Skewness Consequences of Seeking Alpha

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Abstract

Mutual funds seek alpha, but residual coskewness is also an important performance attribute. Alpha and residual coskewness relative to the market are negatively correlated in theory, so funds may generate undesirable residual coskewness in the pursuit of alpha. Empirically, the trade-off exists for mutual funds and is driven by both fund composition and actions of managers. Sorting funds by proxies for active management generates positive alpha, but also undesirable coskewness. Investment styles also carry skewness consequences, but only partially explain the trade-off in funds. A minority of funds overcome the trade-off. Thus, seeking alpha generally comes at a skewness cost.

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1. Introduction

Mutual fund performance is often measured by alpha relative to a benchmark (Jensen, 1969). This makes sense for quadratic utility investors, as mean-variance efficiency can be be improved by a marginal investment in a positive alpha fund (Dybvig and Ross, 1985). However, mounting evidence suggests that investors care about moments beyond mean and variance, in particular skewness (e.g., Golec and Tamarkin, 1998; Garrett and Sobel, 1999; Kumar, 2009). For these investors, the marginal effect of an investment in a mutual fund on the investor's portfolio skewness is also important.

For the type of zero-beta investment analyzed by Dybvig and Ross (1985), the marginal effect on portfolio skewness of an investment in an asset is governed by the asset's residual coskewness, meaning the coskewness between the investor's portfolio (benchmark) and the residual in the projection of the asset return on the benchmark. If there is an asset with a positive alpha and positive residual coskewness, then an investment in the asset can improve the mean, variance, and skewness of the investor's portfolio. If investors care exclusively about mean, variance, and skewness, then it should be impossible in equilibrium to make such improvements. This means that there should be a trade-off in equilibrium between alpha and residual coskewness—positive alphas can be achieved only at the expense of negative residual coskewness and vice versa.

In this paper, we examine the skewness cost created by active mutual funds seeking alpha. The trade-off between alpha and residual coskewness has been documented for stock returns (Kraus and Litzenberger, 1976; Harvey and Siddique, 2000). However, it is not obvious how such a cost of alpha will translate to delegated portfolios. If a mutual fund is just a static portfolio of stocks, then the trade-off in stocks would obviously result in a trade-off at the fund level. Of course, fund managers do not choose stocks randomly. One contribution of our study is to document the extent to which fund managers choose portfolios of stocks with high alpha but undesirable coskewness properties.

Mutual fund managers generally do not hold static portfolios. Funds employ dynamic trading strategies that may impact the trade-off betweeen alpha and residual coskewness. It is possible that skilled mutual fund managers are able to overcome the skewness cost of alpha. On the other hand, stock picking or market timing could exacerbate the trade-off. A second contribution of our study is to document how the actions of managers impact the trade-off between alpha and residual coskewness at the fund level.

We find that the trade-off between alpha and residual coskewness holds for mutual funds, not just for stocks. To investigate whether this merely reflects the underlying trade-off in stocks, we decompose alphas into a part due to average holdings and the remainder, which is due to trading. Both parts of alpha are negatively related to residual coskewness, and the trade-off between residual coskewness and the non-holdings component of alpha is driven by both market timing and stock picking activity. Thus, the trade-off between alpha and residual coskewness in mutual fund returns is not solely a function of average fund holdings.

Various measures of fund activity have been shown to be associated with alpha. We show that the same measures are negatively related to residual coskewness. We sort funds by Industry Concentration (Kacperczyk, Sialm, and Zheng, 2005), Return Gap (Kacperczyk, Sialm, and Zheng, 2008), Active Share (Cremers and Petajisto, 2009), $1 - R^2$ (Amihud and Goyenko, 2013), a time-varying Skill Index (Kacperczyk, Van Nieuwerburgh, and Veldkamp, 2014), and Active Weight (Doshi, Elkamhi, and Simutin, 2015). As has been shown before, each of these sorts produces a long-short portfolio with a positive alpha. We show that each of the long-short portfolios also has undesirable residual coskewness. Thus, alphas produced by fund activities come at a coskewness cost.

For stocks, the relation between alpha and residual coskewness is partly due to styles (Harvey and Siddique, 2000). We show that this is also true for funds. Standard style tilts (size, value, momentum) exhibit a trade-off between alpha and residual coskewness (for example, SMB, HML, and UMD all have positive alphas and negative residual coskewness). However, style tilts do not fully account for the negative relationship between alpha and residual coskewness in funds. When we control for styles, the coskewness costs due to average alpha and due to trading both remain significant. Styles have a larger impact on the trade-off for the portfolios based on proxies for active management. For Industry Concentration, Active Share, and the Skill Index, the trade-off is driven by style exposures. However, the trade-off between style-adjusted alpha and residual coskewness remains economically important for the other three proxies: Return Gap, $1 - R^2$, and Active Weight.

There is a small subset of funds that seem to have both positive alphas and desirable residual coskewness. These funds stand as exceptions to our general conclusion that funds are indifferent about skewness costs. We investigate those funds further. On average, they are more actively managed and hold concentrated portfolios that differ from the average holdings of other funds (i.e., less herding). They also have higher levels of stock-picking ability and more profitable unobserved actions.

For fund managers, performance measures are important in part because of the fund flows generated by superior performance. We show that flows respond not only to alpha as shown in previous work, but also to residual coskewness. Consistent with the trade-off between alpha and residual coskewness, the relationship between flows and alpha strengthens if one controls for the level of residual coskewness.

The interest in our results depends on the extent to which investors care about skewness. In theory, preferences for skewness are common. For example, investors with constant relative risk aversion care about skewness. There is a large literature focusing on investors' preferences for skewness. Golec and Tamarkin (1998) and Garrett and Sobel (1999) explain horse track betting and lottery participation through skewness preferences. Kumar (2009) links skewness preferences to individual investors' stock decisions, showing that those that play the lottery also choose stocks with positive idiosyncratic skewness. Goetzmann and Kumar (2008) show that individuals who hold undiversified portfolios hold stocks with high levels of skewness, and Bailey, Kumar, and Ng (2011) show that individual investors also tend to choose mutual funds that hold stocks with high levels of skewness. Heuson, Hutchinson, and Kumar (2016) show that hedge funds with more skewed returns receive greater capital flows. Consistent with Goetzmann and Kumar (2008), Mitton and Vorkink (2007) show that the prevalence of undiversified portfolios can be explained by heterogeneous preferences for skewness. Kadan and Liu (2014) show that the riskiness measures of Aumann and Serrano (2008) and Foster and Hart (2009) depend on higher moments (as does expected utility when it is not quadratic).

Kraus and Litzenberger (1976) document that returns are related to coskewness in the cross-section. Other empirical research on the coskewness pricing model includes Harvey and Siddique (2000), Dittmar (2002), and Guidolin and Timmermann (2008). Harvey and Siddique (2000) test the coskewness model allowing for time-varying betas and coskewness. Dittmar (2002) shows that if there is a representative investor whose marginal utility function can be well approximated by a cubic function, then risk premia should be determined by betas, coskewness, and cokurtosis relative to the market portfolio. He shows that the coskewness-cokurtosis pricing model works well for industry portfolios, but the parameter estimates indicate that the representative investor's utility function is not concave over the entire relevant domain. Likewise, Post, van Vliet, and Levy (2008) provide evidence that the utility function is S-shaped. Guidolin and Timmermann (2008) estimate the coskewness-cokurtosis pricing model from global return data, assuming a regime-shifting model for the prices of risks. They show that coskewness and cokurtosis premia are comparable in size to the covariance premium. They also show that home bias for U.S. investors can be at least partly explained by the desirable coskewness and cokurtosis of the U.S. market return relative to the global market return.

Using earlier data, Arditti (1971) shows that on average mutual fund returns have total skewness that exceeds that of the market return. Duarte, Longstaff, and Yu (2007) examine alphas and skewness of fixed income arbitrage strategies commonly employed by hedge funds. They show that most of the strategies have positive total skewness. Polkovnichenko, Wei, and Zhao (2014) examine the performance of actively managed funds versus passive benchmarks in up and down markets, which is related to skewness. In contrast to previous studies, we study residual coskewness rather than skewness. We show that residual coskewness is the right measure of performance for an investor who cares about skewness and is considering a small investment in a fund.

Moreno and Rodríguez (2009) create a coskewness factor by sorting stocks based on coskewness with the market (a Spanish stock index in their case) and following the procedure used by Fama and French (1993) to construct SMB and HML. They evaluate Spanish mutual fund performance using the Fama-French model augmented by the coskewness factor. The motivation for the coskewness factor is empirical, similar to SMB and HML. Covariance with the coskewness factor is obviously not the same as coskewness with the market, which is what we study.

The remainder of the paper is organized as follows. Section 2 extends Dybvig and Ross (1985) to account for skewness and shows the theoretical trade-off between alpha and residual coskewness for the coskewness pricing model. Section 3 describes the data and the estimation of residual coskewness. Section 4 documents the empirical coskewness cost per unit of alpha in mutual funds and in stocks and explores the source of the cost for funds. Section 5 discusses the impact of styles on the coskewness cost of seeking alpha. Section 6 characterizes the minority of funds that overcome the coskewness costs of seeking alpha. Section 7 investigates whether residual coskewness enters the flow-performance relationship. Section 8 concludes.

2. Residual Coskewness

This section defines residual coskewness, explains why it is an important attribute of performance, and shows that the coskewness pricing model is a negative linear relation between alpha and residual coskewness. We can define residual coskewness (like alpha) relative to an arbitrary benchmark, but we use the market return as the benchmark in our empirical work, so we also use it as the benchmark here. Let R_m denote the market return, and let R_f denote the risk-free return. Given another return R, project its excess return on the market excess return as usual:

$$R - R_f = \alpha + \beta(R_m - R_f) + \varepsilon\,. \tag{1}$$

Define residual coskewness as

$$\operatorname{cov}(\varepsilon, R_m^2) = \mathsf{E}[\varepsilon(R_m - \bar{R}_m)^2] = \mathsf{E}[\varepsilon R_m^2]\,, \tag{2}$$

where the overbar denotes expectation.

Given a return R and a constant $\lambda \geq 0$, consider the return

$$R_\lambda \;=\; R_m + \lambda[R - R_f - \beta(R_m - R_f)] \;=\; R_m + \lambda[\alpha + \varepsilon]\,. \tag{3}$$

This is the benchmark combined with an investment in a zero-beta version of R. The derivatives of the first three moments of R_λ with respect to λ evaluated at $\lambda = 0$ are

$$\left.\frac{\mathrm{d}\bar{R}_\lambda}{\mathrm{d}\lambda}\right|_{\lambda=0} = \alpha\,, \tag{4a}$$

$$\left.\frac{\mathrm{d}\operatorname{var}(R_\lambda)}{\mathrm{d}\lambda}\right|_{\lambda=0} = 0\,, \tag{4b}$$

$$\frac{1}{3}\cdot\left.\frac{\mathrm{d}\mathsf{E}[(R_\lambda - \bar{R}_\lambda)^3]}{\mathrm{d}\lambda}\right|_{\lambda=0} = \mathsf{E}[\varepsilon(R_b - \bar{R}_b)^2]\,. \tag{4c}$$

The derivatives tell us the signs of the changes in the return moments produced by a small investment in the return, relative to holding the market. From (4a), we see that the investment increases the mean return if the alpha is positive. From (4b), we see that the investment has only a second-order effect on variance. Thus, a marginal investment in a return with a positive alpha can improve mean-variance efficiency (Dybvig and Ross, 1985).[1] From (4c), we see that a marginal investment in the return increases skewness if the return has positive residual coskewness. Therefore, a marginal investment in a return with a positive alpha and

[1]Because the effect of moving from the benchmark to R_λ is second order in variance, we can modify R_λ to improve both mean and variance. Set $R_{\lambda k} = R_\lambda - k(R_m - R_f)$. Then, for λ sufficiently small and k sufficiently small (depending on λ), $R_{\lambda k}$ has both a higher mean and lower variance than does the benchmark R_m.

positive residual coskewness can improve mean-variance-skewness efficiency. As remarked before, if investors care only about the first three moments of returns, then in equilibrium there should be no returns that have both positive alphas and positive residual coskewness.

The coskewness pricing model formalizes the intuition that there should be no returns that have both positive alphas and positive residual coskewness, and it implies a linear relationship between alpha and residual coskewness. The usual statement of the coskewness pricing model is: For some $\lambda_1 > 0$ and $\lambda_2 > 0$ and for all returns R,

$$\bar{R} - R_f = \lambda_1 \operatorname{cov}(R, R_m) - \lambda_2 \operatorname{cov}\left(R, (R_m - \bar{R}_m)^2\right) . \tag{5}$$

Substitute $R = R_f + \alpha + \beta(R_m - R_f) + \varepsilon$ to calculate the right-hand side of (5) as

$$\begin{aligned} &\lambda_1 \operatorname{cov}(\beta R_m + \varepsilon, R_m) - \lambda_2 \operatorname{cov}\left(\beta R_m + \varepsilon, (R_m - \bar{R}_m)^2\right) \\ &\qquad = \beta\left[\lambda_1 \operatorname{var}(R_m) - \lambda_2 \operatorname{cov}\left(R_m, (R_m - \bar{R}_m)^2\right)\right] - \lambda_2 \operatorname{cov}\left(\varepsilon, (R_m - \bar{R}_m)^2\right) . \end{aligned} \tag{6}$$

Substitute this into (5) and apply (5) for the return $R = R_m$ (with $\beta = 1$ and $\varepsilon = 0$) to see that the expression in square braces in (6) is the market risk premium. Thus, for any return R,

$$\bar{R} - R_f = \beta(\bar{R}_m - R_f) - \lambda_2 \operatorname{cov}\left(\varepsilon, (R_m - \bar{R}_m)^2\right) .$$

Rearranging gives the following linear relationship between alpha and residual coskewness:

$$\alpha = -\lambda_2 \operatorname{cov}\left(\varepsilon, (R_m - \bar{R}_m)^2\right) . \tag{7}$$

Thus, the coskewness model implies that alpha and residual coskewness are negatively correlated in the cross-section and should have opposite signs.

A formula for the coefficient λ_2 in (7) in terms of the representative investor's utility function u is

$$\lambda_2 = \frac{u'''(\bar{R}_m)}{2u'(\bar{R}_m) + u'''(\bar{R}_m) \operatorname{var}(R_m)} . \tag{8}$$

To see this, approximate the utility function by a third-order Taylor series expansion around the mean market return. Denote the approximation by $\hat{u}$. Consider the return $R_\lambda = R_m + \lambda(\alpha + \varepsilon)$ defined in (3). A straightforward calculation shows that

$$\frac{\mathrm{d}}{\mathrm{d}\lambda}\mathsf{E}[\hat{u}(R_\lambda)]\bigg|_{\lambda=0} = \left[u'(\bar{R}_m) + \frac{1}{2}u'''(\bar{R}_m)\operatorname{var}(R_m)\right]\alpha + \frac{1}{2}u'''(\bar{R}_m)\mathsf{E}[\varepsilon R_m^2]\,. \tag{9}$$

At the investor's optimum, he must be indifferent about all marginal changes. Equating the derivative (9) to zero gives the tradeoff

$$\alpha = -\frac{u'''(\bar{R}_m)}{2u'(\bar{R}_m) + u'''(\bar{R}_m)\operatorname{var}(R_m)}\mathsf{E}[\varepsilon R_m^2]\,. \tag{10}$$

Thus, λ_2 is as stated in (8). For example, with constant relative risk aversion θ, we have

$$\alpha = -\frac{\theta(\theta+1)}{2\bar{R}_m^2 + \theta(\theta+1)\operatorname{var}(R_m)}\mathsf{E}[\varepsilon R_m^2]\,. \tag{11}$$

With constant relative risk aversion equal to 10, the coefficient on the right-hand side is 0.54 when we measure alpha in basis points and we measure residual coskewness in $\%^3$, given the daily market return mean and variance in our sample period (September 1, 1998 through June 30, 2014). Thus, each unit of residual coskewness requires 0.54 units of alpha (of the opposite sign) as compensation at the margin, when the representative investor has risk aversion equal to 10. If risk aversion is 4 instead, then each unit of residual coskewness equates to 0.10 units of alpha.

3. Data and Estimation

To estimate alpha and residual coskewness in mutual funds, we use daily net returns data from the CRSP Survivor-Bias-Free U.S. Mutual Fund Database. We merge the daily fund data to holdings data from Thomson Reuters using the WRDS MF Links file. For a given fund, we consider average returns across share classes, weighting by total net assets in each class. The sample contains active domestic equity mutual funds.[2] We exclude index and

[2]This corresponds to CRSP objective codes with 'E' in the first position, 'D' in the second position, and 'C' or 'Y' in the third position. We exclude any hedged or short funds (third/fourth positions of 'YH' or 'YS' as well as option income funds (si_obj_code of 'OPI')).

target date funds. We also exclude any funds holding less than 10 stocks in each reporting period. Our analysis includes holdings-based attribution analyses (described in Section 4) and holdings-based style categories following Daniel et al. (1997) and Wermers (2003) (described in Section 5). The sample excludes any funds for which we cannot determine these values, which reduces our sample by 25 funds. We include funds with at least sixty days of returns. We also exclude any fund for which less than 90% of the daily observations in CRSP contain reported returns. This filter eliminates a further 47 funds which appear to report returns weekly rather than monthly. The sample runs from September 1, 1998 through June 30, 2014 and includes 3,425 funds.

We also estimate alpha and residual coskewness for various portfolios of stocks sorted on characteristics that have been shown to spread returns. We use the same sample horizon as the mutual fund sample. The first set of stock portfolios is the 125 size, book-to-market, and momentum sorted portfolios following Daniel et al. (1997). We use the annual stock assignment file from Russ Wermers' website and create daily value-weighted return series for each of the 5x5x5 sorts.[3] We also use several portfolios from Kenneth French's website, specifically the 100 Fama-French portfolios formed by bivariate sorts of size and book-to-market, investment, or profitability as well as the 25 size and momentum portfolios. We obtain benchmark market excess returns and risk-free returns from Kenneth French's website.[4] We use CRSP daily and monthly stock returns for various holdings-based measures described throughout the text.

We take the market excess return as the benchmark return in equation (1). The recent literature on fund performance focuses on Fama-French-Carhart alphas. However, given the widely recognized failures of the Fama-French-Carhart model (see, for example, the new factor models proposed by Fama and French (2015) and Hou, Xue, and Zhang (2015)) and the practice in the industry to benchmark to passive indices, it is worthwhile to study alphas

[3]http://www.smith.umd.edu/faculty/rwermers/ftpsite/Dgtw/coverpage.htm.
[4]http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data library.html.

relative to the market index. Additionally, Berk and van Binsbergen (2016) and Barber, Huang, and Odean (2016) provide evidence that the market model best explains investor behavior. We adjust for size, value, and momentum styles in Section 5.

For each asset i, we estimate α_i and β_i by OLS from the usual regression equation (1). Let γ_i denote residual coskewness. Given a sample of size T_i, we estimate residual coskewness as

$$\widehat{\gamma}_i = \frac{1}{T_i} \sum_{t=1}^{T_i} \varepsilon_{it} (R_{mt} - R_{ft})^2 , \tag{12}$$

where the ε_{it} are the fitted residuals from the regression (1). For most of our results, we estimate the regression (1) and residual coskewness (12) once for each asset, using the full time series available for the asset. However, we also allow for time variation in parameters by estimating rolling regressions, using five years of daily data in each regression.

Table 1 reports summary statistics for the distributions of alpha, beta, and residual coskewness point estimates estimated using (1) and (12) for funds over the full time-series (Panel A) and for funds over five-year rolling windows (Panel B). Alpha and residual coskewness are of opposite signs for 65% of the funds under the static estimates. Consistent with the trade-off suggested by the coskewness model and with funds seeking alpha, the most common combination is a positive alpha estimate coupled with negative residual coskewness (42% of funds). These funds look more attractive under mean-variance preferences than under mean-variance-skewness preferences. Among the funds with positive alpha estimates, 82% have negative residual coskewness estimates. The same figure for funds with negative alpha estimates is only 52%. The correlation between alpha and residual coskewness estimates in the cross-section of funds is −28%.[5]

Panel B documents that the negative correlation between alpha and residual coskewness also holds under the time-varying estimates. Alpha and residual coskewness are of opposite signs for 61% of the estimates. As with the static estimates, the most common combination of

[5]When assessing the trade-off between alpha and residual coskewness, we winsorize the distributions of alpha and residual coskewness point estimates at the 1/99% levels to limit effects of outliers.

alpha and residual coskewness is a positive alpha and negative residual coskewness. Overall, the static estimates of alpha and residual coskewness look very similar to the time-varying estimates for mutual funds over our sample period.

4. Main Results

This section documents that there is a coskewness cost of alpha for both funds and stocks. However, we find that the residual coskewness for funds is not entirely due to that found in the underlying stocks. We show that both the holdings and non-holdings components of alpha are negatively related to residual coskewness. We also show that activity measures that have been shown to be positively related to fund alphas are negatively related to residual coskewness. Thus, seeking alpha by funds comes at a skewness cost, and the skewness cost exceeds what can be explained by holdings alone.

4.1. Coskewness Costs of Stocks and Funds

Table 2 documents that there is a residual coskewness cost to seeking alpha for mutual funds and that this cost also exists in stock portfolios. Panel A presents coefficient estimates from cross-sectional regressions of residual coskewness on alpha using the full time-series estimates. The first column presents results for mutual funds. In terms of the cross-sectional distribution of parameter estimates, the residual coskewness cost per unit of alpha is large. A one standard deviation increase in alpha (1.6 basis points) is associated with a decrease in residual coskewness of $0.05\%^3$, which is about 30% of the cross-sectional standard deviation in residual coskewness. The economic value of this effect depends on an investor's preferences, as discussed in Section 2.

Columns 2–6 of Panel A present estimates for five sets of characteristic-sorted portfolios described in the previous section. The relationship is negative and significant for all five. While the point estimates differ slightly across different stock portfolios, the residual coskewness costs associated with alpha are significantly negative and of the same order of magnitude as funds. The point estimates suggest that the cost of residual coskewness per unit of alpha varies across different portfolio sorts. For example, the estimate across the 100 Fama-French size and book-to-market portfolios is roughly one half the magnitude of the cost estimated within the 25 Fama-French size and momentum portfolios.

Panel B of Table 2 presents estimates of the negative relationship between alpha and residual coskewness using the time-varying parameter estimates. The coefficients presented are the time-series averages of daily cross-sectional regressions. The relationship is again significantly negative for both funds and stocks. The point estimate for mutual funds is similar in magnitude to the estimate in Panel A. For the stock portfolios, the relationship between time-varying estimates of alpha and residual coskewness is robustly negative, but of a smaller magnitude compared to the static estimates presented in Panel A.

4.2. Coskewness Costs of Holdings and Non-Holdings Alpha

A natural question given the results above is whether the undesirable residual coskewness per unit of alpha found in funds merely reflects the average underlying trade-off in the stocks they hold. On one hand, if mutual fund managers passively hold stock portfolios similar to those examined in Table 2, we expect the underlying holdings to drive the trade-off at the fund level. On the other hand, if managers dynamically change their portfolios in order to earn alpha, it is possible that the residual coskewness cost in funds reflects these activities. Some managers may even overcome the underlying trade-off between alpha and residual coskewness through trading activity.

To address this, we decompose alpha into two components, the portion implied by a fund's time-series average holdings and the remainder, which is due to trading. The first component of the estimated alpha is holding alpha defined as $\sum_{j=1}^{N_i} \bar{\omega}_j^i \hat{\alpha}_j$ where $\bar{\omega}_j^i$ denotes the time-series average holding of stock j by fund i, $\hat{\alpha}_j$ is the estimated market-model alpha for stock j, and N_i is the number of stocks reported held by the fund. Non-holding alpha is the fund's estimated alpha minus the holding alpha. Column 2 of Table 3 reports regressions of residual coskewness on each component of alpha. The results show that the negative trade-off between alpha and residual coskewness is due both to fund composition (holding alpha) and other fund choices (non-holding alpha). Interestingly, the residual coskewness cost of the holding alpha is actually larger than the cost for total alpha (column 1). The amount of undesirable residual coskewness per unit of total alpha is therefore impacted by the negative correlation between holding and non-holding alpha.

We can examine the skewness costs due to non-holding alpha in greater detail by decomposing alpha further, similar in spirit to work that segments performance into stock picking versus market timing (e.g., Daniel et al., 1997). Specifically, the estimated alpha for fund i can be written as:

$$\begin{aligned}\hat{\alpha}_i = \; & \underbrace{\sum_{j=1}^{N_i} \bar{\omega}_j^i \hat{\alpha}_j}_{\text{Average Holding Alpha}} + \underbrace{\frac{1}{T_i}\sum_{t=1}^{T_i}\left(R_{it} - \sum_{j=1}^{N_i}\omega_{jt}^i R_{jt}\right)}_{\text{Avg Return Gap}} + \underbrace{\sum_{j=1}^{N_i}\left(\frac{1}{T_i}\sum_{t=1}^{T_i}(\omega_{jt}^i - \bar{\omega}_j^i)\varepsilon_{jt}\right)}_{\text{Dynamic Picking}} \\ & + \underbrace{\sum_{j=1}^{N_i}(\hat{\beta}_j - \hat{\beta}_i)\left(\frac{1}{T_i}\sum_{t=1}^{T_i}(\omega_{jt}^i - \bar{\omega}_j^i)(R_{mt}^e - \bar{R}_m^e)\right)}_{\text{Market Timing}} + \underbrace{\bar{R}_{mt}^e \sum_{j=1}^{N_i}\bar{\omega}_j^i(\hat{\beta}_j - \hat{\beta}_i)}_{\text{Avg Market Timing}}.\end{aligned} \tag{13}$$

This decomposition is similar to the dynamic extension of the Brinson et al. (1995) attribution methodology from Hsu et al. (2010) with the alteration that the benchmark return is $\beta_i R_m^e$. We estimate each component of the decomposition using holdings data and the underlying asset returns. Both dynamic picking and market timing have a negative and statistically significant coskewness cost. On the other hand, the average return gap and market timing components appear to mitigate the coskewness cost. Both the dynamic picking and market timing components of alpha are due to deviations in portfolio holdings from the fund's time-series average weight, so the evidence shows that active portfolio choices resulting in return outperformance have undesirable skewness consequences. Of the two, the market timing component has the largest coskewness cost.

4.3. Coskewness Costs of Active Management

The mutual fund literature documents that alpha can be generated by sorting funds on various characteristics proxying for the extent of active management. We use the same sorts to show that active management has a skewness cost. The characteristics we consider are

Industry Concentration, Return Gap, Active Share, $1 - R^2$, Skill Index, and Active Weight.

- Industry Concentration (Kacperczyk, Sialm, and Zheng, 2005) measures the deviation of a fund's industry weights from the market industry weights.
- Return Gap (Kacperczyk, Sialm, and Zheng, 2008) measures the deviation of a fund's realized return from those implied by its reported holdings.
- Active Share (Cremers and Petajisto, 2009) measures the deviation of a fund's portfolio weights from those of its stated benchmark.
- $1-R^2$ (Amihud and Goyenko, 2013) uses the R^2 from a Fama-French-Carhart monthly regression estimated over the previous 24 months to proxy for a fund's selectivity.
- Skill Index (Kacperczyk, Van Nieuwerburgh, and Veldkamp, 2014) is a time-varying composite measure of market timing and stock picking where the weight on timing is the real-time recession indicator from Chauvet and Piger (2008).[6] Market timing and stock picking are measured by a fund's systematic or idiosyncratic performance relative to the market-weighted systematic or idiosyncratic performance, respectively.
- Active Weight (Doshi, Elkamhi, and Simutin, 2015) measures the deviation of a fund's portfolio weights from a value-weighted portfolio comprised of the fund's holdings.

For each of these characteristics, we sort funds into deciles each calendar quarter and form equal-weighted portfolios of funds. Table 4 reports the alphas and residual coskewness of the portfolios estimated from daily returns.[7] The relationships between the activity measures and alphas are consistent with the prior literature. The estimated alphas of high minus low decile portfolios are both economically and statistically significant. However, these portfolios also all have negative residual coskewness estimates. For Active Share and $1 - R^2$, the

[6] In our sample period, Skill Index predominantly sorts on stock picking, as the recession probability is less than one percent for 75% of the sample.

[7] Active Share data are obtained from Antti Petajisto's website and are only available until 2009. Therefore our daily return series stops in 2009 for this strategy.

magnitudes of residual coskewness fall in the lowest quartile of the mutual fund distribution. For each characteristic, the table also reports the coefficient obtained by regressing residual coskewness on alpha across the decile portfolios. Each characteristic that produces alpha also produces undesirable residual coskewness. The negative relation is statistically significant for all but Industry Concentration, which still has an economically large negative point estimate and is marginally significant (p=0.12).

5. Styles

Previous research suggests that investment styles such as size, value, and momentum are related to coskewness (Harvey and Siddique, 2000). This is consistent with the negative relationship between alpha and residual coskewness we document in Table 2 for stock portfolios formed by sorting on these characteristics. In Table 3, we document that the coskewness cost of alpha is driven by both average holdings and dynamic trading. It is possible that one or both of these components reflects the underlying style-based strategies of the fund. The goal of this section is to assess the extent to which these results are driven by style tilts.

First, we provide additional evidence that there is a trade-off between alpha and residual coskewness for styles. Table 5 reports estimates of alpha and residual coskewness relative to the market for the FFC (Fama-French-Carhart— Fama and French, 1993; Carhart, 1997) factors and a number of Russell and S&P benchmark indices related to size and value. SMB, HML, and UMD all have desirable alphas and undesirable residual coskewness during our sample period. The S&P 500, 400, and 600 indices provide benchmarks for large, mid-cap, and small-cap equities, respectively. The Russell 1000 measures large-cap performance; the Russell Midcap consists of the smallest 800 or so firms in the Russell 1000. The Russell 2000 index measures small-cap performance. The indices exhibit size and value effects for residual coskewness that are the opposite of the alpha effects: Smaller capitalization indices have less desirable (more negative) residual coskewness than do larger cap indices, and value indices have less desirable residual coskewness than do growth indices. Among the 14 indices, the correlation between alpha and residual coskewness is −83%.

To examine the extent to which the results presented previously are due to variation in investment styles, we control for styles in two different ways. First, we classify funds into style categories using a holdings-based approach following Daniel et al. (1997) and Wermers (2003). Specifically, we classify each holding into one of five characteristic quintiles using the stock assignment file from Russ Wermer's website. The characteristics we consider are size, book-to-market ratio, and momentum. To aggregate the holding-specific classification to the fund level, we first value-weight the quintile assignments for each reporting date. We then average across reporting dates to arrive at fund-specific average size, book-to-market, and momentum quintiles. We sort funds into terciles on each characteristic based on these averages. We run the regressions of Table 2 within style bins (Table 6), and we repeat the holdings/non-holdings analysis of Table 3 with style fixed effects (Table 7).

Table 6 reports mean alpha, mean residual coskewness, and the regression coefficient of residual coskewness on alpha within style bins. We intersect the size sort with the value sort (Panel A), the size sort with the momentum sort (Panel B), and the value sort with the momentum sort (Panel C), creating nine bins in each case. The regression coefficient is negative in all bins and statistically significant at the 10% level in 23 of the 27 bins. Clearly, there is a coskewness cost of alpha even controlling for styles.

Table 7 repeats the holdings/non-holdings analysis of Table 3 but with dummy variables for the 27 styles formed by intersecting the size, book-to-market, and momentum terciles. Adding style fixed effects reduces the coefficients, but (with one exception in the last column) the coefficients remain statistically significant. In particular, there are still significant negative relations between residual coskewness and both holding and non-holding alpha. When we decompose non-holding alpha into four components in the last column, the point estimates retain the same signs but dynamic picking is no longer significant. This indicates that the skewness costs of dynamic stock picking are due to differences in dynamic picking across styles. On the other hand, market timing continues to have a significant and large coskewness cost, even controlling for styles. This sheds light not only on the skewness costs of seeking alpha, but also on the relation between certain alpha-producing activities and underlying styles. Overall, a substantial portion of the skewness costs of seeking alpha, due to compositional effects and due to other actions of managers, is not explained by style tilts.

Our second method of controlling for styles is to replace the CAPM alphas and residuals in Table 4 with FFC alphas and residuals.[8] The motivation for this exercise is that we consider an investor holding the market portfolio who considers investing in one of the decile portfolios (or in a high-minus-low portfolio) while hedging the FFC factor exposures. If the investor cares only about the first three moments of returns, then at the margin the change in his utility will depend on the FFC alpha and the coskewness of the FFC residual with the market return. Table 8 presents the results. The residual coskewness estimates in Table 8 are computed as before as the sample mean of $\varepsilon_{it}(R_{mt} - R_{ft})^2$ but with the ε_{it} being the fitted residuals from the FFC model.

As in previous research, the point estimates of the FFC alphas of the high-minus-low portfolios are all positive. The point estimates of residual coskewness of the high-minus-low portfolios are all negative, but of a smaller magnitude compared to Table 4. So, substantial portions of both the alpha and residual coskewness of the high-minus-low portfolios are explained by the FFC factors. However, the trade-off between alpha and residual coskewness among the decile portfolios is not explained by the FFC factors for all of the strategies. In regressions of residual coskewness on alpha across the decile portfolios, the coefficient is negative for four of six strategies. The economic magnitude of the trade-off is largest for Return Gap and $1-R^2$, which aim to capture unobserved actions and selectivity of managers. Outperformance on these dimensions come with a coskewness cost, even controlling for styles. On the other hand, the coskewness costs associated with Industry Concentration and Skill Index appear to be driven by actions that are common to funds within a given style.

[8]We cannot control for style using holdings-based fixed effects as in Table 7, because the activity sorts result in only ten decile portfolios.

6. Exceptional Funds

Any fund that creates both positive alpha and positive residual coskewness is desirable to investors who like high expected returns, low variance, and positive skewness. There is a small minority of funds that seem to do so. It is interesting to ask what makes these funds different. This section presents some evidence on this topic.

Table 9 presents average characteristics of funds divided into two groups: those that have a negative point estimate for either alpha or residual coskewness (Column 1) and those for which both point estimates are positive (Column 2). It also reports average characteristics for the subset of the second group for which at least one of the positive point estimates is significant at the 5% level (Column 3). Consistent with the trade-off documented earlier, the vast majority of funds (91%) are undesirable on at least one dimension (that is, at least one of the point estimates is negative). Less than 2% of funds fit the criteria of Column 3. The stars in Table 9 indicate the characteristics for which the desirable funds in Column 2 or Column 3 differ significantly from the less desirable funds in Column 1. Desirable funds hold fewer stocks on average, but manage larger funds in terms of total net assets (TNA). The fund size may reflect flows due to performance, which we examine in the next subsection. Desirable funds also have higher tracking errors.

Table 9 presents the average values for each set of funds of the activity measures from Tables 4 and 8. We disaggregate the two components of the Skill Index (market timing and stock picking) because the Skill Index varies across time based on estimated recession probabilities. In addition, we calculate the dispersion of holdings following Kacperczyk et al. (2014) to determine the extent of herding with other managers.

In general, desirable funds exhibit higher measures of "activity." The most significant differences between desirable funds and undesirable funds are in the Industry Concentration, Return Gap, Active Weight, and Stock Picking characteristics. The most desirable funds (Column 3) exhibit significantly higher Active Share also. Finally, desirable funds also herd less with other managers as evidenced by the higher levels of the Dispersion measure.

7. The Flow-Performance Relationship

A large empirical literature documents that funds receive net flows in response to high past returns (e.g., Chevalier and Ellison, 1997; Sirri and Tufano, 1998; Berk and van Binsbergen, 2016; Barber et al., 2016). To determine whether money flows to funds that have desirable residual coskewness, we augment the traditional flow-performance regressions of new money growth on alpha to include residual coskewness as well. We measure monthly new money growth (NMG_{t+1}) for each fund as

$$\frac{\text{TNA}_{i,t+1} - \text{TNA}_{i,t}(1 + R_{i,t+1})}{\text{TNA}_{i,t}(1 + R_{i,t+1})} \times 100 \tag{14}$$

where $\text{TNA}_{i,t}$ is the total net assets of fund i in month t and $R_{i,t+1}$ is the return of fund i from month t to $t+1$. We regress this on time-varying estimates of alpha and residual coskewness measured over the five-year period ending at the end of the prior month. We report the results in Table 10. The independent variables alpha and residual coskewness are each standardized to have unit standard deviations. The first column confirms that flows are related to realized alpha in our sample. A one standard deviation increase in alpha is associated with 0.56% increase in total net assets. Residual coskewness is also related to new money growth, and the point estimate is about 10% of the effect associated with alpha. Interestingly, when we control for a fund's residual coskewness, the coefficient on alpha increases slightly. The flow-performance relationship thus exists for both alpha and residual coskewness, and each relationship becomes stronger with the inclusion of time and style fixed effects. While not surprisingly a second order effect relative to alpha, residual coskewness apparently does affect fund flows.

8. Conclusion

Residual coskewness is an important attribute of performance. In theory, a search for alpha relative to the market will create undesirable (negative) residual coskewness. Empirically, alpha and residual coskewness relative to the market are indeed negatively correlated both in the cross-section of stocks and actively managed mutual funds. Thus, at least part of the value of the alpha of an actively managed mutual fund is typically offset by an undesirable effect on portfolio skewness.

The coskewness cost of seeking alpha reflects both the inherent trade-off found in the cross-section of stocks and dynamic actions of mutual fund managers. Alpha due to actions such as stock picking and market timing is negatively associated with residual coskewness. Like alpha, residual coskewness is related to investment styles like size, value, and momentum. Styles that do better on alphas do worse on residual coskewness. However, the trade-off between alpha and residual coskewness holds for active funds even accounting for funds' styles. The results suggest that the vast majority of funds that successfully search for alpha do so at the expense of residual coskewness.

Moments beyond mean, variance, and skewness may also be important for performance evaluation. For instance, decreasing absolute prudence (Kimball, 1990) implies a negative fourth derivative of the utility function and hence a preference for lower kurtosis (see also Haas, 2007). In unreported results, we extend our analysis to residual cokurtosis, which governs a fund's marginal contribution to a benchmark portfolio's kurtosis. Negative residual cokurtosis funds are attractive because adding them to a portfolio reduces portfolio kurtosis. Under the coskewness/cokurtosis pricing model, positive alpha funds should be undesirable on residual coskewness and/or residual cokurtosis. We find no evidence of a trade-off between alpha and residual cokurtosis. In terms of higher moments, the primary cost of seeking alpha seems to be its skewness consequence.

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Table 1: Distributions of Point Estimates of Alpha and Residual Coskewness

In panel A, alpha, residual coskewness (γ), and beta are estimated for 3,425 active mutual funds over the time period September 1, 1998 through June 30, 2014 using the full sample of daily returns. In panel B, alpha, residual coskewness (γ), and beta are estimated using rolling regressions over five years of data. $\hat{\alpha}$ is measured in basis points (*bps*) per day and residual coskewness $\hat{\gamma}$ is measured in $\%^3$ per day.

Panel A: Static Estimates			
	$\hat{\alpha}$	$\hat{\gamma}$	$\hat{\beta}$
10th	-1.84	-0.31	0.69
25th	-0.82	-0.19	0.87
Median	0.02	-0.06	0.98
75th	0.91	0.03	1.07
90th	1.83	0.10	1.16
IQRange	1.73	0.22	0.19
Std.Dev	1.64	0.18	0.20
Distribution of Point Estimates			
	$\hat{\gamma} > 0$	$\hat{\gamma} < 0$	Total
$\hat{\alpha} > 0$	9.05	41.61	50.66
$\hat{\alpha} < 0$	23.77	25.58	49.34
Total	32.82	67.18	100.00

Panel B: Time-varying Estimates			
	$\hat{\alpha}$	$\hat{\gamma}$	$\hat{\beta}$
10th	-1.52	-0.39	0.68
25th	-0.71	-0.17	0.87
Median	0.09	-0.04	0.98
75th	1.11	0.02	1.06
90th	2.56	0.10	1.16
IQRange	1.81	0.19	0.19
Std.Dev	1.81	0.20	0.21
Distribution of Point Estimates			
	$\hat{\gamma} > 0$	$\hat{\gamma} < 0$	Total
$\hat{\alpha} > 0$	12.16	40.84	53.01
$\hat{\alpha} < 0$	20.20	26.80	46.99
Total	32.36	67.64	100.00

Table 2: Trade-off Between Alpha and Residual Coskewness—Funds and Stocks

Alpha and residual coskewness (γ) are estimated for active mutual funds and stock portfolios over the time period September 1, 1998 through June 30, 2014 using daily returns. Point estimates for funds are winsorized at 1%/99%. $\hat{\alpha}$ is measured in % per day and residual coskewness $\hat{\gamma}$ is measured in $\%^3$ per day. The table reports cross-sectional regressions of residual coskewness on alpha for mutual funds and stock portfolios. There are 3,425 active mutual funds and 125 DGTW portfolios. There are 25 Fama-French (FF) size and momentum portfolios and 100 Fama-French portfolios for each of the remaining classifications. Panel A presents results from a cross-sectional regression of residual coskewness on alpha estimated over the full time-series. Panel B presents the time-series means of regression coefficients obtained from daily cross-sectional regressions using the alpha and residual coskewness estimates from rolling five year time-series regressions. t statistics are reported in parentheses. The standard errors of the daily estimates are corrected for 1,260 (5 years of) lags of autocorrelation. Statistical significance is represented by * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.

Panel A. Coskewness cost per unitof α - Static Estimates

		Stock Portfolios				
	Mutual Funds	DGTW Size/BM/Mom	FF Size/BM	FF Size/Inv	FF Size/Mom	FF Size/Profit
	$\hat{\gamma}$	$\hat{\gamma}$	$\hat{\gamma}$	$\hat{\gamma}$	$\hat{\gamma}$	$\hat{\gamma}$
$\hat{\alpha}$	-3.12***	-2.49***	-3.89**	-4.22***	-7.28***	-3.78**
	(-12.46)	(-10.90)	(-2.11)	(-2.80)	(-5.74)	(-2.42)
Constant	-0.09***	0.14***	-0.16***	-0.13***	-0.02	-0.12***
	(-30.65)	(5.38)	(-3.88)	(-3.42)	(-0.52)	(-3.22)

Panel B. Coskewness cost per unit of α - Rolling Estimates

		Stock Portfolios				
	Mutual Funds	DGTW Size/BM/Mom	FF Size/BM	FF Size/Inv	FF Size/Mom	FF Size/Profit
	$\hat{\gamma}$	$\hat{\gamma}$	$\hat{\gamma}$	$\hat{\gamma}$	$\hat{\gamma}$	$\hat{\gamma}$
$\hat{\alpha}$	-2.08***	-2.71***	-2.04***	-1.18***	-1.67***	-1.00***
	(-9.55)	(-3.62)	(-8.14)	(-4.78)	(-2.95)	(-3.83)
Constant	-0.09***	0.16***	-0.19***	-0.18***	-0.10	-0.17***
	(-2.66)	(4.31)	(-3.50)	(-3.04)	(-1.52)	(-2.63)

Table 3: Coskewness Costs of Holding and Non-Holding Alphas

The table reports cross-sectional regressions of residual coskewness on alpha and components of alpha. Alpha and residual coskewness (γ) are estimated for active mutual funds and their holdings over the time period September 1, 1998 through June 30, 2014 using daily returns and winsorized at the 1/99% level. $\hat{\alpha}$ is measured in basis points (bps) per day and residual coskewness $\hat{\gamma}$ is measured in $\%^3$ per day. Alpha and residual coskewness for active funds are decomposed into the alpha and residual coskewness implied by a fund's time-series average holdings, respectively. Holding $\hat{\alpha}_i$ is $\sum_{j=1}^{N_i} \bar{\omega}_j^i \hat{\alpha}_j$ where $\bar{\omega}_j^i$ denotes the time-series average holding of stock j by fund i, $\hat{\alpha}_j$ is the estimated alpha for stock j, and N_i is the number of stocks reported held by the fund. Non-holding $\hat{\alpha}$ is the fund's estimated alpha minus the holding alpha. The components of alpha in the final column are defined by the decomposition in Equation (13). t statistics are in parentheses, and statistical significance is represented by * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.

	$\hat{\gamma}$	$\hat{\gamma}$	$\hat{\gamma}$
$\hat{\alpha}$	-3.12***		
	(-12.46)		
Holding $\hat{\alpha}$		-5.13***	-4.23***
		(-20.81)	(-16.61)
Non-Holding $\hat{\alpha}$		-2.26***	
		(-8.94)	
Avg Return Gap			0.98**
			(2.41)
Dynamic Picking			-0.59***
			(-4.43)
Market Timing			-6.76***
			(-5.27)
Avg Mkt Timing			2.26***
			(3.01)
Constant	-0.09***	0.02***	0.05***
	(-30.65)	(2.96)	(6.38)

Table 4: Coskewness Costs of Active Management

Daily return series are formed by quarterly sorts of funds based on a given activity measure. Alpha and residual coskewness (γ) are estimated using each decile's resulting return series over the time period September 1, 1998 through June 30, 2014 using daily returns. The Active Share decile time-series run from 1998 to 2009 because the Active Share data obtained from Antti Petajisto's website is only available until 2009. $\hat{\alpha}$ is measured in basis points (*bps*) per day and residual coskewness $\hat{\gamma}$ is measured in $\%^3$ per day. Industry Concentration (Kacperczyk, Sialm, and Zheng, 2005) measures the deviation of a fund's industry weights from the market industry weights. Return Gap (Kacperczyk, Sialm, and Zheng, 2008) measures the deviation of a fund's realized return from those implied by its reported holdings. Active Share (Cremers and Petajisto, 2009) measures the deviation of a fund's portfolio weights from those of its stated benchmark. $1-R^2$ (Amihud and Goyenko, 2013) uses the R^2 from a Fama-French-Carhart monthly regression estimated over the previous 24 months to proxy for a fund's selectivity. Skill Index (Kacperczyk, Van Nieuwerburgh, and Veldkamp, 2014) is a time-varying composite measure of market timing and stock picking where the weight on timing is the real-time recession indicator from Chauvet and Piger (2008). Market timing and stock picking are measured by a fund's systematic or idiosyncratic performance relative to the market-weighted systematic or idiosyncratic performance, respectively. Active Weight (Doshi, Elkamhi, and Simutin, 2015) measures the deviation of a fund's portfolio weights from a value-weighted portfolio comprised of the fund's holdings. For each characteristic, the table reports the regression coefficient of residual coskewness on alpha (as in Table 2). Statistical significance is represented by * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.

Decile	Industry Concentration		Return Gap		Active Share		$1-R^2$		Skill Index		Active Weight	
	$\hat{\alpha}$	$\hat{\gamma}$	$\hat{\alpha}$	$\hat{\gamma}$	$\hat{\alpha}$	$\hat{\gamma}$	$\hat{\alpha}$	$\hat{\gamma}$	$\hat{\alpha}$	$\hat{\gamma}$	$\hat{\alpha}$	$\hat{\gamma}$
Lo	-0.46	-0.00	-0.29	-0.07	-0.61	0.00	-0.54	0.00	-0.22	-0.06	0.06	-0.12
2	-0.04	-0.08	0.13	-0.07	-0.46	0.00	-0.57	-0.01	-0.33	-0.09	0.14	-0.11
3	-0.03	-0.09	0.20	-0.05	-0.30	0.00	-0.13	-0.04	-0.08	-0.11	0.31	-0.09
4	0.14	-0.08	0.29	-0.06	-0.34	-0.03	-0.24	-0.06	-0.04	-0.08	0.05	-0.07
5	0.25	-0.10	0.21	-0.07	0.13	-0.06	0.09	-0.08	-0.00	-0.05	0.07	-0.06
6	0.34	-0.07	0.13	-0.06	0.35	-0.09	0.40	-0.10	0.07	-0.05	0.04	-0.06
7	0.28	-0.10	0.27	-0.07	0.74	-0.16	0.54	-0.12	0.12	-0.05	0.18	-0.04
8	0.60	-0.11	0.40	-0.08	1.34	-0.19	1.02	-0.12	0.44	-0.06	0.18	-0.05
9	0.89	-0.09	0.76	-0.12	1.31	-0.22	1.03	-0.17	1.02	-0.09	0.52	-0.07
Hi	0.60	-0.08	0.85	-0.16	1.71	-0.26	1.22	-0.20	1.72	-0.14	0.96	-0.12
Hi-Lo	1.06*	-0.08*	1.14**	-0.09	2.32**	-0.26**	1.77***	-0.20***	1.94	-0.08	0.90***	-0.01
t(Hi-Lo)	(1.89)	(-1.82)	(2.15)	(-1.41)	(2.33)	(-2.35)	(3.15)	(-3.96)	(1.64)	(-1.14)	(2.78)	(-0.23)
Coef($\hat{\gamma}, \hat{\alpha}$)		-4.94		-8.07**		-11.85***		-9.54***		-3.02**		-4.56*
t(Coef)		(-1.69)		(-2.56)		(-21.04)		(-9.79)		(-2.62)		(-2.12)

Table 5: Alpha and Residual Coskewness for FFC Factors and Common Indices
Alpha is measured in basis points (*bps*) per day and residual coskewness (γ) is measured in $\%^3$ per day. SMB, HML, and UMD are the FFC factors. The indices are the Russell 1000/Midcap/2000 total, growth, and value indices and the S&P 500 (total, growth, value), 400, and 600 indices. The S&P 500, 400, and 600 indices provide benchmarks for large, mid-cap, and small-cap equities, respectively. The Russell 1000 measures large-cap performance; the Russell Midcap consists of the smallest 800 or so firms in the Russell 1000. The Russell 2000 index measures small-cap performance. The sample uses daily returns from September 1, 1998 through June 30, 2014.

	$\hat{\alpha}$ (*bps*)	$\hat{\gamma}$ ($\%^3$)
FFC Factors		
SMB	1.49	-0.24
HML	1.34	-0.31
UMD	2.52	-0.11
Size-based Benchmark Indices		
S&P 600	2.32	-0.17
S&P 400	1.84	-0.14
S&P 500	-0.27	0.04
Russell 2000	0.96	-0.21
Russell Midcap	1.33	-0.13
Russell 1000	-0.11	0.02
Value/Growth Benchmark Indices		
S&P 500 Growth	-0.50	0.13
S&P 500 Value	-0.02	-0.05
Russell 2000 Growth	0.43	-0.17
Russell 2000 Value	1.40	-0.23
Russell Midcap Growth	0.70	0.00
Russell Midcap Value	1.62	-0.21
Russell 1000 Growth	-0.67	0.13
Russell 1000 Value	0.34	-0.06

Table 6: Trade-offs Between Alpha and Residual Coskewness within Style Bins

Alpha and residual coskewness (γ) are estimated for active mutual funds over the time period September 1, 1998 through June 30, 2014 using daily returns and winsorized at the 1/99% level. Alpha is measured in basis points (*bps*) per day and residual coskewness (γ) is measured in $\%^3$ per day. Style classifications are based on funds' holdings. At each reporting date, we assign each stock to size, book-to-market, and momentum quintiles based on Russ Wermer's stock assignment file. For each characteristic and each fund, we value weight the rankings and average across reporting dates. We sort funds into terciles on each characteristic and intersect the sorts. The table presents the average values for each cell and the regression coefficients and associated t-statistics of residual coskewness on alpha (as in Table 2).

Panel A: Size and Value	Small	Medium	Large
Growth			
$\hat{\alpha}$ (bps)	0.44	-0.30	-1.33
$\hat{\gamma}$ ($\%^3$)	-0.20	-0.00	0.08
Coef($\hat{\gamma}$, $\hat{\alpha}$)	-2.52	-2.06	-3.85
t(Coef($\hat{\gamma}$, $\hat{\alpha}$)	-2.84	-3.76	-11.67
Neutral			
$\hat{\alpha}$ (bps)	0.60	-0.08	-0.55
$\hat{\gamma}$ ($\%^3$)	-0.22	-0.07	0.00
Coef($\hat{\gamma}$, $\hat{\alpha}$)	-4.14	-1.59	-0.85
t(Coef($\hat{\gamma}$, $\hat{\alpha}$)	-5.14	-1.63	-0.83
Value			
$\hat{\alpha}$ (bps)	0.74	0.33	-0.23
$\hat{\gamma}$ ($\%^3$)	-0.24	-0.12	-0.03
Coef($\hat{\gamma}$, $\hat{\alpha}$)	-5.22	-2.85	-1.10
t(Coef($\hat{\gamma}$, $\hat{\alpha}$)	-5.39	-2.87	-1.18

Panel B: Size and Momentum	Small	Medium	Large
Loser			
$\hat{\alpha}$ (bps)	0.44	0.22	-0.42
$\hat{\gamma}$ ($\%^3$)	-0.17	-0.08	-0.00
Coef($\hat{\gamma}$, $\hat{\alpha}$)	-2.82	-1.56	-2.67
t(Coef($\hat{\gamma}$, $\hat{\alpha}$)	-2.75	-1.78	-3.73
Average			
$\hat{\alpha}$ (bps)	0.83	0.00	-0.85
$\hat{\gamma}$ ($\%^3$)	-0.24	-0.08	0.02
Coef($\hat{\gamma}$, $\hat{\alpha}$)	-5.77	-1.05	-2.05
t(Coef($\hat{\gamma}$, $\hat{\alpha}$)	-7.29	-1.01	-3.15
Winner			
$\hat{\alpha}$ (bps)	0.47	-0.17	-1.22
$\hat{\gamma}$ ($\%^3$)	-0.22	-0.05	0.05
Coef($\hat{\gamma}$, $\hat{\alpha}$)	-3.06	-3.47	-3.24
t(Coef($\hat{\gamma}$, $\hat{\alpha}$)	-3.90	-5.20	-6.18

Panel C: Value and Momentum	Growth	Neutral	Value
Loser			
$\hat{\alpha}$ (bps)	-0.95	-0.22	0.19
$\hat{\gamma}$ ($\%^3$)	0.06	-0.03	-0.09
Coef($\hat{\gamma}$, $\hat{\alpha}$)	-2.37	-2.53	-2.16
t (Coef($\hat{\gamma}$, $\hat{\alpha}$)	-2.95	-3.03	-2.73
Average			
$\hat{\alpha}$ (bps)	-0.66	-0.00	0.41
$\hat{\gamma}$ ($\%^3$)	0.02	-0.10	-0.16
Coef($\hat{\gamma}$, $\hat{\alpha}$)	-2.78	-2.14	-5.37
t (Coef($\hat{\gamma}$, $\hat{\alpha}$)	-5.42	-2.34	-5.49
Winner			
$\hat{\alpha}$ (bps)	-0.13	0.14	0.32
$\hat{\gamma}$ ($\%^3$)	-0.10	-0.15	-0.21
Coef($\hat{\gamma}$, $\hat{\alpha}$)	-3.01	-3.12	-4.92
t (Coef($\hat{\gamma}$, $\hat{\alpha}$)	-5.51	-3.55	-2.85

Table 7: Coskewness Costs of Holding and Non-Holding Alphas with Style Fixed Effects
The table reports cross-sectional regressions of residual coskewness on alpha and components of alpha. Alpha and residual coskewness (γ) are estimated for active mutual funds and their holdings over the time period September 1, 1998 through June 30, 2014 using daily returns and winsorized at the 1/99% level. $\hat{\alpha}$ is measured in basis points (bps) per day and residual coskewness $\hat{\gamma}$ is measured in $\%^3$ per day. Alpha and residual coskewness for active funds are decomposed into the alpha and residual coskewness implied by a fund's time-series average holdings, respectively. Holding $\hat{\alpha}_i$ is $\sum_{j=1}^{N_i} \bar{\omega}_j^i \hat{\alpha}_j$ where $\bar{\omega}_j^i$ denotes the time-series average holding of stock j by fund i, $\hat{\alpha}_j$ is the estimated alpha for stock j, and N_i is the number of stocks reported held by the fund. Non-holding $\hat{\alpha}$ is the fund's estimated alpha minus the holding alpha. The components of alpha in the final column are defined by the decomposition in Equation (13). Style classifications are based on funds' holdings. At each reporting date, we assign each stock to size, book-to-market, and momentum quintiles based on Russ Wermer's stock assignment file. For each characteristic and each fund, we value weight the rankings and average across reporting dates. We sort funds into terciles on each characteristic and intersect the sorts. We include dummy variables in the regression for each of the 27 classifications. t statistics are in parentheses, and statistical significance is represented by * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.

	$\hat{\gamma}$	$\hat{\gamma}$	$\hat{\gamma}$
$\hat{\alpha}$	-0.82***		
	(-3.03)		
Holding $\hat{\alpha}$		-1.93***	-1.36***
		(-5.55)	(-4.42)
Non-Holding $\hat{\alpha}$		-0.66**	
		(-2.45)	
Avg Return Gap			0.70*
			(1.89)
Dynamic Picking			-0.08
			(-0.59)
Market Timing			-4.19***
			(-3.56)
Avg Mkt Timing			3.03***
			(4.14)
Style Controls	Yes	Yes	Yes

Table 8: Coskewness Costs of Active Management with Style Hedges

Daily return series are formed by quarterly sorts of funds based on a given activity measure. To adjust for styles, each decile's resulting return series is adjusted for its Fama-French-Carhart (Fama and French, 1993; Carhart, 1997) factor exposures. The reported alphas are the Fama-French-Carhart (FFC) alphas of the portfolio returns. The reported residual coskewness estimates are computed as the sample mean of $\varepsilon_{it}(R_{mt} - R_{ft})^2$, with the ε_{it} being the fitted residuals from the FFC model. The sample period is September 1, 1998 through June 30, 2014 for all activity measures except Active Share. The Active Share decile time-series run from 1998 to 2009 because the Active Share data obtained from Antti Petajisto's website is only available until 2009. $\hat{\alpha}$ is measured in basis points (*bps*) per day and residual coskewness $\hat{\gamma}$ is measured in $\%^3$ per day. The activity characteristics are described in Table 4. For each characteristic, the table reports the regression coefficient of residual coskewness on alpha (as in Table 2). Statistical significance is represented by * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.

Decile	Industry Concentration		Return Gap		Active Share		$1 - R^2$		Skill Index		Active Weight	
	$\hat{\alpha}$	$\hat{\gamma}$	$\hat{\alpha}$	$\hat{\gamma}$	$\hat{\alpha}$	$\hat{\gamma}$	$\hat{\alpha}$	$\hat{\gamma}$	$\hat{\alpha}$	$\hat{\gamma}$	$\hat{\alpha}$	$\hat{\gamma}$
Lo	-0.45	-0.00	-0.53	-0.03	-0.50	-0.01	-0.62	0.03	-0.29	-0.01	-0.63	-0.00
2	-0.38	-0.02	-0.33	-0.00	-0.41	-0.01	-0.68	0.02	-0.52	-0.03	-0.50	-0.01
3	-0.47	-0.02	-0.24	0.02	-0.32	0.00	-0.34	0.01	-0.38	-0.05	-0.21	-0.01
4	-0.31	-0.01	-0.14	0.01	-0.44	-0.01	-0.52	-0.00	-0.31	-0.03	-0.37	-0.01
5	-0.26	-0.02	-0.26	0.00	-0.23	0.01	-0.31	-0.01	-0.28	-0.00	-0.23	-0.01
6	-0.17	0.00	-0.31	0.01	-0.23	0.00	-0.12	-0.01	-0.31	0.01	-0.22	-0.02
7	-0.26	-0.02	-0.15	-0.00	-0.11	-0.01	-0.00	-0.02	-0.34	0.01	-0.04	-0.00
8	0.05	-0.02	-0.07	-0.01	0.22	-0.01	0.45	-0.03	-0.17	0.01	-0.10	-0.01
9	0.43	-0.00	0.19	-0.05	0.03	0.00	0.33	-0.06	0.21	0.00	0.26	-0.02
Hi	0.32	-0.02	0.22	-0.09	0.41	-0.02	0.51	-0.07	0.66	-0.02	0.49	-0.04
Hi-Lo	0.78*	-0.02	0.75*	-0.06	0.91*	-0.01	1.13**	-0.10***	0.95	-0.01	1.12***	-0.04
t(Hi-Lo)	(1.75)	(-0.66)	(1.93)	(-1.46)	(1.99)	(-0.19)	(2.30)	(-2.85)	(0.97)	(-0.14)	(3.30)	(-1.53)
Coef($\hat{\gamma}, \hat{\alpha}$)		0.17		-8.90		-0.78		-6.60***		1.06		-2.82**
t(Coef)		(0.14)		(-1.60)		(-0.67)		(-5.66)		(0.61)		(-2.63)

Table 9: Characteristics of Exceptional Funds
Alpha and residual coskewness are estimated for all active funds over the time period September 1, 1998 through June 30, 2014 using daily returns. We present average characteristics of funds for which at least one of the point estimates is negative (Column 1), both point estimates are positive (Column 2) and both point estimates are positive and at least one is significant at the 5% level (Column 3). For each fund, we calculate the time-series average of each characteristic, which are then averaged cross-sectionally within each group. TNA is the average total net assets of the fund. Turnover is the average fund turnover as reported by CRSP. Active share and tracking error are the averages taken through 2009 as reported in the data from Antii Petajisto. Industry concentration, active weight, return gap, and $1 - R^2$ are calculated as in Kacperczyk et al. (2005), Doshi et al. (2015), Kacperczyk et al. (2008), and Amihud and Goyenko (2013), respectively. Market timing, stock picking, and dispersion are calculated as in Kacperczyk et al. (2014). Statistical significance of tests of differences relative to Column 1 is represented by * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.

	Not Both Positive (1)	Both Positive (2)	Significant Positive (3)
Proportion (%)	90.95	9.05	1.31
Fund Characteristic:			
Number of Stocks	105.79	75.68***	83.39
TNA (million)	651.00	763.56	1289.38***
Turnover	0.96	0.86**	1.04
Tracking Error (%)	7.50	8.11**	9.00**
Industry Concentration (%)	6.41	8.87***	13.49***
Return Gap (%)	−0.03	0.00**	0.08***
Active Share (%)	78.84	78.99	84.39*
$1 - R^2$ (%)	12.69	14.92**	14.20
Active Weight (%)	38.94	42.25***	42.68***
Market Timing (%)	0.29	0.31	0.35
Stock Picking (%)	0.25	0.33***	0.38***
Dispersion (%)	1.63	1.71	2.14**

Table 10: Sensitivity of Flows to Alpha and Residual Coskewness

New money growth (NMG) is measured as $\frac{\text{TNA}_{i,t+1}-\text{TNA}_{i,t}(1+R_{i,t+1})}{\text{TNA}_{i,t}(1+R_{i,t+1})} \times 100$ where $\text{TNA}_{i,t}$ is the total net assets of fund i in month t and $R_{i,t+1}$ is the return of fund i from month t to $t+1$. Residual coskewness (γ) and alpha are estimated daily using the past five years of returns over the time period September 1, 1998 through June 30, 2014. We use the estimates on the last trading day of each month. Expense ratio is the ratio of the management fees and funds expenses to total net assets. All explanatory variables are standardized. Standard errors are clustered by fund and month. Statistical significance is represented by * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.

	NMG_{t+1}	NMG_{t+1}	NMG_{t+1}	NMG_{t+1}
$\hat{\alpha}$	0.56***	0.58***	0.63***	1.14***
	(14.61)	(16.02)	(18.09)	(21.63)
$\hat{\gamma}$		0.07**	0.10***	0.19***
		(2.26)	(3.01)	(5.02)
Ln(TNA)			-0.11***	-0.17***
			(-3.15)	(-5.49)
Expense Ratio			0.07	0.21***
			(1.41)	(4.29)
Fund Age			-0.19***	-0.12***
			(-9.79)	(-5.62)
Constant	-0.20***	-0.17***	1.36***	0.73***
	(-4.15)	(-3.54)	(10.79)	(4.65)
Time Effects	No	No	Yes	Yes
Style Effects	No	No	No	Yes