Risk Shifting and Mutual Fund Performance*

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Abstract

Mutual funds change their risk levels significantly over time. This paper investigates whether risk shifting has an impact on fund performance. Using a holdings-based measure of risk shifting, we find that funds that shift risk perform worse than funds that keep stable risk levels over time. This result is consistent with risk shifters having inferior ability or acting opportunistically due to agency conflicts and inconsistent with skilled fund managers taking advantage of changing investment opportunities.

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1 Introduction

The literature on delegated portfolio management has identified risk shifting as an agency problem in which fund managers manipulate their risk levels to improve their payoffs at the expense of fund investors. For example, given the well-documented convex relationship between prior fund performance and subsequent inflows, fund managers can attract additional money inflows and increase their personal compensation by opportunistically shifting risk over time.[1] Alternatively, risk levels of funds can also change when fund managers adjust the composition of their portfolios to take advantage of changing investment opportunities. Our paper investigates whether funds that shift risk exhibit different subsequent performance compared to funds with more consistent risk levels.

Investigating the relation between risk shifting and fund performance sheds light on the significance of agency problems and managerial ability in delegated portfolio management. Depending on its cause, risk shifting can either improve or worsen the performance of mutual funds. If risk shifting occurs because skilled fund managers take advantage of time-varying investment opportunities, then we should expect that risk shifters exhibit superior performance compared to funds that have more stable risk exposures. On the other hand, opportunistic risk shifting causes trading costs, constrains the investment opportunity set, and distracts fund managers from their goal of investing in the most promising securities. In addition, fund managers with inferior investment abilities might be more likely to change their trading strategy, resulting in more risk shifting. Thus, if risk shifting is caused by agency issues in delegated portfolio management, then we should expect that risk shifters exhibit inferior performance compared to funds that have more stable risk exposures.

[1] See, for example, Grinblatt and Titman (1989), Brown, Harlow, and Starks (1996), Chevalier and Ellison (1997), Koski and Pontiff (1999), Carpenter (2000), and Ross (2004).

We employ a holdings-based risk shifting measure that is defined as the difference between a fund's intended volatility and its realized volatility. The realized volatility is estimated as the standard deviation of a fund's actual return over the prior 36 months and the intended volatility as the standard deviation over the prior 36 months of a fund's most recently disclosed portfolio. The intended volatility captures the fund manager's revealed preference for risk and is a good estimate of the fund's total risk level over the next period. A fund has a positive risk shifting measure if the most recently disclosed portfolio has a higher volatility than the actual fund returns over the prior 36 months. Traditionally, risk shifting is estimated by comparing the standard deviations of realized fund returns over two non-overlapping time periods. Our holdings-based risk shifting measure has two advantages relative to the traditional measure. First, our measure is not affected by changes in the market volatility over time since both the intended and realized volatility are based on returns over the same time period. Thus, it captures the changes in the portfolio composition and is not contaminated by changes in the volatility of the underlying securities. Second, our holdings-based risk shifting measure can be computed as frequently as mutual funds are required to disclose their asset positions.

We study risk shifting activities of mutual funds using a sample of 2,335 U.S. equity funds over the period between 1980 and 2006. Mutual funds change their risk levels considerably over time. In a given quarter, 27.3 percent of equity mutual funds change their annualized volatility by more than 2.5 percentage points and 9.6 percent of funds change their volatility by more than 5 percentage points. These changes are significant given that their average long-term volatility level is only 17.9 percent. Mutual funds can change the total risk of their portfolios through three different channels: 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 idiosyncratic risk exposures (e.g., by concentrating the holdings on a few highly correlated positions). We find evidence that all of these channels are important in explaining the risk shifting of mutual funds over time.

Our paper documents a strong relation between risk shifting and subsequent fund performance using various factor- and holdings-based performance measures. Mutual funds that intend to increase their volatility by more than 5 percentage points exhibit an annualized abnormal return of -5.47 percent over the following quarter using the CAPM and funds that intend to decrease their volatility by more than 5 percentage points exhibit an annualized abnormal return of -2.09 percent. On the other hand, funds with the most consistent risk levels tend to slightly outperform the market even after subtracting fund expenses.

The poor subsequent performance of funds that increase risk is robust using alternative risk shifting measures. For example, we find that both funds that increase total risk by reducing the proportion invested in cash and funds that increase total risk by switching towards an equity portfolio with higher risk tend to exhibit negative abnormal returns in subsequent quarters. We also obtain similar performance results if we measure risk shifting using total risk (standard deviation of returns) or using idiosyncratic risk (standard deviation of residuals from CAPM or Carhart (1997) factor regressions). On the other hand, the performance of funds that shift risk by changing their exposure to market risk is not significantly different from the performance of funds that maintain a stable market exposure. This finding suggests that the poor performance of risk shifters is not driven by the unsuccessful attempt of fund managers to time the aggregate market. Furthermore, the results hold up after controlling for additional fund attributes, such as age, size, expenses, turnover, prior fund performance, and prior money flows.

Ever since Jensen (1968) there has been a constant debate in the academic literature whether mutual fund managers exhibit superior investment ability. Whereas the literature does not conclude that fund managers have significant market timing ability, there is ample evidence that some managers can deliver superior performance, at least before expenses.[2] Our evidence complements this literature by pointing out that risk shifting behavior is not an indication of superior ability. Rather, the risk shifting behavior is more consistent with opportunistic behavior of fund managers due to agency problems or inferior investment ability.

Several studies have identified a convex flow-performance relationship, because mutual fund investors tend to invest in funds with stellar performance and do not penalize poor performance equivalently.[3] Fund managers have therefore an incentive to take excessive risk to increase future expected fund inflows because their compensation depends primarily on the assets under management. Based on this convex flow-performance relationship, Brown, Harlow, and Starks (1996) view the mutual fund market as a tournament in which funds compete with each other. They suggest that fund managers manipulate fund risk depending on their prior performance. In particular, they show that funds that performed relatively poorly in the first half of the year tend to increase

[2]See, for example, Treynor and Mazuy (1966), Henriksson and Merton (1981), Grinblatt and Titman (1993), Brown and Goetzmann (1995), Ferson and Schadt (1996), Gruber (1996), Carhart (1997), Daniel, Grinblatt, Titman, and Wermers (1997), Wermers (2000), Baks, Metrick, and Wachter (2001), Bollen and Busse (2001), Coval and Moskowitz (2001), Jiang (2003), Berk and Green (2004), Chen, Hong, Huang, and Kubik (2004), Christoffersen and Sarkissian (2005), Cohen, Coval, and Pastor (2005), Kacperczyk, Sialm, and Zheng (2005), Gaspar, Massa, and Matos (2006), Kacperczyk, Sialm, and Zheng (2006), Kosowski, Timmermann, Wermers, and White (2006), Cohen, Frazzini, and Malloy (2007), Cremers and Petajisto (2007), Da, Gao, and Jagannathan (2007), Kacperczyk and Seru (2007), Mamaysky, Spiegel, and Zhang (2007), and Breon-Drish and Sagi (2008).

[3]See for example, Ippolito (1992), Brown, Harlow, and Starks (1996), Gruber (1996), Chevalier and Ellison (1997), Goetzmann and Peles (1997), Sirri and Tufano (1998), Zheng (1999), DelGuercio and Tkac (2002), Lynch and Musto (2003), Nanda, Wang, and Zheng (2004), Huang, Wei, and Yan (2007), Ivkovich and Weisbenner (2007), and Chen, Goldstein, and Jiang (2008).

their risk levels in the second half of the year. Chevalier and Ellison (1997) analyze the convex flow-performance relationship and find evidence that mutual funds that are well ahead of their peers also have an incentive to increase risk and speculate that this might be an attempt to make year-end 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. Since these early contributions, numerous theoretical and empirical studies have improved our understanding of risk shifting behavior of mutual funds.[4] Our paper contributes to this literature by investigating the consequences of risk shifting on fund performance, which have not previously been analyzed in the extensive mutual fund literature. Studying the performance consequences of risk shifting also gives us important insights into the motivations for risk shifting.

Our paper is also related to the literature on the performance consequences of style drift. Brown and Harlow (2002) use return-based measures of style drift and find that style drifters generally perform worse. On the other hand, Wermers (2002), uses a holdings-based definition of style drift and finds that style drifters perform better. The difference may be due to the elusive nature of style definitions. In contrast, we focus on changes in the overall risk level of mutual funds. Our results indicate that funds that follow consistent investment policies tend to outperform funds with varying policies.

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. The main results of the paper investigating whether risk shifting affects fund performance are contained in Section 4.

[4]Papers on risk shifting include, for example, Starks (1987), Grinblatt and Titman (1989), Brown, Harlow, and Starks (1996), Chevalier and Ellison (1997), Koski and Pontiff (1999), Carpenter (2000), Busse (2001), Elton, Gruber, and Blake (2003), Goriaev, Palomino, and Prat (2003), Ross (2004), Elton, Gruber, Krasny, and Ozelge (2006), Li and Tiwari (2006), Ammann and Verhofen (2007), Basak, Pavlova, and Shapiro (2007), Chen and Pennacchi (2007), Kempf and Ruenzi (2007), Kempf, Ruenzi, and Thiele (2007), Massa and Patgiri (2007), and Hu, Kale, Pagani, and Subramanian (2008).

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 explicitly their portfolio holdings. We measure risk shifting of a mutual fund f at time t by comparing the fund's intended volatility $\sigma^I_{f,t}$ with its past realized volatility $\sigma^R_{f,t}$:

$$RS_{f,t} = \sigma^I_{f,t} - \sigma^R_{f,t}. \tag{1}$$

The intended volatility measures the risk of the fund's most recently disclosed holdings and is estimated using the returns of these holdings over a prior period. We term it the intended volatility since it reveals the risk level that the fund intends to achieve by choosing this portfolio. To the extent that the disclosed portfolio provides a good estimate of the fund's holdings over the next period, the intended volatility captures the forward-looking total risk of the fund. The realized volatility, on the other hand, measures the backward-looking total risk of the fund and is estimated using the realized fund returns over the same prior period. The remainder of this section explains in more detail how the two measures are computed.

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 $\mathbf{R_t}$:

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

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

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 $\boldsymbol{\Sigma}$. 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.

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

To estimate the intended volatility of fund f at time t, we compute 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 the variance of the most recent mutual fund portfolio using the estimated variance-covariance matrix of individual assets over the prior 36 months, but is computationally less demanding.

The realized volatility of fund f at time t is estimated as the sample standard deviation of the actual fund return over the prior 36 months. It captures the total risk of the actual positions held over the prior 36 months. The realized volatility will be identical to the intended 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 over the prior 36 months than the actual fund holdings over the corresponding time period and is negative otherwise. A positive risk shifting measure indicates that a mutual fund shifts towards more risky positions 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.[5] Using a holdings-based measure of risk shifting has at least two advantages. First, the volatility of the same portfolio can change significantly over time due to changes in stock characteristics or due to aggregate shocks to the return process. 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 intended and the realized volatilities 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. Second, the indented volatility captures the risk level of the most recent fund portfolio and can be computed as frequently as mutual funds are required to disclose their asset positions.

3 Data and Summary Statistics

This section explains the data sources and investigates the characteristics of mutual funds that tend to shift risk.

3.1 Sample Selection

For our empirical analysis, we merge the CRSP Survivorship Bias Free Mutual Fund Database with the Thompson 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

[5]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 (2007) use mutual fund holdings data to compute changes in risk levels.

returns, total assets under management, different types of fees, investment objectives, and other fund characteristics. The Thompson 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 percent of the observations are from the most recent quarter and only 3 percent 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.[6] 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.

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 funds with relatively short return histories.

We report in Table 1 summary statistics on fund total net assets (TNA), age, expense

[6]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. Funds with names including 'index' or 'idx' are identified as index funds and excluded from our sample.

ratio, turnover, asset allocations, and net investor returns based on the CRSP mutual fund data. The mean assets under management equal $1,383 million. The average age of a fund is about 18 years with a standard deviation of 15 years. The mean expense ratio is 1.28 percent per year and the mean turnover ratio is about 91 percent per year. Since we focus our analysis on equity funds, the vast majority of the assets are invested in common stocks (91.28 percent) and cash (6.26 percent). Bonds, preferred stocks, and other securities each comprise a relatively small proportion of the total holdings.

Based on the CRSP data we compute the new money growth (NMG), which is defined as the growth rate of the assets under management after adjusting for the appreciation of the mutual funds assets (RF_t), assuming that all the cash flows are invested at the end of the period:

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

Since estimated fund flows are very volatile, we winsorize both the top and the bottom parts of the distribution at the 1 percent level. Funds in our sample experience an inflow of around 1.29 percent per quarter.

The average investor return of mutual funds in our sample equals 0.83 percent per month. We compute the gross holdings return based on the most recently disclosed quarter-end Thompson 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. To adjust fund holdings returns for various asset classes, we proxy for these asset returns using published indices. For bonds we use the total return of the Lehman Brothers Aggregate Bond Index, while for cash holdings we use the Treasury bill rate. No reliable index returns are available for preferred stocks and for other assets. Thus, we assume that the return on preferred stocks equals the return of the Lehman Brothers Aggregate Bond Index, and the return on other assets equals the Treasury bill rate. The mean gross holdings return equals 0.92 percent per month and has a correlation of 94.5 percent 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 Thompson 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.[7] The average fund holds approximately 89 stocks and exhibits an ICI of 0.12.

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, and momentum scores for each mutual fund in each period. For example, a mutual fund that invests only in stocks in the smallest size quintile has a size score of one, whereas a mutual fund that invests only in the largest size quintile has a size score of five. Mutual funds in our sample tend to hold stocks in the largest size quintile and have a slight bias towards growth and momentum stocks.

[7]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).

The last three rows of Table 1 report the intended volatility, the realized volatility, and the risk shifting measure, as defined in Section 2. To compute the intended volatility, we use the total return of the Lehman Brothers Aggregate Bond Index as the return for the bond and preferred stock positions and the Treasury bill rate as the return for cash holdings and other securities. We exclude the holdings of stocks that do not have complete return histories over the prior 36 months. Both the intended and the realized volatilities are computed and updated at a quarterly frequency. The risk shifting measure is simply the difference between the intended and the realized volatilities.

The mean annualized intended volatility of 17.54 percent is slightly smaller than the mean annualized realized volatility of 17.86 percent. These two measures of volatility have a very high correlation of 82.7 percent. The mean risk shifting measure is slightly negative and has an economically significant annualized standard deviation of 4.58 percent or about one quarter of the average realized volatility over the prior three years. We also compute alternative risk shifting measures using the ratio of the two volatilities, based only on equity positions (ignoring changes in cash or other non-equity positions), and based on the difference between the current intended and the average of past intended volatilities. These alternative risk shifting measures are highly correlated with the proposed measure and the results are qualitatively and quantitatively similar.

3.3 Fund Characteristics by Risk Shifting

To investigate the relation between risk shifting and fund attributes, we sort all mutual funds in each month into portfolios according to the most recent RS measure: Funds in the middle portfolio change risk by less than 1 percent per year, funds in the bottom portfolio reduce risk by more than 5 percent, and funds in the top portfolio increase risk by more than 5 percent. The middle portfolio includes 41 percent of mutual funds, whereas the bottom and the top portfolios include about 6 and 4 percent of the funds in our sample.[8]

Table 2 summarizes the characteristics of mutual funds sorted according to the RS measure. Funds in the bottom portfolio intend to decrease risk on average by 9.8 percent per year or by approximately 39 percent of the realized volatility over the prior 36 months. On the other hand, funds in the top RS portfolio increase risk on average by 8.2 percent per year or by approximately 42 percent of the prior realized volatility. Thus, funds exhibit significant changes in their overall risk levels over time.

We find an asymmetric pattern in the drivers of the RS measure. Funds in the top RS portfolio exhibit high intended volatilities, whereas their realized volatilities are not very different from the average fund. On the other hand, funds in the bottom RS portfolios have high realized volatilities, whereas their intended volatility levels are not substantially lower than the average mutual fund. Thus, funds in the top portfolio intend to increase their total risk significantly from the average risk levels and funds in the bottom portfolio intend to reduce their total risk from their elevated levels back to the average. This asymmetric pattern suggests that increasing volatility is an active choice for funds while decreasing volatility is driven more by the reversion back to normal risk levels. In addition, part of this pattern can also be contributed to the fact that equity mutual funds cannot reduce the total risk levels below the level of a well-diversified portfolio as long as they hold a significant amount of equity securities.[9]

Most fund attributes exhibit a non-monotonic pattern. Funds with relatively consistent risk levels are larger, older, less active, charge lower expenses, and hold better

[8]The results in the paper are similar if the mutual funds are sorted into decile portfolios instead. We choose to form portfolios over these pre-specified ranges because funds in the middle portfolio have very little risk shifting, while funds in the top and bottom portfolios shift risk very significantly. Using these pre-specified ranges allows us to pool together funds with similar risk shifting measures.

[9]The value-weighted total market index computed by CRSP has an annualized volatility of 14.9 percent over our sample period.

diversified portfolios across individual stocks and industries than funds that shift risk levels.

3.4 Mechanism of Risk Shifting

Mutual funds have several potential channels 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 their diversification levels (e.g., by changing the number of stocks or the concentration in particular industries and styles).

Table 3 summarizes the changes in the holdings characteristics of mutual funds in the various RS portfolios. We report the differences in fund characteristics between the most recent holdings and the holdings over the prior three years. 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 their holdings of small capitalization, growth, and momentum stocks, reduce the number of stock positions, and increase their industry concentration levels. Funds that decrease risk experience exactly the opposite changes.

We also investigate the persistence of the risk shifting behavior by calculating the absolute level of the risk shifting measure over several years after the portfolio formation and find significant persistence. These unreported results indicate that funds that tend to shift risk do so persistently over longer time periods.

4 Performance Implications of Risk Shifting

The main question of our paper asks whether risk shifting has any performance implications. This section compares the performance of funds that tend to shift risk with the performance of funds with more stable risk properties. We analyze only the future performance of funds after computing the risk shifting measure to avoid any potential issues of reverse causality. Investigating only the future fund performance ignores the direct trading costs (or trading benefits) caused by current risk shifting activity and is conservative for our purpose of identifying any performance consequence of risk shifting.

To evaluate fund performance we use various factor and holdings-based performance measures developed in the mutual fund performance literature.

4.1 Portfolio Performance

Table 4 reports the performance of the mutual fund portfolios sorted by their risk shifting. At the end of each month we sort mutual funds into portfolios according to their most recent RS measure. We compute the equal weighted average investor returns of all funds in the corresponding portfolios over the next month. Subsequently, we compute the average excess and abnormal returns using the time-series of fund portfolio returns.

We report five different performance measures for the fund portfolios. The first performance measure is simply the difference between the fund portfolio return and the aggregate market return. To adjust for risk and style effects, abnormal asset returns are also computed using the one-factor CAPM, the Fama and French (1993), and the Carhart (1997) 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 fund 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 large and small 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).

The Ferson and Schadt (1996) conditional model is specified as follows:

$$RF_{k,t} - R_{TB,t} = \alpha_k + \beta_k^M (R_{M,t} - R_{TB,t}) + \sum_{j=1}^{5} \beta_k^j (R_{M,t} - R_{TB,t}) \times MACRO_{t-1}^j + \epsilon_{k,t}, \quad (6)$$

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.[10] In all five 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.[11]

We observe that funds that shift risk tend to have relatively low excess and abnormal returns. The poor performance is particularly pronounced for funds that intend to

[10]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).

[11]Using a five factor model including the Pastor and Stambaugh (2003) liquidity factor does not affect the results qualitatively and quantitatively.

increase their risk levels. For example, funds in the top RS portfolio (that increase risk the most) exhibit an abnormal return of -46 basis points per month or about -5.47 percent per year using the CAPM. On the other hand, funds in the bottom RS portfolio (that decrease risk the most) exhibit a CAPM-adjusted return of -17 basis points per month or -2.09 percent per year. Finally, funds with the most consistent risk levels tend to slightly outperform the CAPM even after subtracting fund expenses. The poor performance of funds that increase risk remains economically and statistically significant using the alternative factor models. Figure 1 illustrates these results graphically.

These performance results indicate that risk shifting funds exhibit lower subsequent fund performance. The findings are consistent with risk shifting being motivated by conflicts of interests between fund managers and their investors or being a consequence of unskilled managers trading on noise or misinformation, but is inconsistent with risk shifting being a consequence of skilled managers taking advantage of time-varying investment opportunities.

4.2 Longer Term Performance Effects

In the prior section we formed portfolios of mutual funds according to the prior quarter RS measure. To investigate whether risk shifting only has short-term performance impact, we form mutual fund portfolios using longer-term lags. Table 5 summarizes 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 the top RS portfolio remains statistically significant over the first four quarters after the portfolio formation. The finding that risk shifting is a persistent characteristic of funds that can predict inferior longer-term fund performance suggests that investors should avoid funds with unstable risk levels.

4.3 Equity and Non-Equity Positions

Funds can change their risk levels by changing the composition of their equity positions or by changing the proportions invested in equity relative to safer securities such as cash. This section considers these two mechanisms of risk shifting by constructing two alternative *RS* measures, one based only on the riskiness of the disclosed equity positions and the other based only on the proportion of fund assets invested in equity securities.

Table 6 reports the performance consequence of risk shifting based on three alternative *RS* measures. The first two columns of the table report the risk shifting ranges and 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 adjustment.

The middle two columns consider only the riskiness of the disclosed equity positions and ignore non-equity positions. This equity-based risk shifting measure is defined as:

$$RS_{f,t}^{equity} = \sigma_{f,t}^{I,equity} - \sigma_{f,t}^{R,equity}, \tag{7}$$

where $\sigma_{f,t}^{I,equity}$ is the intended volatility estimated using the returns of the most recently disclosed equity positions over the prior 36 months and $\sigma_{f,t}^{R,equity}$ 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.

We form the fund portfolios depending on whether the risk shifting measure based on equity holdings is in pre-determined ranges as summarized in Table 6. For example, Portfolio (1) includes funds that reduce their equity risk shifting measure by more than 4 percentage points per year and Portfolio (7) includes the funds that increase their equity risk shifting measure by more than 4 percentage points.

The last two columns focus on the aggregate proportion invested in equity securities and ignore the riskiness of the equity positions. This equity allocation-based measure of risk shifting is defined as:

$$RS_{f,t}^{w(equity)} = w_{f,t}^{equity} - \overline{w}_{f,t}^{equity}, \tag{8}$$

where $w_{f,t}^{equity}$ is the most recently disclosed proportion invested in equity securities according to the CRSP mutual fund database and $\overline{w}_{f,t}^{equity}$ is the average proportion invested in equity securities over the prior 36 months. Portfolios (1) to (7) are formed using the $RS^{w(equity)}$ measure in specific ranges. For example, Portfolio (1) includes funds that reduced the proportion invested in equity securities by more than 12.5 percent and Portfolio (7) includes funds that increased the proportion invested in equity securities by more than 12.5 percent.

The results from Table 6 indicate that funds that intend to increase risk have poor subsequent performance, whether they intend to increase the volatility of their equity holdings (the middle two columns) or intend to increase the proportion invested in equity securities (the last two columns). In unreported results we find that the poor performance is particularly pronounced if mutual funds increase risk by both increasing their proportion invested in equity securities and by increasing the volatility of their equity positions.

The asset allocations used in the base case specification in Table 4 are obtained from the CRSP mutual fund database whereas the equity holdings are obtained from Thompson Financial. The asset allocations are generally available at a lower frequency than the equity holdings, which might add noise to the estimates of our base case risk shifting measure. Another potential concern of our base case measure is that the intended volatility is based on the disclosed holdings returns whereas the realized volatility is based on realized fund returns, which might capture the impact of dynamic trading strategies, window dressing, or other systematic biases. Using the two alternative risk shifting measures reported in Table 6 where both the intended and the realized volatilities are based on disclosed holdings mitigates these potential concerns.

4.4 Systematic and Idiosyncratic Risk

Fund managers might shift risk in an effort to take advantage of time-varying investment opportunities. In particular, 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 fact that funds that shift risk underperform funds with more stable risk levels indicates that these fund managers do not have superior investment ability. This section decomposes the total risk of a mutual fund into a systematic component and an idiosyncratic component to investigate whether the underperformance is more pronounced for funds that attempt to time the market or whether it is more pronounced for funds that change the idiosyncratic risk of their portfolios.

Table 7 summarizes the risk-adjusted returns of portfolios of mutual funds formed according to different risk shifting measures. Panel A reports the performance results using the Carhart factor model to adjust for risk and style. We compare the future abnormal performance of fund portfolios formed according to four different risk shifting measures. The first risk shifting measure corresponds to our base case in Table 4 and is based on the total volatility of mutual funds. The second measure is based on changes in systematic risk and is defined as:

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

where $\beta^{I}_{f,t}$ 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. Portfolios (1) to (7) are formed for specific ranges of risk shifting. For example, Portfolio (1) includes funds that, on average, reduced their CAPM beta by -0.386 and Portfolio (7) includes funds that, on average, increased their average beta by 0.403 relative to their betas over the prior three years.

The third and fourth risk shifting measures are based on the idiosyncratic volatilities computed using the CAPM and the Carhart factor models. The idiosyncratic risk shifting measures are defined as

$$RS^{idiosync}_{f,t} = \sigma^{I,idiosync}_{f,t} - \sigma^{R,idiosync}_{f,t}, \tag{10}$$

where $\sigma^{I,idiosync}_{f,t}$ is the idiosyncratic volatility of the most recently disclosed fund holdings over the prior 36 months and $\sigma^{R,idiosync}_{f,t}$ is the idiosyncratic volatility of the actual fund holdings over the prior 36 months. The idiosyncratic volatilities are computed as the standard deviations of the residuals from the CAPM or Carhart factor regressions over the prior 36 months.

Whereas we do not find a statistically significant return pattern for fund portfolios sorted according to changes in systematic risk, we find a particularly striking relation between risk shifting and fund performance for portfolios sorted according to changes in idiosyncratic volatilities. Funds that increase their idiosyncratic volatility perform very poorly in the subsequent quarter. For example, funds in the top idiosyncratic RS portfolio have abnormal alphas of between -68 and -80 basis points per month depending on whether idiosyncratic risk is measured relative to the market model or the four-factor Carhart model. The abnormal performance of funds increasing idiosyncratic risk is substantially more negative than the abnormal performance of funds increasing total risk, which exhibit an alpha of -31 basis points. On the other hand, funds with decreasing levels of idiosyncratic risk do not appear to perform differently from funds with minor changes in idiosyncratic risk. The fact that our results are driven by changes in idiosyncratic risk levels and not by changes in systematic risk levels suggests 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, by either reducing the number of stock holdings or by concentrating their holdings in a narrow set of industries or styles.

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 the Fama-French-Carhart factor model by including an idiosyncratic volatility factor. Following Ang, Hodrick, Xing, and Zhang (2006) we form value-weighted quintile portfolios of individual stocks based on their prior-month idiosyncratic volatility relative to the Fama and French (1993) model. The return on the idiosyncratic volatility factor is computed as the difference in the returns between the top and the bottom quintile portfolios.[12] The corresponding results are reported in Panel B of Table 7. The fund portfolios for the various risk shifting measures are identical to those reported in Panel A.

Consistent with Ang, Hodrick, Xing, and Zhang (2006), we find that the idiosyncratic volatility factor earns a negative average return. Funds that significantly shift risk (in either the top or the bottom risk shifting portfolios) have positive loadings

[12] We thank Jie Cao for providing the idiosyncratic volatility factor.

on the idiosyncratic volatility factor whereas funds that maintain stable risk levels (in the middle risk shifting portfolios) have negative loadings on the idiosyncratic volatility factor. However, 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. Consistent with the results in Panel A, we find that changes in idiosyncratic risk are the driving force behind the poor performance of risk shifters and not changes in systematic risk. Thus, our results are not explained by the poor performance of high idiosyncratic volatility stocks.

4.5 Return Decomposition

To investigate whether our results are due to the underperformance of disclosed stock positions, expenses, or unobserved actions, we decompose the net investor return of a fund:

$$RF_{f,t} = RH_{f,t} - EXP_{f,t} + RG_{f,t}, \tag{11}$$

where the investor return is denoted by RF, the holdings return by RH, and the expense ratio by EXP. The return gap RG is defined following Kacperczyk, Sialm, and Zheng (2006) as the residual that captures the impact of unobserved actions on fund returns.

Following Daniel, Grinblatt, Titman, and Wermers (1997), we can further decompose the holdings return into the Characteristic Selectivity (CS), the Characteristic Timing (CT), and the Average Style (AS) performance measures:

$$CS_{f,t} = \sum_{i=1}^{N} w^i_{f,t}[R_{i,t} - BR_{i(t-1),t}], \tag{12}$$

$$CT_{f,t} = \sum_{i=1}^{N}[w^i_{f,t}BR_{i(t-1),t} - w^i_{f,t-13}BR_{i(t-13),t}], \tag{13}$$

$$AS_{f,t} = \sum_{i=1}^{N}[w^i_{f,t-13}BR_{i(t-13),t}]. \tag{14}$$

The return on stock i during period t is denoted by $R_{i,t}$ and the return on a benchmark portfolio during period t to which stock i was allocated during month $t-k$ according to its size, value, and momentum characteristics is denoted by $BR_{i(t-k),t}$. The weight invested in stock i at the beginning of month t in the mutual fund f is denoted by $w^i_{f,t}$. The CS component measures the characteristics-adjusted return of the long-term holdings of a mutual fund and the CT component measures any performance driven by the ability to time the characteristics of a fund. The AS measure captures the average return of the long-term style of the mutual fund. The three components add up to the holdings return RH.

Table 8 summarizes the various components of the investor return. While most of the negative performance of high RS funds is driven by unobserved actions, the CS and CT measures, which capture the investment ability of fund managers before subtracting trading costs and expenses, also contribute to the poor performance of funds that intend to increase risk. In particular, the return gap of the top RS portfolio underperforms the return gap of the middle portfolio by 25 basis points per month, and both the CS and CT measures of the top RS portfolio underperform the corresponding measures of the middle portfolio by about 10 basis points per month.

The expense ratio of risk shifters is significantly higher than the expense ratio of funds with more stable risk exposures. However, differences in fees play a minor role in explaining the poor investor returns. The difference in the expense ratio between the top RS portfolio and the middle RS portfolio equals only 3 basis points per month.

4.6 Multivariate Regression

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

$$
\begin{aligned}
RF_{f,t} \;=\;& \beta_0 + \beta_1 MAX(0, RS_{f,t-1}) + \beta_2 MIN(0, RS_{f,t-1}) + \beta_3 \sigma^R_{f,t-1} + \beta_4 RF_{f,t-1} \\
&+ \beta_5 LOGAGE_{f,t-1} + \beta_6 LOGTNA_{f,t-1} + \beta_7 EXP_{f,t-1} + \beta_8 TO_{f,t-1} + \beta_9 NMG_{f,t-1} \\
&+ \beta^{cash} w^{cash}_{f,t-1} + \sum_{j=1}^{4} \beta^{size(j)} w^{size(j)}_{f,t-1} + \sum_{j=1}^{4} \beta^{btm(j)} w^{btm(j)}_{f,t-1} + \sum_{j=1}^{4} \beta^{mom(j)} w^{mom(j)}_{f,t-1} + \epsilon_{f,t}.
\end{aligned} \quad (15)
$$

The dependent variable in each cross-section is the return of an individual mutual fund RF 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 relationship between risk shifting and returns when RS is positive and β_2 captures the relationship 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 growth rate in new money over the prior year NMG. To adjust for risk and style, we include in some specifications the proportion invested in cash, and the proportions of equity securities invested in the bottom four quintiles based on the size, the book-to-market, and the momentum quintiles of the mutual fund holdings. The coefficients on these style proportions capture the impact of styles on the fund return in each month. For example, $w^{size(1)}_{f,t-1}$ equals the weight invested in stocks in the smallest size quintile by a mutual fund in the prior month. 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 funds that change their risk over time. The factor loadings estimated over prior windows might not be accurate for funds that either increased or decreased the risk levels significantly. Instead, we include the most recent weights invested in different styles as explanatory variables to adjust the fund returns for risk and style.[13]

Table 9 reports the multivariate regression estimates. Whereas the first two specifications do not adjust for style and risk, the last two specifications include the aforementioned (unreported) style and risk effects. The first specification indicates a significantly negative relationship between risk shifting and fund returns for positive risk shifters and an insignificantly positive relationship between risk shifting and raw fund returns for negative risk shifters. The second column adds additional control variables. These variables do not have a significant impact on the risk shifting coefficients. Consistent with the prior mutual fund literature, we find that expenses have a significantly negative impact and that past returns have a significantly positive impact on fund returns. Turnover has a significantly positive relation and new money growth has a significantly negative relation with fund performance. The coefficient estimates are not affected significantly after adjusting for risk and style, as reported in the last two columns.

The results in this section confirm the portfolio results reported in Table 4 and Figure 1 that funds that intend to increase risk perform poorly in the future, even after

[13]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.

adjusting for other fund characteristics and after controlling for risk and style. On the other hand, funds that intend to reduce their risk levels do not significantly underperform other funds. This asymmetry is consistent with the finding in Table 2 that increasing fund risk is driven by the high intended volatility and is more of an active choice by funds while decreasing risk is driven by high realized volatility and is more of a passive reversion back to the long-term risk levels. Increases in risk levels can be achieved by shifting towards riskier securities and by concentrating the portfolio on fewer securities and fewer sectors as discussed in Table 3. On the other hand, decreases in risk levels can be achieved by holding a more balanced and better diversified portfolio. Thus, funds tend to face a more restrictive choice set when increasing risk than when reducing risk levels, which can justify the asymmetric impact of risk shifting on fund performance.

4.7 Interactions with Fund Characteristics

To shed light on the significance of agency problems and managerial ability in mutual funds, we study the relation between risk shifting and fund performance in different subgroups of funds. Table 10 reports the coefficient estimates of a multivariate Fama-MacBeth regression, where the specification in equation (15) is expanded by splitting up the risk shifting coefficients into two groups according to different fund characteristics. The risk shifting variables are interacted with indicator variables (LOW and $HIGH$) denoting whether one of six different fund characteristics (age, size, expense ratio, prior-year return, turnover, and prior-year new money growth) is above or below its median in each time period.

Chevalier and Ellison (1997) find that young funds with less established track records have larger incentives to shift risk since flow sensitivity to performance is more pronounced for young funds. Similarly, small funds might also have larger incentives to shift risk than larger funds. By interacting the age and size of funds with the risk shifting measure, we find that the impact of increasing risk is particularly pronounced for funds with below median age and size. This finding is consistent with agency conflicts being a driver behind risk shifting behavior.

Sirri and Tufano (1998) and Huang, Wei, and Yan (2007) suggest that funds that charge higher expense ratios spend more on marketing expenses, which reduce the search cost for investors and increase the flow-sensitivity to good past performance. Thus, these funds might have more incentives to strategically shift their risk levels and might be more willing to accept the potential performance deterioration resulting from risk shifting. In addition, Ruiz-Verdu and Gil-Bazo (2007) find that funds with higher fees do not perform better even before subtracting fees and suggest that high expense ratio funds target naive investors who are not responsive to expenses. Conflicts of interest are likely more important for such high-expense funds. Consistent with this hypothesis, we find that the negative impact of increasing risk is particularly pronounced for funds with above median expense ratios.

Mutual funds with worse prior performance are likely to have inferior ability given the persistence of their poor performance. In addition, they might also be more willing to shift risk for opportunistic reasons. Our results reported in the fourth column of Table 10 indicate that increasing risk has more detrimental performance implications for funds with below median prior-year returns.

The poor performance of funds that increase risk could be due to the more significant trading costs incurred by such funds. 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 for the poor performance of risk shifters, then we should observe that the relationship between performance and risk shifting is particularly pronounced for high turnover funds. In contrast, we find that increasing risk has a slightly worse impact on future performance for funds with low turnover than for funds with high turnover. Thus, trading costs are unlikely the main reason behind the poor performance of risk shifters.

Coval and Stafford (2007) and Chen, Hanson, Hong, and Stein (2007) 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 fund as they reduce their cash positions and as they reduce their portfolio diversification by selling some of their positions. The last column in Table 10 investigates whether the risk shifting effect depends on the new money growth during the prior year. We do not find that fund performance is significantly related to risk increases for funds with poor recent new money growth. Thus, our results are not a consequence of fire sales by distressed mutual funds.

4.8 Robustness Tests

In this section we discuss additional robustness tests. Table 11 divides the sample into two sub-periods (1983-1994 and 1995-2006) and shows that funds that intend to increase their risk levels perform relatively poorly in the subsequent month for both sub-periods.

Table 12 reports the multivariate regression results using the Return Gap and the Characteristic Selectivity and Characteristic Timing measures as the dependent variables. Consistent with the portfolio results in Table 8, we find a significantly negative relationship between risk shifting and the Return Gap for funds which intend to increase the risk above the prior level. The corresponding relationship is also negative for the

CS and CT measures, although at lower levels of statistical significance.

Our base case specification defines risk shifting as the difference between the intended volatility including cash positions and the average realized volatility over the prior 36 months. The results are not affected significantly using alternative definitions of risk shifting. The mutual fund literature has developed two methods to compute risk shifting. Brown, Harlow, and Starks (1996) use the ratio of the risk levels, whereas Koski and Pontiff (1999) use the difference in the risk levels. In unreported results we find that using the ratio between intended volatility and realized volatility as opposed to the difference does not have a significant impact on the results.

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 included in the MFLINKS file that matches CRSP with Thompson. Including all funds increases the number of funds in our sample from 2335 to 3395 and increases the number of fund-month observations from 184,519 to 281,959. We also investigate the impact of excluding sector funds or including index funds relative to our base-case sample. Since these fund categories do not account for a large proportion of the mutual fund sample, it is not surprising that the results are not affected substantially using this alternative sample selection.

5 Conclusions

As more and more investors delegate their portfolio decisions to mutual fund managers, potential agency problems between fund managers and investors have become increasingly important. Our paper extends the literature on one particular agency problem – the incentive for fund managers to shift the risk level of their portfolios to increase their personal compensation – and investigates its consequences for fund investors.

Risk shifting per se does not necessarily 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.

We find that even if investors are fully aware of the risk shifting behavior, they are better off avoiding funds that are prone to switch risk over time. The reason is that funds that shift risk perform worse than funds that keep stable risk levels over time, due both to trading costs and to their worse investment ability. These results are consistent with risk shifting being a consequence of opportunistic behavior of fund managers or being a signal of inferior managerial ability and inconsistent with risk shifting being a consequence of skilled fund managers taking advantage of time-varying investment opportunities.

References

Ammann, M. and M. Verhofen (2007). The impact of prior performance on the risk-taking of mutual fund managers. University of St.Gallen.

Ang, A., R. Hodrick, Y. Xing, and X. Zhang (2006). The cross-section of volatility and expected returns. *Journal of Finance 61*, 259–299.

Baks, K. P., A. Metrick, and J. Wachter (2001). Should investors avoid all actively managed mutual funds? A study in Bayesian performance evaluation. *Journal of Finance 56*, 45–86.

Basak, S., A. Pavlova, and A. Shapiro (2007). Optimal asset allocation and risk shifting in money management. *Review of Financial Studies 20*(5), 1583–1621.

Berk, J. and R. C. Green (2004). Mutual fund flows and performance in rational markets. *Journal of Political Economy 112*, 1269–1295.

Bollen, N. P. B. and J. A. Busse (2001). On the timing ability of mutual fund managers. *Journal of Finance 56*, 1075–1094.

Breon-Drish, B. and J. S. Sagi (2008). Do fund managers make informed asset allocation decisions. University of California at Berkeley and Vanderbilt University.

Brown, K. C. and W. V. Harlow (2002). Staying the course: The impact of investment style consistency on mutual fund performance. University of Texas at Austin and Fidelity Investments.

Brown, K. C., W. V. Harlow, and L. T. Starks (1996). Of tournaments and temptations: An analysis of managerial incentives in the mutual fund industry. *Journal of Finance 51*(1), 85–110.

Brown, S. J. and W. N. Goetzmann (1995). Performance persistence. *Journal of Finance 50*, 853–873.

Busse, J. A. (2001). Another look at mutual fund tournaments. *Journal of Financial and Quantitative Analysis 36*(1), 53–73.

Carhart, M. M. (1997). On persistence in mutual fund performance. *Journal of Finance 52*(2), 57–82.

Carpenter, J. N. (2000). Does option compensation increase managerial risk appetite. *Journal of Finance 55*, 2311–2331.

Chalmers, J. M., R. M. Edelen, and G. B. Kadlec (1999). An analysis of mutual fund trading costs. Univeristy of Oregon, University of Pennsylvania, and Virginia Tech.

Chen, H.-L. and G. G. Pennacchi (2007). Does prior performance affect a mutual fund's choice of risk? Theory and further empirical evidence. University of Illinois at Chicago and University of Illinois at Urbana-Champaign.

Chen, J., S. Hanson, H. Hong, and J. C. Stein (2007). Do hedge funds profit from mutual-fund distress? USC, Harvard University, and Princeton University.

Chen, J., H. Hong, M. Huang, and J. Kubik (2004). Does fund size erode performance? Liquidity, organizational diseconomies and active money management. *American Economic Review 94*, 1276–1302.

Chen, Q., I. Goldstein, and W. Jiang (2008). Payoff complementarities and financial fragility: Evidence from mutual fund outflows. Duke University, University of Pennsylvania, and Columbia University.

Chevalier, J. and G. Ellison (1997). Risk taking by mutual funds as a response to incentives. *Journal of Political Economy 105*(6), 1167–1200.

Christoffersen, S. and S. Sarkissian (2005). City size and fund performance. McGill University.

Cohen, L., A. Frazzini, and C. Malloy (2007). The small world of investing: Board connections and mutual fund returns. Harvard University and University of Chicago.

Cohen, R., J. D. Coval, and L. Pastor (2005). Judging fund managers by the company that they keep. *Journal of Finance 60*, 1057–1096.

Coval, J. and E. Stafford (2007). Asset fire sales (and purchases) in equity markets. *Journal of Financial Economics 86*, 479–512.

Coval, J. D. and T. J. Moskowitz (2001). The geography of investment: Informed trading and asset prices. *Journal of Political Economy 109*, 811–841.

Cremers, M. and A. Petajisto (2007). How active is your fund manager? A new measure that predicts performance. Forthcoming: Review of Financial Studies.

Da, Z., P. Gao, and R. Jagannathan (2007). Informed trading, liquidity provision, and stock selection by mutual funds. University of Notre Dame and Northwestern University.

Daniel, K., M. Grinblatt, S. Titman, and R. Wermers (1997). Measuring mutual fund performance with characteristic-based benchmarks. *Journal of Finance 52*(3), 1035–1058.

DelGuercio, D. and P. A. Tkac (2002). The determinants of the flow of funds of managed portfolios: Mutual funds versus pension funds. *Journal of Financial and Quantitative Analysis 37*, 523–557.

Elton, E. J., M. J. Gruber, and C. R. Blake (2003). Incentive fees and mutual funds. *Journal of Finance 58*(2), 779–804.

Elton, E. J., M. J. Gruber, Y. Krasny, and S. Ozelge (2006). The effect of the frequency of holding data on conclusions about mutual fund management behavior. New York University.

Fama, E. F. and K. R. French (1993). Common risk factors in the return on bonds and stocks. *Journal of Financial Economics 33*, 3–53.

Ferson, W. and R. Schadt (1996). Measuring fund strategy and performance in changing economic conditions. *Journal of Finance 51*, 425–462.

Gaspar, J.-M., M. Massa, and P. Matos (2006). Favoritism in mutual fund families? Evidence on strategic cross-fund subsidization. *Journal of Finance 61*, 73–104.

Goetzmann, W. N. and N. Peles (1997). Cognitive dissonance and mutual fund investors. *Journal of Financial Research 20*(2), 145–158.

Goriaev, A., F. Palomino, and A. Prat (2003). Mutual fund tournament: Risk taking incentives induced by ranking objectives. New Economic School, HEC School of Management, and London School of Economics.

Grinblatt, M. and S. Titman (1989). Adverse risk incentives and the design of performance-based contracts. *Management Science 35*, 807–822.

Grinblatt, M. and S. Titman (1993). Performance measurement without benchmarks: An examination of mutual fund returns. *Journal of Business 66*, 47–68.

Gruber, M. J. (1996). Another puzzle: The growth in actively managed mutual funds. *Journal of Finance 51*(3), 783–810.

Henriksson, R. D. and R. C. Merton (1981). On market timing and investment performance. II. statistical procedures for evaluating forecasting skills. *Journal of Business 54*, 513–533.

Hu, P., J. R. Kale, M. Pagani, and A. Subramanian (2008). Fund flows, performance, managerial career concerns, and risk-taking. Georgia State University and San Jos State University.

Huang, J., K. D. Wei, and H. Yan (2007). Participation costs and the sensitivity of fund flows to past performance. *Journal of Finance 62*(3), 1273–1311.

Ippolito, R. A. (1992). Consumer reaction to measures of poor quality: Evidence from the mutual fund industry. *Journal of Law and Economics 35*(1), 45–70.

Ivkovich, Z. and S. Weisbenner (2007). Old money matters: The sensitivity of mutual fund redemption decisions to past performance. Michigan State University and University of Illinois at Urbana-Champaign.

Jensen, M. C. (1968). The performance of mutual funds in the period 1945 − 1964. *Journal of Finance 23*, 389–416.

Jiang, W. (2003). A nonparametric test of market timing. *Journal of Empirical Finance 10*, 399–425.

Kacperczyk, M. and A. Seru (2007). Fund manager use of public information: New evidence on managerial skills. *Journal of Finance 62*, 485–528.

Kacperczyk, M., C. Sialm, and L. Zheng (2005). On the industry concentration of actively managed equity mutual funds. *Journal of Finance 60*(4), 1983–2012.

Kacperczyk, M., C. Sialm, and L. Zheng (2006). Unobserved actions of equity mutual funds. Forthcoming: Review of Financial Studies.

Kempf, A. and S. Ruenzi (2007). Tournaments in mutual fund families. Forthcoming: Review of Financial Studies.

Kempf, A., S. Ruenzi, and T. Thiele (2007). Employment risk, compensation incentives and managerial risk taking: Evidence from the mutual fund industry. University of Cologne.

Koski, J. L. and J. Pontiff (1999). How are derivatives used? Evidence from the mutual fund industry. *Journal of Finance 54*(2), 791–816.

Kosowski, R., A. Timmermann, R. Wermers, and H. White (2006). Can mutual fund 'stars' really pick stocks? New evidence from a bootstrap analysis. *Journal of Finance 61*, 2551–2595.

Li, W. and A. Tiwari (2006). On the consequences of mutual fund tournaments. University of Iowa.

Lynch, A. W. and D. K. Musto (2003). How investors interpret past fund returns. *Journal of Finance 58*, 2033–2058.

Mamaysky, H., M. I. Spiegel, and H. Zhang (2007). Improved forecasting of mutual fund alphas and betas. Forthcoming: Review of Finance.

Massa, M. and R. Patgiri (2007). Incentives and mutual fund performance: Higher performance or just higher risk taking? Forthcoming: Review of Financial Studies.

Nanda, V., Z. J. Wang, and L. Zheng (2004). Family values and the star phenomenon: Strategies of mutual fund families. *Review of Financial Studies 17*(3), 667–698.

Pastor, L. and R. F. Stambaugh (2003). Liquidity risk and expected stock returns. *Journal of Political Economy 111*(3), 642–685.

Ross, S. A. (2004). Compensation, incentives, and the duality of risk aversion and riskiness. *Journal of Finance 59*, 207–225.

Ruiz-Verdu, P. and J. Gil-Bazo (2007). Yet another puzzle? The relation between price and performance in the mutual fund industry. Universidad Carlos III de Madrid.

Sirri, E. R. and P. Tufano (1998). Costly search and mutual fund flows. *Journal of Finance 53*(5), 1589–1622.

Starks, L. T. (1987). Performance incentive fees: An agency theoretic approach. *Journal of Financial and Quantitative Analysis 22*(1), 17–32.

Treynor, J. L. and K. Mazuy (1966). Can mutual funds outguess the market? *Harvard Business Review 44*, 131–136.

Wermers, R. (2000). Mutual fund performance: An empirical decomposition into stock-picking talent, style, transactions costs, and expenses. *Journal of Finance 55*(4), 1655–1703.

Wermers, R. (2002). A matter of style: The causes and consequences of style drift in institutional portfolios. University of Maryland.

Wermers, R. (2003). Is money really 'smart'? New evidence on the relation between mutual fund flows, manager behavior, and performance persistence. University of Maryland.

Zheng, L. (1999). Is money smart? A study of mutual fund investors' fund selection ability. *Journal of Finance 54*, 901–933.

Table 1: **Summary Statistics**
This table summarizes the characteristics for the mutual funds in our sample over the period between 1980 and 2006. We measure risk shifting of a mutual fund as the difference between the intended volatility (the standard deviation of the returns of the most recently disclosed fund holdings over the prior 36 months) and the realized volatility (the standard deviation of the realized fund returns over the prior 36 months).

Variable	Mean	Std.Dev.	Median
Total Net Assets (TNA) (in Millions)	1382.54	4739.35	277.84
Age (in Years)	17.54	15.29	12.00
Expense Ratio (in Percent)	1.28	0.46	1.24
Turnover Ratio (in Percent)	90.65	112.98	66.00
Common Stock Proportion (in Percent)	91.28	12.04	95.00
Cash Proportion (in Percent)	6.26	9.04	3.78
Bond Proportion (in Percent)	1.58	6.49	0.00
Preferred Stock Proportion (in Percent)	0.39	2.57	0.00
Other Securities Proportion (in Percent	0.49	3.81	0.00
New Money Growth (in Percent per Quarter)	1.29	15.11	-1.07
Investor Return (in Percent per Month)	0.83	5.34	1.07
Holdings Return (in Percent per Month)	0.92	5.71	1.12
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
Intended Volatility (in Percent per Year)	17.54	7.62	16.41
Realized Volatility (in Percent per Year)	17.86	7.93	16.42
Risk Shifting (in Percent per Year)	-0.33	4.58	0.01
Total number of funds	2335		
Total number of observations	184,519		

Table 2: **Fund Characteristics by Risk Shifting Range**
This table summarizes the average characteristics of portfolios of mutual funds sorted according to the most recent risk shifting measure. We measure risk shifting of a mutual fund as the difference between the intended volatility (the standard deviation of the returns of the most recently disclosed fund holdings over the prior 36 months) and the realized volatility (the standard deviation of the realized fund returns over the prior 36 months).

Portfolio	*RS* Range	Prop. of Obs. (%)	*RS* Mean	Intended Vol.	Realized Vol.	Total Net Assets	Age	Turnover	Expense Ratio	Num. of Stocks	Industry Concen. Index
1	$(-\infty,-5]$	5.800	−9.812	15.188	25.000	407.584	17.458	132.619	1.386	72.919	0.189
2	(-5,-2.5]	8.396	−3.452	16.023	19.474	840.801	18.835	106.984	1.263	76.401	0.149
3	(-2.5,-1]	15.395	−1.632	15.605	17.236	971.230	19.900	87.071	1.198	84.302	0.124
4	(-1,1)	41.091	0.016	15.848	15.833	1245.885	22.196	69.674	1.126	92.313	0.111
5	[1,2.5)	16.367	1.634	17.826	16.192	1021.063	19.990	76.707	1.189	82.554	0.117
6	[2.5,5)	9.198	3.425	20.936	17.511	880.898	18.302	93.780	1.284	66.129	0.159
7	$[5,\infty)$	3.834	8.223	27.728	19.505	582.867	16.042	110.802	1.485	45.204	0.246

Table 3: **Changes in Fund Characteristics.**
This table summarizes the changes in the average characteristics between the most recent holdings and the average levels over the prior 36 months according to the most recent risk shifting measure. We measure risk shifting of a mutual fund as the difference between the intended volatility (the standard deviation of the returns of the most recently disclosed fund holdings over the prior 36 months) and the realized volatility (the standard deviation of the realized fund returns over the prior 36 months).

Portfolio	RS Range	Realized Volatility	Cash Holdings	Market Beta	Size Score	Value Score	Momen. Score	Number of Stocks	Industry Concen.
1	$(-\infty,-5]$	−9.812	0.075	−0.333	0.080	0.079	−0.112	3.207	−0.017
2	(-5,-2.5]	−3.452	0.033	−0.192	0.114	0.032	−0.098	2.850	−0.007
3	(-2.5,-1]	−1.632	0.012	−0.101	0.076	0.007	−0.029	3.711	−0.004
4	(-1,1)	0.016	−0.007	−0.007	0.046	−0.019	−0.006	3.162	−0.003
5	[1,2.5)	1.634	−0.029	0.085	0.038	−0.015	0.014	1.260	0.000
6	[2.5,5)	3.425	−0.044	0.174	−0.008	−0.013	0.031	−0.911	0.005
7	$[5,\infty)$	8.223	−0.071	0.348	−0.104	−0.032	0.050	−3.689	0.023

Table 4: **Future Performance of *RS*-Portfolios**

This table reports the excess and abnormal monthly returns of portfolios of mutual funds sorted according to the most recent risk shifting measure. The table summarizes the excess return of a fund portfolio over the value-weighted CRSP market return, and the intercepts from factor regressions based on the CAPM, Fama-French, Carhart, and Ferson-Schadt models. We measure risk shifting of a mutual fund as the difference between the intended volatility (the standard deviation of the returns of the most recently disclosed fund holdings over the prior 36 months) and the realized volatility (the standard deviation of the realized fund returns over the prior 36 months). All returns are expressed in percent per month. The significance levels are abbreviated with asterisks: One, two, and three asterisks denote significance at the 10, 5, and 1 percent level, respectively.

Portfolio	RS Range	Excess Return	CAPM	Fama-French	Carhart	Ferson-Schadt
1	$(-\infty,-5]$	-0.221	-0.174	-0.161	-0.111	-0.128
		(0.170)	(0.171)	(0.167)	(0.170)	(0.172)
2	(-5,-2.5]	-0.109	-0.094	-0.078	-0.061	-0.104
		(0.073)	(0.073)	(0.067)	(0.068)	(0.075)
3	(-2.5,-1]	-0.060	-0.020	-0.050	-0.044	-0.073
		(0.055)	(0.054)	(0.052)	(0.053)	(0.054)
4	(-1,1)	-0.043	0.013	-0.067	-0.057	-0.056
		(0.054)	(0.049)	(0.048)	(0.049)	(0.045)
5	[1,2.5)	-0.050	-0.028	-0.079	-0.094	-0.092
		(0.061)	(0.061)	(0.056)	(0.057)	(0.061)
6	[2.5,5)	-0.109	-0.135	-0.115	-0.180^{**}	-0.155
		(0.094)	(0.094)	(0.074)	(0.073)	(0.098)
7	$[5,\infty)$	-0.389^{**}	-0.456^{***}	-0.251^{*}	-0.310^{**}	-0.351^{**}
		(0.167)	(0.166)	(0.132)	(0.134)	(0.169)

Table 5: **Longer-Term Performance Effects**
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. We measure risk shifting of a mutual fund as the difference between the intended volatility (the standard deviation of the returns of the most recently disclosed fund holdings over the prior 36 months) and the realized volatility (the standard deviation of the realized fund returns over the prior 36 months). All returns are expressed in percent per month. The significance levels are abbreviated with asterisks: One, two, and three asterisks denote significance at the 10, 5, and 1 percent level, respectively.

		Number of Lags in Quarters			
Portfolio	*RS* Range	1	2	3	4
1	(-∞,-5]	−0.111	−0.029	−0.121	−0.032
		(0.170)	(0.178)	(0.148)	(0.164)
2	(-5,-2.5]	−0.061	−0.010	−0.022	−0.068
		(0.068)	(0.069)	(0.069)	(0.067)
3	(-2.5,-1]	−0.044	−0.053	−0.040	−0.009
		(0.053)	(0.056)	(0.053)	(0.051)
4	(-1,1)	−0.057	−0.058	−0.066	−0.063
		(0.049)	(0.047)	(0.046)	(0.044)
5	[1,2.5)	−0.094	−0.077	−0.034	−0.065
		(0.057)	(0.055)	(0.052)	(0.050)
6	[2.5,5)	−0.180**	−0.153**	−0.180**	−0.156**
		(0.073)	(0.077)	(0.078)	(0.079)
7	[5,∞)	−0.310**	−0.469***	−0.367***	−0.258*
		(0.134)	(0.148)	(0.128)	(0.133)

Table 6: **Future Performance of Portfolios for Risk Shifting Based on Equity and Non-Equity Positions**

This table reports the average risk shifting measure and the monthly Carhart-adjusted returns of portfolios of mutual funds sorted according to the most recent risk shifting measure. Three different risk shifting measures are used: The first measure computes risk shifting using both equity and non-equity positions and corresponds to the base case summarized in Table 4. The second risk shifting measure is defined as the difference between the intended volatility of the equity positions (the standard deviation of the returns of the most recently disclosed fund holdings in common stocks over the prior 36 months) and the realized volatility of the equity positions (the standard deviation of the historically disclosed holdings in common stocks over the prior 36 months). The third risk shifting measure is simply defined as the difference between the most recently disclosed proportion invested in equity securities and the average proportion invested in equity securities over the prior 36 months. All returns are expressed in percent per month. The significance levels are abbreviated with asterisks: One, two, and three asterisks denote significance at the 10, 5, and 1 percent level, respectively.

	Risk Shifting Using All Holdings		Risk Shifting Using Equity Holdings		Risk Shifting Using Proportion of Equity	
Portfolio	RS Range	Alpha	RS Range	Alpha	RS Range	Alpha
1	$(-\infty,-5]$	-0.111	$(-\infty,-4]$	0.021	$(-\infty,-12.5]$	-0.071
		(0.170)		(0.102)		(0.064)
2	(-5,-2.5]	-0.061	(-4,-2]	-0.036	(-12.5,-7.5]	-0.034
		(0.068)		(0.064)		(0.052)
3	(-2.5,-1]	-0.044	(-2,-1]	-0.058	(-7.5,-2.5]	-0.043
		(0.053)		(0.064)		(0.044)
4	(-1,1)	-0.057	(-1,1)	-0.066	(-2.5,2.5)	-0.068
		(0.049)		(0.047)		(0.042)
5	[1,2.5)	-0.094	[1,2)	-0.138^{**}	[2.5,7.5)	-0.094^{**}
		(0.057)		(0.060)		(0.047)
6	[2.5,5)	-0.180^{**}	[2,4)	-0.227^{***}	[7.5,12.5)	-0.094^{*}
		(0.073)		(0.077)		(0.057)
7	$[5,\infty)$	-0.310^{**}	$[4,\infty)$	-0.207^{*}	$[12.5,\infty)$	-0.134^{**}
		(0.134)		(0.105)		(0.064)

Table 7: **Future Performance of Mutual Funds by Systematic and Idiosyncratic Risk Shifting**

This table reports the abnormal monthly returns of portfolios of mutual funds sorted according to the most recent risk shifting measure which is defined as the difference between the intended risk (the risk of the most recently disclosed fund holdings over the prior 36 months) and the realized risk (the risk of the realized fund returns over the prior 36 months). We compute four different measures of risk used in the risk shifting measure: (1) the standard deviation of the fund returns; (2) the systematic risk, defined as the CAPM beta; (3) and (4) the idiosyncratic risk, defined as the standard deviation of the residuals from the CAPM and Carhart regression, respectively. All returns are expressed in percent per month. Panel A reports the abnormal returns (the intercepts from factor regressions) based on the Carhart model. Panel B reports the abnormal returns based on five-factor regressions with the four factors from the Carhart model and an additional idiosyncratic volatility factor, which is constructed as the return difference between the top and the bottom quintile portfolios of idiosyncratic volatility stocks according to Ang, Hodrick, Xing, and Zhang (2006). The significance levels are abbreviated with asterisks: One, two, and three asterisks denote significance at the 10, 5, and 1 percent level, respectively.

Panel A: Fund Alphas Estimated Using the Four-Factor Carhart Model

	Risk Shifting Using Total Volatility		Risk Shifting Using CAPM Beta		Risk Shifting Using Idiosyncratic Volatility (CAPM)		Risk Shifting Using Idiosyncratic Volatility (Carhart)	
	RS Range	Alpha	*RS* Range	Alpha	*RS* Range	Alpha	*RS* Range	Alpha
1	(-∞,-5]	−0.111	(-∞,-0.25]	−0.193*	(-∞,-4]	0.073	(-∞,-4]	0.025
		(0.170)		(0.110)		(0.235)		(0.232)
2	(-5,-2.5]	−0.061	(-0.25,-0.15]	−0.056	(-4,-2]	−0.002	(-4,-2]	0.084
		(0.068)		(0.071)		(0.070)		(0.077)
3	(-2.5,-1]	−0.044	(-0.15,-0.05]	−0.042	(-2,-1]	−0.038	(-2,-1]	0.007
		(0.053)		(0.050)		(0.059)		(0.054)
4	(-1,1)	−0.057	(-0.05,0.05)	−0.063	(-1,1)	−0.070	(-1,1)	−0.055
		(0.049)		(0.047)		(0.047)		(0.050)
5	[1,2.5)	−0.094	[0.05,0.15)	−0.063	[1,2)	−0.093	[1,2)	−0.117*
		(0.057)		(0.049)		(0.061)		(0.070)
6	[2.5,5)	−0.180**	[0.15,0.25)	−0.076	[2,4)	−0.118	[2,4)	−0.162*
		(0.073)		(0.063)		(0.083)		(0.085)
7	[5,∞)	−0.310**	[0.25,∞)	−0.097	[4,∞)	−0.797***	[4,∞)	−0.680***
		(0.134)		(0.103)		(0.193)		(0.220)

Panel B: Fund Alphas Estimated Using Five-Factor Model Including Idiosyncratic Volatility Factor

	Risk Shifting Using Total Volatility		Risk Shifting Using CAPM Beta		Risk Shifting Using Idiosyncratic Volatility (CAPM)		Risk Shifting Using Idiosyncratic Volatility (Carhart)	
	RS Range	Alpha	*RS* Range	Alpha	*RS* Range	Alpha	*RS* Range	Alpha
1	(-∞,-5]	0.013	(-∞,-0.25]	−0.149	(-∞,-4]	0.165	(-∞,-4]	0.070
		(0.150)		(0.113)		(0.240)		(0.238)
2	(-5,-2.5]	−0.052	(-0.25,-0.15]	−0.058	(-4,-2]	0.017	(-4,-2]	0.096
		(0.072)		(0.073)		(0.072)		(0.079)
3	(-2.5,-1]	−0.086	(-0.15,-0.05]	−0.097**	(-2,-1]	−0.104*	(-2,-1]	−0.041
		(0.052)		(0.049)		(0.058)		(0.054)
4	(-1,1)	−0.148***	(-0.05,0.05)	−0.138***	(-1,1)	−0.150***	(-1,1)	−0.143***
		(0.045)		(0.043)		(0.043)		(0.046)
5	[1,2.5)	−0.167***	[0.05,0.15)	−0.105**	[1,2)	−0.177***	[1,2)	−0.213***
		(0.053)		(0.049)		(0.058)		(0.067)
6	[2.5,5)	−0.192**	[0.15,0.25)	−0.074	[2,4)	−0.169**	[2,4)	−0.174**
		(0.078)		(0.064)		(0.084)		(0.088)
7	[5,∞)	−0.223*	[0.25,∞)	−0.032	[4,∞)	−0.782***	[4,∞)	−0.612***
		(0.117)		(0.104)		(0.198)		(0.224)

Table 8: **Holdings-Based Performance Measures of RS-Portfolios**
This table reports the monthly holdings-based performance measures of portfolios of mutual funds sorted according to the most recent risk shifting measure. The table summarizes the Characteristic Selectivity (CS), the Characteristic Timing (CT), and the Average Style (AS) measures from Daniel, Grinblatt, Titman, and Wermers (1997). Furthermore, the table also summarizes the Return Gap (RG) based on Kacperczyk, Sialm, and Zheng (2006) and the monthly expense ratio. The sum of the different measures corresponds to the investor return of a fund. We measure risk shifting RS of a mutual fund as the difference between the intended volatility (the standard deviation of the returns of the most recently disclosed fund holdings over the prior 36 months) and the realized volatility (the standard deviation of the realized fund returns over the prior 36 months). All returns are expressed in percent per month. The significance levels are abbreviated with asterisks: One, two, and three asterisks denote significance at the 10, 5, and 1 percent level, respectively.

Portfolio	RS Range	Character. Selectivity	Character. Timing	Average Style	Return Gap	Expense Ratio
1	$(-\infty,-5]$	-0.008	-0.025	1.088^{***}	0.107	0.115^{***}
		(0.130)	(0.051)	(0.292)	(0.133)	(0.001)
2	(-5,-2.5]	0.062	-0.012	1.063^{***}	0.008	0.105^{***}
		(0.053)	(0.040)	(0.284)	(0.033)	(0.001)
3	(-2.5,-1]	0.046	0.045	1.054^{***}	0.026	0.100^{***}
		(0.039)	(0.036)	(0.269)	(0.018)	(0.001)
4	(-1,1)	0.043	0.054	1.071^{***}	-0.001	0.094^{***}
		(0.033)	(0.034)	(0.263)	(0.012)	(0.001)
5	[1,2.5)	0.050	0.042	1.066^{***}	-0.034^{**}	0.099^{***}
		(0.040)	(0.032)	(0.267)	(0.017)	(0.001)
6	[2.5,5)	-0.013	0.046	1.078^{***}	-0.070^{**}	0.107^{***}
		(0.068)	(0.032)	(0.275)	(0.030)	(0.001)
7	$[5,\infty)$	-0.054	-0.046	0.971^{***}	-0.251^{***}	0.124^{***}
		(0.148)	(0.049)	(0.293)	(0.091)	(0.001)

Table 9: **Multi-Variate Performance Regression**
To investigate the relationship between risk shifting and subsequent fund performance we run a multivariate Fama-MacBeth regression. The dependent variable in each cross-section is the return of an individual mutual fund RF in a particular month. We measure risk shifting RS of a mutual fund as the difference between the intended volatility (the standard deviation of the returns of the most recently disclosed fund holdings over the prior 36 months) and the realized volatility (the standard deviation of the realized fund returns over the prior 36 months). 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 include in some specifications the proportion invested in cash, and the proportions of equity securities invested in the bottom four quintiles based on the size, the book-to-market, and the momentum quintiles of the mutual fund holdings. The significance levels are abbreviated with asterisks: One, two, and three asterisks denote significance at the 10, 5, and 1 percent level, respectively.

MAX(0,RS)	−0.044**	−0.035***	−0.032***	−0.024***
	(0.019)	(0.010)	(0.009)	(0.008)
MIN(0,RS)	0.015	−0.008	0.008	−0.006
	(0.018)	(0.016)	(0.012)	(0.013)
Realized Volatility		−0.002		0.001
		(0.014)		(0.011)
Lagged Return		0.249***		0.219***
		(0.064)		(0.050)
Age		−0.010		0.002
		(0.017)		(0.013)
Size		−0.011		−0.011*
		(0.009)		(0.007)
Expense Ratio		−0.921**		−1.191***
		(0.374)		(0.306)
Turnover		0.067***		0.045**
		(0.023)		(0.019)
New Money Growth		−0.384**		−0.283*
		(0.187)		(0.145)
Cash				−0.054
				(0.138)
Intercept	1.037***	0.919***	1.314***	1.064***
	(0.243)	(0.188)	(0.332)	(0.241)
Risk and Style Adjustments	NO	NO	YES	YES

Table 10: **Multi-Variate Regression with Characteristics Interactions**
To investigate the relationship between fund performance and risk shifting interacted with various fund characteristics we run a multivariate Fama-MacBeth regression. The dependent variable in each cross-section is the return of an individual mutual fund RF in a particular month. We measure risk shifting RS of a mutual fund as the difference between the intended volatility (the standard deviation of the returns of the most recently disclosed fund holdings over the prior 36 months) and the realized volatility (the standard deviation of the realized fund returns over the prior 36 months). The risk shifting variables are interacted with indicator variables (LOW and $HIGH$) denoting whether one of six different fund characteristics (age, size, expense ratio, turnover, new money growth, and lagged return) is above or below its median in each time period. 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 include the proportion invested in cash, and the proportions of equity securities invested in the bottom four quintiles based on the size, the book-to-market, and the momentum quintiles of the mutual fund holdings. The return is expressed in percent per month. The significance levels are abbreviated with asterisks: One, two, and three asterisks denote significance at the 10, 5, and 1 percent level, respectively.

	Age	Size	Expense Ratio	Lagged Return	Turnover	New Money Growth
MAX(0,RS)×LOW	−0.027***	−0.031***	−0.009	−0.033***	−0.026**	−0.018
	(0.010)	(0.011)	(0.011)	(0.011)	(0.012)	(0.011)
MAX(0,RS)×$HIGH$	−0.018*	−0.014	−0.032***	−0.013	−0.020*	−0.023*
	(0.010)	(0.011)	(0.010)	(0.010)	(0.011)	(0.012)
MIN(0,RS)×LOW	0.002	0.002	−0.002	−0.012	0.002	0.006
	(0.013)	(0.013)	(0.014)	(0.014)	(0.019)	(0.012)
MIN(0,RS)×$HIGH$	−0.003	−0.013	−0.005	0.001	−0.005	−0.015
	(0.014)	(0.014)	(0.014)	(0.015)	(0.012)	(0.017)
Realized Volatility	0.001	0.002	0.001	0.000	0.001	0.002
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Lagged Return	0.222***	0.217***	0.219***	0.206***	0.221***	0.215***
	(0.050)	(0.049)	(0.050)	(0.058)	(0.049)	(0.050)
Age	−0.005	0.003	0.002	−0.001	0.004	0.004
	(0.016)	(0.014)	(0.013)	(0.013)	(0.013)	(0.013)
Size	−0.011	−0.018**	−0.011*	−0.009	−0.011	−0.011*
	(0.007)	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)
Expense Ratio	−1.223***	−1.142***	−1.280***	−1.123***	−1.231***	−1.179***
	(0.322)	(0.297)	(0.393)	(0.298)	(0.298)	(0.302)
Turnover	0.044**	0.042**	0.045**	0.046**	0.042**	0.043**
	(0.019)	(0.018)	(0.018)	(0.019)	(0.018)	(0.019)
New Money Growth	−0.285**	−0.295**	−0.315**	−0.263*	−0.295**	−0.247*
	(0.144)	(0.145)	(0.145)	(0.145)	(0.137)	(0.136)
Cash	−0.033	−0.040	−0.038	−0.080	−0.044	−0.037
	(0.140)	(0.137)	(0.137)	(0.138)	(0.135)	(0.137)
$HIGH$	0.005	−0.001	0.032	0.020	−0.010	−0.023
	(0.025)	(0.028)	(0.026)	(0.025)	(0.036)	(0.025)
Intercept	1.082***	1.079***	1.058***	1.107***	1.087***	1.060***
	(0.245)	(0.245)	(0.240)	(0.239)	(0.242)	(0.238)
Risk and Style Adjustment	YES	YES	YES	YES	YES	YES

Table 11: **Multi-Variate Regression by Subperiods**
To investigate the relationship between risk shifting and subsequent fund performance over two subperiods we run a multivariate Fama-MacBeth regression. The dependent variable in each cross-section is the return of an individual mutual fund RF in a particular month. We measure risk shifting RS of a mutual fund as the difference between the intended volatility (the standard deviation of the returns of the most recently disclosed fund holdings over the prior 36 months) and the realized volatility (the standard deviation of the realized fund returns over the prior 36 months). 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 include the proportion invested in cash, and the proportions of equity securities invested in the bottom four quintiles based on the size, the book-to-market, and the momentum quintiles of the mutual fund holdings. The return is expressed in percent per month. The significance levels are abbreviated with asterisks: One, two, and three asterisks denote significance at the 10, 5, and 1 percent level, respectively.

	1983-1994		1995-2006	
MAX(0,RS)	-0.029^{**}	-0.025^{*}	-0.036^{***}	-0.023^{***}
	(0.014)	(0.014)	(0.012)	(0.008)
MIN(0,RS)	-0.008	-0.012	0.022^{**}	0.000
	(0.022)	(0.023)	(0.011)	(0.013)
Realized Volatility		0.003		0.000
		(0.015)		(0.016)
Lagged Return		0.154^{**}		0.283^{***}
		(0.074)		(0.066)
Age		0.004		0.001
		(0.023)		(0.013)
Size		-0.019		-0.003
		(0.012)		(0.006)
Expense Ratio		-1.689^{***}		-0.704^{***}
		(0.555)		(0.266)
Turnover		0.058^{*}		0.032^{*}
		(0.034)		(0.016)
New Money Growth		-0.257		-0.309^{**}
		(0.253)		(0.148)
Cash		-0.191		0.080
		(0.192)		(0.199)
Intercept	1.418^{***}	1.420^{***}	1.212^{**}	0.715^{**}
	(0.378)	(0.327)	(0.543)	(0.352)
Risk and Style Adjustment	YES	YES	YES	YES

Table 12: **Multi-Variate Regression for Holdings-Based Performance Measures**
To investigate the relationship between risk shifting and subsequent fund performance using holdings-based performance measures, we run a multivariate Fama-MacBeth regression. The dependent variables in the three specifications are the Return Gap based on Kacperczyk, Sialm, and Zheng (2006) and the Characteristic Selectivity and the Characteristic Timing measures based on Daniel, Grinblatt, Titman, and Wermers (1997). We measure risk shifting RS of a mutual fund as the difference between the intended volatility (the standard deviation of the returns of the most recently disclosed fund holdings over the prior 36 months) and the realized volatility (the standard deviation of the realized fund returns over the prior 36 months). 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. The performance measures are expressed in percent per month. The significance levels are abbreviated with asterisks: One, two, and three asterisks denote significance at the 10, 5, and 1 percent level, respectively.

	Return Gap	Characteristic Selectivity	Characteristic Timing
MAX(0,RS)	-0.023^{***}	-0.018^{*}	-0.005
	(0.008)	(0.009)	(0.004)
MIN(0,RS)	-0.010	-0.012	-0.000
	(0.010)	(0.011)	(0.004)
Realized Volatility	-0.006^{**}	-0.006	-0.005^{*}
	(0.003)	(0.010)	(0.003)
Lagged Return	0.041^{***}	0.118^{**}	0.051^{***}
	(0.013)	(0.050)	(0.017)
Age	-0.014^{**}	-0.003	-0.004
	(0.007)	(0.014)	(0.005)
Size	-0.002	-0.003	0.002
	(0.005)	(0.007)	(0.003)
Expense Ratio	-0.086	0.205	0.186
	(0.193)	(0.295)	(0.128)
Turnover	-0.014	0.042^{**}	0.006
	(0.011)	(0.020)	(0.007)
New Money Growth	-0.022	-0.047	-0.089
	(0.083)	(0.145)	(0.061)
Intercept	0.155^{***}	-0.021	0.070
	(0.055)	(0.158)	(0.070)
Risk and Style Adjustment	NO	NO	NO

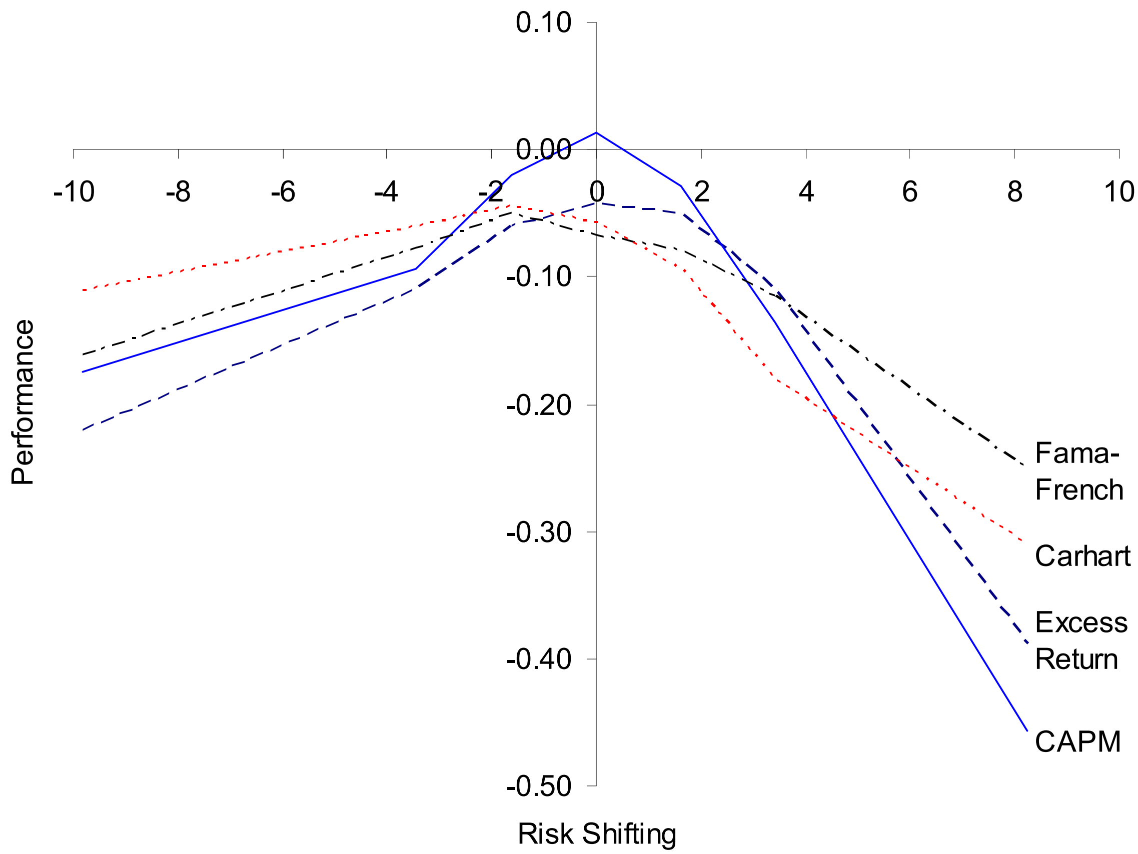

Figure 1: **Future Performance of Portfolios by Risk Shifting Measure.**
This figure depicts the excess and abnormal monthly returns of portfolios of mutual funds sorted according to the most recent risk shifting measure. The figure summarizes the excess return of a fund portfolio over the value-weighted CRSP market return, and the intercepts from factor regressions based on the CAPM, Fama-French, and Carhart models. We measure risk shifting of a mutual fund as the difference between the intended volatility (the standard deviation of the returns of the most recently disclosed fund holdings over the prior 36 months) and the realized volatility (the standard deviation of the realized fund returns over the prior 36 months). All returns are expressed in percent per month.