

Title	Mutual fund performance and families
Authors	Clare, Andrew;O'Sullivan, Niall;Sherman, Meadhbh
Publication date	2014-06
Original Citation	CLARE, A., O'SULLIVAN, N. & SHERMAN, M. 2014. Family status and mutual fund performance. Journal of Asset Management, 15, 163-175. <a href="http://dx.doi.org/10.1057/jam.2014.19">http://dx.doi.org/10.1057/jam.2014.19</a>
Type of publication	Article (non peer-reviewed)
Link to publisher's version	<a href="http://dx.doi.org/10.1057/jam.2014.19">10.1057/jam.2014.19</a>
Rights	This is a pre-print of an article published in Journal of Asset Management. The definitive publisher-authenticated version CLARE, A., O'SULLIVAN, N. & SHERMAN, M. 2014. Family status and mutual fund performance. Journal of Asset Management, 15, 163-175. is available online at: <a href="http://dx.doi.org/10.1057/jam.2014.19">http://dx.doi.org/10.1057/jam.2014.19</a>
Download date	2024-05-02 18:47:04
Item downloaded from	<a href="https://hdl.handle.net/10468/1716">https://hdl.handle.net/10468/1716</a>

# Mutual Fund Performance and Families<sup>1</sup>

Andrew Clare<sup>a,\*</sup>,

Niall O'Sullivan<sup>b</sup>

and

Meadhbh Sherman<sup>b</sup>

<sup>a</sup> *The Centre for Asset Management Research,  
The Sir John Cass Business School, City University, London, UK.*

<sup>b</sup> *University College Cork, Cork, Ireland.*

May 2013

---

## Abstract

Using a large and long sample of US and European mutual funds we examine the impact that the membership of a fund family has on performance. We test for strategic and competitive behaviour among family funds and whether this affects performance persistence and risk taking behaviour. We find no conclusive evidence of stronger performance persistence among family funds versus non-family funds, although we do find some significant differences in the future performance of portfolios of family and non-family funds formed on the basis of past performance. However, we do provide strong evidence to suggest that a fund's mid-year ranking within its family affects its risk over the remainder of the year and, most interestingly, that family mid-year rankings have a different impact in the US mutual fund industry than it does in its European equivalent. Among US funds, the results point to intra-family competition where mid-year losers increase risk by more than mid-year winners in an attempt to catch up. The opposite is found to be true for European family funds. Our results therefore highlight significant differences in the ways in which the US and European fund management industries operate.

*JEL classification:* G02, G11, G15.

*Keywords:* Mutual fund family, performance persistence and risk.

---

---

<sup>1</sup> This is preliminary work. Please do not cite without author permission.

\*Corresponding author. Tel.: +44 207 040 5169. E-mail addresses: [a.clare@city.ac.uk](mailto:a.clare@city.ac.uk) (Clare); [niall.osullivan@ucc.ie](mailto:niall.osullivan@ucc.ie) (O'Sullivan); [m.sherman@ucc.ie](mailto:m.sherman@ucc.ie) (Sherman).

## **1. Introduction**

A mutual fund family is a group of funds that are managed by the same fund management company. According to Nanda, Wang and Zheng (2004) over 80% of US mutual funds belong to a family. They argue that being part of a fund family conveys certain benefits on the individual funds. In particular, the ‘family members’ may benefit from economies of scale in terms of promotion, advertising and distribution that the fund management company can provide for all of its funds. In addition, they argue that fund family members may benefit from the greater flexibility afforded by a larger parent organization in terms of the reallocation of human capital in response to changes in financial market conditions. Since being part of a fund family is such a prevalent organizational structure, it is interesting that more research has not been carried out on the possible impact that family status may have on fund performance. Furthermore, the limited number of studies that do exist focus on US fund families. Employing a large data set of both US and European funds over a long time period, we examine two possible strategic behavior effects on the part of fund management companies operating fund families: firstly, we examine fund performance persistence and secondly, we look at fund manager risk taking behavior. Examining the European industry sheds light on whether past related findings are a uniquely US phenomenon or have a more global relevance.

We begin by looking at the impact of family status on the persistence of fund returns. Guedj and Papastaikoudi (2005) suggest that funds within a family are more likely to have persistent performance than those not in a family. This is based on evidence of a convex relationship between performance and fund flows, that is, good performance tends to attract positive flows, while poor performance does not tend to lead to commensurate fund out flows (see for example, Nanda, Wang and Zheng (2004)). This convex performance/fund flow

relationship may provide fund management companies with an incentive to engage in strategic behaviour by supporting and resourcing their better performing funds at the expense of their poorer performing funds. This convexity may lead to a situation where given a choice between operating two funds with median performance, or two funds, one a top performing fund and the other a poorly performing fund, then the company would choose the latter. This leads to a hypothesis that such strategic resource allocations may increase the chances of this good and bad relative performance persisting, i.e. a finding of positive persistence among funds in a family. To investigate this hypothesis we employ two tests of performance persistence. We use the well known recursive portfolio technique (see for example Hendricks, Patel, and Zeckhauser (1993), Carhart (1997)) in the first instance, and then a utility-based measure of performance persistence developed by Rhodes (2000). We examine the hypothesis that funds within a family are more likely to display persistence in performance than their non-family counterparts.

The second possible, related strategic behaviour by fund management companies that we explore relates to the impact of family status on risk taking behaviour. We explore whether risk taking behaviour among funds within families is altered according to the funds' relative performance. Specifically, we test whether, among a fund family, the risk of top performing funds (over say the first half of the year) is reduced in the second half of the year while the risk of the bottom performing funds is increased. This negative relationship between performance and subsequent risk taking behaviour over the course of the year may arise for two reasons: First, a fund management company acting strategically may decide to protect or 'bank' good performance achieved in the early part of the investment period by reducing top funds' risk in the latter part of the period. Similarly, the convex performance/fund flow relationship gives the company an incentive to transfer risk to the

lower performing funds. If the risks pay off, great; if not, the fund outflows are smaller than the inflows enjoyed by the better performing funds. Second, risk profiles across funds within a family may change over the year due to intra-firm competitive behaviour by funds rather than because of the strategic behaviour of the fund management company. Funds within a fund family may compete for resources including salaries, marketing budgets and, of course, performance bonuses. As resources are likely to be skewed towards the top performing funds, such internal competition may alter risk taking behaviour by funds over the year in an effort to improve their ranking. Kempf and Ruenzi (2008) hypothesize that a negative relation between fund performance and subsequent risk taking is an indication of competition between funds but they do not allow for the possibility that it could equally be explained by the strategic behavior described above. We examine this possibility.

The work presented here on this important but relatively unexplored relationship between the organizational structure of fund management companies and mutual fund performance, improves our understanding of this relationship with the examination of a large and long sample of international (US and European) funds. To our knowledge we are using methodologies not previously applied to this question. Our results, first on the persistence tests, point to positive persistence among both family and non-family funds in both Europe and the US and, contrary to the hypothesis, do not point to stronger persistence among fund families. However, low ranked non-family funds go on to significantly under perform their family fund counterparts. We find strong evidence to suggest that family status does have an impact on the risk taking behavior of funds although this impact is different in the US mutual fund industry than it is in its European equivalent. Overall, these results suggest that the structure of the US and European fund management industries operate in a different manner. The rest of this paper is organised as follows: in Section 2 we review the limited set of papers

in this area; in Section 3 we present a discussion of our methodology and data; in Section 4 we present our results; and finally Section 5 concludes.

## **2. Related Literature**

The mutual fund performance evaluation literature is vast; for a relatively recent review of it see Cuthbertson, Nitzsche and O’Sullivan (2008). In this section of the paper we present a more focused discussion of the most relevant literature on mutual fund families, which we have structured to reflect the different aspects of this literature.

### *2.1. Performance Within Mutual Fund Families*

A number of studies have focused on the performance of funds within their fund families. Guedj and Papastaikoudi (2005) examine fund performance within US mutual fund families using monthly mutual fund return data from 1990 to 2002. They hypothesise that families may want to promote their funds selectively and that this bias may cause unequal performance within these families. They base this hypothesis on the fairly well established empirical finding that fund inflows are attracted to good past performance while bad performance does not lead to commensurate levels of fund outflows (see for example Nanda, Wang and Zheng (2004)). This convex relationship gives fund families the incentive to prioritize some funds over others. The fact that the majority of mutual funds generate fees for their fund management parents as a percentage of assets under management (AUM) rather than on the basis of performance gives a further incentive to this strategy, while the percentage of AUM fee structure also allows larger families to charge lower percentage fees. Kempf and Ruenzi (2004) find that top performing funds in a family grow faster compared to lower ranked funds while Khorana and Servaes (1999) find that new fund openings by families are positively related to the ability of families to generate additional fee income and

family size. In addition, Guedj and Papastaikoudi also hypothesise that larger families should be more capable of affecting the performance of their funds since they would be more able to exploit marketing economies of scale.

In order to test their hypothesis, Guedj and Papastaikoudi use Carhart's (1997) recursive portfolio formation methodology to test fund performance persistence. They find evidence of short term persistence among family funds and cite this as evidence that fund management companies actively intervene in their funds' performance. They find that the average annual abnormal return difference between last year's top performing funds and the worst performing funds was 0.58% per month, significant at the 1% significance level. They also find that persistence in fund performance is positively related to the number of funds in a family.

In a similar study, Gaspar, Massa and Matos (2006) examine the issue of favouritism within the top 50 US mutual fund families over the period 1991 to 2001. Favouritism is the adoption of a strategy that involves transferring performance (e.g., assigning cheap IPO offerings or similar strategies) across member funds to favour particular funds - usually the high performance/high fee funds. They call this strategy 'cross-fund subsidisation'. They also argue that the existence of a convex relationship between fund flows and performance is the key motivation for this type of strategic behavior even if it is at the expense of some investors. They investigate cross-subsidisation behaviour by examining whether families enhance the performance of 'high-value' funds (high fee, high performance and young funds) at the expense of 'low-value' funds (low fee, low performance and old funds). They find that families enhance the performance of high-value funds by between 0.7% and 3.3% per year (depending on classifications used). Using fund holdings data, they also investigate

‘preferential allocation’ (favouritism in allocation of cheap IPO offerings) and ‘opposite trades’ (coordinating trades of funds such that they place opposite orders). They match up pairs of high-value and low-value funds, regressing the difference in returns between each pair on two dummy variables representing whether the two funds belong to the same fund family and whether the two funds belong to the same style. They also include some control variables for the size of the funds, the age of the funds, the size and age of the funds’ family. They find that ‘high-value’ funds benefit from both ‘preferential allocation’ and ‘opposite trade’ strategies. To some extent this finding is also substantiated by Cuthbertson, Nitzsche and O’Sullivan’s (2008) finding that old funds tend to underperform new funds.

Tower and Zheng (2008) examine the role of the characteristics of mutual fund families in explaining fund performance and the influence of the expense ratio on fund performance. They hypothesize that returns gross of all published expenses is negatively affected by expenses and turnover. They evaluate performance in three different ways. By comparing fund performance to different types of indices - a tracking index and the Wilshire 5000 index - the authors measure stock selection, style selection and family style selection skills. Their main finding is that the best performing (gross returns after adjusting for style) mutual fund families have low expense ratios, low turnover and low maximum front end and deferred loads for their most preferred clients.

## 2.2. *Competition, Cash Flows and Advertising*

When studying the effects of diversification within mutual fund families (adding more funds with different styles to the family), Siggelkow (2003) finds that funds belonging to more focused fund families outperform similar funds in more diversified families. Siggelkow also analyses the driver of the focus effect by testing whether a mutual fund benefits from

belonging to a family which specializes in that type of fund, or merely by belonging to a family with a narrow product portfolio, regardless of whether the family specializes in that fund or not. The results indicate that the former is the one that matters. Finally, Siggelkow examines whether the interests of investors and family owners are aligned when it comes to the issue of focus. The results show that there is a divergence of interests between the two: investors benefit from focused families whereas owners benefit from and have an incentive to broaden a family's offerings to attract cash flows.

Kempf and Ruenzi (2004) argue that funds not only compete for cash flows within their market segment, but also within their family. The position of a fund within a family will influence its growth because families advertise their star performers. Using US mutual fund data the authors find that there is a positive and convex relationship between a fund's family rank and its subsequent growth. The top 20% of funds in a family grow on average by an additional 6.78% per year as compared to the other funds in the family after controlling for their position within their market sector.

The spillover hypothesis suggests that investors might come to a more favourable view of other funds in a family through association if there is a star fund in the family (a fund performing among the top 5% of funds). Nanda, Wang and Zheng (2004) study the spillover effect by comparing the growth of new money for families with a star to that of families that do not have a star. Having a star performer in the family is found to have a positive effect on the cash flows of other family members, as well as on the cashflows of the star performer itself. More specifically, they find that a star performer in a family delivers an aggregate cashflow increase to the family that is more than three times larger than is attracted by a stand-alone star fund. They also verify the asymmetric cash flow response to fund

performance by examining the spillover effects of having a 'dog' in the family, that is a fund performing among the bottom 5% of funds. They find that while there is a negative cashflow effect for this particular fund, there are no significant spillover effects on the other family members. It follows then that families may well engage in a strategy of creating a star performer. Lastly, they examine whether having a star performer impacts on performance: using the Fama and French (1993) three factor model and the Carhart (1997) four factor model, they find that a naive strategy of chasing families with star performers does not enhance investor return.

Spillover effects relating to the marketing decisions of fund families is examined by Verbeek and Huij (2007) who test whether the performance-flow relationship is affected by the marketing and distribution expenses at an individual fund level as well as at the family level. They find that positive returns generate cash inflows that are twice as big for funds with a high marketing spend compared with funds with a low marketing spend. The same effect is not present for negative returns. They find that families with relatively high marketing spends provide favourable conditions to incubate new funds - this is because even if the fund does not advertise itself, it benefits from being associated with the family.

Gallaher, Kaniel and Starks (2006) investigate the impact that a family's strategic decisions may have on investor demand for their funds. They focus on aggregate flows to the entire fund families. They look at the possible influence of family performance, family offerings, fees and operating costs. They find that there is a positive relationship between family performance and the number of funds that a family offers and cash flows to the family and a negative relationship between fees and expenses and cash flows to the family. Using monthly advertising data from Competitive Media Research (CMR) on the print advertising

expenditures of mutual fund families, they also focus on the relationship between the family's advertising decision and cash flows to the family. They find that high relative levels of advertising are significantly related to high fund flows. They also examine the determinants of the family's advertising expenditures by regressing the relative level of advertising on proxies for family quality plus other strategic decision and control variables. They identify the main influencing factors as the expense ratio of the family, which they find to have a positive effect, and the distribution channel - fund families with higher average load fees do not advertise as much as fund families with lower average load fees.

Expanding on their earlier work on advertising and the mutual fund family, Gallaher, Kaniel and Starks (2009) find that advertising has a significant impact on cash flows to the industry as a whole, at the family level and at an individual fund level. At the industry level, they find that every family seems to benefit from advertising expenditure, not just those families doing the advertising. They find that cashflows are higher in months where more advertising expenditure takes place. At the family level, they again find high relative levels of advertising are significantly related to high fund flows and that there is no significant relationship for low levels of relative advertising. At the individual fund level, the effect of advertising is different depending on whether they are top or bottom performing funds. Advertising for bottom performing funds lowers their flow-performance sensitivity while advertising increases flow-performance sensitivity for top performing funds.

### *2.3 Mutual Fund Families and Risk*

Elton, Green and Gruber (2007) study the correlation between US mutual fund returns within and between fund families. They find that returns are more closely correlated within families. The average correlation between stock funds and combination funds is 0.757 if they are

inside a family and 0.709 if they are from two separate families. This correlation is mainly attributed to common stock holdings and to similar exposures to broad economic factors. Thus a strategy of investing within one family is a riskier one than diversifying across families.

Kempf and Ruenzi (2008) examine the issue of intra-family competition in the US mutual fund industry. They show that fund managers within families compete against other managers in the same family for scarce resources - the highest salary, bonuses or the best advertising budget etc. The authors show that over a year fund manager adjusts their risk in the second half of the year based on their performance in the first half of the year in an attempt to catch up with their peers. They also analyse competition within families of different sizes and show that strategic interaction takes place in small families but not in large ones. Thus family size is a key determinant of whether a fund competes or behaves strategically within its family.

#### *2.4 Performance and Industry Structure and Entry Decisions*

Khorana and Servaes (1999) investigate the rationale behind the decision to launch a new mutual fund. They look at 1,163 new US fund offerings over the period 1979-1992. To explain the launch of new funds, they regress fund openings on a number of explanatory variables such as cash inflows, performance, family size, etc. They find that fund openings are positively related to a number of factors: the ability of families to generate additional fee income; family size (larger families are more likely to open new funds because substantial economies of scale exist in the fund opening decision) and the decision making process of large families (families are more likely to open a fund in an objective/class where a large family had already opened a fund in that objective in the previous year). Zhao (2005) extends the work of Khorana and Servaes (1999) by making a distinction between two

separate entry decisions: the introduction of new portfolios (either single-class or multiple-class) and the introduction of new classes (variations of the same fund, i.e. Growth A and Growth B etc) for existing portfolios. He finds that factors such as performance, cash flows, size, expenses and tax considerations affect whether a family introduces a new fund or a new class of an existing fund.

The link between industry structure and US mutual fund family performance is also analyzed by Massa (2003). Massa suggests that family-specific characteristics influence the way investors evaluate funds. The most important of these characteristics being the idea that investors can move in and out of funds within a family at very low cost. The larger the number of funds in a family, the greater the value of this option. The results show that this low cost ability to switch between funds affects the degree of competition between them. The greater the value an investor puts on the low-cost switching option, the less the competition between funds and the greater the segmentation of the industry, in terms of family affiliation. Massa also finds that investors are influenced by a number of other factors - namely their investment horizons, family size and fees and the fact that investors perceive funds as differentiated products. If families are able to differentiate themselves in terms of non-performance-related characteristics (e.g., a higher degree of fee differentiation), they have less need to compete in terms of performance.

## 2.5. *Summary*

Family fund research has centred on a range of related themes. With respect to the relationship between family membership and fund performance it has been found that bigger families tend to display more persistence in performance than smaller families. Also, better performing funds within families appear to get preferential treatment from their fund

management company parent in the allocation of resources. The presence of a star in the fund family, family performance, family offerings, fees and operating costs and advertising have all been found to have an impact on performance. The fund family structure has also been found to have an impact on the decision to launch new funds, while the focus of the family has also been shown to have an impact on fund flows. Finally, it has been shown that family members compete with one another for resources by changing the risk profiles of their funds.

All of the papers discussed briefly here have made an important contribution to our understanding of the relevance of fund family membership on various aspects of fund performance and behaviour. They are all based on the US mutual fund industry. We examine whether some of these findings also apply to the European mutual fund industry.

### **3. Methodology and Data**

A mutual fund family is a group of funds that are all managed from within the same fund management company. This study examines the extent to which fund performance is influenced by family status, we employ two methodologies to test whether there is greater persistence among family funds as a group compared to non-family funds. Using a distinct third methodology we also examine the risk taking behavior of funds in a family and how it is related to their relative performance.

#### *3.1. Tests for Persistence*

##### *3.1.1. The recursive portfolio technique*

We begin by examining performance persistence using the recursive portfolio formation technique (for example, see Hendricks, Patel, and Zeckhauser (1993), Carhart (1997)). This technique involves forming portfolios of funds based upon the funds' performance over some

past ranking period and evaluating how these portfolios go on to perform over some holding period. Specifically here, based on fund alphas from a single factor model over the past 12 months, we form (equally weighted) decile portfolios of funds and hold these decile portfolios for one year. This process is repeated recursively annually and hence generates ten time series of ‘forward looking’ portfolio returns. If persistence exists the ten alphas of these forward looking portfolios should be close to monotonically decreasing. (If the persistence is to be of economic significance at least some of the upper decile portfolio alphas should be statistically significantly greater than zero). We perform this analysis for our set of family and non-family funds separately<sup>2</sup>.

We also test whether the alphas of the forward looking decile portfolios for family funds and non-family funds are significantly different. For example, whether the alpha produced by decile 1 of funds in a family is different than the alpha produced by decile 1 of non-family funds. To do this we run the following regression

$$R_{F,it} - R_{NF,it} = \alpha_i + \beta_i (R_{M,t}) + \varepsilon_{it} \quad (1)$$

where  $R_{F,it}$  is the excess return (over the risk free rate) at time  $t$  on the  $i$ th decile portfolio of family funds,  $R_{NF,it}$  is the excess return at time  $t$  on the  $i$ th decile portfolio of non-family funds.  $R_{M,t}$  is the excess return at time  $t$  on a proxy for the market portfolio and  $\varepsilon_{it}$  is a white noise error term. A statistically significant value of  $\alpha_i$  in (1) indicates that the decile

---

<sup>2</sup> We also estimated the alphas using Fama and French’s three factor model but the results were qualitatively unaffected. To test the robustness of our results to alternative portfolio formation techniques we also formed portfolios based upon their alpha quartile rankings. We also ranked funds based upon the t-statistic of alpha rather than the level of alpha. Our results were unaffected by these variations in the portfolio construction process. To conserve space we do not present these results here.

portfolio alphas of family funds and non-family funds are significantly different from each other.

### *3.1.2. A utility-based approach to testing persistence*

As an alternative test of persistence, we also employ the utility-based method developed by Rhodes (2000). The method sorts funds into fractiles (quintiles here) based on raw return each year. Funds are then assigned a score based on their quintile ranking: quintile 5 (lowest performance) is assigned a score of 2 while quintile 1 is assigned a score of 10. Using a utility function, investor utility measures are then assigned based on the fund's score. The utility function is assumed to exhibit diminishing marginal utility. The concave shape of the utility function implies that the average utility over two periods from a score of say 2 in period 1 and 6 in period 2 is less than the average utility from a score of 4 in both periods even though the average performance is the same in both scenarios. That is, given the same average performance outcome, less volatility is preferred to more. For each fund the average utility may be calculated across all the years for which returns are available. Funds which consistently remain in the higher) quintiles will yield higher average utility. Rhodes demonstrates that under the null hypothesis of no persistence the cross section of average utilities is normally distributed<sup>3</sup>.

Rhodes (2000) carries out the normality tests with a number of alternative utility function specifications to change the level of risk aversion. The study's conclusions are generally found to be quite robust. To test whether the utility scores are normal we use three statistics: the Skewness/Kurtosis test; the Sharpio-Wilk test; and the Sharpio-Francia test. All

---

<sup>3</sup> Average utility scores were adjusted to account for funds with different life spans. This utility measure of persistence does not equally weight the scores for funds which have different numbers of observations, each individual score must be weighted by the square root of the ratio of two expected variances.

tests operate under the null hypothesis that the distributions of average utility scores are normal.

### 3.2. Risk Adjustment Strategy

To our knowledge, the relative performance and risk taking behaviour of funds within a family has received little attention in the past. There are a couple of reasons, *a priori*, to believe that these may be related. First, because fund managers within a family must share scarce resources (salary, marketing activities, bonuses etc) it seems plausible that they would compete with one another. Here, a manager may feel compelled to increase the risk in their fund in the second half of the year if they find that their mid-year intra-firm ranking is low. Second, on the other hand, fund families may behave strategically where high (low) performing funds over the first half of the year may reduce (increase) risk in the second half of the year. In this case, the fund management company, or family, may wish to secure rather than risk the strong mid-year performance of top funds and transfer risk to low performing funds. As noted previously, the convex nature of the performance/fund-flow relationship gives firms an incentive to engage in this strategy. Both these hypotheses indicate a negative relationship between mid-year performance and subsequent risk in the second half of the year. However, for top funds in the second instance we would also expect the difference in risk between the second and first halves of the year to be negative. In addition, the degree of both intra-firm competition and firm level strategic behaviour may be a positive function of the number of fund in the family. We also examine this possibility.

To test whether a change in the risk profile of a fund from the first to the second half of the year is due to its mid-year rank within the family rank we estimate various forms of the following model which are loosely based on Kempf and Ruenzi (2008).

$$\Delta\sigma_{i,t} = b_0 + b_1 R_{i,t}^F + b_2 R_{i,t}^S + b_3 \sigma_{i,t}^{(1)} + b_4 S_{i,t} + b_5 \Delta\sigma_{m,t} + b_6 (D_{i,t} * R_{i,t}^F) + \varepsilon_{i,t} \quad (2)$$

where  $\Delta\sigma_{i,t} = \sigma_{i,t}^{(2)} - \sigma_{i,t}^{(1)}$  represents the change in the standard deviation of fund  $i$ 's monthly returns over the first half (January – June inclusive) to the second half (July – December inclusive) of year  $t$ .  $R_{i,t}^F$  is fund  $i$ 's mid-year rank based on all funds' (within its family) average return over January - June inclusive, in year  $t$ .<sup>4</sup> A rank of 1 is assigned to the worst fund within the family, a rank of 2 to the second worst fund and so on. Thus, the higher the rank the better the performance of the fund within the family. The ranks are normalised to make families of different sizes comparable. We test the hypothesis that  $b_1 < 0$ .  $R_{i,t}^S$  is fund  $i$ 's mid-year rank relative to all funds in the same sector rather than family. The normalised ranks assigned to each fund are constructed similarly to that of  $R_{i,t}^F$ . It is hypothesised that  $b_2 < 0$ . In order to control for mean reversion in volatility,  $\sigma_{i,t}^{(1)}$  is specified as a regressor where it is expected that  $b_3 < 0$ .  $S_{i,t}$  is the number of funds in fund  $i$ 's family in year  $t$ . This allows us to test the hypothesis that either competitive or strategic behaviour may be a function of the number of funds in the family. We hypothesise that  $b_4 > 0$ . As all funds in this study are equity funds, in order to control for changes in equity market risk between the second and first half of the year,  $\Delta\sigma_{m,t}$  represents the change in the standard deviation of returns in either the US or European equity market (as appropriate to fund  $i$ ) between the first half and the second half of year  $t$ . It is hypothesised that  $b_5 > 0$ .  $D_{i,t} * R_{i,t}^F$  is an interactive dummy variable to examine whether the sensitivity of a fund's reaction to its mid-year rank differs depending on whether it is a high ranked or low ranked fund. Here,  $D = 1$  if fund  $i$

---

<sup>4</sup> Patel, Zeckhauser and Hendricks (1994) show that investors care more about raw returns than risk adjusted returns and more about rankings than about absolute performance.

ranks below the family median and  $D = 0$  otherwise. Equation 2 is estimated as a pooled regression.

### *3.3. Data*

The dataset is comprised of European and US equity mutual fund monthly returns between January 1970 and June 2010. Non-surviving funds are included to account for survivorship bias. A non-surviving fund is one which has existed for some time during the sample period but has not ‘survived’ until the end of the sample period. These funds do not survive for a variety of reasons, for example, due to a merger with other funds or closure due to bad performance. In total there are 5,714 funds of which 3,703 US funds while 2,011 are European funds. Returns are gross of buying and selling expenses but are net of annual management fees and are gross of income-tax so that they are comparable between the two regions. Finally, all returns are inclusive of reinvested income. Morningstar also provides information on each fund’s sector. For statistical robustness a minimum observation restriction of 60 months was applied.

A mutual fund family is a group of funds managed by the same fund management company. In our study we distinguish between funds that belong to a family and ones that do not. Morningstar provides the management company name of each fund, making it possible to identify a fund’s family. There are 666 families in the dataset with the number of funds per family ranging from 2 to 141. The majority of families are small; 80% of families comprise 9, or fewer funds. Only 9% of families have 20 or more funds. There are 498 funds that we are able to classify as being non-family funds. This information is summarised in Figure 1.

US and European equity market indices used to calculate  $\Delta\sigma_{M,t}$  in (2) are taken from Datastream.

## **4. Results**

### *4.1. Persistence in Family and Non-Family funds*

#### *4.1.1. Recursive portfolio methodology*

In Table 1 we present the results of persistence tests based upon the recursive portfolio technique outlined in section 3. We present the results for US equity family (Panel A) and non-family (Panel B) funds and for European family (Panel C) and non-family funds (Panel D). Decile 1 is formed by holding the ten percent of funds with the highest pre-ranking alphas while decile 10 is comprised of the ten percent of funds with the lowest pre-ranking alphas. Each panel presents the average monthly return for each decile, along with each decile's monthly alpha and its t-statistic.

There is evidence of persistence in all four panels because both the average returns and alphas decline from decile 1 to decile 10, though not completely monotonically. In results not shown, for each of the four panels a simple regression of the ten decile alphas on a trend from 1 to 10 showed a statistically significantly negative slope indicating declining alphas and hence persistence. Across all four panels there is very little evidence of economically significant persistence as top decile alphas are not positive and statistically significant, the only exception here is decile 1 for European non-family funds. There is stronger evidence of persistence among low ranked deciles many of which show significantly negative alphas at 5% significance one-tail tests.

We set out to test the hypothesis that strategic behavior among family funds would be more likely to generate persistence than among non-family funds. Our results demonstrate statistical persistence among both family and non-family funds in both the US and Europe and therefore we fail to find evidence that there is more persistence among family funds than non-family funds. However, as outlined in Section 3 we test whether the decile alphas of family funds are significantly different from the corresponding decile alphas of non-family funds. We find that among lower deciles (between decile 7 to decile 10) the worst performing family funds go on to perform significantly better, or rather less badly, than their non-family counterparts.

In summary, we find evidence of persistence among all four categories or groups of funds. We fail to find evidence of greater persistence among or within family funds compared non-family funds. We find that lower decile ranked non-family funds go on to significantly underperform their family fund counterparts. So the finding of persistence among family funds doesn't rule out the hypothesis that family funds are behaving strategically (taking advantage of the convex performance-flow relationship) but we do not find that this behavior is greater among family funds than among the control group of non-family funds. Indeed it may be the case that relatively poorly performing funds within a family enjoy some benefits associated with family membership, such as knowledge spillovers and economies of scale which may aid their subsequent performance compared to equivalent poorly performing non-family funds.

#### *4.1.2. Utility-based methodology*

In Table 2 we report the results of the utility-based test of persistence. We use three tests of normality – the Skewness/Kurtosis, the Sharpio-Wilk and Sharpio-Francia tests – and the

table presents the probability values of the three tests. Panel A of Table 2 presents the results for the combined full sample, for both US and European funds. The null hypothesis of no persistence is rejected both for family and non-family funds. In Panel B we have separated the funds between US and European mutual funds. The results again strongly reject the null hypothesis of a normal distribution or no persistence for both sub-samples using each of the three tests for normality. The results of the utility based test of persistence are consistent with the recursive portfolio methodology in failing to show stronger persistence among the group of family funds compared to non-family funds.

#### *4.2. Risk Adjustment Strategy*

In this section of the paper we report the results of our tests designed to investigate the hypothesis that, arising from either strategic or competitive behaviour, fund managers in a fund family adjust the risk profile of their fund in the second half of the year based upon their relative performance in the first half of the year. We estimate a number of forms of Equation (2). Table 3 presents results for the full combined set of family funds while Tables 4 and Table 5 report results for US family funds and European family funds respectively. For each estimated model the tables show OLS coefficients with p values in parentheses. All regressions also included a constant.

For the combined sample reported in Table 3 we find that the coefficient on  $R_{i,t}^F$  is negative in all model estimations and is significant at the 10% significance level for all except one model. Even after controlling for other factors, these results provide reasonably strong evidence to suggest that mid-year fund losers increase risk more than mid-year fund winners. However, as discussed, an alternative explanation for a negative coefficient here is that mid-year winners reduce risk in the second half of the year. If this was the case, mid-year

winners should exhibit  $\Delta\sigma = [\sigma^{(2)} - \sigma^{(1)}] < 0$  on average. However, our data shows that although there is a negative relationship between  $\Delta\sigma$  and  $R^F$ ,  $\Delta\sigma$  is positive on average both for low (below the median) ranked and high (above the median) ranked funds. This indicates that the explanation for the negative relation between fund rank and a subsequent change in risk lies in competitive intra-firm behavior rather than being due to strategic behavior by the fund management company in transferring risk from high performers to low performers. This negative relation is strongly confirmed when we focus on US fund families (Table 4). For US fund families family rank,  $R^F$ , is significant at the 1% level of confidence in all but one model (where it is significant at the 10% level). However, interestingly, when we look at European fund families in Table 5 we find the opposite result: mid-year winners increase risk more than mid-year losers. This finding does not support the hypothesis of the existence of intra-family competition among family funds in Europe. A possible explanation for this finding is that mid-year winning European fund managers feel more confident in taking on increased risk and/or feel that they have greater scope to do so given the higher level of return achieved by mid-year. By contrast, amongst US fund managers, the intra-firm competition effect dominates.

While for US family funds in particular the above establishes a negative relation between mid-year rank and subsequent risk, we also examined whether a fund's reaction to its mid-year rank differs depending on whether it is a high or a low ranked fund. We do this by introducing an interactive dummy variable  $(D_{i,t} * R^F_{i,t})$  where  $D = 1$  if fund  $i$  ranks below the family median and  $D = 0$  otherwise. From Table 4 we find that the coefficient on this dummy variable is positive and significant at the 10% level of confidence. This lends support to the earlier finding that mid-year losers tend to increase the risk in their fund by more than mid-year winners, though at a diminishing rate.

Moving to the effect of a fund's sector rank,  $R_{i,t}^S$ , on its subsequent risk, the positive coefficients in Table 3 are a little surprising. However, we note that these coefficients are generally insignificant at the 10% level of confidence. Furthermore, in the full sample the correlation between family rank and sector rank is 0.6 making it difficult to disentangle their effects. When we look at the findings around sector rank for US and European funds separately, we see that the results are similar to those found around family rank: in the case of US family funds mid-year losers increase risk more than mid-year winners, while the opposite is the case for European family funds. These results are significant at the 1% level of significance. Again, this points to stronger intra-sector competition in the US compared to Europe. In Table 3, in the combined sample the positive, but generally insignificant coefficients on  $R_{i,t}^S$  are likely to be the result of the opposing negative and positive effects of this variable among US and European family funds respectively. In examining the role played by a fund's mid-year family rank and sector rank on its subsequent risk, we wish to control for the possible role played by the size of the fund family. We see from Table 3 that funds in larger families increase risk in the second half of the year by more than funds from small families. From Tables 4 and 5 it is evident that this effect is driven by European family funds, because this coefficient is found to be negative and significant for US family funds, but positive and highly significant for European funds. Finally, the coefficients on our control variables for (i) mean reversion in volatility and (ii) changes in equity market risk between the second and first halves of the year are consistently signed in accordance with expectations across all models and are also highly statistically significant.

## 5. Conclusions

In this paper we examine the impact that a mutual fund's family status has on its performance. We test extant hypotheses in the literature around family status; first that it may give rise to strategic behaviour on the part of fund management companies which in turn may generate stronger performance persistence among family funds compared to non-family funds; and second that family membership may give rise to intra-family competition which in turn affects the risk taking behaviour of funds. We apply both a recursive portfolio formation and utility based methodology to test for persistence but fail to find evidence of stronger persistence among family funds compared with non-family funds. We do, however, show that holding portfolios of funds based on their past performance leads in some instances to significant differences in performance between family versus non-family funds.

We also provide strong evidence to suggest that a fund's mid-year ranking within its family affects its risk over the remainder of the year but interestingly that this effect differs between US and European family funds. Among US funds, the results point to intra-family competition where mid-year losers increase risk by more than mid-year winners (albeit at a diminishing rate) in an attempt to catch up. The opposite is found to be the case for European family funds. Overall then, these results highlight significant differences in the ways in which the US and European fund management industries operate.

One of the main reasons why researchers seek to examine a financial market phenomenon that has been identified using data from one financial market, using new data from another, is to see whether the phenomenon is pervasive, or whether it is market specific. Our investigation into the risk taking behaviour of European family funds establishes clearly that European fund managers do not behave in the way that their US counterparts do. Our

work here, being the first to examine this issue using non-US data (to our knowledge), has identified an interesting difference between the two mutual fund industries. Hopefully, future research may be able to identify the industry practices and cultures that are the source of this difference.

## References

- Carhart, M. (1997) 'Om Persistence in Mutual Fund Performance', *Journal of Finance*, 52, pp. 57-82.
- Elton, E., Green, M. and Gruber, T. (2007), 'The impact of mutual fund family membership on investor risk', *Journal of Financial and Quantitative Analysis*, Vol 42, pp.252-272.
- Fama, E., and French, K. (1993), 'Common risk factors in the returns of stocks and bonds', *Journal of Financial Economics*, Vol. 33, pp. 3-56.
- Freund, John (2003) 'Mathematical Statistics', Pearson, 7<sup>th</sup> Edition, pp 462-463.
- Gallagher, G., Kaniel, R. and Starks, L. (2009) 'Advertising and Mutual Funds: From Families to Individual Funds', <http://ssrn.com/abstract=1362535>.
- Gallagher, G., Kaniel, R. and Starks, L. (2006) 'Madison Avenue Meets Wall Street: Mutual Fund Families, Competition and Advertising', <http://ssrn.com/abstract=937952>
- Gaspar, J., Massa, M and Matos P. (2006) 'Favouritism in Mutual Fund Families? Evidence on Strategic Cross-Fund Subsidization', *Journal of Finance*, Vol 61, pp.73-104
- Guedj, I. and Papastaikoudi, J (2005) 'Can mutual fund families affect the performance of their funds?' <http://ssrn.com/abstract=467282>
- Hendricks, D, Patel, J., and Zeckhauser, R. (1993) 'Hot hands in mutual funds: Short-run persistence of performance, 1974-88', *Journal of Finance* Vol. 48, pp. 93-130.
- Huij, J. and Verbeek, M. (2007) 'Spillover effects of marketing in mutual fund families' <http://ssrn.com/abstract=958784>.
- Kempf, A and Ruenzi, S. (2004) 'Family Matters: the performance flow relationship in the mutual fund industry', <http://ssrn.com/abstract=549121>.
- Kempf, A and Ruenzi, S. (2008) 'Tournaments in mutual fund families', *The Review of Financial Studies*, Vol 21, pp.1013-1036.
- Khorana, A and Servaes, H. (1999) 'The determinants of mutual fund starts', *Review of Financial Studies*, Vol 12, pp.1043-1074.
- Massa, M. (2003) 'How do family strategies affect fund performance? When performance-maximisation is not the only game in town', *Journal of Financial Economics*, Vol 67, pp.249-304.
- Nanda, V., Wang, Z. and Zheng, L. (2004) 'Family values the star phenomenon: Strategies and Mutual fund families', *Review of Financial Studies*, Vol 17, pp.667-698
- Cuthbertson, K., Nitzsche, D. and O'Sullivan, N. (2008). 'UK mutual fund performance: skill or luck?', *Journal of Empirical Finance*, Vol. 15, No. 4, pp. 613-634.

Patel, J., R.J. Zeckhauser and D. Hendricks (1994). Investor Flows and Performance: Evidence from Mutual Fund, Cross Border Investments and New Issues in *Japan, European and International Financial Markets: Analytical and Empirical Perspectives*, ed. By R. Sato,

Levich, R.M. and R.V. Ramachandran, Cambridge University Press, Cambridge (UK), pp.51-72.

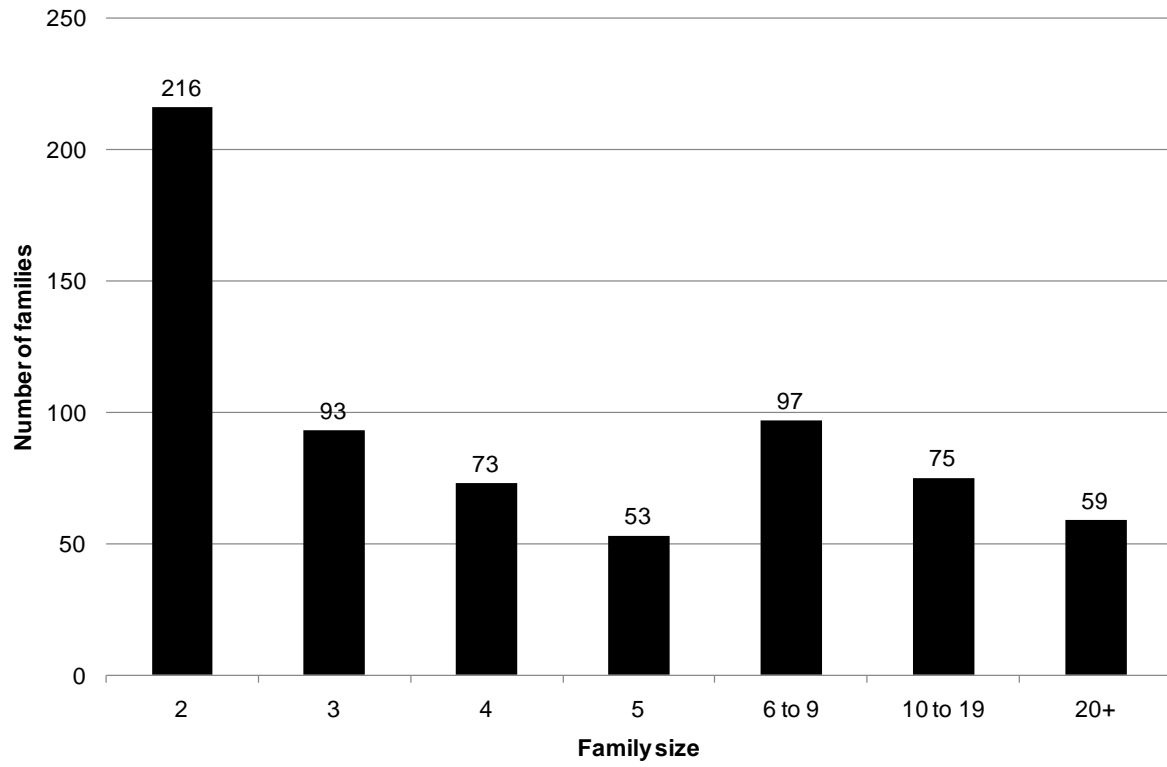
Rhodes, M. (2000) 'Past Imperfect? The Performance of UK equity managed funds,' Financial Services Authority Occasional Series no 9.

Siggelkow, N. (2003) 'Why focus? A study of intra-industry focus effects', *Journal of Industrial Economics*, Vol 51 pp.121-150.

Tower, E. and Zheng, W. (2008) 'Ranking Mutual Fund Families: Minimum expenses and maximum loads as markers for moral turpitude', *International Review of Economics*, Vol 55, pp.315-350.

Zhao, X. (2005) 'Entry decisions by mutual fund families', Stock Exchanges, IPO's and Mutual Funds, Nova Science Publishers, pp.151-179

**Figure 1: Breakdown of Families by Number of Funds**



**Table 1: Recursive Portfolio Formation Tests of Persistence**

Table 1 presents the results of the recursive portfolio methodology for testing for performance persistence. At time  $t$  we sort the funds in our sample on a single factor model alpha over  $t$  to  $t-12$  into equally weighted deciles, where decile 1 contains the top 10% of funds while decile 10 contains the lowest 10% of funds. We hold these decile portfolios over  $t$  to  $t+1$ . This process is repeated recursively over the sample period to generate a time series of holding period or 'forward looking' returns. The Table reports the average return, alpha and  $t$ -statistic of alpha of these forward looking decile portfolios. The sample period is January 1970 – June 2010.

Panel A: Family US mutual funds										
Decile Portfolio	1	2	3	4	5	6	7	8	9	10
Average return	0.41%	0.44%	0.45%	0.39%	0.34%	0.32%	0.31%	0.28%	0.36%	0.34%
Alpha	-0.03%	0.02%	0.05%	0.00%	-0.05%	-0.06%	-0.07%	-0.11%	-0.03%	-0.07%
T-stat	0.16	0.14	0.49	-0.03	-0.70	-0.80	-0.94	-1.25	-0.31	-0.53
Panel B: Non-family US mutual funds										
Decile Portfolio	1	2	3	4	5	6	7	8	9	10
Average return	0.38%	0.34%	0.37%	0.38%	0.27%	0.24%	0.14%	0.37%	0.20%	0.04%
Alpha	-0.06%	-0.07%	0.00%	0.03%	-0.09%	-0.13%	-0.21%	0.01%	-0.18%	-0.37%
T-stat	-0.35	-0.56	-0.01	0.23	-0.92	-1.43	-1.95	0.10	-1.72	-3.01
T-stat for diff	0.25	0.94	0.54	-0.32	0.49	1.01	1.84	-1.90	1.75	2.58
Panel C: Family European mutual funds										
Decile Portfolio	1	2	3	4	5	6	7	8	9	10
Average return	0.40%	0.38%	0.28%	0.25%	0.24%	0.21%	0.21%	0.19%	0.16%	0.21%
Alpha	0.02%	0.00%	-0.10%	-0.13%	-0.14%	-0.16%	-0.16%	-0.17%	-0.21%	-0.17%
T-stat	0.12	-0.01	-1.17	-1.72	-1.72	-2.13	-2.00	-2.09	-2.20	-1.71
Panel D: Non-family European mutual funds										
Decile Portfolio	1	2	3	4	5	6	7	8	9	10
Average return	0.68%	0.07%	0.13%	0.37%	0.22%	0.05%	0.11%	-0.03%	-0.05%	-0.03%
Alpha	0.36%	-0.03%	-0.19%	0.01%	-0.14%	-0.30%	-0.25%	-0.39%	-0.41%	-0.41%
T-stat	2.28	-1.70	-1.33	0.10	-0.98	-2.44	-1.99	-3.27	-2.96	-2.47
T-stat for diff	-2.26	2.13	0.76	-1.47	0.05	1.44	0.98	2.42	1.99	1.91

**Table 2: Utility-based Tests of Persistence**

*Table 2 presents the results of the Rhodes utility based persistence test described in Section 3. Panels A and B presents the probability values for three tests of normality, the Skewness/Kurtosis, Sharpio-Wilk and Sharpio-Francia tests. If the distribution of utility scores is normal then the null hypothesis of no persistence is rejected.*

<b>Panel A: Utility Based Test of Persistence – Full Sample</b>		
	<b>Family Funds</b>	<b>Non-Family Funds</b>
Skewness/Kurtosis Test	0.00	0.00
Sharpio – Wilk Test	0.00	0.00
Sharpio – Francia Test	0.00	0.00
<b>Panel B: Utility Based Test of Persistence – Sub-Samples</b>		
	<b>Family Funds</b>	<b>Non-Family Funds</b>
<b>US Mutual Funds</b>		
Skewness/Kurtosis Test	0.00	0.00
Sharpio – Wilk Test	0.00	0.00
Sharpio – Francia Test	0.00	0.00
<b>European Funds</b>		
Skewness/Kurtosis Test	0.00	0.00
Sharpio – Wilk Test	0.00	0.00
Sharpio – Francia Test	0.00	0.00

**Table 3: Risk Adjustment Strategy – All Family Funds**

$$\Delta\sigma_{i,t} = b_0 + b_1 R_{i,t}^F + b_2 R_{i,t}^S + b_3 \sigma_{i,t}^{(1)} + b_4 S_{i,t} + b_5 \Delta\sigma_{m,t} + b_6 (D_{i,t} * R_{i,t}^F) + \varepsilon_{i,t}$$

Table 3 shows the results of pooled regressions of the change in a fund's risk between the first and second half of the year on a number of fund characteristics and control variables. Results relate to the combined sample of US and European family funds.  $\Delta\sigma_{i,t} = \sigma_{i,t}^{(2)} - \sigma_{i,t}^{(1)}$  represents the change in the standard deviation of fund  $i$ 's monthly returns over the first half (January – June inclusive) to the second half (July – December inclusive) of year  $t$ .  $R_{i,t}^F$  is fund  $i$ 's mid-year rank based on all funds' (within its family) average return over January - June inclusive, in year  $t$ . A rank of 1 is assigned to the worst fund within the family, a rank of 2 to the second worst fund and so on. The ranks are normalised to make families of different sizes comparable.  $R_{i,t}^S$  is fund  $i$ 's mid-year (similarly normalised) rank relative to all funds in the same sector.  $\sigma_{i,t}^{(1)}$  is specified to control for mean reversion in volatility.  $S_{i,t}$  is the number of funds in fund  $i$ 's family in year  $t$ .  $\Delta\sigma_{m,t}$  represents the change in the standard deviation of returns in either the US or European equity market (as appropriate to fund  $i$ ) over the first half (January – June inclusive) to the second half (July – December inclusive) of year  $t$ . This is specified to control for changing risk in equity markets generally.  $D_{i,t} * R_{i,t}^F$  is an interactive dummy variable to examine whether a fund's reaction to its mid-year rank differs depending on whether it is a high ranked or low ranked fund. Here,  $D = 1$  if fund  $i$  ranks below the family median and  $D = 0$  otherwise.

Model	$R_{i,t}^F$	$R_{i,t}^S$	$\sigma_{i,t}^{(1)}$	$S_{i,t}$	$\Delta\sigma_{m,t}$	$D_{i,t}$
(1)	-0.069 (0.062)		-0.430 (0.000)			
(2)	-0.044 (0.087)		-0.239 (0.000)		0.578 (0.000)	
(3)	-0.078 (0.018)	0.059 (0.078)	-0.240 (0.000)		0.579 (0.000)	
(4)	-0.055 (0.093)	0.049 (0.132)	-0.240 (0.000)	0.001 (0.001)	0.578 (0.000)	
(5)	-0.013 (0.375)	0.049 (0.129)	-0.239 (0.000)	0.001 (0.001)	0.578 (0.000)	0.116 (0.031)

**Table 4: Risk Adjustment Strategy – US Family Funds**

$$\Delta\sigma_{i,t} = b_0 + b_1 R_{i,t}^F + b_2 R_{i,t}^S + b_3 \sigma_{i,t}^{(1)} + b_4 S_{i,t} + b_5 \Delta\sigma_{m,t} + b_6 (D_{i,t} * R_{i,t}^F) + \varepsilon_{i,t}$$

Table 4 shows the results of pooled regressions of the change in a fund's risk between the first and second half of the year on a number of fund characteristics and control variables. Results relate to US family funds.  $\Delta\sigma_{i,t} = \sigma_{i,t}^{(2)} - \sigma_{i,t}^{(1)}$  represents the change in the standard deviation of fund  $i$ 's monthly returns over the first half (January – June inclusive) to the second half (July – December inclusive) of year  $t$ .  $R_{i,t}^F$  is fund  $i$ 's mid-year rank based on all funds' (within its family) average return over January - June inclusive, in year  $t$ . A rank of 1 is assigned to the worst fund within the family, a rank of 2 to the second worst fund and so on. The ranks are normalised to make families of different sizes comparable.  $R_{i,t}^S$  is fund  $i$ 's mid-year (similarly normalised) rank relative to all funds in the same sector.  $\sigma_{i,t}^{(1)}$  is specified to control for mean reversion in volatility.  $S_{i,t}$  is the number of funds in fund  $i$ 's family in year  $t$ .  $\Delta\sigma_{m,t}$  represents the change in the standard deviation of returns in either the US or European equity market (as appropriate to fund  $i$ ) over the first half (January – June inclusive) to the second half (July – December inclusive) of year  $t$ . This is specified to control for changing risk in equity markets generally.  $(D_{i,t} * R_{i,t}^F)$  is an interactive dummy variable to examine whether a fund's reaction to its mid-year rank differs depending on whether it is a high ranked or low ranked fund. Here,  $D = 1$  if fund  $i$  ranks below the family median and  $D = 0$  otherwise.

Model	$R_{i,t}^F$	$R_{i,t}^S$	$\sigma_{i,t}^{(1)}$	$S_{i,t}$	$\Delta\sigma_{m,t}$	$D_{i,t}$
(1)	-0.340 (0.000)		-0.400 (0.000)			
(2)	-0.273 (0.000)		-0.219 (0.000)		0.527 (0.000)	
(3)	-0.214 (0.000)	-0.103 (0.010)	-0.219 (0.000)		0.528 (0.000)	
(4)	-0.212 (0.093)	-0.104 (0.010)	-0.219 (0.000)	0.0001 (0.382)	0.528 (0.000)	
(5)	-0.174 (0.000)	-0.104 (0.010)	-0.219 (0.000)	0.0002 (0.341)	0.528 (0.000)	0.104 (0.092)

**Table 5: Risk Adjustment Strategy - European Family Funds**

$$\Delta\sigma_{i,t} = b_0 + b_1 R_{i,t}^F + b_2 R_{i,t}^S + b_3 \sigma_{i,t}^{(1)} + b_4 S_{i,t} + b_5 \Delta\sigma_{m,t} + b_6 (D_{i,t} * R_{i,t}^F) + \varepsilon_{i,t}$$

Table 5 shows the results of pooled regressions of the change in a fund's risk between the first and second half of the year on a number of fund characteristics and control variables. Results relate to European family funds.  $\Delta\sigma_{i,t} = \sigma_{i,t}^{(2)} - \sigma_{i,t}^{(1)}$  represents the change in the standard deviation of fund  $i$ 's monthly returns over the first half (January – June inclusive) to the second half (July – December inclusive) of year  $t$ .  $R_{i,t}^F$  is fund  $i$ 's mid-year rank based on all funds' (within its family) average return over January - June inclusive, in year  $t$ . A rank of 1 is assigned to the worst fund within the family, a rank of 2 to the second worst fund and so on. The ranks are normalised to make families of different sizes comparable.  $R_{i,t}^S$  is fund  $i$ 's mid-year (similarly normalised) rank relative to all funds in the same sector.  $\sigma_{i,t}^{(1)}$  is specified to control for mean reversion in volatility.  $S_{i,t}$  is the number of funds in fund  $i$ 's family in year  $t$ .  $\Delta\sigma_{m,t}$  represents the change in the standard deviation of returns in either the US or European equity market (as appropriate to fund  $i$ ) over the first half (January – June inclusive) to the second half (July – December inclusive) of year  $t$ . This is specified to control for changing risk in equity markets generally.  $(D_{i,t} * R_{i,t}^F)$  is an interactive dummy variable to examine whether a fund's reaction to its mid-year rank differs depending on whether it is a high ranked or low ranked fund. Here,  $D = 1$  if fund  $i$  ranks below the family median and  $D = 0$  otherwise.

Model	$R_{i,t}^F$	$R_{i,t}^S$	$\sigma_{i,t}^{(1)}$	$S_{i,t}$	$\Delta\sigma_{m,t}$	$D_{i,t}$
(1)	0.557 (0.000)		-0.495 (0.000)			
(2)	0.474 (0.000)		-0.270 (0.000)		0.795 (0.000)	
(3)	0.155 (0.009)	0.579 (0.000)	-0.275 (0.000)		0.797 (0.000)	
(4)	0.202 (0.001)	0.560 (0.000)	-0.275 (0.000)	0.002 (0.000)	0.796 (0.000)	
(5)	0.221 (0.001)	0.561 (0.000)	-0.276 (0.000)	0.002 (0.000)	0.7978 (0.000)	0.055 (0.329)