table VIII. First, I interact the performance ranks with dummies for bull and bear markets to test whether market conditions affect fund risk-shifting behaviour in general (see column (1)). I find that during bull markets fund risk-shifting is significantly more pronounced than during bear markets: coefficient b_1 is significantly larger in absolute

[14] During tough market conditions fund managers are more likely to work harder and accumulate experience faster than during favorable market conditions (see chapter **??** and also Kempf, Manconi, and Spalt (2013) for a detailed discussion). Urgency to concentrate on securing positive returns is also likely to divert managers' attention from their relative performance rankings and to discourage tournament participation.

value than coefficient b_2 (F-statistic$_{(1,12467)}$ = 673.03, p-value = 0.0000). These findings are in line with the results of Kempf et al. (2009), who argue that relative importance of compensation and employment incentives drives the difference in risk-shifting behaviour in bull and bear markets. In down markets, midyear losers decrease their risk relative to midyear winners in the second half of the year in order to prevent a further deterioration of the fund's performance and their potential job loss. In up markets, the employment risk is low and the compensation incentives become more relevant. In this case, midyear losers are likely to increase their risk relative to midyear winners in order to catch up with performance.

For the funds with linear advisory contracts and high effective rate, the compensation incentives are always more important, even during bear markets, than for the funds with concave advisory contracts and low effective rate. So, I expect that during bear market periods the effect of linear contracts and high effective rate will be more pronounced than during the bull market periods. Column (2) presents the estimation results for these predictions: although the coefficient c_3 is larger in absolute value than coefficient c_2, they are not statistically different from each other ($c_2 = -0.0017$, $c_3 = -0.0021$, F-statistic$_{(1,12461)}$ = 0.34, and p-value = 0.56). The effect of Coles' linearity measure on risk shifting has similar magnitude during bull and bear markets, though only the coefficient for $CLM_{it} \cdot R^1_{it} \cdot D^{Bull}_t$ is significant (see column (3)). Thus, the difference in risk shifting between managers of funds with linear and concave contracts is relatively stable over business cycles. The conditional linearity affects risk change to performance sensitivity only under bull market conditions (see column (4)), because it captures only expected decrease in marginal fee rate when a fund grows, not when it shrinks.

The estimation results in columns (2)-(4) also indicate that the difference in risk change to performance rank sensitivity between funds with high and low effective rate is larger during bear markets than during bull markets. Coefficients d_2 and d_3 are negative and significant, and d_3 is greater in absolute value than d_2 and the coefficients are statistically different from each other in all models (the lowest F-statistic$_{(1,12461)}$ is 10.48, p-value is 0.0012, see columns (2)-(4)).

In columns (5)-(7), instead of effective rate, effective rate rank is used as one of the key explanatory variables; this substitution does not affect the main findings. Hence, while the effect of contract shape on mutual fund manager tournament participation is relatively stables over business cycles, the effect of contract slope (effective rate) is more pronounced in down market than in up markets. Note also that once controls for the contractual incentives are introduced into the regression model (starting from model (2)), I do not find evidence for risk-shifting behaviour during bear markets anymore; the coefficient for $R^1_{it} \cdot D^{Bear}_t$ decreases in absolute value and becomes insignificant.This result suggests that it is mostly funds with linear contracts and funds with high effective fee rates which still engage in annual tournaments in times of down markets, whereas funds with concave contracts and relatively low effective fee rates shy away from tournament competition.

F. Effects of extreme performance

In this section I consider a discrete alternative to a continuous measure of fund's performance rank R^1_{it}, used in the previous sections. As I are mostly interested in risk-shifting behaviour of mid-year winners and mid-year losers, I introduce dummy variables for extreme fund performance. $D^{top25\%}_{it}$ ($D^{top10\%}_{it}$) equals 1 for 25% (10%) best performing funds within their investment style, based on their net cumulative returns in the first half of year t , and 0 otherwise. Dummy variables $D^{bottom25\%}_{it}$ and $D^{bottom10\%}_{it}$ are defined in the same way for 25% and 10% worst performing funds within their investment style. In equation 3 I substitute R^1_{it} variable with a pair of dummy variables to obtain the following equation:

$$\begin{aligned}\Delta\sigma_{it} = a &+ b_1 \cdot D^{bottomX\%}_{it} + b_2 \cdot D^{topX\%}_{it} \\ &+ c_1 \cdot D^{Lin}_{it} + c_2 \cdot D^{Lin}_{it} \cdot D^{bottomX\%}_{it} + c_3 \cdot D^{Lin}_{it} \cdot D^{topX\%}_{it} \\ &+ d_1 \cdot ER^1_{it} + d_2 \cdot ER^1_{it} \cdot D^{bottomX\%}_{it} + d_3 \cdot ER^1_{it} \cdot D^{topX\%}_{it} \\ &+ h_1 \cdot \sigma^1_{it} + h_2 \cdot \Delta\sigma^m_{it} + \epsilon_{it}\end{aligned} \tag{6}$$

Table IX presents the estimation results for equation 6, where $X = 25$ in models (1) and (2) and $X = 10$ in models (3) and (4). In columns (1) and (3) I include only dummy variables for the best and worst performing funds. I find that funds with poor performance tend to increase their risk taking in the second half of the year (the coefficient for $D^{bottomX\%}_{it}$ is positive and significant) and funds with good performance tend to decrease their risk taking in the second half of the year (the coefficient for $D^{topX\%}_{it}$ negative and significant) in comparison with the other funds. Note also that funds with more extreme performance (both good and bad) tend to engage in risk shifting to a greater extent than funds with moderately high and low net cumulative mid-year returns: coefficients b_1 and b_2 are larger in absolute value in model (3) than in model (1).

In models (2) and (4) I compare risk shifting behaviour of extreme mid-year winners and extreme losers under linear and concave contracts, and under high and low effective fee rates. The coefficient for $D^{Lin}_{it} \cdot D^{bottomX\%}_{it}$ is positive and the coefficient for $D^{Lin}_{it} \cdot D^{topX\%}_{it}$ is negative,[15] suggesting that extreme mid-year winners decrease their risk taking more and extreme mid-year losers increase their risk taking more under linear contracts than under concave contracts. I observe a similar effect for the effective fee rate: the coefficient $ER^1_{it} \cdot D^{bottomX\%}_{it}$ is positive and significant and the coefficient for $ER^1_{it} \cdot D^{topX\%}_{it}$ is negative and significant in both model (2) and (4). Thus, funds with extreme mid-year performance tend to risk-shift more under high effective fee rates than under low effective fee rates. Note also that the effect of extreme performance *per se* becomes insignificant (coefficients b_1 and b_2 decrease in absolute value and become insignificant in models (2) and (4)) once I add controls for funds' contractual characteristics, contract shape and slope.

[15]The coefficients are significant only in model (4)

V. Conclusion

I test how advisory contracts affect the manager behaviour in yearly tournaments in the US mutual fund industry. Yearly tournaments among mutual funds arise because fund manager compensation is directly linked to the fund size and a convex relationship between past fund performance and future money inflow exists. However, the way this convex relationship is translated into managerial pay depends on the characteristics of the contracts between mutual funds and their advisors/managers. I show that funds with linear advisory contracts are more likely to participate in yearly tournaments and change their risk exposure in response to their midyear performance than their counterparts with concave advisory contracts. The reason is that because linear contracts preserve convexity while concave contracts distort it. Furthermore, I demonstrate that advisory contracts with higher effective rates increase funds' tendency to engage in yearly tournaments because they strengthen the connection between fund size and managerial compensation in comparison with lower effective rates. The effect of contractual characteristics on mutual fund manager tournament participation is more pronounced during bear markets than during bull markets. It persists in the presence of fund characteristics controls, such as fund size, age, turnover, and management style.

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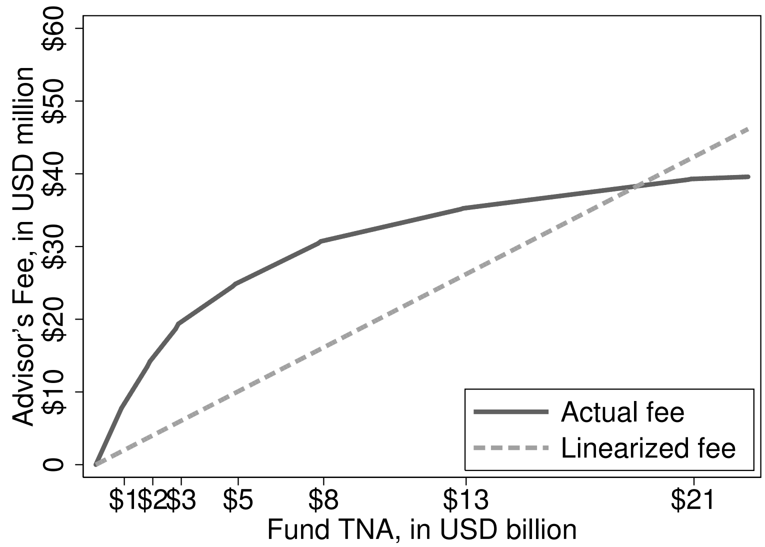

Figure 1. An example of a concave advisory contract

The figure shows the concave relationship between fund size and advisor's fee, based on the advisory contract between American Mutual Fund and CRMC, the fund's investment advisor, 2012. The contract has seven thresholds equal to \$1, \$2, \$3, \$5, \$8, \$13, and \$21 billion and eight matching fee rates equal to 0.384%, 0.330%, 0.294%, 0.270%, 0.252%, 0.240%, 0.230%, and 0.225% respectively.

Table I Fund characteristics

The table presents the summary statistics of the sample funds for the period 2002 to 2011. The sample consists of US equity funds with these styles: "Growth", "Growth and Income", "Income", "Medium Cap", and "Small Cap". It contains observations after matching the CRSP Survivor-Bias Free US Mutual Fund Database and the N-SARA and N-SARB filings from the US SEC EDGAR database. For each sample year, I show fund counts, the average age, the mean total net assets (TNA), the mean turnover ratio, the median annual return, and the funds' median annual return volatility.

Year	# of funds	Average age (in years)	Mean TNA (in $m)	Mean turnover (in %)	Median return (in %)	Median st. deviation (in %)
2002	1,517	10.19	648.17	106.80	−22.18	19.96
2003	1,532	10.72	892.39	98.91	31.23	12.74
2004	1,540	11.21	1,046.13	87.17	12.22	10.23
2005	1,560	11.44	1,047.75	90.00	6.63	10.48
2006	1,603	11.93	1,100.02	86.06	13.43	8.98
2007	1,658	12.02	1,293.38	93.12	6.07	10.72
2008	1,618	12.32	794.52	106.93	−37.75	24.87
2009	1,564	12.59	1,005.22	83.70	30.77	22.29
2010	1,467	13.40	1,155.49	75.00	17.50	20.33
2011	1,246	13.95	1,049.18	72.67	−1.91	18.69
Total	15,305	11.94	1,025.57	90.50	9.62	15.37

Table II Contract characteristics

The table presents the summary statistics of the fund contracts for the sample period 2002 to 2011. For each sample year, I show fund counts, the percentage of funds with linear advisory contracts, the mean effective rate in basis points (for linear and concave contracts separately), and the mean number of thresholds for concave contracts.

Year	# of funds	Funds with linear	Linear contract	Concave contract	
			Effective rate, in bp	Effective rate, in bp	Mean # of thresholds
2002	1,517	68.49	77.29	67.18	2.85
2003	1,532	66.91	75.46	68.15	2.94
2004	1,540	59.87	74.54	71.30	2.97
2005	1,560	56.22	72.51	70.45	2.99
2006	1,603	56.33	71.87	70.17	3.01
2007	1,658	55.97	70.62	69.72	3.13
2008	1,618	55.75	68.84	70.38	3.08
2009	1,564	57.48	69.20	70.79	3.07
2010	1,467	56.58	70.76	70.60	3.05
2011	1,246	56.50	70.22	70.58	3.11
Total	15,305	58.99	72.31	70.04	3.03

Table III Funds with linear and concave advisory contracts

The table compares the funds with linear advisory contracts and those with concave ones in terms of their midyear performance, midyear performance rank, effective rate, fund size, age, and turnover. Fund midyear return is the net cumulative fund return achieved by fund i by the end of the first half of year t. The performance rank R^1_{it} is based on the fund's midyear return and calculated for each investment style and each year separately. The ranks are normalized to be equally distributed between 0 and 1, with a fund performing the best within its investment style being assigned the rank number one. ER^1_{it} is fund's i effective rate at the end of the first half of year t. tna_{it} is fund total net assets, in \$m; age_{it} is fund age, in years; $turnover_{it}$ is turnover of fund i, in%; $single_{it}$ is a dummy variable, which equals 1 for single-managed funds and 0 for team-managed funds. Sd stands for standard deviation. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.

Variable	Linear contract, 9,029 obs.			Concave contract, 6,276 obs.			t-test on the equality of means		Non-parametric test on the equality of medians	
	mean	median	sd	mean	median	sd	t-statistic	p-value	χ^2	p-value
Midyear return, in %	4.58	6.30	19.13	4.27	5.87	17.87	1.04	0.301	1.50	0.220
R^1_{it}	0.510	0.511	0.290	0.500	0.499	0.283	1.59	0.112	3.30*	0.096
ER^1_{it}	0.723	0.750	0.302	0.700	0.700	0.230	5.02***	0.000	128.29***	0.000
tna_{it}	515.9	105.6	1879.1	1681.7	336.8	6921.0	15.23***	0.000	825.48***	0.000
age_{it}	9.39	7.00	8.89	15.60	11.00	15.62	31.21***	0.000	609.37***	0.000
$turnover_{it}$	103.2	61.0	235.3	82.0	63.0	75.4	6.90***	0.000	2.83*	0.093
$single_{it}$	0.314	0.000	0.464	0.282	0.000	0.450	4.23***	0.000	-	-

Table IV Fund risk shifting and advisory contract shape

The table presents the estimation results for equations 1 (columns (1)-(6)), 2a (column (7)) and 2b (column (8)). The dependent variable $\Delta\sigma_{it}^{1}$ is change in risk taking by fund i in the second part of year t in comparison with the first part of the year. R_{it}^{1} is the rank of fund i in its style based on the fund's net cumulative returns in the first half of year t. D_{it}^{Lin} is a dummy variable, which equals 1 if fund i has a linear contract in year t and 0 otherwise. In columns (7) and (8) CLM_{it} and $CL_{i}t$ are used as alternative measures of contract linearity. CLM_{it} is Coles' linearity measure equal to the difference between the last (lowest) and the first (highest) marginal fee rates divided by the effective marginal fee rate. CL_{it} is conditional linearity and it equals the ratio of the last (lowest) marginal fee rate and the effective marginal fee rate. σ_{it}^{1} is risk of fund i in the first part of year t. $\Delta\sigma_{it}^{m}$ is median change in style volatility. Columns (1)-(4) present the results for the pooled regressions; columns (6)-(8) present the results for the panel regressions. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.

Panel A. The dependent variable, σ_{it}^{66}, is change in risk taking by fund i in the last 6 months in comparison with the first 6 months of year t.

	Pooled regression				Panel regression			
Independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
R_{it}^1	-0.0022***	-0.0016***	-0.0016***	-0.0018***	-0.0026***	-0.0033***	-0.0049***	0.0035
	(0.0004)	(0.0005)	(0.0005)	(0.0005)	(0.0004)	(0.0004)	(0.0004)	(0.0028)
D_{it}^{Lin}		0.0004	0.0007*	0.0006*	0.0006	0.0000		
		(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0005)		
$D_{it}^{Lin} \cdot R_{it}^1$		-0.0011*	-0.0014**	-0.0015***	-0.0017***	-0.0019***		
		(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)		
CLM_{it}							0.0028*	
							(0.0015)	
$CLM_{it} \cdot R_{it}^1$							-0.0053***	
							(0.0017)	
CL_{it}								0.0070***
								(0.0023)
$CL_{it} \cdot R_{it}^1$								-0.0084***
								(0.0030)
σ_{it}^1	-0.1799***	-0.1800***	-0.3948***	-0.4614***	-0.5963***	-0.7555***	-0.7552***	-0.7552***
	(0.0131)	(0.0131)	(0.0214)	(0.0224)	(0.0177)	(0.0170)	(0.0170)	(0.0170)
$\Delta\sigma_{it}^m$	0.9304***	0.9304***	0.8576***	0.6872***	0.6141***	0.5119***	0.5115***	0.5117***
	(0.0072)	(0.0072)	(0.0203)	(0.0237)	(0.0223)	(0.0215)	(0.0216)	(0.0215)
Time-Fixed Effects	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Style-Fixed Effects	No	No	No	Yes	Yes	Yes	Yes	Yes
Fund-Fixed Effects	No	No	No	No	No	Yes	Yes	Yes
R2	0.85	0.86	0.87	0.87	0.91	0.91	0.91	0.91
Obs.	15,305	15,305	15,305	15,305	15,305	15,305	15,305	15,305

Panel B. The dependent variable, σ_{it}^{75}, is change in risk taking by fund i in the last 5 months in comparison with the first 7 months of year t.

	Pooled regression				Panel regression			
Independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
R_{it}^1	-0.0014***	-0.0000	-0.0001	-0.0003	-0.0011**	-0.0018***	-0.0041***	0.0067**
	(0.0004)	(0.0006)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0031)
D_{it}^{Lin}		0.0009**	0.0012***	0.0011**	0.0011**	0.0004		
		(0.0005)	(0.0004)	(0.0004)	(0.0004)	(0.0006)		
$D_{it}^{Lin} \cdot R_{it}^1$		-0.0024***	-0.0026***	-0.0026***	-0.0027***	-0.0027***		
		(0.0008)	(0.0008)	(0.0008)	(0.0007)	(0.0007)		
CLM_{it}							0.0024	
							(0.0019)	
$CLM_{it} \cdot R_{it}^1$							-0.0070***	
							(0.0021)	
CL_{it}								0.0072***
								(0.0026)
$CL_{it} \cdot R_{it}^1$								-0.0107***
								(0.0034)
σ_{it}^1	-0.1809***	-0.1809***	-0.4207***	-0.5033***	-0.6662***	-0.8405***	-0.8400***	-0.8402***
	(0.0120)	(0.0119)	(0.0195)	(0.0211)	(0.0160)	(0.0160)	(0.0160)	(0.0159)
$\Delta\sigma_{it}^m$	0.9498***	0.9499***	0.7539***	0.7537***	0.7015***	0.6351***	0.6349***	0.6346***
	(0.0055)	(0.0055)	(0.0216)	(0.0213)	(0.0212)	(0.0214)	(0.0215)	(0.0215)
Time-Fixed Effects	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Style-Fixed Effects	No	No	No	Yes	Yes	Yes	Yes	Yes
Fund-Fixed Effects	No	No	No	No	No	Yes	Yes	Yes
R2	0.84	0.84	0.85	0.86	0.90	0.90	0.90	0.90
Obs.	15,305	15,305	15,305	15,305	15,305	15,305	15,305	15,305

Table V Fund risk shifting and effective rate

The table presents the coefficients for equation 3, estimated using a panel model with fixed effects. The dependent variable $\Delta\sigma_{it}^{1}$ is change in risk taking by fund i in the second part of year t in comparison with the first part of the year. R_{it}^{1} is the rank of fund i in its style based on the fund's net cumulative returns in the first half of year t. D_{it}^{Lin} is a dummy variable, which equals 1 if fund i has a linear contract in year t and 0 otherwise. In columns (1)-(4), ER_{it}^{1} is fund's i effective rate at the end of the first part of year t; in columns (5)-(8), ER_{it}^{1} is the rank of fund i in its investment style based on the fund's effective rate at the end of the first part of year t. In columns (3), (4), (7), and (8) CLM_{it} and $CL_{i}t$ are used as alternative measures of contract linearity. CLM_{it} is Coles' linearity measure equal to the difference between the last (lowest) and the first (highest) marginal fee rates divided by the effective marginal fee rate. CL_{it} is conditional linearity and it equals the ratio of the last (lowest) marginal fee rate and the effective marginal fee rate. σ_{it}^{1} is risk of fund i in the first part of year t. $\Delta\sigma_{it}^{m}$ is median change in style volatility. Time- and style-fixed effects are included in all models. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.

Panel A. The dependent variable, σ_{it}^{66}, is change in risk taking by fund i in the last 6 months in comparison with the first 6 months of year t.

	ER_{it}^{1} is effective rate				ER_{it}^{1} is effective rate rank			
Independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
R_{it}^{1}	0.0002	0.0009	-0.0004	0.0077**	-0.0019***	-0.0012	-0.0025***	0.0058*
	(0.0011)	(0.0012)	(0.0011)	(0.0032)	(0.0006)	(0.0007)	(0.0007)	(0.0030)
D_{it}^{Lin}		-0.0001				-0.0001		
		(0.0005)				(0.0005)		
$D_{it}^{Lin} \cdot R_{it}^{1}$		-0.0015**				-0.0016**		
		(0.0006)				(0.0006)		
ER_{it}^{1}	0.0028	0.0027	0.0025	0.0032	0.0016	0.0017	0.0014	0.0018
	(0.0020)	(0.0020)	(0.0020)	(0.0020)	(0.0013)	(0.0013)	(0.0013)	(0.0013)
$ER_{it}^{1} \cdot R_{it}^{1}$	-0.0061***	-0.0058***	-0.0057***	-0.0060***	-0.0047***	-0.0043***	-0.0042***	-0.0046***
	(0.0016)	(0.0015)	(0.0016)	(0.0015)	(0.0013)	(0.0013)	(0.0013)	(0.0013)
CLM_{it}			0.0017				0.0020	
			(0.0016)				(0.0016)	
$CLM_{it} \cdot R_{it}^{1}$			-0.0030*				-0.0035**	
			(0.0017)				(0.0017)	
CL_{it}				0.0068***				0.0066***
				(0.0023)				(0.0023)
$CL_{it} \cdot R_{it}^{1}$				-0.0080***				-0.0082***
				(0.0030)				(0.0030)
σ_{it}^{1}	-0.7535***	-0.7539***	-0.7536***	-0.7536***	-0.7532***	-0.7536***	-0.7533***	-0.7533***
	(0.0167)	(0.0167)	(0.0167)	(0.0167)	(0.0168)	(0.0168)	(0.0168)	(0.0168)
$\Delta\sigma_{it}^{m}$	0.5119***	0.5117***	0.5115***	0.5114***	0.5132***	0.5130***	0.5128***	0.5129***
	(0.0215)	(0.0215)	(0.0215)	(0.0215)	(0.0216)	(0.0215)	(0.0216)	(0.0216)
R2	0.91	0.92	0.91	0.91	0.91	0.91	0.91	0.91
Obs.	15,305	15,305	15,305	15,305	15,295	15,295	15,295	15,295

Panel B. The dependent variable, σ_{it}^{75}, is change in risk taking by fund i in the last 5 months in comparison with the first 7 months of year t.

	ER_{it}^{1} is effective rate				ER_{it}^{1} is effective rate rank			
Independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
R_{it}^{1}	0.0016	0.0026**	0.0006	0.0112***	-0.0004	0.0007	-0.0012	0.0095***
	(0.0012)	(0.0013)	(0.0012)	(0.0035)	(0.0007)	(0.0008)	(0.0008)	(0.0033)
D_{it}^{Lin}		0.0003				0.0003		
		(0.0006)				(0.0006)		
$\cdot D_{it}^{Lin} \cdot R_{it}^{1}$		-0.0024***				-0.0024***		
		(0.0007)				(0.0007)		
ER_{it}^{1}	0.0024	0.0022	0.0022	0.0026	0.0017	0.0017	0.0015	0.0018
	(0.0020)	(0.0020)	(0.0020)	(0.0021)	(0.0014)	(0.0014)	(0.0014)	(0.0014)
$ER_{it}^{1} \cdot R_{it}^{1}$	-0.0065***	-0.0060***	-0.0058***	-0.0064***	-0.0056***	-0.0050***	-0.0049***	-0.0055***
	(0.0017)	(0.0016)	(0.0017)	(0.0017)	(0.0015)	(0.0014)	(0.0015)	(0.0014)
CLM_{it}			0.0014				0.0015	
			(0.0020)				(0.0020)	
$CLM_{it} \cdot R_{it}^{1}$			-0.0047**				-0.0050**	
			(0.0021)				(0.0021)	
CL_{it}				0.0067**				0.0068***
				(0.0027)				(0.0026)
$CL_{it} \cdot R_{it}^{1}$				-0.0102***				-0.0105***
				(0.0034)				(0.0034)
σ_{it}^{1}	-0.8381***	-0.8387***	-0.8383***	-0.8382***	-0.8376***	-0.8382***	-0.8378***	-0.8377***
	(0.0158)	(0.0158)	(0.0158)	(0.0158)	(0.0158)	(0.0158)	(0.0158)	(0.0158)
$\Delta\sigma_{it}^{m}$	0.6353***	0.6354***	0.6352***	0.6349***	0.6365***	0.6365***	0.6364***	0.6362***
	(0.0214)	(0.0214)	(0.0214)	(0.0214)	(0.0215)	(0.0214)	(0.0215)	(0.0214)
R2	0.91	0.92	0.91	0.91	0.91	0.91	0.91	0.91
Obs.	15,305	15,305	15,305	15,305	15,295	15,295	15,295	15,295

Table VI Fund risk shifting and fund characteristics

The table presents the coefficients for equation 4, estimated using a panel model with fixed effects. The dependent variable $\Delta\sigma_{it}^{1}$ is change in risk taking by fund i in the second part of year t in comparison with the first part of the year. R_{it}^{1} is the rank of fund i in its style based on the fund's net cumulative returns in the first half of year t. D_{it}^{Lin} is a dummy variable, which equals 1 if fund i has a linear contract in year t and 0 otherwise. In columns (1)-(4), ER_{it}^{1} is fund's i effective rate at the end of the first part of year t; in columns (5)-(7), ER_{it}^{1} is the rank of fund i in its investment style based on the fund's effective rate at the end of the first part of year t. CLM_{it} is Coles' linearity measure equal to the difference between the last (lowest) and the first (highest) marginal fee rates divided by the effective marginal fee rate. CL_{it} is conditional linearity and it equals the ratio of the last (lowest) marginal fee rate and the effective marginal fee rate. $\ln(tna)_{it}$ is natural logarithm of fund total net assets. age_{it} and $turnover_{it}$ is the age and turnover of fund i. *single* is a dummy variable, which equals 1 for single-managed funds and 0 for team-managed funds. σ_{it}^{1} is risk of fund i in the first part of year t. $\Delta\sigma_{it}^{m}$ is median change in style volatility. Time- and style-fixed effects are included in all models. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.

Panel A. The dependent variable, σ_{it}^{66}, is change in risk taking by fund i in the last 6 months in comparison with the first 6 months of year t.

		ER_{it}^{1} is effective rate			ER_{it}^{1} is effective rate rank		
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
R_{it}^{1}	-0.0134***	-0.0051	-0.0068**	-0.0002	-0.0075**	-0.0090***	-0.0023
	(0.0029)	(0.0034)	(0.0033)	(0.0043)	(0.0033)	(0.0031)	(0.0042)
D_{it}^{Lin}		-0.0003			-0.0003		
		(0.0005)			(0.0005)		
$D_{it}^{Lin} \cdot R_{it}^{1}$		-0.0013**			-0.0012**		
		(0.0006)			(0.0006)		
ER_{it}^{1}		0.0020	0.0019	0.0025	0.0011	0.0011	0.0012
		(0.0015)	(0.0015)	(0.0016)	(0.0013)	(0.0013)	(0.0013)
$ER_{it}^{1} \cdot R_{it}^{1}$		-0.0046***	-0.0044***	-0.0046***	-0.0033***	-0.0032***	-0.0034***
		(0.0011)	(0.0012)	(0.0011)	(0.0011)	(0.0011)	(0.0011)
CLM_{it}			0.0014			0.0015	
			(0.0019)			(0.0019)	
$CLM_{it} \cdot R_{it}^{1}$			-0.0026			-0.0029	
			(0.0020)			(0.0020)	
CL_{it}				0.0066***			0.0064***
				(0.0024)			(0.0024)
$CL_{it} \cdot R_{it}^{1}$				-0.0075**			-0.0076**
				(0.0030)			(0.0030)
$\ln(tna)_{it}$	-0.0003**	-0.0002	-0.0002	-0.0003*	-0.0002	-0.0002	-0.0003*
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
$\ln(tna)_{it} \cdot R_{it}^{1}$	0.0006***	0.0004**	0.0004**	0.0004***	0.0004**	0.0004**	0.0005***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
age_{it}	-0.0001	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
$age_{it} \cdot R_{it}^{1}$	-0.0000	-0.0001**	-0.0001**	-0.0001**	-0.0001**	-0.0001**	-0.0001**
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
$turnover_{it}$	0.0004***	0.0003***	0.0003***	0.0003***	0.0003***	0.0003***	0.0003***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
$turnover_{it} \cdot R_{it}^{1}$	-0.0010***	-0.0009***	-0.0009***	-0.0009***	-0.0009***	-0.0009***	-0.0009***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
$single_{it}$	-0.0001	-0.0002	-0.0002	-0.0001	-0.0002	-0.0002	-0.0001
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
$single_{it} \cdot R_{it}^{1}$	0.0002	0.0003	0.0003	0.0002	0.0002	0.0002	0.0002
	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)
σ_{it}^{1}	-0.7513***	-0.7509***	-0.7505***	-0.7505***	-0.7504***	-0.7500***	-0.7500***
	(0.0080)	(0.0080)	(0.0080)	(0.0080)	(0.0080)	(0.0080)	(0.0080)
$\Delta\sigma_{it}^{m}$	0.5118***	0.5116***	0.5115***	0.5112***	0.5128***	0.5126***	0.5125***
	(0.0177)	(0.0177)	(0.0177)	(0.0177)	(0.0177)	(0.0177)	(0.0177)
R2	0.91	0.92	0.92	0.92	0.92	0.92	0.92
Obs.	15,305	15,305	15,305	15,305	15,295	15,295	15,295

Panel B. The dependent variable, σ_{it}^{75}, is change in risk taking by fund i in the last 5 months in comparison with the first 7 months of year t.

		ER_{it}^1 is effective rate			ER_{it}^1 is effective rate rank		
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
R_{it}^1	-0.0130***	-0.0031	-0.0059	0.0026	-0.0049	-0.0075**	0.0012
	(0.0033)	(0.0039)	(0.0037)	(0.0049)	(0.0037)	(0.0036)	(0.0048)
D_{it}^{Lin}		0.0001			0.0001		
		(0.0006)			(0.0006)		
$R_{it}^1 \cdot D_{it}^{Lin}$		-0.0021***			-0.0020***		
		(0.0007)			(0.0007)		
ER_{it}^1		0.0015	0.0014	0.0018	0.0011	0.0009	0.0009
		(0.0017)	(0.0017)	(0.0018)	(0.0015)	(0.0015)	(0.0015)
$ER_{it}^1 \cdot R_{it}^1$		-0.0048***	-0.0045***	-0.0048***	-0.0040***	-0.0038***	-0.0041***
		(0.0013)	(0.0013)	(0.0013)	(0.0012)	(0.0012)	(0.0012)
CLM_{it}			0.0009			0.0010	
			(0.0021)			(0.0021)	
$CLM_{it} \cdot R_{it}^1$			-0.0042*			-0.0043*	
			(0.0023)			(0.0023)	
CL_{it}				0.0066**			0.0066**
				(0.0028)			(0.0027)
$CL_{it} \cdot ER_{it}^1$				-0.0097***			-0.0099***
				(0.0034)			(0.0035)
$\ln(tna)_{it}$	-0.0003**	-0.0002	-0.0002	-0.0003*	-0.0002	-0.0002	-0.0003*
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
$\ln(tna)_{it} \cdot R_{it}^1$	0.0006***	0.0003*	0.0004*	0.0004**	0.0003*	0.0004**	0.0004**
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
age_{it}	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
$age_{it} \cdot R_{it}^1$	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
$turnover_{it}$	0.0004***	0.0004***	0.0004***	0.0004***	0.0004***	0.0004***	0.0004***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
$turnover_{it} \cdot R_{it}^1$	-0.0010***	-0.0009***	-0.0009***	-0.0009***	-0.0009***	-0.0010***	-0.0009***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
$single_{it}$	0.0007	0.0006	0.0006	0.0007	0.0006	0.0007	0.0007
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
$single \cdot R_{it}^1$	-0.0004	-0.0003	-0.0004	-0.0004	-0.0004	-0.0004	-0.0005
	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)	(0.0007)
σ_{it}^1	-0.8364***	-0.8359***	-0.8354***	-0.8353***	-0.8352***	-0.8347***	-0.8347***
	(0.0097)	(0.0097)	(0.0097)	(0.0097)	(0.0097)	(0.0097)	(0.0097)
$\Delta\sigma_{it}^m$	0.6357***	0.6361***	0.6361***	0.6355***	0.6372***	0.6370***	0.6366***
	(0.0141)	(0.0140)	(0.0141)	(0.0140)	(0.0141)	(0.0141)	(0.0141)
R2	0.89	0.90	0.90	0.90	0.90	0.90	0.90
Obs.	15,305	15,305	15,305	15,305	15,295	15,295	15,295

Table VII Stability of the results over time

The table presents the coefficients for equation 1, estimated on two-year and one-year subsamples. The dependent variable $\Delta\sigma_{it}$ is change in risk taking by fund i in the second part of year t in comparison with the first part of the year. R^1_{it} is the rank of fund i in its investment style based on the fund's net cumulative returns in the first part of year t. D^{Lin}_{it} is a dummy variable, which equals 1 if fund i has a linear contract in year t and 0 otherwise. ER^1_{it} is fund's i effective rate at the end of the first half of year t. Controls include natural logarithm of fund total net assets, fund age, turnover and a dummy variable for single-managed funds, as well as their interaction terms with the performance rank R^1_{it}. σ^1_{it} is risk of fund i in the first part of year t. $\Delta\sigma^m_{it}$ is median change in style volatility. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.

Panel A. Two-year subsample regressions

Year	R^1_{it}	D^{Lin}_{it}	$D^{Lin}_{it} \cdot R^1_{it}$	ER^1_{it}	$ER^1_{it} \cdot R^1_{it}$	σ^1_{it}	$\Delta\sigma^m_{it}$	N	Adj. R2
2002-2003	-0.0094	0.0020*	-0.0042**	0.0088***	-0.0167***	-0.3096***	0.9781***	3,049	0.742
	(0.0096)	(0.0011)	(0.0019)	(0.0019)	(0.0032)	(0.0169)	(0.0191)		
2004-2005	-0.0046	0.0009	-0.0022**	0.0024	-0.0022*	-0.2481***	0.9182***	3,100	0.689
	(0.0055)	(0.0006)	(0.0010)	(0.0015)	(0.0012)	(0.0125)	(0.0146)		
2006-2007	-0.0002	-0.0001	0.0001	0.0023*	0.0006	-0.3372***	0.8625***	3,261	0.744
	(0.0053)	(0.0006)	(0.0010)	(0.0012)	(0.0019)	(0.0136)	(0.0123)		
2008-2009	-0.0015	-0.0012	-0.0012	0.0021***	-0.0125***	-0.5948***	0.7564***	3,182	0.924
	(0.0084)	(0.0009)	(0.0009)	(0.0006)	(0.0027)	(0.0118)	(0.0073)		
2010-2011	0.0161**	-0.0018**	0.0027**	0.0022	0.0004	-0.1046***	0.9496***	2,713	0.897
	(0.0076)	(0.0008)	(0.0014)	(0.0014)	(0.0025)	(0.0194)	(0.0131)		

Panel B. Yearly regressions

Year	R^1_{it}	D^{Lin}_{it}	$D^{Lin}_{it} \cdot R^1_{it}$	ER^1_{it}	$ER^1_{it} \cdot R^1_{it}$	σ^1_{it}	$\Delta\sigma^m_{it}$	N	Adj. R2
2002	0.0169***	0.0031*	-0.0065**	0.0104***	-0.0250***	-0.2196***	0.7796***	1,517	0.126
	(0.0044)	(0.0017)	(0.003)	(0.0031)	(0.0051)	(0.0291)	(0.0935)		
2003	0.0020	-0.0004	-0.0015	0.0034*	-0.0042***	-0.5857***	0.7368***	1,532	0.378
	(0.0027)	(0.0011)	(0.0019)	(0.0018)	(0.0032)	(0.0214)	(0.1501)		
2004	-0.0003	0.0014	-0.0038**	0.0003	0.0011	-0.1864***	1.1468***	1,540	0.214
	(0.0024)	(0.0009)	(0.0016)	(0.0017)	(0.0029)	(0.0236)	(0.0601)		
2005	0.0022	0.0007	-0.0007	0.0021***	-0.0044**	-0.4661***	-0.1522***	1,560	0.479
	(0.0015)	(0.0006)	(0.0010)	(0.010)	(0.0018)	(0.0145)	(0.0574)		
2006	-0.0099***	0.0001	-0.0020	0.0004	0.0028	-0.3519***	0.0267	1,603	0.398
	(0.0019)	(0.0007)	(0.0012)	(0.0015)	(0.0024)	(0.0144)	(0.0775)		
2007	0.0048**	-0.0003	0.0009	0.0006	0.0013	-0.609***	0.7161***	1,658	0.405
	(0.0021)	(0.0008)	(0.0013)	(0.0014)	(0.0025)	(0.0388)	(0.0361)		
2008	0.0064*	0.0031**	-0.0056**	0.0076***	-0.0091**	-0.3716***	1.0014***	1,618	0.292
	(0.0036)	(0.0014)	(0.0023)	(0.0026)	(0.0042)	(0.0342)	(0.0439)		
2009	0.0088***	0.0001	0.0017	0.0117***	-0.0117***	-0.6796***	0.2266***	1,564	0.761
	(0.0024)	(0.0010)	(0.0016)	(0.0017)	(0.0029)	(0.0103)	(0.0709)		
2010	-0.0059***	-0.0005	0.0006	-0.0012	-0.0048**	-0.2048***	0.4018***	1,467	0.151
	(0.0017)	(0.0006)	(0.0011)	(0.0012)	(0.002)	(0.0158)	(0.0899)		
2011	-0.0054	-0.0048***	0.0078***	0.0024	0.0006	0.4274***	0.7386***	1,246	0.300
	(0.0038)	(0.0015)	(0.0025)	(0.0026)	(0.0046)	(0.0703)	(0.0459)		

Table VIII Risk shifting over business cycle

The table presents the coefficients for equation 5, estimated using a panel model with fixed effects. The dependent variable $\Delta\sigma^{66}_{it}$ is change in risk taking by fund i in the last 6 months in comparison with the first 6 months of year t. R^1_{it} is the rank of fund i in its style based on the fund's net cumulative returns in the first half of year t. D^{Bull}_t (D^{Bear}_t) is a dummy variable if the market return over the first half a year is positive (negative) and zero otherwise. D^{Lin}_{it} is a dummy variable, which equals 1 if fund i has a linear contract in year t and 0 otherwise. In columns (2)-(4), ER^1_{it} is fund's i effective rate at the end of the first part of year t; in columns (5)-(7), ER^1_{it} is the rank of fund i in its investment style based on the fund's effective rate at the end of the first part of year t. CLM_{it} is Coles' linearity measure equal to the difference between the last (lowest) and the first (highest) marginal fee rates divided by the effective marginal fee rate. CL_{it} is conditional linearity and it equals the ratio of the last (lowest) marginal fee rate and the effective marginal fee rate. σ^1_{it} is risk of fund i in the first part of year t. $\Delta\sigma^m_{it}$ is median change in style volatility. Time- and style-fixed effects are included in all models. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.

		ER^1_{it} is effective rate			ER^1_{it} is effective rate rank		
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$R^1_{it} \cdot D^{Bull}_t$	-0.0191***	-0.0094**	-0.0116***	-0.0025	-0.0113***	-0.0134***	-0.0042
	(0.0034)	(0.0040)	(0.0039)	(0.0052)	(0.0039)	(0.0037)	(0.0051)
$R^1_{it} \cdot D^{Bear}_t$	-0.0083**	0.0047	0.0022	0.0072	0.0020	-0.0003	0.0049
	(0.0034)	(0.0041)	(0.0039)	(0.0057)	(0.0039)	(0.0037)	(0.0056)
D^{Lin}_{it}		0.0012**			0.0012**		
		(0.0006)			(0.0006)		
$D^{Lin}_{it} \cdot R^1_{it} \cdot D^{Bull}_t$		-0.0017**			-0.0017**		
		(0.0007)			(0.0007)		
$D^{Lin}_{it} \cdot R^1_{it} \cdot D^{Bear}_t$		-0.0021**			-0.0021**		
		(0.0009)			(0.0009)		
ER^1_{it}		0.0022	0.0018	0.0034*	0.0028*	0.0024	0.0034**
		(0.0018)	(0.0018)	(0.0018)	(0.0016)	(0.0016)	(0.0016
$ER^1_{it} \cdot R^1_{it} \cdot D^{Bull}_t$		-0.0045***	-0.0041***	-0.0044***	-0.0034***	-0.0031**	-0.0035***
		(0.0014)	(0.0014)	(0.0014)	(0.0016)	(0.0016)	(0.0016)
$ER^1_{it} \cdot R^1_{it} \cdot D^{Bear}_t$		-0.0084***	-0.0081***	-0.0085***	-0.0077***	-0.0074***	-0.0078**
		(0.0015)	(0.0016)	(0.0015)	(0.0015)	(0.0015)	(0.0015)
CLM_{it}			0.0049**			0.0047**	
			(0.0022)			(0.0022)	
$CLM_{it} \cdot R^1_{it} \cdot D^{Bull}_t$			-0.0044*			-0.0046*	
			(0.0024)			(0.0024)	
$CLM_{it} \cdot R^1_{it} \cdot D^{Bear}_t$			-0.0045			-0.0046	
			(0.0028)			(0.0028)	
CL_{it}				0.0108***			0.0107***
				(0.0029)			(0.0028)
$CL_{it} \cdot R^1_{it} \cdot D^{Bull}_t$				-0.0105***			-0.0107***
				(0.0037)			(0.0037)
$CL_{it} \cdot R^1_{it} \cdot D^{Bear}_t$				-0.0062			-0.0065
				(0.0044)			(0.0044)
σ^1_{it}	-0.3253***	-0.3263***	-0.3261***	-0.3261***	-0.3260***	-0.3258***	-0.3258***
	(0.0060)	(0.0060)	(0.0060)	(0.0060)	(0.0060)	(0.0060)	(0.0060)
$\Delta\sigma^m_{it}$	0.8300***	0.8290***	0.8290***	0.8288***	0.8289***	0.8290***	0.8287***
	(0.0049)	(0.0049)	(0.0049)	(0.0049)	(0.0049)	(0.0049)	(0.0049)
R2	0.87	0.88	0.88	0.88	0.88	0.88	0.88
Obs.	15,305	15,305	15,305	15,305	15,295	15,295	15,295

Table IX Risk shifting and extreme performance

The table presents the coefficients for equation 6, estimated using a panel model with fixed effects. The dependent variable $\Delta\sigma_{it}^{66}$ is change in risk taking by fund i in the last 6 months in comparison with the first 6 months of year t. $D_{it}^{top25\%}$ ($D_{it}^{top10\%}$) equals 1 for 25% (10%) top performing funds within their investment style, based on net cumulative returns in the first half of year t, and 0 otherwise. Dummy variable $D_{it}^{bottom25\%}$ ($D_{it}^{bottom10\%}$) is defined in the same way for 25% (10%) worst performing funds. D_{it}^{Lin} is a dummy variable, which equals 1 if fund i has a linear contract in year t and 0 otherwise. ER_{it}^{1} is fund's i effective rate at the end of the first part of year t. σ_{it}^{1} is risk of fund i in the first part of year t. $\Delta\sigma_{it}^{m}$ is median change in style volatility. Time- and style-fixed effects are included in all models. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
$D_{it}^{bottom25\%}$	0.0018***	0.0002		
	(0.0002)	(0.0007)		
$D_{it}^{top25\%}$	-0.0015***	0.0005		
	(0.0002)	(0.0006)		
$D_{it}^{bottom10\%}$			0.0033***	-0.0001
			(0.0003)	(0.0009)
$D_{it}^{top10\%}$			-0.0020***	0.0014
			(0.0003)	(0.0009)
D_{it}^{Lin}		-0.0009**		-0.0008**
		(0.0004)		(0.0004)
$D_{it}^{Lin} \cdot D_{it}^{bottom25\%}$		0.0007		
		(0.0004)		
$D_{it}^{Lin} \cdot D_{it}^{top25\%}$		-0.0004		
		(0.0004)		
$D_{it}^{Lin} \cdot D_{it}^{bottom10\%}$				0.0012**
				(0.0006)
$D_{it}^{Lin} \cdot D_{it}^{top10\%}$				-0.0020***
				(0.0006)
ER_{it}^{1}		-0.0001		-0.0003
		(0.0014)		(0.0014)
$ER_{it}^{1} \cdot D_{it}^{bottom25\%}$		0.0016**		
		(0.0008)		
$ER_{it}^{1} \cdot D_{it}^{top25\%}$		-0.0024***		
		(0.0008)		
$ER_{it}^{1} \cdot D_{it}^{bottom10\%}$				0.0034***
				(0.0011)
$ER_{it}^{1} \cdot D_{it}^{top10\%}$				-0.0026**
				(0.0011)
σ_{it}^{1}	-0.7539***	-0.7530***	-0.7513***	-0.7507***
	(0.0080)	(0.0080)	(0.0080)	(0.0080)
$\Delta\sigma_{it}^{m}$	0.5121***	0.5116***	0.5131***	0.5138***
	(0.0178)	(0.0178)	(0.0178)	(0.0177)
R2	0.91	0.91	0.91	0.91
Obs.	15,305	15,305	15,305	15,305