Risk Shifting and Mutual Fund Performance*

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Abstract

Mutual funds change their risk levels significantly over time. This paper investigates the performance consequences of risk shifting, as well as the economic motivations and the mechanisms of risk shifting. Mutual funds might actively shift the risk of their portfolios to take advantage of time-varying investment opportunities. Alternatively, mutual funds with inferior investment abilities or subject to more severe agency issues might be more prone to shift their risk levels. Using a holdings-based measure of risk shifting, we find that funds that increase risk perform worse than funds that keep stable risk levels over time. In addition, younger, smaller funds and funds with higher expense ratios are more likely to shift risk and perform particularly poorly after increasing risk.

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1 Introduction

Mutual funds change their total risk exposure substantially over time. Using the disclosed holdings of a sample of 2,335 U.S. equity funds over the period between 1980 and 2006, we document that 27.1% of equity mutual funds change their annualized volatility by more than 2.5% in a given quarter, and 9.6% of funds change their volatility by more than 5%. These changes are significant given that their average long-term volatility level is only 17.9%.

Risk shifting per se does not necessarily benefit or hurt fund investors. As long as the act of risk shifting is well-known and has no performance consequences, investors can form efficient portfolios by adjusting their allocation to the funds based on the expected ability and risk levels. However, if investors are not fully aware of the risk shifting behavior or if the changing risk level hampers their ability to assess fund performance, then individual portfolios are less likely to be efficient.

Our paper studies whether funds that shift risk exhibit different subsequent performance compared to funds with more consistent risk levels. We further investigate the mechanisms and the economic motivations of risk shifting.

Mutual funds might change their risk levels for several reasons, which have different performance consequences. On the one hand, funds might change their risk levels to capitalize on time-varying investment opportunities. If funds that actively adjust the composition of their portfolios have superior investment abilities, then they should perform better than funds that have more stable risk exposures. On the other hand, mutual funds with inferior ability might be more prone to shift risk. In addition, agency issues in delegated portfolio management might induce fund managers to strategically change their risk levels to increase the expected money inflows to the fund (e.g., Brown, Harlow, and Starks (1996) and Chevalier and Ellison (1997)) or to manipulate their performance numbers (e.g., Goetzmann, Ingersoll, Spiegel, and Welch (2007)). To the extent that opportunistic risk shifting causes trading costs, constrains the investment opportunity sets, and distracts fund managers from their goal of investing in the most promising securities, we should expect risk shifters to perform worse.

To measure risk shifting of mutual funds, we propose a holdings-based measure that is defined as the difference between a fund's current holdings volatility and its past realized volatility. The current holdings volatility is the standard deviation of the most recently disclosed fund holdings, and the past realized volatility is the standard deviation of the fund's actual return. A fund has a positive risk shifting measure if the most recently disclosed holdings are riskier than the actual fund holdings.

We sort mutual funds into portfolios according to their most recent risk shifting measure and compare their subsequent performance. We find that funds that increase risk the most perform significantly worse (with an annualized abnormal return of -2.6% using the Carhart model) than funds that maintain stable risk levels (with an abnormal return of -0.7%). These results are robust using alternative performance measures. The poor performance of risk shifters suggests that they are unlikely to possess superior ability.

To understand the sources of the poor performance of risk shifters, we study the various mechanisms through which funds can change risk: First, funds can shift risk by changing the composition between equity holdings and cash holdings. Second, within their equity holdings, funds can shift risk by changing their exposure to systematic risk (e.g., by switching between low beta stocks and high beta stocks). Third, funds can shift risk by changing their exposure to idiosyncratic risk (e.g., by concentrating the holdings on a few positions or industries). We find evidence that all of these mechanisms are important in explaining the risk shifting behavior of mutual funds. In contrast, the performance consequences are significant mainly for funds increasing idiosyncratic risk exposure, whereas both the reduction in cash holdings and the increase in systematic risk lead to only mild reductions in fund performance. Thus, the poor performance of risk shifters is driven not by the unsuccessful attempts of fund managers to time the aggregate market but by their desire to take on idiosyncratic risks. We also sort funds into subgroups with different turnover to study the impact of transaction costs. Surprisingly, the poor performance of risk shifters is concentrated in low turnover funds. To the extent that turnover is a proxy for trading costs, our finding suggests that direct trading costs are unlikely the main driver of risk shifters' poor performance.

To further investigate the motivation for the risk shifting behavior of mutual funds, we separate funds into subgroups by various fund characteristics (e.g., expense ratio, age, family size, and prior fund performance). We find that the propensity to shift risk and the performance consequences of risk shifting differ substantially across funds. For example, 14.7% of funds with above-median expense ratios increase their volatility by more than 2.5% and experience a Carhart alpha of -2.9% per year, whereas only 10.5% of funds with below-median expense ratios increase their volatility by more than 2.5% and experience a Carhart alpha of -1.2%. Similarly, younger, smaller funds and funds with worse prior performance experience more severe performance consequences when they shift risk.

Several studies have identified a convex flow-performance relation, in which mutual fund investors tend to invest in funds with stellar performance and do not penalize poor performance equivalently. This convex flow-performance relation motivates mutual funds to strategically shift risk levels to attract additional fund flows. For example, Brown, Harlow, and Starks (1996) suggest that mutual funds compete with each other in a tournament and might manipulate fund risk depending on their prior performance. In particular, they show that funds with poor past performance tend to increase their risk levels. Chevalier and Ellison (1997) analyze the convex flow-performance relation and find evidence that mutual funds that are well ahead of their peers also have an incentive to increase risk to make lists of "top performers." Koski and Pontiff (1999) confirm this risk shifting behavior and suggest that risk levels of mutual funds might also change in response to unpredictable fund flows. Furthermore, as discussed by Goetzmann, Ingersoll, Spiegel, and Welch (2007), fund managers have an incentive to change risk levels to manipulate their performance numbers. Recently, several theoretical and empirical studies have improved our understanding of risk shifting behavior of mutual funds.[1] Our paper contributes to this literature by investigating the consequences

[1] Additional papers on risk shifting include Starks (1987), Ippolito (1992), Grinblatt and Titman (1989), Goetzmann and Peles (1997), Sirri and Tufano (1998), Zheng (1999), Carpenter (2000), Busse (2001), DelGuercio and Tkac (2002), Elton, Gruber, and Blake (2003), Lynch and Musto (2003), Palomino and Prat (2003), Nanda, Wang, and Zheng (2004), Ross (2004), Elton, Gruber, Krasny, and Ozelge (2006), Li and Tiwari

of risk shifting on fund performance, which have not previously been analyzed. Studying the performance consequences of risk shifting gives us important insights into the motivations for risk shifting.

The remainder of this paper is structured as follows: Section 2 derives our holdings-based measure of risk shifting. Section 3 explains the data sources and gives some basic summary statistics. Section 4 describes the characteristics of risk shifters and the mechanisms of shifting risk. Section 5 documents a negative relation between risk shifting and subsequent fund performance. Section 6 investigates the mechanisms and the economic motivation behind risk shifting . Section 7 uses a multivariate regression analysis to control for additional fund characteristics and Section 8 concludes.

2 Risk Shifting Measure

Mutual funds can change the total risk of their portfolio by holding assets with different risk properties or by changing the diversification level of their overall portfolio. To capture the risk shifting behavior of mutual funds, we examine their portfolio holdings. We measure risk shifting of a mutual fund f at time t by comparing the current holdings volatility based on the fund's most recently disclosed positions $\sigma^H_{f,t}$ with the past realized volatility based on the fund's realized returns $\sigma^R_{f,t}$:

$$RS_{f,t} = \sigma^H_{f,t} - \sigma^R_{f,t}. \qquad (1)$$

The return of mutual fund f at time t is the scalar product of the portfolio weight $\mathbf{w_{f,t}}$ and the returns of the assets $\mathbf{R_t}$:

$$RF_{f,t} = \mathbf{w'_{f,t}} \mathbf{R_t} = \sum_{i=1}^{N} w^i_{f,t} R^i_t, \qquad (2)$$

where $\mathbf{R_t} = [R^1_t, \ldots, R^N_t]'$ is the vector of the returns for all available assets and $\mathbf{w_{f,t}} = [w^1_{f,t}, \ldots, w^N_{f,t}]'$ is the vector for the portfolio weights invested in these assets by fund f at time

(2006), Basak, Pavlova, and Shapiro (2007), Guasoni, Huberman, and Wang (2007), Huang, Wei, and Yan (2007), Massa and Patgiri (2007), Kempf and Ruenzi (2008), Kempf, Ruenzi, and Thiele (2008), Hu, Kale, Pagani, and Subramanian (2008), Chen and Pennacchi (2009), and Ivkovich and Weisbenner (2009).

t. The weights add up to one ($\mathbf{w}'_{\mathbf{f},\mathbf{t}}\mathbf{1} = \sum_{i=1}^{N} w^i_{f,t} = 1$).

The variance of the returns of mutual fund f at time t depends on the weights invested in the various assets and on the $N \times N$ variance-covariance matrix of the individual assets $\mathbf{\Sigma}$. The variance of a portfolio can be determined by either computing the variance of the portfolio returns or by pre- and post-multiplying the variance-covariance matrix of the underlying stock returns by the weight vector.

$$\text{VAR}(RF_{f,t}) = \text{VAR}(\mathbf{w}'_{\mathbf{f},\mathbf{t}}\mathbf{R_t}) = \mathbf{w}'_{\mathbf{f},\mathbf{t}}\text{VAR}(\mathbf{R_t})\mathbf{w_{f,t}} = \mathbf{w}'_{\mathbf{f},\mathbf{t}}\mathbf{\Sigma_t}\mathbf{w_{f,t}}. \tag{3}$$

To estimate the current holdings volatility of fund f at time t, we compute the square root of $\text{VAR}(RF_{f,t})$ by estimating the sample standard deviation of the return of a hypothetical portfolio that holds the most recently disclosed fund positions over the prior 36 months. This method is equivalent to calculating the square root of $\mathbf{w}'_{\mathbf{f},\mathbf{t}}\mathbf{\Sigma_t}\mathbf{w_{f,t}}$.

The past realized volatility of fund f at time t is estimated as the sample standard deviation of the actual fund returns over the prior 36 months. It captures the total risk of the actual positions. The realized volatility is identical to the current holdings volatility if a fund maintains constant portfolio weights over the prior 36 months.

The risk shifting measure RS is positive if the most recently disclosed holdings exhibit a higher volatility than the actual fund holdings over the prior 36 months and is negative otherwise. Thus, a positive risk shifting measure indicates that a mutual fund increases the portfolio risk, which is achievable either by holding assets with higher risk levels or by concentrating its portfolio more.

Most previous papers analyze risk shifting by comparing the standard deviations of the returns of mutual funds over two non-overlapping time periods.[2] Comparing risk levels of a fund over two non-overlapping time periods may capture the exogenous changes in market conditions rather than the intentional changes in portfolio risk, especially during periods of dramatic market movements. By using identical time periods to estimate both the current

[2]See for example, Brown, Harlow, and Starks (1996), Koski and Pontiff (1999), Busse (2001), and Elton, Gruber, and Blake (2003). On the other hand, Chevalier and Ellison (1997) and Kempf, Ruenzi, and Thiele (2008) do use mutual fund holdings data to compute changes in risk levels.

holdings volatility and the realized volatility for a fund, our measure of risk shifting is designed to capture the changes in risk levels induced by changes in the portfolio composition and is unaffected by changes in market conditions.

One potential concern of our risk shifting measure is that our measure might capture the impact of interim trades, window dressing, or other unobserved actions, since the current holdings volatility is based on disclosed holdings returns and the realized volatility is based on realized fund returns. In Section 6, we introduce several alternative risk shifting measures, one of which (the equity-based risk shifting measure) is based solely on disclosed holdings and is defined as the difference between the volatility of current equity holdings and the volatility of past equity holdings. The results are similar using these alternative measures.

3 Data and Summary Statistics

This section explains the data sources and describes the main characteristics of mutual funds in our sample.

3.1 Sample Selection

For our empirical analysis, we merge the CRSP Survivorship Bias Free Mutual Fund Database with the Thomson Financial CDA/Spectrum holdings database and the CRSP stock price data using the MFLINKS file based on Wermers (2000) and available through the Wharton Research Data Services. Our sample covers the time period between 1980 and 2006. The CRSP mutual fund database includes information on fund returns, total assets under management, different types of fees, investment objectives, and other fund characteristics. The Thomson Financial database provides long positions in domestic common stock holdings of mutual funds. The data are collected both from reports filed by mutual funds with the SEC and from voluntary reports generated by the funds. During most of our sample period, funds are required by law to disclose their holdings semi-annually. Nevertheless, about 78% of the observations are from the most recent quarter and only 3% of the holdings are more than two quarters old.

We focus our analysis on actively-managed domestic equity mutual funds for which the holdings data are most complete and reliable. Therefore, we eliminate balanced, bond, money market, international, and index funds.[3] We also exclude funds which in the previous month manage less than \$5 million and funds that did not disclose their holdings in the previous 36 months. For funds with multiple share classes, we compute fund-level variables by aggregating across the different share classes.[4]

3.2 Summary Statistics

Table 1 reports summary statistics of the main fund attributes. Our sample includes 2,335 distinct funds and 184,519 fund-month observations with a valid risk shifting measure RS. The number of funds ranges from 141 (April 1983) to 1,559 (October 2006). Since we need 36 months of prior fund return data to compute the risk shifting measure, we lose the first three years of the return histories of all mutual funds. Thus, our final sample covers the period between 1983 and 2006.

We report summary statistics on fund total net assets (TNA), age, expense ratio, turnover, asset allocations, and net investor returns based on the CRSP mutual fund data. Based on the CRSP data we compute the fund flow ($FLOW$), which is defined as the growth rate of the assets under management after adjusting for the appreciation of the mutual fund's assets (RF_t), assuming that all the cash flows are invested at the end of the period:

$$FLOW_{f,t} = \frac{TNA_{f,t} - TNA_{f,t-1}(1 + RF_{f,t})}{TNA_{f,t-1}}. \quad (4)$$

[3]First, we select funds with the following S&P objectives: AGG, GMC, GRI, GRO, ING, SCG, ENV, FIN, GLD, HLT, NTR, RLE, SEC, TEC, UTI. If a fund does not have any of the above objectives, we select funds with the following ICDI objectives: AG, GI, LG, IN, PM, SF or UT. If a fund has neither the S&P nor the ICDI objective, then we go to the Wiesenberger Fund Type Code and pick funds with the following objectives: G, G-I, IEQ, GCI, LTG, MCG, SCG, GPM, HLT, TCH, or UTL. If none of these objectives are available and the fund has the CS or SPEC policy, then the fund will be included. Index funds are identified based on their names.

[4]Our sample focuses on actively-managed domestic equity mutual funds, for which the holdings data are most complete and reliable. In unreported results we show that the results are slightly stronger if we include all funds which are listed in the MFLINKS file that matches CRSP with Thomson. The results are not affected substantially if we exclude sector funds or include index funds.

Since estimated fund flows are very volatile, we winsorize both the top and the bottom parts of the distribution at the 1% level.

The average investor return of mutual funds in our sample equals 0.83% per month. We compute the gross holdings return based on the most recently disclosed quarter-end Thomson equity holdings and the asset allocation weights from CRSP. The holdings database includes only long positions in domestic common stocks and excludes other non-equity holdings. Since we focus our analysis on equity mutual funds, these disclosed holdings compose the vast majority of fund assets (91.28%), with the remaining assets invested in cash (6.26%) and other non-equity holdings (2.46%) including bonds, preferred stocks, and other securities. We proxy for these asset returns using published indices. For bonds and preferred stocks we use the total return of the Lehman Brothers Aggregate Bond Index; for cash holdings and other assets we use the Treasury bill rate. The gross holdings return has a mean of 0.91% per month and a correlation of 95.5% with the net investor return across the mutual funds in our sample.

Important determinants of the risk level of a fund are the number of stocks and the concentration of stocks in particular industries. The number of stocks is computed based on the holdings information from Thomson Financial and the Industry Concentration Index (ICI) is computed following Kacperczyk, Sialm, and Zheng (2005) as the concentration of the stock portfolio in ten broadly defined industries.[5]

Table 1 also summarizes holdings-based style characteristics for the mutual funds in our sample. We group fund holdings according to their size, book-to-market, and momentum characteristics as proposed by Daniel, Grinblatt, Titman, and Wermers (1997) and Wermers (2003). Each stock listed in CRSP is grouped into respective quintiles according to its market value (using NYSE cutoff levels), its industry-adjusted book-to-market ratio, and its lagged one-year return. Using the quintile information, we compute the value-weighted size, value,

[5]The Industry Concentration Index of fund f at time t is defined as $ICI_{f,t} = \sum_{j=1}^{10}(w_{f,t}^{j} - \overline{w}_{f,t}^{j})^2$, where $w_{f,t}^{j}$ is the value weight of the stocks held by the mutual fund in the j-th industry and $\overline{w}_{f,t}^{j}$ is the weight of the CRSP total market portfolio corresponding to the j-th industry. Industry concentration is measured across ten broadly defined industries as summarized in Table AI of Kacperczyk, Sialm, and Zheng (2005).

and momentum scores for each mutual fund in each period. For example, a mutual fund that invests one half of its value in stocks in the largest size quintile and the other half in stocks in the second largest size quintile has a size score of 4.5. Mutual funds in our sample tend to hold stocks in the largest size quintile and have a slight bias towards growth and momentum stocks.

The last three rows of Table 1 report the current holdings volatility, the past realized volatility, and the risk shifting measure, as defined in Section 2. To compute the current holdings volatility, we exclude the holdings of stocks that do not have complete return histories over the prior 36 months.[6] Both the current holdings volatility and the realized volatility are computed and updated at a quarterly frequency. The current holdings volatility and the realized volatility have similar means (17.54% and 17.86% per year, respectively) and a high correlation of 0.83. The risk shifting measure has a mean close to zero and an annualized standard deviation of 4.58%, which is about one quarter of the average realized volatility. Thus, mutual funds shift risk significantly.

To test whether the current holdings volatility is a good proxy for the future realized volatility of a mutual fund, in unreported analysis we regress the future 12-month realized volatility of a mutual fund on the current holdings volatility and the past realized volatility over the prior 36 months. We find that the coefficient on the current holdings volatility is larger and more statistically significant than the coefficient on the past realized volatility. Thus, the current holdings volatility captures an important aspect of the future risk exposure.

4 Characterization of Risk Shifting

This section discusses the characteristics of risk shifters and clarifies the main mechanisms through which mutual funds shift risk.

[6]The holdings volatility is not affected significantly if stocks that were publicly listed during the prior 36 months are included. Including recent IPO stocks increases the holdings volatility only marginally from 17.54% to 17.61%. The correlation between the two volatilities equals 0.995. The correlation of the risk shifting measures with and without recent IPO stocks is 0.986.

4.1 Characteristics of Risk Shifters

To identify the characteristics of risk shifters, we sort all mutual funds in each quarter into five portfolios according to the most recent RS measure and compute average characteristics of these funds. Funds in Portfolio 1 (5) decrease (increase) risk by more than 2.5% per year and compose 14% (13%) of our sample, whereas funds in Portfolio 3 change risk by less than 1% and compose 41% of our sample.[7]

Table 2 summarizes the characteristics of mutual funds sorted according to the RS measure. Funds in Portfolio 1 decrease risk on average by 5.60% per year, which is approximately 26% of their realized volatility over the prior 36 months. On the other hand, funds in Portfolio 5 increase risk by 4.75% per year, which is also approximately 26% of their prior realized volatility. Thus, funds exhibit significant changes in their overall risk levels over time.

The current holdings volatility and the realized volatility contribute asymmetrically to the RS measure across different RS portfolios. Funds in Portfolio 5 exhibit high current holdings volatility, and their realized volatility is not very different from the mean realized volatility. On the other hand, funds in Portfolio 1 have high realized volatility, and their current holdings volatility is not substantially different from the mean holdings volatility. Thus, funds in Portfolio 5 increase their total risk significantly from the average risk level and funds in Portfolio 1 reduce their total risk from their elevated levels back to the average. This asymmetric pattern suggests that increasing volatility is more of an active choice for funds while decreasing volatility is driven more by the reversion back to the mean risk level.

Most fund characteristics exhibit a U or inverse-U pattern, which indicates that funds that increase risk share similar characteristics to funds that decrease risk. Funds that shift risk are smaller, younger, charge higher expense ratios, and have higher turnover than funds with more consistent risk levels.

[7]Mutual funds are sorted into five groups according to fixed cutoff levels to maintain similar risk shifting levels within each group over time. The results are similar if the mutual funds are sorted into decile portfolios instead, as discussed in more detail below.

4.2 Mechanism of Risk Shifting

Mutual funds have several potential mechanisms through which they change the riskiness of their portfolios. First, they can change the composition between equity holdings and cash holdings. Second, within their equity holdings, funds can change their exposure to systematic risks by switching between low beta stocks and high beta stocks. Third, funds can change their idiosyncratic risk exposures by changing the number of stocks or the concentration in particular industries and styles.

Table 3 summarizes the initial characteristics (Panel A) and the changes in the characteristics (Panel B) of mutual funds in the various RS portfolios. The initial levels are defined as the average values of the various characteristics over the prior three years and the changes are defined as the differences in characteristics between the most recent quarter and the average over the prior three years.

Funds with more consistent risk exposures have lower market betas despite holding smaller cash positions than funds which shift risk. Risk shifters have higher initial levels of idiosyncratic volatility and hold more concentrated portfolios as reflected by the lower number of stocks and the higher industry concentration index. Risk shifters also differ in their style exposure from funds with more consistent risk exposures as they focus their holdings on small, growth, and momentum stocks.

Panel B indicates that the changes in the various characteristics are monotonic across the RS portfolios and illustrate the multiple mechanisms through which mutual funds change risk. For example, funds that increase risk tend to reduce their cash holdings, increase market risk exposure, increase idiosyncratic risk exposure by reducing the number of stock positions or increasing their industry concentration levels, and increase their holdings of small capitalization, growth, and momentum stocks.

Figure 1 depicts the persistence of the RS measure four quarters before and eight quarters after the formation of the five RS portfolios. Risk shifting builds up gradually over the year prior to the portfolio formation and dissipates to a large extend two years after the portfolio formation. The short-term persistence in risk shifting occurs partly because the persistence in trading strategies and partly because the past realized volatility is based on overlapping data. Over longer horizons, however, it would be difficult for mutual funds to consistently increase or decrease risk. We frequently observe that funds in one of the extreme portfolios switch to the other extreme, while funds with stable risk levels tend to remain in the middle portfolios.

5 Performance Consequences of Risk Shifting

This section compares the performance of funds that shift risk with the performance of funds with more stable risk properties. We use various performance measures to evaluate fund performance.

5.1 Performance Measures

At the end of each month we sort mutual funds into portfolios according to their most recent RS measure. We compute the fund portfolio return as the equal-weighted average return of all funds in the corresponding portfolio over the next month. Subsequently, we compute the abnormal returns using the time-series of fund portfolio returns. We analyze the future performance of funds after computing the risk shifting measure to avoid any potential issues of reverse causality.

We report four different performance measures for the fund portfolios. To adjust for risk and style effects, abnormal returns are computed using the one-factor CAPM, the Fama and French (1993), the Carhart (1997), and the Ferson and Schadt (1996) models. The Fama-French-Carhart model is specified as follows:

$$\begin{aligned} RF_{k,t} - R_{TB,t} &= \alpha_k + \beta_k^M (R_{M,t} - R_{TB,t}) + \beta_k^{SMB} (R_{S,t} - R_{B,t}) \\ &\quad + \beta_k^{HML} (R_{H,t} - R_{L,t}) + \beta_k^{UMD} (R_{U,t} - R_{D,t}) + \epsilon_{k,t}. \end{aligned} \tag{5}$$

The return of portfolio k during time period t is denoted by $RF_{k,t}$. The index M corresponds to the market portfolio and the index TB to the risk-free Treasury bill rate. Portfolios of small and large stocks are denoted by S and B; portfolios of stocks with high and low ratios between their book values and their market values are denoted by H and L; and portfolios of stocks with relatively high and low returns during the previous year are denoted by U and D. The Fama-French-Carhart model nests the CAPM model (which includes only the market factor) and the Fama-French model (which includes the size and the book-to-market factors in addition to the market factor).

Following Wermers (2003), we use the Ferson and Schadt (1996) conditional model that nests the Carhart model.

$$\begin{aligned} RF_{k,t} - R_{TB,t} &= \alpha_k + \beta_k^M (R_{M,t} - R_{TB,t}) + \beta_k^{SMB} (R_{S,t} - R_{B,t}) + \beta_k^{HML} (R_{H,t} - R_{L,t}) \\ &+ \beta_k^{UMD} (R_{U,t} - R_{D,t}) + \sum_{j=1}^{5} \beta_k^j (R_{M,t} - R_{TB,t}) \times MACRO_{t-1}^j + \epsilon_{k,t}, \end{aligned} \quad (6)$$

where $MACRO_{t-1}^j$ denotes one of five demeaned lagged macro-economic variables including the Treasury bill yield, the dividend yield of the S&P Composite Index, the Treasury yield spread (long- minus short-term bonds), the quality spread in the corporate bond market (low- minus high-grade bonds), and an indicator variable for the month of January.[8] In all four models, the factor loadings β_k denote the sensitivities of the returns of portfolio k to the various factors and are estimated for each of the portfolios separately. The intercepts α_k capture the abnormal returns of the corresponding models and are reported in Table 4.

5.2 Base Case Performance Results

Table 4 reports the performance of mutual fund portfolios sorted by their risk shifting. We observe that funds that increase risk experience significantly worse subsequent abnormal returns than funds with stable risk levels. Funds that reduce risk also experience relatively poor

[8]The market, size, book-to-market, momentum factors and the risk-free rate are obtained from Ken French's website (http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/index.html). The dividend yield of the S&P Composite Index is obtained from Shiller's website (http://www.econ.yale.edu/ shiller/data.htm). The Treasury and corporate bond yields are obtained from the Federal Reserve Board (http://www.federalreserve.gov). Using a five factor model including the Pastor and Stambaugh (2003) liquidity factor does not affect the results qualitatively and quantitatively.

performance, although not significantly different from funds with stable risk levels. For example, funds that increase risk the most (in Portfolio 5) exhibit an abnormal return of -22 basis points per month using the Carhart model; funds that decrease risk the most (in Portfolio 1) exhibit a Carhart alpha of -7 basis points per month; and funds with the most consistent risk levels (in Portfolio 3) have an abnormal return of -6 basis points per month.[9] The poor performance of funds that increase risk remains economically and statistically significant using alternative factor models. Figure 2 illustrates these results graphically.[10]

In unreported results, we find that the performance results become substantially stronger if we subdivide Portfolio 5 into more extreme portfolios. For example, the abnormal return of mutual funds that increase their risk levels by more than 5% (corresponding to 3.8% of the mutual fund observations) amounts to -31 basis points per month using the Carhart model, and ranges between -25 and -46 basis points per month using the other factor models.

The asymmetry between the performance of funds that increase and decrease risk is consistent with the finding in Table 2 that increasing risk is driven by the high current holdings volatility and is more of an active choice by funds while decreasing risk is driven by high past realized volatility and is more of a passive reversion back to the long-term mean. Increases in risk levels are achieved by shifting towards riskier securities and by concentrating the portfolio on fewer securities and fewer sectors as documented in Table 3. On the other hand, decreases in risk levels are achieved by holding a more balanced and better diversified portfolio. The poor performance of funds that increase risk suggests that their portfolio choices are not motivated by superior investment ability.

Our performance results contribute to the literature on delegated portfolio management.

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[9] The results are not affected qualitatively if mutual funds are grouped into deciles instead. For example, funds in the highest risk shifting decile have a Carhart alpha of -22 basis points per month, whereas funds in the lowest risk shifting decile have a Carhart alpha of -12 basis points per month. Funds in the fifth decile perform the best relative to the other deciles and have a Carhart alpha of -3 basis points per month.

[10] Our results are robust if we use the manipulation-proof performance measure (MPPM) suggested by Goetzmann, Ingersoll, Spiegel, and Welch (2007). For example, funds in Portfolio 5 exhibit the worst manipulation-proof performance. Whereas funds in Portfolio 3 generate the highest MPPM of 0.35% per month, mutual funds in Portfolios 1 and 5 generate MPPMs of 0.19% and 0.08%, using a curvature coefficient of $\rho = 3$. At a curvature coefficient of $\rho = 4$, Portfolio 5 is the only portfolio that has a negative MPPM of -0.06%, whereas the other portfolios have all positive MPPMs ranging between 0.08% and 0.25% per month.

Whereas the recent mutual fund literature finds that some mutual fund managers have significant stock selection ability, our paper indicates that risk shifting is unlikely an indication of superior investment ability. Rather, risk shifting is either an indication of inferior ability or is motivated by agency problems.[11]

5.3 Return Distribution of Risk Shifters

Figure 3 depicts the cumulative distribution functions of the performance ranking of mutual funds in different risk shifting groups. At the end of each quarter, we first compute the percentile ranks for all the funds in our sample. The percentile ranks are based on the Carhart alphas over the subsequent 12-month period. In a second step, we sort mutual funds into the same five portfolios as reported in Table 2. Finally, we compute the cumulative distribution function of the performance ranks for each of the five portfolios. The figure shows the cumulative distributions for three different groups of mutual funds. The curve $RS1$ corresponds to funds in Portfolio 1 that reduce risk the most, $RS5$ to funds in Portfolio 5 that increase risk the most, and $RS3$ to funds in Portfolio 3 that maintain stable risk levels. The intermediate groups $RS2$ and $RS4$ are not depicted separately, but fall between the middle and extreme groups.

Funds that increase risk are more likely to be ranked in the extreme of the mutual fund distribution than funds with more stable risk exposures. For example, around 17.7% of mutual funds in the $RS5$ group and just 7.1% of mutual funds in the $RS3$ group rank in the bottom decile. Risk shifting also increases the probability of being ranked at the top of the performance distribution. For example, 15.2% of mutual funds in the $RS5$ group and only 8.7% of mutual

[11] The literature on the investment ability of mutual fund managers include Treynor and Mazuy (1966), Henriksson and Merton (1981), Grinblatt and Titman (1993), Brown and Goetzmann (1995), Ferson and Schadt (1996), Carhart (1997), Busse (1999), Daniel, Grinblatt, Titman, and Wermers (1997), Wermers (2000), Baks, Metrick, and Wachter (2001), Bollen and Busse (2001), Coval and Moskowitz (2001), Jiang (2003), Chen, Hong, Huang, and Kubik (2004), Cohen, Coval, and Pastor (2005), Kacperczyk, Sialm, and Zheng (2005), Gaspar, Massa, and Matos (2006), Kosowski, Timmermann, Wermers, and White (2006), Jiang, Yao, and Yu (2007), Kacperczyk and Seru (2007), Mamaysky, Spiegel, and Zhang (2007), Breon-Drish and Sagi (2008), Cohen, Frazzini, and Malloy (2008), Cohen, Polk, and Silli (2008), Cremers and Petajisto (2008), Da, Gao, and Jagannathan (2008), Kacperczyk, Sialm, and Zheng (2008), Yuan (2008), Christoffersen and Sarkissian (2009), and Brown, Harlow, and Zhang (2009).

funds in the $RS3$ group rank in the top decile. Furthermore, 1.8% of funds in the $RS5$ group and only 0.6% of funds in the $RS3$ group rank in the top percentile of all funds. The higher likelihood of risk shifting funds to be ranked very highly might justify why mutual funds shift risk. Funds might prefer the return distribution of the $RS5$ group because it enables them to take advantage of the convex flow-performance relation.

5.4 Long Term Performance Impact

Table 5 summarizes the long-term impact of risk shifting. We form mutual fund portfolios using longer-term lags and report the Carhart alphas of mutual fund portfolios formed based on lagged RS measures. The first column repeats the performance results from Table 4, which use the RS measure in the prior quarter to form portfolios. The remaining columns form portfolios based on the lagged RS measures up to four quarters earlier. The poor performance of Portfolio 5 remains statistically significant over the first four quarters after the portfolio formation.

6 Mechanism and Motivation of Risk Shifting

In this section, we study the mechanism and the economic motivation of risk shifting. Mutual funds can change the riskiness of their portfolios by changing the composition between equity holdings and cash holdings, by changing their exposure to systematic risks within their equity portfolios, and by changing their idiosyncratic risk exposures. We construct alternative RS measures based on these various mechanisms of risk shifting and investigate the performance consequences of risk shifting using each alternative measure. This analysis sheds light on the sources of the poor performance of risk shifters.

To better understand the motivation behind risk shifting, we also investigate whether the propensity to shift risk and the performance consequences of risk shifting differ across funds with different incentives to shift risk. In particular, we study whether the incentives to shift risk depend on the expense ratio, the age, the family size, and the prior performance of a fund.

6.1 Cash and Equity Holdings

Table 6 reports the performance consequences of risk shifting based on six alternative RS measures. The first column reports the Carhart alphas for fund portfolios formed according to our base case RS measure which is computed using the complete holdings of the fund. The results correspond to the results in Table 4 using the Carhart risk and style adjustments.

The second column focuses on the aggregate proportion invested in cash and other non-equity positions and ignores the riskiness of the equity positions. This cash-based measure of risk shifting is defined as:

$$RS^{cash}_{f,t} = -(w^{cash}_{f,t} - \overline{w}^{cash}_{f,t}), \tag{7}$$

where $w^{cash}_{f,t}$ is the most recently disclosed proportion invested in cash and other non-equity securities according to the CRSP mutual fund database and $\overline{w}^{cash}_{f,t}$ is the average proportion invested in non-equity securities over the prior 36 months. Other non-equity positions include bonds, preferred stocks, and other securities, and are only 2.46% of fund assets. To be consistent with the other RS measures in which a higher RS measure corresponds to a riskier current position relative to the past, we multiply the difference by minus one. The portfolios are formed using the RS^{cash} measure in specific ranges to maintain a similar distribution of funds in the five groups as in our base case. Portfolio 1 (5) includes funds that increase (decrease) the proportion invested in cash by more than 7.5% and Portfolio 3 includes funds that change their cash proportion by less than 2.5%.

The third column considers only the riskiness of the disclosed equity positions and ignores non-equity positions. This equity-based risk shifting measure is defined as:

$$RS^{equity}_{f,t} = \sigma^{H,equity}_{f,t} - \sigma^{R,equity}_{f,t}, \tag{8}$$

where $\sigma^{H,equity}_{f,t}$ is the current holdings volatility estimated using the returns of the most recently disclosed equity positions and $\sigma^{R,equity}_{f,t}$ is the realized holdings volatility estimated using the returns of a hypothetical portfolio that maintains the historically disclosed equity positions, updated whenever new holdings become available, over the prior 36 months. Portfolio 1 (5) includes funds that decrease (increase) their equity risk by more than 2% per year and Portfolio 3 includes funds that change their equity risk by less than 1%.

The results from Table 6 indicate that funds that increase risk have poor subsequent performance, whether they decrease the proportion invested in cash or increase the volatility of their equity holdings. The impact of increasing the volatility of equity holdings is similar to the base case result using all the holdings (with a performance difference of about 17 basis points per month), while the performance consequence of reducing cash holdings is substantially lower (at 6 basis points per month). Therefore, increasing the volatility of equity holdings is more costly in terms of their subsequent performance. In addition, the weaker result using cash holdings suggests that activities that mainly affect the fraction of cash holdings (for example, fund flows and fund managers's effort to time the aggregate market) have a smaller impact on fund performance.

6.2 Systematic and Idiosyncratic Risk

Fund managers might shift risk in an effort to take advantage of time-varying investment opportunities. They might change their exposure to systematic risk if they believe that they have superior market timing abilities; or they might change the idiosyncratic risk of their portfolio in order to utilize their (perceived) stock selection ability.

The last three columns of Table 6 compare the future abnormal performance of fund portfolios sorted by systematic and idiosyncratic risk levels. The fourth column is based on changes in systematic risk and is defined as:

$$RS^{\beta}_{f,t} = \beta^{H}_{f,t} - \beta^{R}_{f,t}, \tag{9}$$

where $\beta^{H}_{f,t}$ is the CAPM beta of the most recently disclosed holdings and $\beta^{R}_{f,t}$ is the CAPM beta of the realized returns over the prior 36 months. Portfolio 1 (5) includes funds that decrease (increase) their CAPM beta by more than 0.15 and Portfolio 3 includes funds that change their betas by less than 0.05.

The final two risk shifting measures in Table 6 are based on the idiosyncratic volatilities computed using the CAPM and the Carhart factor models. The idiosyncratic risk shifting measures are defined as

$$RS_{f,t}^{idiosync} = \sigma_{f,t}^{H,idiosync} - \sigma_{f,t}^{R,idiosync}, \tag{10}$$

where $\sigma_{f,t}^{H,idiosync}$ is the idiosyncratic volatility of the most recently disclosed fund holdings return and $\sigma_{f,t}^{R,idiosync}$ is the idiosyncratic volatility of the past realized fund return. The idiosyncratic volatilities are computed as the standard deviations of the residuals from the CAPM or the Carhart factor regressions over the prior 36 months. Portfolio 1 (5) includes funds that decrease (increase) their idiosyncratic risk by more than 2% per year and Portfolio 3 includes funds that change their idiosyncratic risk by less than 1%.

We find a strong relation between risk shifting and fund performance for portfolios sorted according to changes in idiosyncratic volatilities, but do not find a statistically significant return pattern for portfolios sorted according to changes in systematic risk. For example, the performance difference between funds that increase their idiosyncratic risk the most (in Portfolio 5) and funds that maintain stable risk levels (in Portfolio 3) is between -18 and -21 basis points per month, both significant at the 5% level, depending on whether idiosyncratic risk is measured relative to the market model or the four-factor Carhart model. On the other hand, the performance difference between funds that increase their systematic risk the most and funds that maintain stable systematic risk is -5 basis points per month and is not statistically significant. Thus, the poor performance of funds that increase risk is driven by the increase in their idiosyncratic risk levels and not by the increase in their systematic risk exposure. Our results suggest that the main driver of the poor performance of risk shifters is not their inability to time the aggregate market movements but their tendency to take on idiosyncratic risk.[12]

[12] Ang, Hodrick, Xing, and Zhang (2006) report that stocks with high idiosyncratic volatility based on daily returns tend to exhibit relatively poor abnormal returns in the subsequent month. To investigate whether this effect can explain our results, we augment, in unreported results, the Fama-French-Carhart factor model by an idiosyncratic volatility factor. Adjusting for the idiosyncratic volatility factor does not qualitatively change our main result that funds that increase their risk the most experience the worst subsequent performance.

Chevalier and Ellison (1997), Basak, Pavlova, and Shapiro (2007), and Chen and Pennacchi (2009) suggest that, if fund managers are evaluated on their performance relative to a benchmark, they have an incentive to increase tracking error volatility. Our finding that some fund managers significantly increase their idiosyncratic volatility is consistent with these predictions.

6.3 Cross-Sectional Differences in Risk Shifting

We study whether the propensity to shift risk and the performance consequences of risk shifting differ across funds with different characteristics. The literature suggests that several fund characteristics affect their flow-performance relation and hence may affect the risk taking incentives of funds. In addition, these funds might differ in the ability level of their fund managers. The fund characteristics that we consider include expense ratio, fund age, family size, and past performance.

For each characteristic we divide mutual funds in each period into two groups depending on whether the fund characteristic is above or below the median value. In a second step, we further divide the two groups of funds into five portfolios according to their most recent risk shifting measure. The first group of columns in Table 7 summarizes the frequency distribution of funds across the two groups and the last group of columns reports the subsequent Carhart alphas for the ten mutual fund portfolios.[13]

Gil-Bazo and Ruiz-Verdu (2009) find that high-expense funds do not perform better than low-expense funds, even before subtracting expenses. They interpret this evidence as an agency problem in which high-expense funds target naive investors who are not responsive to expenses. Thus, high-expense funds might also have bigger incentives to manipulate their risk levels by opportunistically shifting risk. Consistent with this hypothesis, we report in Panel A of Table 7 that 7.36% of funds charging above-median expense ratios belong to Portfolio 5, whereas only 5.27% of funds charging below-median expense ratios belong to Portfolio 5. We

[13]The frequencies are computed on a quarterly basis and the differences in the frequencies use Newey-West standard errors with a lag length of four quarters. The Carhart alphas are computed as described in Section 5.

also find that risk shifting is more costly for high-expense funds. For example, high-expense funds in Portfolio 5 exhibit a Carhart alpha of -24 basis points per month, which is statistically significant at the 1% level, whereas low-expense funds in Portfolio 5 have an insignificant alpha of -10 basis points per month. The performance difference between high- and low-expense risk shifters (at 14 basis points per month) is substantially higher than the performance difference between all high- and low-expense funds (at only 3 basis points per month).

Chevalier and Ellison (1997) find that younger funds with less established track records have a more convex flow-performance relation. Thus, younger mutual funds might have bigger incentives to shift risk. Similarly, smaller fund families also have more significant incentives to shift risk, as discussed in Huang, Wei, and Yan (2007). Panels B and C of Table 7 confirm that young funds and small fund families are more likely to shift risk and they experience particularly poor abnormal returns if they increase their risk levels.[14] Since the average performance of funds sorted by each of these characteristics is similar across the high and low groups, these characteristics are not significantly related to investment ability. The fact that these characteristics are related to the potential benefits of risk shifting provide supportive evidence that agency problems play a role in explaining risk shifting behavior.

The past fund performance may reveal the ability and incentives of fund managers. Mutual funds with worse prior performance are likely to have inferior ability and might continue to perform poorly. The literature suggests that past winners and losers have different incentives to take risk. Panel D of Table 7 sorts mutual funds by their prior year performance and the risk shifting measure. We find that funds with relatively disappointing performance are relatively more likely to shift risk down (in Portfolio 1), whereas funds with superior performance are more likely to shift risk up (in Portfolio 5). To investigate the relation between prior performance and risk shifting in more detail, we analyze in unreported results the economic determinants of risk shifting using a multivariate regression analysis. We find that both funds with very poor and with very high past performance increase risk above their prior realized

[14]In unreported analysis we find that results for small funds are similar to the results for funds from small fund families.

risk levels. This result is consistent with Hu, Kale, Pagani, and Subramanian (2008), who develop a unified theory that generates a U-shape relation between risk choices and prior performance. They find evidence that managers that significantly outperform or underperform the benchmark exhibit higher subsequent risk levels. The asymmetry in the frequency distribution in Panel D occurs because the incentive to shift risk is on average more pronounced for winner funds than for loser funds.

The performance consequences of risk shifting are stronger for loser funds than for winner funds. Within loser funds, we find that funds that increase risk the most underperform funds that maintain stable risk levels by 16 basis points per month. On the other hand, the corresponding performance difference for winner funds is only 7 basis points and is not statistically significantly different from zero.

6.4 Trading Costs

In this section we consider whether the poor performance of risk shifters is caused by the additional trading costs to implement risk shifting strategies or to accommodate fund flows.

Since we analyze only the future performance of funds after computing the risk shifting measure, our performance measures are not contaminated by the direct trading costs to implement the current risk shifting strategy. However, since risk shifting is persistent, these funds might also have higher trading costs in the future.

We use turnover as a proxy for trading costs since it captures the majority of trading costs as described by Chalmers, Edelen, and Kadlec (1999). If trading costs are the main cause of the poor performance of risk shifters, then we should observe that the relation between performance and risk shifting is particularly pronounced for high turnover funds. We sort funds into subgroups with different turnover and risk shifting measures, following the procedure in Section 6.3, and report the frequency distribution and the Carhart alphas in Panel A of Table 8. Surprisingly, we find that increasing risk has worse performance consequences for funds with low turnover than for funds with high turnover. For example, the performance difference between Portfolios 5 and 3 is -25 basis points per month for funds with low turnover and only -8 basis points for funds with high turnover. Thus, direct trading costs are unlikely the main reason behind the poor performance of risk shifters.

Another proxy for trading costs is fund flows. Edelen (1999) documents that the extra trading and the resulting price impact induced by fund flows can significantly reduce the average performance of mutual funds. In addition, Coval and Stafford (2007), Chen, Hanson, Hong, and Stein (2007), and Zhang (2008) show that distressed mutual funds experiencing large money outflows are forced to liquidate their positions in "fire sales." Such outflows can increase the total risk level of mutual funds as they reduce their cash positions or as they reduce their portfolio diversification by selling some of their positions. To examine the impact of fund flows, we divide mutual funds into groups depending on whether their fund flows in the prior year are below or above the median level. Panel B shows that there are no significant differences in the propensities to shift risk for funds in these two groups, suggesting that most funds are able to undo the effect of funds flows and reach their desired risk level. In addition, although funds with below-median flows perform slightly worse than funds with above-median flows when they increase risk, the performance difference is not significantly different from zero. Therefore, fund flows cannot explain the poor performance of risk shifters either.

7 Multivariate Regression

This section uses a multivariate regression analysis to investigate the relation between risk shifting and subsequent fund performance. This methodology allows us to control for additional fund characteristics. We run the following Fama-MacBeth specification:

$$\begin{aligned} PERF_{f,t} &= \beta_0 + \beta_1 MAX(0, RS_{f,t-1}) + \beta_2 MIN(0, RS_{f,t-1}) + \beta_3 \sigma^R_{f,t-1} \\ &+ \beta_4 RF_{f,t-1} + \beta_5 LOGAGE_{f,t-1} + \beta_6 LOGTNA_{f,t-1} + \beta_7 EXP_{f,t-1} \\ &+ \beta_8 TO_{f,t-1} + \beta_9 FLOW_{f,t-1} + \epsilon_{f,t}. \end{aligned} \quad (11)$$

The dependent variable in each cross-section is a performance measure of an individual mutual fund $PERF$ in a particular month. To capture the non-monotonic impact of risk shifting on performance, we split RS into two components depending on whether it is positive or negative. The coefficient β_1 captures the relation between risk shifting and returns when RS is positive and β_2 captures the relation between risk shifting and returns when RS is negative. The additional control variables are the realized volatility over the prior 36 months σ^R, the prior-year return of a fund $RF_{f,t-1}$, the age of the fund defined as the logarithm of $(1 + AGE)$, the logarithm of the assets under management $LOGTNA$, the expense ratio of the fund EXP, the turnover ratio TO, and the fund flow over the prior year $FLOW$. All control variables are lagged by at least one month. In a first step, we run in each month a cross-sectional regression. In a second step, we compute the means of the cross-sectional coefficients over the whole time period between 1983 and 2006.

One commonly used methodology to adjust for risk and style in the mutual fund literature is to first estimate the factor loadings for each fund over a rolling window using prior data and then compute abnormal returns in the subsequent period as the difference between the actual fund return and the expected fund return based on the estimated factor loadings. This methodology is not appropriate in our context since we focus on the risk shifting behavior of funds over time. The factor loadings estimated over prior windows might not be accurate for funds that shift risk levels significantly.[15] Instead, the risk adjustments for our performance measures are based on the most recent portfolio holdings.

We use four different performance measures: (1) the raw fund return; (2) the Carhart abnormal return; (3) the characteristics-adjusted return; and (4) the return gap. The Carhart alpha of a fund is defined in a similar way to the bottom-up alphas of Elton, Gruber, and Blake (2007) as the fund return minus the expected factor return:

$$\alpha_{k,t}^{Carhart} = (RF_{k,t} - R_{TB,t}) - \Big[\beta_{k(H),t-1}^{M}(R_{M,t} - R_{TB,t}) + \beta_{k(H),t-1}^{SMB}(R_{S,t} - R_{B,t})$$

[15]Despite this concern, the results are not substantially different if we use fund-specific abnormal returns as dependent variables. This is consistent with the prior portfolio results which indicate that the performance results are not very sensitive to alternative factor adjustments.

$$+\beta^{HML}_{k(H),t-1}(R_{H,t} - R_{L,t}) + \beta^{UMD}_{k(H),t-1}(R_{U,t} - R_{D,t})\Big] . \tag{12}$$

The expected factor return is computed as the product of the betas of the most recent holdings of the fund and the returns of the four Carhart factors. The betas of the most recent holdings are obtained by regressing the hypothetical return of the most recent portfolio holdings (including non-equity positions) over the last 36 months on the Carhart factors.

The characteristics-adjusted return is defined as the difference between the fund return and the benchmark return of securities with similar risk and style characteristics:

$$\alpha^{CharacAdj}_{k,t} = RF_{k,t} - \left(\sum_{i=1}^{N} w^{i}_{f,t}[BR_{i(t-1),t}]\right), \tag{13}$$

The weight invested in position i at the beginning of month t in the mutual fund f is denoted by $w^i_{f,t}$ and the benchmark return to which position i was allocated during month $t-k$ is denoted by $BR_{i(t-k),t}$. For equity positions, we follow Daniel, Grinblatt, Titman, and Wermers (1997) and define the return on a benchmark portfolio as the value-weighed return of stocks that fall in the identical size, value, and momentum quintiles as the equity holdings of a fund. For non-equity positions we set the benchmark returns equal to the returns corresponding to the Lehman Brothers Aggregate Bond Index (for bonds and preferred stocks) and to the Treasury bill rate (for cash and other securities).

Finally, the return gap is computed following Kacperczyk, Sialm, and Zheng (2008) as the residual that captures the impact of unobserved actions on fund returns:

$$RG_{f,t} = RF_{f,t} - RH_{f,t} + EXP_{f,t}, \tag{14}$$

where the investor return is denoted by RF, the holdings return by RH, and the expense ratio by EXP.

Table 9 reports the multivariate regression estimates. All specifications indicate a significantly negative relation between risk shifting and the various performance measures for funds that increase risk and a generally insignificant relation for funds that decrease risk. The performance consequences of increasing risk are similar in magnitude to the results reported in Table 4. For example, the first column indicates that an increase in RS from 0 to 5% (corresponding roughly to the difference in risk shifting between portfolios 3 and 5 in Table 2), reduces the raw fund return by 22 basis points per month. The impact of increasing risk by five percentage points ranges between 8 basis points for the return gap and 30 basis points for the four-factor adjusted fund return.

Including additional control variables does not have a significant impact on the risk shifting coefficients. The level of the realized volatility over the prior 36 months does not have a significant explanatory power for fund performance, consistent with the evidence in Panel D of Table 8. The positive coefficient on the lagged return indicates some performance persistence. The coefficient on the expense ratio is significantly different from zero in the first three specifications which use an after-expense performance measure. On the other hand the expense ratio has no significant relation to the return gap, which is measured after adjusting for fund expenses. Finally, funds with higher turnover tend to exhibit slightly higher performance using all four performance measures.

The results in this section confirm the portfolio results reported in Table 4 that funds that increase risk perform poorly in the future, even after adjusting for other fund characteristics and after controlling for risk and style.

8 Conclusions

The literature on delegated portfolio management has identified risk shifting as a potential agency problem in which fund managers strategically shift their risk levels to increase fund flows. However, other than the potential difficulty for investors to understand the true risk of the fund and to form efficient portfolios, there is no direct evidence that these fund managers are destroying value through their strategic behavior.

Our paper fills the gap by investigating the performance consequences of risk shifting. We find that funds that shift risk perform significantly worse than funds that keep stable risk levels over time. Our finding is consistent with risk shifters on average having inferior investment ability, for example, because they erroneously believe that they have timing ability or because they lack the confidence to maintain a stable investment strategy. We also find that funds with larger incentives to shift risk are more likely to increase risk and they perform particularly poorly after increasing risk. Thus, agency issues also play a role in the poor performance of risk shifters. Independent of the sources of their poor performance, our findings suggest that investors are better off avoiding funds that are more prone to shift risks.

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Table 1: **Summary Statistics**
This table summarizes the characteristics of the mutual funds in our sample over the period between 1980 and 2006.

Variable	Mean	Std.Dev.	Median
Total Net Assets (TNA) (in Millions)	1,382.54	4,739.35	277.84
Age (in Years)	17.54	15.29	12.00
Expense Ratio (in %)	1.28	0.46	1.24
Turnover Ratio (in %)	90.65	112.98	66.00
Common Stock Proportion (in %)	91.28	12.04	95.00
Cash Proportion (in %)	6.26	9.04	3.78
Bond Proportion (in %)	1.58	6.49	0.00
Preferred Stock Proportion (in %)	0.39	2.57	0.00
Other Securities Proportion (in %)	0.49	3.81	0.00
Flow (in % per Month)	0.43	5.04	-0.36
Investor Return (in % per Month)	0.83	5.34	1.07
Holdings Return (in % per Month)	0.91	5.21	1.10
Number of Stock Positions	89.23	130.77	62.00
Industry Concentration Index	0.12	0.20	0.05
Size Score	4.20	0.85	4.53
Value Score	2.80	0.46	2.79
Momentum Score	3.10	0.59	3.07
Current Holdings Volatility (in % per Year)	17.54	7.62	16.41
Past Realized Volatility (in % per Year)	17.86	7.93	16.42
Risk Shifting (in % per Year)	-0.33	4.58	0.01
Total number of funds	2,335		
Total number of observations	184,519		

Table 2: **Fund Characteristics by Risk Shifting**
This table summarizes the average characteristics of portfolios of mutual funds sorted according to the most recent risk shifting measure.

RS Portfolio	*RS* Range	Prop. of Obs. (%)	*RS* Mean	Current Holdings Volatility	Past Realized Volatility	Net Assets	Age	Expense Ratio	Turnover
1	(-∞,-2.5]	14.20	−5.60	15.84	21.45	703.19	18.13	1.31	117.73
2	(-2.5,-1]	15.39	−1.63	15.61	17.24	959.89	19.77	1.20	87.23
3	(-1,1)	41.09	0.02	15.85	15.83	1,231.34	22.05	1.13	69.73
4	[1,2.5)	16.37	1.63	17.83	16.19	1,010.16	19.85	1.19	76.53
5	[2.5,∞)	12.95	4.75	22.84	18.08	769.64	17.66	1.34	99.58

Table 3: **Mechanisms of Risk Shifting.**
This table summarizes the initial levels (Panel A) and the changes (Panel B) in the fund characteristics that determine the total risk of a fund. The initial levels correspond to the average characteristics over the prior 36 months and the changes correspond to the difference between the most recent characteristics and the average characteristics over the prior 36 months according to the most recent risk shifting measure. Portfolios 1 to 5 are defined in Table 2 with cutoff RS measures of $\{\pm 1\%, \pm 2.5\%\}$.

Panel A: Initial Fund Characteristics

RS Portfolio	Cash Holdings	Market Beta	Idiosyn. Volatility	Size Score	Value Score	Momen. Score	Number of Stocks	Industry Concen.
1	0.12	1.11	3.42	3.89	2.72	3.34	72.50	0.17
2	0.10	1.00	2.29	4.06	2.80	3.20	80.26	0.13
3	0.08	0.93	2.00	4.21	2.89	3.10	89.45	0.11
4	0.09	0.94	2.18	4.02	2.87	3.14	81.31	0.12
5	0.10	0.96	2.84	3.82	2.81	3.23	62.18	0.17

Panel B: Changes in Fund Characteristics

RS Portfolio	Cash Holdings	Market Beta	Idiosyn. Volatility	Size Score	Value Score	Momen. Score	Number of Stocks	Industry Concen.
1	0.05	−0.25	−1.02	0.10	0.06	−0.11	3.20	−0.01
2	0.01	−0.10	−0.17	0.06	0.00	−0.03	3.98	0.00
3	−0.01	−0.01	0.05	0.03	−0.02	−0.01	3.58	0.00
4	−0.03	0.08	0.26	0.02	−0.01	0.01	1.50	0.00
5	−0.05	0.22	0.82	−0.05	−0.03	0.04	−1.59	0.01

Table 4: **Performance Consequences of Risk Shifting**
This table reports the abnormal monthly returns of portfolios of mutual funds sorted according to the most recent risk shifting measure. The table summarizes the intercepts from factor regressions based on the CAPM, Fama-French, Carhart, and Ferson-Schadt models. All returns are expressed in % per month. Portfolios 1 to 5 are defined in Table 2 with cutoff RS measures of $\{\pm 1\%, \pm 2.5\%\}$. The significance levels are abbreviated with asterisks: One, two, and three asterisks denote significance at the 10, 5, and 1% level, respectively.

RS Portfolio	CAPM	Fama-French	Carhart	Ferson-Schadt
1	−0.12	−0.10	−0.07	−0.09
	(0.09)	(0.08)	(0.08)	(0.08)
2	−0.02	−0.05	−0.04	−0.08
	(0.05)	(0.05)	(0.05)	(0.05)
3	0.01	−0.07	−0.06	−0.09**
	(0.05)	(0.05)	(0.05)	(0.05)
4	−0.03	−0.08	−0.09	−0.13**
	(0.06)	(0.06)	(0.06)	(0.06)
5	−0.22**	−0.14*	−0.22***	−0.21***
	(0.11)	(0.08)	(0.08)	(0.08)
(1)-(3)	−0.14	−0.03	−0.01	0.00
	(0.09)	(0.07)	(0.08)	(0.07)
(5)-(3)	−0.23**	−0.07	−0.16**	−0.12*
	(0.10)	(0.07)	(0.07)	(0.07)

Table 5: **Longer-Term Performance Consequences of Risk Shifting**
This table reports Carhart-adjusted monthly returns of portfolios of mutual funds sorted according to the prior risk shifting measure. The performance of the fund portfolios is computed based on the risk shifting measures of funds over the prior four quarters. All returns are expressed in % per month. Portfolios 1 to 5 are defined in Table 2 with cutoff *RS* measures of $\{\pm 1\%, \pm 2.5\%\}$. The significance levels are abbreviated with asterisks: One, two, and three asterisks denote significance at the 10, 5, and 1% level, respectively.

RS	Number of Lags in Quarters			
Portfolio	1	2	3	4
1	−0.07	−0.02	−0.03	−0.08
	(0.08)	(0.08)	(0.08)	(0.08)
2	−0.04	−0.05	−0.04	−0.01
	(0.05)	(0.06)	(0.05)	(0.05)
3	−0.06	−0.06	−0.07	−0.06
	(0.05)	(0.05)	(0.05)	(0.04)
4	−0.09	−0.08	−0.03	−0.07
	(0.06)	(0.06)	(0.05)	(0.05)
5	−0.22***	−0.21***	−0.22***	−0.18**
	(0.08)	(0.08)	(0.08)	(0.08)
(1)-(3)	−0.01	0.04	0.04	−0.02
	(0.08)	(0.08)	(0.07)	(0.07)
(5)-(3)	−0.16**	−0.16**	−0.15**	−0.11
	(0.07)	(0.07)	(0.07)	(0.07)

Table 6: **Performance Consequences Using Alternative Risk Shifting Measures**
This table reports the abnormal monthly returns of portfolios of mutual funds sorted according to the most recent risk shifting measure. We compute six different measures of risk shifting: the standard deviation of the fund returns using all holdings; the proportion of the portfolio invested in cash and other non-equity securities; the standard deviation of the returns using only equity positions; the systematic risk, defined as the CAPM beta; and the idiosyncratic risk, defined as the standard deviation of the residuals from the CAPM and Carhart regressions, respectively. All returns are expressed in % per month. Portfolios 1 to 5 are defined similarly to Table 2 with different cutoffs for each *RS* measure: $\{\pm 1\%, \pm 2.5\%\}$ for all holdings; $\{\pm 2.5\%, \pm 7.5\%\}$ for cash proportions; $\{\pm 1\%, \pm 2\%\}$ for equity holdings; $\{\pm .05, \pm 0.15\}$ for CAPM beta; and $\{\pm 1\%, \pm 2\%\}$ for both idiosyncratic risk measures. The significance levels are abbreviated with asterisks: One, two, and three asterisks denote significance at the 10, 5, and 1% level, respectively.

RS Portfolio	All Holdings	Proportion of Equity	Equity Holdings	CAPM Beta	Idiosync. Volatility (CAPM)	Idiosync. Volatility (Carhart)
1	−0.07	−0.05	−0.07	−0.10	−0.04	0.04
	(0.08)	(0.05)	(0.08)	(0.07)	(0.08)	(0.10)
2	−0.04	−0.04	−0.08	−0.04	−0.04	0.01
	(0.05)	(0.04)	(0.06)	(0.05)	(0.06)	(0.05)
3	−0.06	−0.07	−0.05	−0.06	−0.07	−0.05
	(0.05)	(0.04)	(0.05)	(0.05)	(0.05)	(0.05)
4	−0.09	−0.09**	−0.10*	−0.06	−0.09	−0.12*
	(0.06)	(0.05)	(0.06)	(0.05)	(0.06)	(0.07)
5	−0.22***	−0.13**	−0.22***	−0.12*	−0.25***	−0.26***
	(0.08)	(0.05)	(0.07)	(0.07)	(0.09)	(0.09)
(1)-(3)	−0.01	0.01	−0.02	−0.03	0.03	0.09
	(0.08)	(0.04)	(0.07)	(0.07)	(0.08)	(0.10)
(5)-(3)	−0.16**	−0.06*	−0.17***	−0.05	−0.18**	−0.21**
	(0.07)	(0.03)	(0.06)	(0.07)	(0.08)	(0.09)

Table 7: **Performance Consequences by Fund Characteristics**
This table reports the frequency distribution and the future Carhart alphas of portfolios of mutual funds sorted according to risk shifting and fund characteristics that are related to risk shifting incentives (expense ratio, age, family size, and prior-year return). Mutual funds are first sorted into two equal-sized groups according to whether the characteristic is above or below its median value. In a second step, funds are further divided into five groups according to their risk shifting level. The table reports the average proportion of funds that fall into one of the ten groups and the Carhart alphas of the ten portfolios and the differences in the future Carhart alphas between selected portfolios. All returns are expressed in % per month. Portfolios 1 to 5 are defined in Table 2 with cutoff RS measures of $\{\pm 1\%, \pm 2.5\%\}$. The significance levels are abbreviated with asterisks: One, two, and three asterisks denote significance at the 10, 5, and 1% level, respectively.

Panel A: Funds Sorted by Expense Ratio

RS	Frequency			Future Carhart Alphas		
Portfolio	Low Exp.	High Exp.	L−H	Low Exp.	High Exp.	L−H
1	5.92	8.28	−2.36***	−0.10	−0.07	−0.03
			(0.24)	(0.10)	(0.10)	(0.12)
2	7.29	8.07	−0.78*	−0.03	−0.06	0.03
			(0.42)	(0.06)	(0.06)	(0.04)
3	22.71	18.63	4.09***	−0.07	−0.05	−0.02
			(0.57)	(0.05)	(0.05)	(0.02)
4	8.64	7.82	0.82*	−0.05	−0.12*	0.07
			(0.42)	(0.06)	(0.07)	(0.04)
5	5.27	7.36	−2.09***	−0.10	−0.24***	0.14**
			(0.36)	(0.07)	(0.08)	(0.06)
All				−0.07*	−0.10**	0.03*
				(0.04)	(0.04)	(0.02)
(1)-(3)				−0.03	−0.02	−0.01
				(0.10)	(0.10)	(0.12)
(5)-(3)				−0.02	−0.19***	0.17**
				(0.06)	(0.07)	(0.07)

Panel B: Funds Sorted by Fund Age

RS	Frequency			Future Carhart Alphas		
Portfolio	Young	Old	Y−O	Young	Old	Y−O
1	7.59	6.62	0.97***	−0.09	−0.07	−0.01
			(0.27)	(0.08)	(0.11)	(0.10)
2	7.82	7.54	0.27	−0.08	−0.04	−0.04
			(0.26)	(0.06)	(0.06)	(0.04)
3	19.06	22.28	−3.23***	−0.06	−0.07	0.00
			(0.54)	(0.05)	(0.05)	(0.03)
4	8.49	7.97	0.53	−0.08	−0.10*	0.02
			(0.47)	(0.06)	(0.06)	(0.04)
5	6.95	5.68	1.26***	−0.21***	−0.13*	−0.08
			(0.39)	(0.07)	(0.07)	(0.06)
All				−0.09**	−0.08**	−0.01
				(0.04)	(0.04)	(0.02)
(1)-(3)				−0.03	−0.01	−0.02
				(0.08)	(0.11)	(0.10)
(5)-(3)				−0.15**	−0.06	−0.09
				(0.07)	(0.06)	(0.07)

Panel C: Funds Sorted by Family Size

RS Portfolio	Frequency Small	Large	S−L	Future Carhart Alphas Small	Large	S−L
1	7.33	6.84	0.49	−0.11	−0.03	−0.08
			(0.30)	(0.09)	(0.10)	(0.09)
2	7.70	7.67	0.04	−0.10*	−0.00	−0.09**
			(0.42)	(0.05)	(0.06)	(0.04)
3	20.07	21.24	−1.16***	−0.05	−0.07	0.02
			(0.40)	(0.05)	(0.05)	(0.03)
4	8.13	8.36	−0.23	−0.10*	−0.09	−0.01
			(0.34)	(0.06)	(0.06)	(0.04)
5	6.68	5.98	0.71**	−0.26***	−0.07	−0.19**
			(0.32)	(0.08)	(0.08)	(0.08)
All				−0.09**	−0.07*	−0.02
				(0.04)	(0.04)	(0.02)
(1)-(3)				−0.06	0.03	−0.10
				(0.09)	(0.10)	(0.10)
(5)-(3)				−0.21***	−0.01	−0.20**
				(0.07)	(0.07)	(0.08)

Panel D: Funds Sorted by Prior Year Fund Performance

RS Portfolio	Frequency Low Ret.	High Ret.	L−H	Future Carhart Alphas Low Ret.	High Ret.	L−H
1	8.54	5.67	2.88***	−0.06	−0.01	−0.05
			(1.02)	(0.10)	(0.11)	(0.15)
2	7.89	7.47	0.43	−0.07	0.01	−0.08
			(0.36)	(0.07)	(0.05)	(0.09)
3	19.87	21.47	−1.60	−0.07	−0.04	−0.03
			(0.99)	(0.06)	(0.05)	(0.07)
4	8.06	8.40	−0.34	−0.13*	−0.05	−0.09
			(0.50)	(0.07)	(0.06)	(0.07)
5	5.58	7.06	−1.48*	−0.23**	−0.11	−0.12
			(0.76)	(0.10)	(0.08)	(0.12)
All				−0.13**	−0.04	−0.08
				(0.06)	(0.04)	(0.08)
(1)-(3)				0.01	0.03	−0.02
				(0.09)	(0.11)	(0.13)
(5)-(3)				−0.16**	−0.07	−0.09
				(0.08)	(0.06)	(0.09)

Table 8: **Performance Consequences by Trading Cost Proxies**
This table reports the frequency distribution and the Carhart alphas of portfolios of mutual funds sorted according to risk shifting and other fund characteristics that are related to trading costs (turnover, prior year flow). Mutual funds are first sorted into two equal-sized groups according to whether the characteristic is above or below its median value. In a second step, funds are further divided into five groups according to their risk shifting level. The table reports the average proportion of funds that fall into one of the ten groups and the Carhart alphas of the ten portfolios and the differences in the Carhart alphas between selected portfolios. All returns are expressed in % per month. Portfolios 1 to 5 are defined in Table 2 with cutoff *RS* measures of $\{\pm 1\%, \pm 2.5\%\}$. The significance levels are abbreviated with asterisks: One, two, and three asterisks denote significance at the 10, 5, and 1% level, respectively.

Panel A: Funds Sorted by Turnover (TO)

RS	Frequency			Future Carhart Alphas		
Portfolio	Low TO	High TO	L−H	Low TO	High TO	L−H
1	5.21	8.99	−3.79***	−0.12	−0.09	−0.03
			(0.77)	(0.13)	(0.08)	(0.13)
2	7.02	8.34	−1.32**	−0.04	−0.07	0.04
			(0.63)	(0.06)	(0.06)	(0.05)
3	24.10	17.22	6.88***	−0.06	−0.07	0.01
			(0.43)	(0.05)	(0.05)	(0.03)
4	8.71	7.75	0.97*	−0.06	−0.13**	0.08*
			(0.52)	(0.06)	(0.06)	(0.04)
5	4.95	7.70	−2.74***	−0.31***	−0.15*	−0.16
			(0.56)	(0.10)	(0.08)	(0.10)
All				−0.07*	−0.10**	0.03
				(0.04)	(0.04)	(0.03)
(1)-(3)				−0.06	−0.02	−0.04
				(0.13)	(0.07)	(0.13)
(5)-(3)				−0.25**	−0.08	−0.17*
				(0.10)	(0.07)	(0.10)

Panel B: Funds Sorted by Prior Year Flows

RS	Frequency			Future Carhart Alphas		
Portfolio	Low Flow	High Flow	L−H	Low Flow	High Flow	L−H
1	7.04	7.16	−0.11	−0.14*	−0.01	−0.14
			(0.66)	(0.07)	(0.11)	(0.12)
2	7.37	8.00	−0.63*	−0.07	−0.07	0.00
			(0.37)	(0.06)	(0.06)	(0.07)
3	20.40	20.94	−0.54	−0.06	−0.06	−0.00
			(0.72)	(0.05)	(0.05)	(0.04)
4	8.58	7.88	0.71*	−0.08	−0.10*	0.01
			(0.37)	(0.07)	(0.06)	(0.05)
5	6.55	6.08	0.48	−0.18**	−0.13*	−0.05
			(0.49)	(0.08)	(0.08)	(0.09)
All				−0.09*	−0.08*	−0.01
				(0.05)	(0.04)	(0.04)
(1)-(3)				−0.08	0.05	−0.13
				(0.06)	(0.11)	(0.12)
(5)-(3)				−0.12*	−0.07	−0.05
				(0.07)	(0.07)	(0.08)

Table 9: **Multi-Variate Performance Regression**

To investigate the relation between risk shifting and subsequent fund performance we run a multivariate Fama-MacBeth regression. The dependent variable in each cross-section is a performance measure in a particular month. The additional control variables are the realized volatility over the prior 36 months, the prior-year return of a fund, the age of the fund defined as the logarithm of $(1+AGE)$, the logarithm of the assets under management, the expense ratio of the fund, the turnover ratio, and the growth rate in new money over the prior year. To adjust for risk and style, we use four different performance measures: (1) the raw fund return; (2) the Carhart abnormal return; (3) the characteristics-adjusted return; and (4) the return gap. The Carhart alpha of a fund is defined as the fund return minus the expected factor return using the betas estimated from the current fund holdings over the last 36 months. The characteristics-adjusted return is defined as the difference between the fund return and the benchmark return of securities with similar size, book-to-market, and momentum characteristics as proposed by Daniel, Grinblatt, Titman, and Wermers (1997). Finally, the return gap is computed following Kacperczyk, Sialm, and Zheng (2008) as the difference between the fund return and the holdings return after adjusting for fund expenses. The significance levels are abbreviated with asterisks: One, two, and three asterisks denote significance at the 10, 5, and 1% level, respectively.

	Raw Fund Return		Four-Factor Adjusted Fund Return		Characteristics-Adjusted Fund Return		Return Gap	
MAX(0,RS)	−0.0435**	−0.0348***	−0.0595***	−0.0517***	−0.0366***	−0.0316***	−0.0168**	−0.0178**
	(0.0188)	(0.0101)	(0.0148)	(0.0110)	(0.0116)	(0.0075)	(0.0085)	(0.0082)
MIN(0,RS)	0.0149	−0.0076	−0.0094	−0.0207	−0.0060	−0.0213*	−0.0116	−0.0106
	(0.0177)	(0.0160)	(0.0158)	(0.0140)	(0.0146)	(0.0123)	(0.0093)	(0.0100)
Realized Volatility		−0.0020		−0.0066		−0.0077		−0.0008
		(0.0136)		(0.0085)		(0.0083)		(0.0024)
Lagged Return		0.2489***		0.0860*		0.1604***		0.0407***
		(0.0637)		(0.0507)		(0.0475)		(0.0121)
Age		−0.0095		−0.0273*		−0.0106		−0.0107*
		(0.0172)		(0.0158)		(0.0126)		(0.0060)
Size		−0.0111		−0.0063		−0.0108		−0.0062
		(0.0087)		(0.0076)		(0.0076)		(0.0050)
Expense Ratio		−0.0768**		−0.0671***		−0.0646**		−0.0016
		(0.0312)		(0.0253)		(0.0253)		(0.0154)
Turnover		0.0007***		0.0004*		0.0005***		0.0002**
		(0.0002)		(0.0002)		(0.0002)		(0.0001)
Flow		−0.0115**		−0.0066		−0.0046		−0.0023
		(0.0056)		(0.0048)		(0.0043)		(0.0022)
Intercept	1.0372***	0.9193***	0.0047	0.1857	−0.0100	0.0596	0.0381**	0.0733
	(0.2426)	(0.1879)	(0.0401)	(0.1396)	(0.0278)	(0.1372)	(0.0154)	(0.0534)

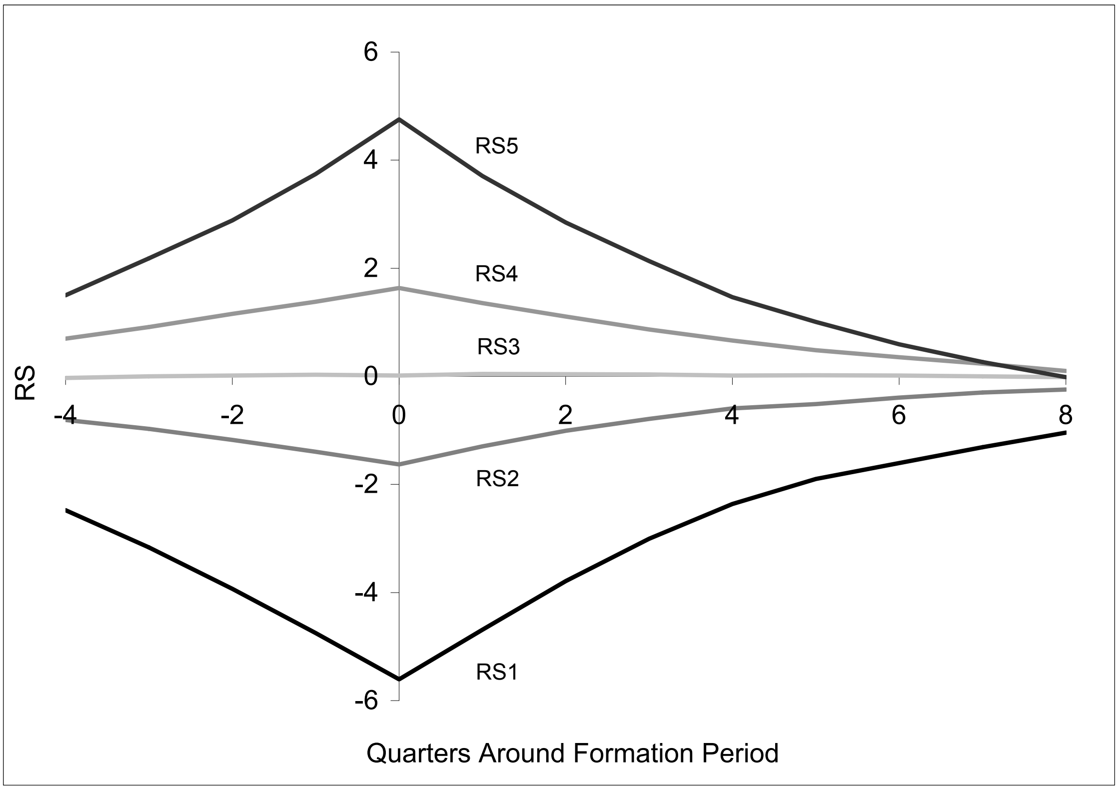

Figure 1: **Persistence of Risk Shifting.**
The figure depicts the average risk shifting level for the five risk shifting portfolios four quarters before and eight quarters after the portfolio formation.

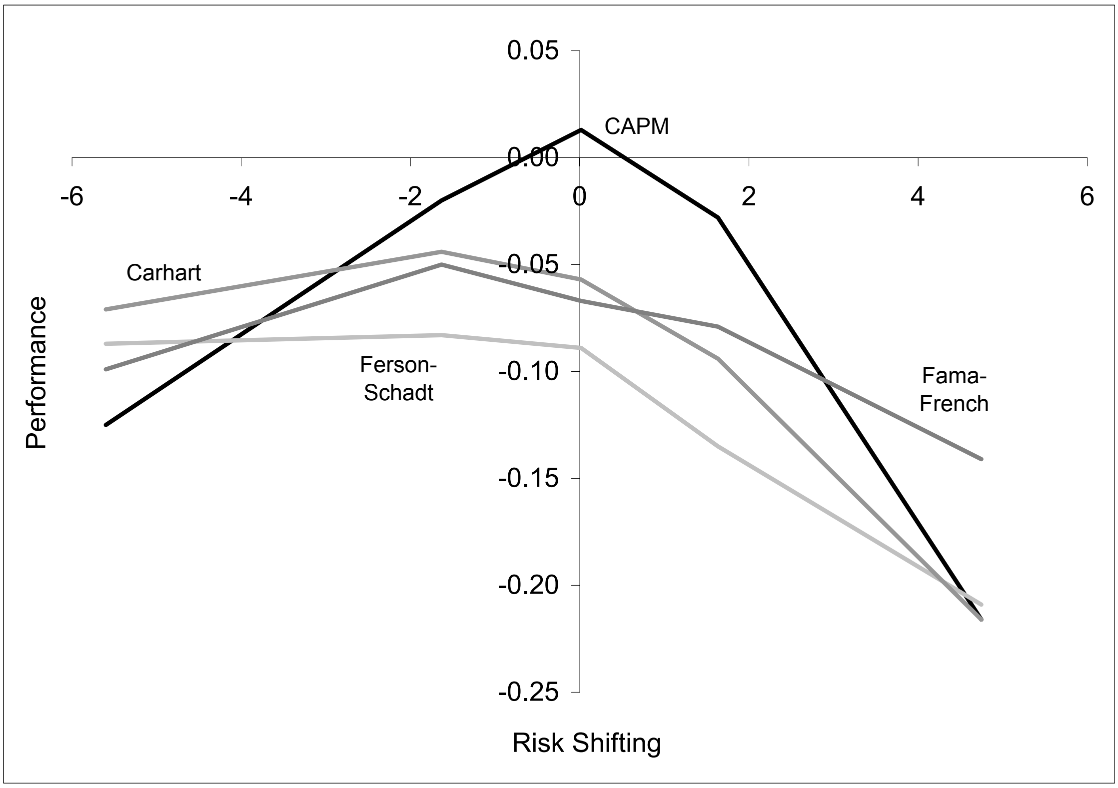

Figure 2: **Future Performance of Portfolios by Risk Shifting Measure.**
This figure depicts the abnormal monthly returns of portfolios of mutual funds sorted according to the most recent risk shifting measure. The figure summarizes the intercepts from factor regressions based on the CAPM, Fama-French, Carhart, and Ferson-Schadt models. All returns are expressed in % per month.

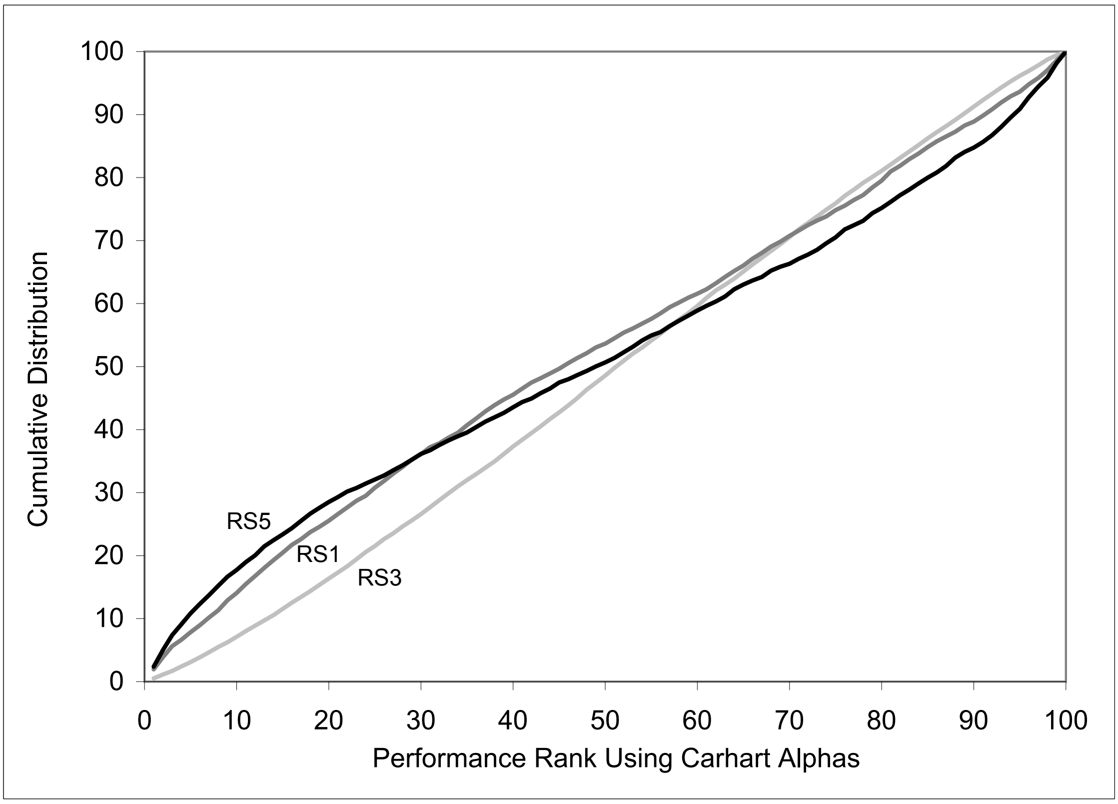

Figure 3: **Cumulative Distribution Function.**
We report the cumulative distribution functions of the fund rankings for mutual funds in different risk shifting groups. We sort mutual funds into the five portfolios according to their most recent risk shifting measure. At the end of every quarter we compute the cumulative distribution function of the percentile ranking of funds based on the Carhart alphas over the subsequent 12-month period for each of the five portfolios. Finally, we depict the average levels of the quarterly cumulative distribution functions. The figure shows the cumulative distributions for three different groups of mutual funds. The curve $RS1$ corresponds to funds in portfolio (1) that reduce their risk by more than 2.5%, $RS5$ to funds that increase their risk by more than 2.5%, and $RS3$ for funds that change their risk by less than 1%. All returns are expressed in % per month.