Industry Concentration and Mutual Fund Performance

MARCIN KACPERCZYK

CLEMENS SIALM

LU ZHENG

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ABSTRACT:

We study the relation between the industry concentration and the performance of actively managed U.S. mutual funds from 1984 to 2003. Our results indicate that the most concentrated funds perform better after controlling for risk and style differences using factor-based performance measures. This finding suggests that investment ability is more evident among managers who hold portfolios concentrated in a few industries.

Keywords: industry concentration; mutual fund performance; active portfolio management

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PRACTITIONER'S DIGEST

Evaluating and predicting mutual fund performance has for long attracted keen attention of practitioners. Investors buy actively managed funds hoping they will "beat the market." Empirical evidence indicates that, on average, actively managed funds do not outperform passive benchmarks after deducting fund expenses. Still, some mutual fund managers might differ substantially in their investment abilities. In this study, we examine whether some fund managers create value by concentrating their portfolios in industries, in which they may have informational advantages.

We develop a new measure of industry concentration, the Industry Concentration Index, to quantify the extent of portfolio concentration in ten broadly defined industries. Our analysis indicates that mutual funds differ substantially in their industry concentration and that concentrated funds tend to follow distinct investment styles. Managers of more concentrated funds overweigh growth and small-cap stocks, whereas managers of more diversified funds hold portfolios that closely resemble the total market portfolio. Most important, we find that more concentrated funds perform better after adjusting for risk and style differences using the three-factor model of Fama and French (1993) and the four-factor model of Carhart (1997). In sum, the evidence shows that some actively-managed fund managers are able to outperform passive benchmarks.

"Wide diversification is only required when investors do not understand what they are doing."
– *Warren Buffett*

Evaluating and predicting mutual fund performance has for long attracted keen attention of practitioners. At least two reasons can be responsible for such interest: First, a significant portion of household wealth is managed by mutual funds; Second, one can observe a steady growth of different funds in the marketplace. Investors buy actively managed funds hoping they will "beat the market." Empirical evidence indicates that, on average, actively managed funds do not outperform passive benchmarks after deducting fund expenses.[1] Still, some mutual fund managers might differ substantially in their investment abilities. In this study, we examine whether some fund managers create value by concentrating their portfolios in industries, in which they may have informational advantages.

Modern portfolio theory suggests that investors should widely diversify their holdings across industries to reduce their portfolios' idiosyncratic risk. Fund managers, however, may want to hold concentrated portfolios if they believe some industries will outperform the overall market or if they have superior information to select profitable stocks in specific industries.[2] Consistent with this hypothesis, we would expect funds with skilled managers to hold more concentrated portfolios.[3]

Mutual fund managers may also hold concentrated portfolios due to a potential conflict of interest between fund managers and investors. Several studies indicate that investors reward

[1] For evidence on fund performance, see, for example, Jensen (1968), Grinblatt and Titman (1989), Gruber (1996), Daniel, Grinblatt, Titman, and Wermers (DGTW, 1997), Cohen, Coval, and Pástor (2004), Kacperczyk and Seru (2005), Mamaysky, Spiegel, and Zhang (2005).

[2] Levy and Livingston (1995) show in a mean-variance framework that managers with superior information should hold a relatively concentrated portfolio. Van Nieuwerburgh and Veldkamp (2005) argue that optimal under-diversification arises because of increasing returns to scale in learning.

stellar performance with disproportionately high money inflows but do not penalize poor performance equivalently.[4] This behavior results in a convex option-like payoff profile for mutual funds. Consequently, some managers, especially those with lower investment abilities, may have an incentive to adopt volatile investment strategies to increase their chances of having extreme performance. Consistent with this hypothesis, funds pursuing such strategies would hold more concentrated portfolios, yet they would not necessarily have superior risk-adjusted performance.

In this study, we develop a new measure of industry concentration -- the Industry Concentration Index -- to quantify the extent of portfolio concentration in ten broadly defined industries. This index is based on the difference between the industry weights of a specific portfolio and the industry weights of the total market portfolio. Using U.S. mutual fund data from 1984 to 2003, we construct portfolios of funds with different industry concentration levels. Our analysis indicates that mutual funds differ substantially in their industry concentration and that concentrated funds tend to follow distinct investment styles. Managers of more concentrated funds overweigh growth and small-cap stocks, whereas managers of more diversified funds hold portfolios that closely resemble the total market portfolio.

We find that more concentrated funds perform better after adjusting for risk and style differences using the three-factor model of Fama and French (1993) and the four-factor model of Carhart (1997). Specifically, for the latter measure, we show that a portfolio including 5% of the most concentrated mutual funds yields an average abnormal return of 3.31% per year before deducting expenses and 1.85% per year after deducting expenses, whereas a similar portfolio

[3] Two related studies by Coval and Moskowitz (1999, 2001) show that mutual funds exhibit a strong preference for investing in locally headquartered firms about which they appear to have informational advantages.

[4] Numerous studies have called attention to the performance-flow relation, for example, Ippolito (1992), Gruber (1996), Chevalier and Ellison (1997), Nanda, Wang, and Zheng (2004). Zheng (1999) documents the "smart money" effect.

composed of the 5% least concentrated funds yields an average abnormal return of 0.41% before and -0.60% after expenses.

1 Data

Our sample is an updated version of the data used in Kacperczyk, Sialm, and Zheng (2005) and covers the time period between 1984 and 2003. The main data set has been created by merging the CRSP Survivorship Bias Free Mutual Fund Database with the Thompson Financial CDA/Spectrum holdings database and the CRSP stock price data. The CRSP Mutual Fund Database includes information on fund returns, total net assets, different types of fees, investment objectives, and other fund characteristics. The CDA database provides stockholdings of mutual funds. The data are collected both from reports filed by mutual funds with the SEC and from voluntary fund reports. We also link each reported stockholding to the CRSP stock database.

We start our matching process with a sample of all funds in the CRSP database. The focus of our analysis is on actively managed open-end domestic equity mutual funds, for which the holdings data are most complete and reliable. For that reason, we eliminate balanced, bond, money market, index, and international funds, as well as funds not invested primarily in equity securities. To gauge funds' *discretionary* concentration decisions, we exclude sector funds, which constrain themselves in their choice of industry concentration. Since different share classes have the same holdings composition, we aggregate all the observations pertaining to different share classes into one fund level observation.[5] We also exclude funds which hold less than 10 stocks and those which in the previous month manage less than $5 million.

With all the exclusions, our sample includes 2,339 distinct funds and 200,726 fund-month observations. Due to the substantial growth in the mutual fund industry over the last 20

[5] For most variables, we use a value-weighted average for the fund level observation. For fund age, we use the maximum of all share classes.

years, we have significantly more funds in the more recent years of our sample period. The specific number of funds ranges from 226 (January 1984) to 1,676 (April 2002).

2 Industry Concentration Index

We define a measure of industry concentration -- the Industry Concentration Index -- based on the fund holdings. Specifically, we assign each stock held by a mutual fund to one of the ten industries as described in the Appendix.

We define the mutual fund's Industry Concentration Index (*ICI*) at time *t* as the sum of the squared deviations of the value weights for each of the ten different industries held by the mutual fund, $w_{j,t}$, relative to the industry weights of the total stock market, $\overline{w}_{j,t}$.

$$ICI_t = \sum_{j=1}^{10} \left(w_{j,t} - \overline{w}_{j,t} \right)^2 \quad (1)$$

The Industry Concentration Index measures how much a mutual fund portfolio deviates from the market portfolio. This index is equal to zero if a mutual fund has exactly the same industry composition as the market portfolio and increases as a mutual fund becomes more concentrated in a few industries.

The Industry Concentration Index is related to the Herfindahl Index, which is commonly used in industrial organization to measure the concentration of companies in an industry. The Industry Concentration Index can be thought of as a market-adjusted Herfindahl Index. We choose the Industry Concentration Index instead of the Herfindahl Index for two reasons. First, the industry weights of the total market portfolio vary over time. The Industry Concentration Index takes this variation into account by adjusting for the time-varying industry weights in the market portfolio. Second, a mutual fund can have a lower Herfindahl Index than the entire market portfolio if it is more equally invested in the different industries. The Industry Concentration

Index is not subject to this problem, because the market portfolio has the lowest possible index value of zero.

Table 1 documents summary statistics for the Industry Concentration Index and other fund characteristics. The average actively managed mutual fund has an Industry Concentration Index of 7.32%. The Industry Concentration Index exhibits a significant cross-sectional variation. Concentrated funds may differ substantially from diversified funds in numerous characteristics such as size, age, managerial fees, loads, and turnover. To identify such patterns in the data, in each month we sort all funds into decile portfolios based on their ICI and calculate average fund characteristics across such deciles. On average, concentrated funds have higher turnover and higher expenses than diversified funds. For example, the most diversified portfolio exhibits an average turnover of 70% per year compared to the most concentrated portfolio whose turnover equals 103.37% per year. Likewise, concentrated funds are younger, hold fewer stocks, and have a lower value of assets under management. Specifically, funds in the most diversified portfolio on average hold 150 different stocks while funds in the most concentrated portfolio on average hold approximately 62 stocks.

Table 1 Industry Concentration and Fund Characteristics. The average fund characteristics for different portfolios of mutual funds are reported for the period of 1984 to 2003. We divide the sample into deciles based on the lagged Industry Concentration Index, which is defined as $ICI = \sum(w_{F,i} - w_{M,i})^2$, where $w_{F,i}$ is the weight of the mutual fund holdings in industry i and $w_{M,i}$ is the weight of the market in industry i.

	Industry Concentration Index (in %)	Number of Stocks	Total Net Assets	Age	Turnover (in %)	Expense Ratio (in %)
All Funds	7.32	94.69	699.17	15.92	85.93	1.24
Bottom Decile	0.88	150.84	1,084.28	21.03	70.00	1.02
2nd Decile	1.73	109.83	955.28	19.53	75.46	1.10
3rd Decile	2.49	113.58	791.94	17.43	82.93	1.17
4th Decile	3.29	105.35	815.31	16.55	83.24	1.18
5th Decile	4.18	88.87	683.81	15.87	82.64	1.22
6th Decile	5.24	88.61	580.36	15.13	86.16	1.24
7th Decile	6.57	80.29	562.14	14.79	88.14	1.29
8th Decile	8.49	77.43	557.88	14.26	91.53	1.31
9th Decile	12.45	70.49	517.45	13.35	97.22	1.37
Top Decile	28.04	61.87	445.30	11.29	103.37	1.49

3 Empirical Evidence

In this section, we present the empirical results. First, we investigate the relation between industry concentration and fund performance using a portfolio approach. Subsequently, we focus on the size and the style of mutual funds to further explore the relation between industry concentration and fund performance.

A. Portfolio Evidence

To gauge the relative performance of funds with different concentration levels, we sort all funds into ten portfolios according to their Industry Concentration Index at the end of each month. For each decile portfolio, we compute the equally weighted average return for each month. Finally, we estimate abnormal returns for each decile using the monthly values. For this estimation, we use the performance information from all funds, including funds with short return histories, thus mitigating a potential selection bias.

In estimating abnormal returns, we use the Fama and French (1993) three-factor model and the Carhart (1997) four-factor model to adjust for return differences due to style and risk factors as follows:

$$R_{i,t} - R_{F,\,t} = \alpha_i + \beta_{i,M}(R_{M,t} - R_{F,t}) + \beta_{i,SMB}\,SMB_t + \beta_{i,HML}\,HML_t + e_{i,t}, \tag{2}$$

$$R_{i,t} - R_{F,\,t} = \alpha_i + \beta_{i,M}(R_{M,t} - R_{F,t}) + \beta_{i,SMB}\,SMB_t + \beta_{i,HML}\,HML_t + \beta_{i,MOM}\,MOM_t + e_{i,t}, \tag{3}$$

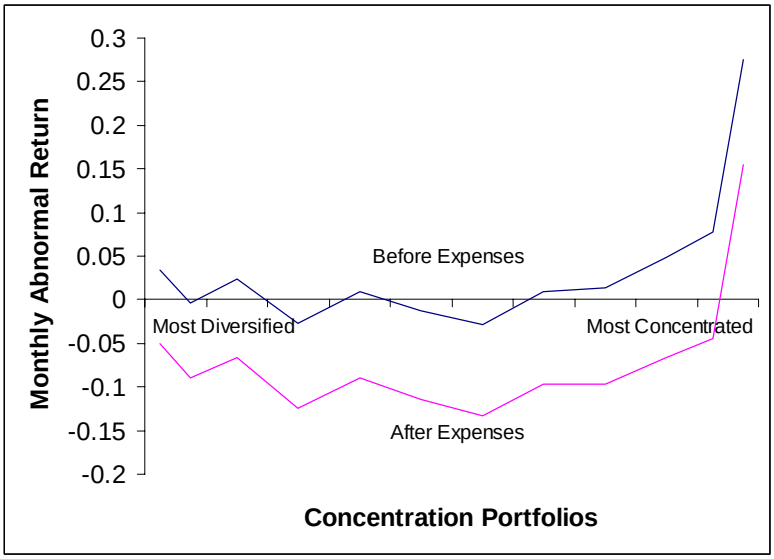
where the dependent variable is the return on portfolio i in month t net of the risk-free rate, and the factor portfolios include the returns of three zero-investment strategies. In particular, the first factor, $R_{Mt} - R_{Ft}$, denotes the excess return on the market portfolio over the risk-free rate,[6] the second factor, *SMB*, is the return difference between small and large capitalization stocks, the

[6] The market return is calculated as the value-weighted return on all NYSE, AMEX, and NASDAQ stocks using the CRSP database. The monthly return of the one-month Treasury bill rate is obtained from Ibbotson Associates.

third factor, *HML*, is the return difference between high and low book-to-market stocks.[7] In the four-factor model, *MOM* is the return difference between stocks with high and low past returns.[8] The intercept of the model, α_i, is the measure of abnormal performance.

Figure 1 summarizes the results for the four-factor model defined in equation (3). We examine the factor-adjusted returns both before and after subtracting fund expense ratios. Looking at the returns before expenses enables us to better evaluate the investment ability of mutual fund managers, since managers with better skills may charge higher expenses to extract rents, consistent with the theory proposed by Berk and Green (2004). On the other hand, the returns after expenses are what matters to mutual fund investors.

Figure 1
Abnormal Four-Factor Performance Before and After Expenses by Industry Concentration



First, we examine in more detail the abnormal returns before deducting expenses. The most concentrated fund portfolios tend to have higher abnormal returns than the less concentrated

[7] The size, the value, and the momentum factor returns were taken from Kenneth French's Web site http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library.
[8] Moskowitz and Grinblatt (1999) document that momentum is stronger at an industry level.

portfolios. Consistent with the information hypothesis, the positive effect on performance shows up predominantly for funds with the most concentrated portfolios, that is, for those funds, which we would expect to have significant information advantages. The ranking of the concentration deciles for the abnormal returns after expenses is very similar to the one before expenses. The difference in the performance between the most concentrated and diversified funds narrows slightly if we study after-expense returns, because highly concentrated funds charge higher expenses than diversified funds.

Table 2 summarizes the results for the four-factor model defined in equation (3). The abnormal returns are calculated using fund returns before subtracting fund expenses and are reported in the first column. The results indicate that the most concentrated fund portfolios tend to have higher abnormal returns than the less concentrated portfolios. Specifically, the most concentrated fund decile portfolio generates an abnormal return of 0.177% per month, while the most diversified fund decile portfolio generates an abnormal return of 0.015% per month. The abnormal return of the most concentrated portfolio is positive and statistically significant at the 10% significance level. In contrast, the abnormal return of the most diversified portfolio is not significantly different from zero. The difference in the monthly abnormal returns between the most and the least concentrated decile equals approximately 0.16% per month, which is statistically significant at the 10% level. The magnitude of the performance difference increases further if we compare the top and the bottom 5% of funds. Hence, the evidence indicates that the most concentrated funds perform better than diversified funds before deducting expenses. This finding is consistent with the information hypothesis, that the most concentrated portfolios have informational advantages. These advantages can be reflected in either superior stock selection, timing, or style selection abilities.[9]

[9] Kacperczyk, Sialm, and Zheng (2005) show for the sample of funds between 1984 and 1999 that concentrated funds have both better stock selection and market timing ability.

Table 2 Coefficient Estimates for the Carhart Factor Model. This table summarizes abnormal returns and the factor loadings using the Carhart (1997) four-factor model for different portfolios of mutual funds for the period of 1984 to 2003. The first column reports the four-factor abnormal returns, and the remaining four columns summarize the factor loadings using returns before expenses. We divide the sample of funds into deciles based on the lagged Industry Concentration Index, which is defined as $ICI = \sum(w_{F,i} - w_{M,i})^2$, where $w_{F,i}$ is the weight of the mutual fund holdings in industry i and $w_{M,i}$ is the weight of the market in industry i. The returns are expressed at a monthly frequency and the portfolios are rebalanced monthly. The standard errors of the regressions are given in parentheses. The table includes the differences in the abnormal returns along with their standard errors between the top and the bottom deciles, and the top and the bottom 5% of the sample.

	Alpha	Market Beta	Size Beta	Value Beta	Momentum Beta
All Funds	0.023	1.003***	0.180***	0.010	0.010
	(0.046)	(0.011)	(0.014)	(0.017)	(0.010)
Bottom 5%	0.034	0.955***	-0.130***	0.020**	-0.011*
Diversified	(0.026)	(0.006)	(0.008)	(0.010)	(0.006)
Bottom Decile	0.015	0.964***	-0.098***	0.032***	-0.006
	(0.025)	(0.006)	(0.008)	(0.009)	(0.005)
2nd Decile	0.024	0.969***	0.010	0.060***	-0.008
	(0.033)	(0.008)	(0.010)	(0.012)	(0.007)
3rd Decile	-0.027	0.986***	0.103***	0.072***	0.013
	(0.041)	(0.010)	(0.012)	(0.015)	(0.009)
4th Decile	0.010	0.991***	0.149***	0.083***	-0.003
	(0.044)	(0.011)	(0.015)	(0.016)	(0.009)
5th Decile	-0.013	0.989***	0.182***	0.049***	0.019*
	(0.046)	(0.011)	(0.014)	(0.017)	(0.010)
6th Decile	-0.029	0.996***	0.221***	0.040**	0.032***
	(0.053)	(0.013)	(0.016)	(0.019)	(0.011)
7th Decile	0.009	1.014***	0.254***	0.040*	0.019
	(0.062)	(0.015)	(0.019)	(0.022)	(0.013)
8th Decile	0.013	1.025***	0.295***	0.004	0.014
	(0.072)	(0.018)	(0.022)	(0.026)	(0.015)
9th Decile	0.048	1.053***	0.319***	-0.064*	0.033*
	(0.087)	(0.021)	(0.026)	(0.032)	(0.018)
Top Decile	0.177*	1.046***	0.366***	-0.218***	-0.011
	(0.096)	(0.023)	(0.029)	(0.035)	(0.020)
Top 5%	0.276**	1.039***	0.348***	-0.307***	-0.038
Concentrated	(0.096)	(0.029)	(0.036)	(0.043)	(0.025)
Top – Bottom Decile	0.162*	0.082***	0.463***	-0.250***	-0.005
	(0.098)	(0.024)	(0.030)	(0.036)	(0.021)
Top – Bottom 5%	0.242**	0.084***	0.478***	-0.327***	-0.028
	(0.121)	(0.029)	(0.037)	(0.044)	(0.026)

*** 1% significance; ** 5% significance; * 10% significance

To further examine the risk and style characteristics of the decile portfolios, we report the factor loadings from the four-factor model using before-expense returns in the last four columns of Table 2. We observe that concentrated funds exhibit higher market betas than diversified funds. Concentrated funds also tend to hold small and growth companies, whereas diversified funds tend to hold large and value companies. However, concentrated funds do not exhibit more momentum in their returns than diversified funds.

The inference about the style differences between concentrated and diversified portfolios is also affected by market conditions. If we exclude the last four years (2000-2003) of the data (as in Table II of Kacperczyk, Sialm, and Zheng (2005)) which can be defined as a bear market followed by a recovery, we can observe that concentrated funds follow more momentum and size strategies. At the same time, they do not differ much in terms of their exposure to market risk. Nevertheless, the differences in fund performance between concentrated and diversified funds, as indicated by their comparable alphas, do not change. Therefore, we could argue that different funds adjust their trading strategies differently in response to changing market conditions, but the main conclusion holds: The more concentrated funds outperform the more diversified ones.[10]

Mutual funds with different portfolio concentration differ in terms of their expense ratios. In particular, the average annual expenses range between 1.49% for the most concentrated funds and 1.02% for the most diversified funds, as indicated in Table 1. In Table 3, we assess the impact of fund expenses on the relation between concentration and performance. We report portfolios' alphas estimated using both gross and net of expenses returns.

[10] An interesting issue to consider could be an impact of the FD regulation on the concentration effect. Given that the regulation has possibly made an access to information more costly one could expect to see some impact on mutual fund concentration strategies. Since the sample size for the post-FD-regulation period is a mere 2-3 years we defer the formal tests of this hypothesis to future research.

Table 3 Abnormal Performance of Portfolio Concentration Portfolios. This table summarizes abnormal returns of the Fama-French three-factor model and the Carhart four-factor model for different portfolios of mutual funds for the period of 1984 to 2003. The first two columns report the abnormal returns estimated using fund returns before subtracting expense ratios, and the last two columns report the abnormal returns estimated using fund returns after subtracting expense ratios. We divide the sample of funds into deciles based on the lagged Industry Concentration Index, which is defined as $ICI = \sum(w_{F,i} - w_{M,i})^2$, where $w_{F,i}$ is the weight of the mutual fund holdings in industry i and $w_{M,i}$ is the weight of the market in industry i. The returns are expressed at a monthly frequency and the portfolios are rebalanced monthly. The standard errors of the regressions are given in parentheses. The table includes the differences in the abnormal returns along with their standard errors between the top and the bottom deciles, and the top and the bottom 5% of the sample.

	Abnormal Return (in % per month)			
	Before Expenses		After Expenses	
	3-Factor	4-Factor	3-Factor	4-Factor
All Funds	0.034	0.023	-0.069	-0.080*
	(0.045)	(0.046)	(0.045)	(0.046)
Bottom 5%	0.022	0.034	-0.062***	-0.050*
Diversified	(0.026)	(0.026)	(0.026)	(0.026)
Bottom Decile	0.010	0.015	-0.075***	-0.070***
	(0.025)	(0.025)	(0.025)	(0.025)
2nd Decile	0.016	0.024	-0.075**	-0.067**
	(0.032)	(0.033)	(0.032)	(0.033)
3rd Decile	-0.013	-0.027	-0.110***	-0.124***
	(0.040)	(0.041)	(0.040)	(0.041)
4th Decile	0.006	0.010	-0.093**	-0.089**
	(0.043)	(0.044)	(0.043)	(0.044)
5th Decile	0.008	-0.013	-0.094**	-0.114**
	(0.045)	(0.046)	(0.045)	(0.046)
6th Decile	0.004	-0.029	-0.100*	-0.133**
	(0.052)	(0.053)	(0.052)	(0.053)
7th Decile	0.029	0.009	-0.077	-0.097
	(0.060)	(0.062)	(0.060)	(0.062)
8th Decile	0.028	0.013	-0.082	-0.097
	(0.070)	(0.072)	(0.070)	(0.072)
9th Decile	0.083	0.048	-0.032	-0.067
	(0.085)	(0.087)	(0.085)	(0.087)
Top Decile	0.166*	0.177*	0.044	0.055
	(0.093)	(0.096)	(0.093)	(0.096)
Top 5%	0.235**	0.276**	0.113	0.154
Concentrated	(0.115)	(0.096)	(0.114)	(0.117)
Top – Bottom Decile	0.156*	0.162*	0.119	0.124
	(0.095)	(0.098)	(0.095)	(0.098)
Top – Bottom 5%	0.213*	0.242**	0.174	0.204*
	(0.117)	(0.121)	(0.117)	(0.120)

*** 1% significance; ** 5% significance; * 10% significance

The ranking of the concentration deciles for the abnormal returns after expenses is very similar to the one before expenses. The difference in the performance between the most concentrated and diversified funds narrows slightly if we study after-expense returns, because highly concentrated funds charge higher expenses than diversified funds. For both the Fama-French three-factor and the Carhart four-factor measures, the after-expense abnormal return of the most concentrated decile exceeds that of the least concentrated decile by about 0.12% per month. However, this difference is statistically insignificant.

B. Size Portfolios

To further analyze whether the effect of the Industry Concentration Index depends on the size of mutual funds, we segregate the mutual funds into different size portfolios and compare the performance of concentrated and diversified funds for these various size portfolios. The distribution of the assets under management in our mutual funds' sample is highly skewed to the right. Diseconomies of scale in money management, as discussed by Berk and Green (2004) and Chen, Hong, Huang, and Kubik (2004), make it difficult for very large funds to outperform passive benchmarks even if fund managers are skilled.

We sort the mutual funds into different size portfolios and compare the performance of concentrated and diversified funds within these size portfolios. Specifically, we first sort funds into size quintiles based on their TNAs at the beginning of each month. Mutual funds in the first quintile manage on average $19 million, while funds in the fifth quintile manage on average $2,816 million. Subsequently, we sort the mutual funds within each size quintile into ten equal-sized groups according to their Industry Concentration Index.

Table 4 Concentration Effect Conditional on Fund Size. Funds are sorted into five equally-sized portfolios according to their beginning-of-month TNA. Funds in each of these size portfolios are further divided into deciles according to the lagged Industry Concentration Index. The Industry Concentration Index is defined as $ICI = \sum(w_{F,i} - w_{M,i})^2$, where $w_{F,i}$ is the weight of the mutual fund holdings in industry i and $w_{M,i}$ is the weight of the market in industry i. The returns are expressed at a monthly frequency and the portfolios are rebalanced monthly. The abnormal returns before expenses using the Carhart (1997) four-factor model are summarized for different portfolios of mutual funds for the period of 1984 to 2003. The standard errors of the regressions are given in parentheses. The table includes the differences in the abnormal returns along with their standard errors between the top and the bottom deciles.

	Abnormal Return (in % per month)				
	Smallest Quintile	2nd Quintile	3rd Quintile	4th Quintile	Largest Quintile
Average TNA (in Millions)	19	63	157	398	2,816
Average ICI (in %)	9.41	8.10	7.16	6.41	5.54
Range of Average Decile ICI (in %)	1.18 – 33.48	1.00 – 30.63	0.94 – 26.83	0.81 – 24.66	0.75 – 19.45
All Funds	0.076	0.041	0.030	-0.025	-0.006
	(0.056)	(0.054)	(0.052)	(0.048)	(0.037)
Diversified	0.001	0.007	0.009	-0.002	0.055*
Decile	(0.044)	(0.039)	(0.035)	(0.032)	(0.030)
2nd Decile	0.008	0.014	0.019	0.020	0.030
	(0.053)	(0.042)	(0.048)	(0.046)	(0.033)
3rd Decile	0.004	0.030	-0.065	0.018	-0.007
	(0.054)	(0.054)	(0.059)	(0.049)	(0.037)
4th Decile	-0.018	0.010	0.047	-0.036	-0.036
	(0.062)	(0.064)	(0.076)	(0.052)	(0.045)
5th Decile	0.112	0.044	-0.026	-0.037	-0.056
	(0.068)	(0.066)	(0.066)	(0.059)	(0.049)
6th Decile	0.111	0.023	-0.020	-0.119*	-0.084*
	(0.076)	(0.067)	(0.078)	(0.061)	(0.047)
7th Decile	0.002	-0.082	-0.003	-0.070	-0.045
	(0.105)	(0.087)	(0.081)	(0.068)	(0.058)
8th Decile	0.073	0.053	0.046	-0.078	-0.035
	(0.101)	(0.093)	(0.086)	(0.078)	(0.073)
9th Decile	0.104	0.032	0.071	0.034	0.080
	(0.106)	(0.112)	(0.096)	(0.113)	(0.079)
Concentrated	0.357***	0.260**	0.217*	0.004	0.042
Decile	(0.129)	(0.116)	(0.130)	(0.105)	(0.111)
Concentrated –	0.356***	0.253**	0.208	0.005	-0.013
Diversified	(0.135)	(0.116)	(0.134)	(0.108)	(0.114)

*** 1% significance; ** 5% significance; * 10% significance

Our findings, reported in Table 4, confirm the results in Chen, Hong, Huang, and Kubik (2004) that small mutual funds outperform large funds. Specifically, mutual funds in the small size quintile exhibit an abnormal return before expenses of 0.076% per month using the four-factor model, while funds in the large size quintile an abnormal return of -0.006% per month.

Table 4 focuses primarily on the effects of the Industry Concentration Index on abnormal performance within the size quintiles. We observe a positive performance difference between the most and the least concentrated funds in three size quintiles using the four-factor measure. However, the performance difference is significant at the 5% level only for the first two quintiles. For the top two quintiles, we do not see an economically significant concentration effect.

The findings indicate that the concentration effect is more significant for smaller funds. This is not necessarily surprising in light of the studies by Berk and Green (2004) and Chen, Hong, Huang, and Kubik (2004), which suggest that larger funds usually suffer from significant diseconomies of scale. If concentrated funds have superior information then we should expect to see this effect more among smaller funds. Large funds, on average, are also less concentrated, which is not surprising given that it is more difficult for them to allocate their flows among few industries without exerting market impact on the stockholdings' prices. Hence, we observe a smaller dispersion in concentration among the very large funds and thus the performance effect becomes smaller. We conclude that the aggregate concentration effect, though economically significant using an equal-weighted basis, is more pervasive among funds with a lower dollar value of funds under management.

C. Style Portfolios

Funds frequently concentrate their holdings in specific investment styles, for example, value versus growth or small versus large capitalization stocks. In this section, we investigate to what extent our concentration results are related to funds' investment styles. We sort our sample of mutual funds into four investment styles based on the characteristics of their stockholdings.

Next, we assign each stock traded on the major U.S. exchanges into respective quintiles according to its market value and its book-to-market ratio. Subsequently, using the quintile information, we compute the value-weighted size score and value score for each mutual fund in each month. For example, a mutual fund that invests only in stocks in the smallest size quintile would have a size score of 1, while a mutual fund that invests only in the largest size quintile would have a size score of 5. We then group all mutual funds according to their size scores and value scores into four portfolios. The small-growth portfolio includes mutual funds with below median size scores and below median value scores. Similarly, we define the large-growth, small-value, and large-value portfolios. Finally, we subdivide each of these four portfolios into deciles according to their Industry Concentration Index.

Table 5 summarizes the four-factor abnormal returns before expenses of these mutual funds' portfolios. Consistent with the findings in DGTW and Chen, Jegadeesh, and Wermers (2000), we observe that mutual funds investing primarily in growth stocks outperform mutual funds investing in value stocks. Specifically, mutual funds focusing on large-growth stocks outperform mutual funds specializing in large-value stocks by about 0.03% per month.

Table 5 Concentration Effect Conditional on Fund Style. Funds are sorted at the beginning of each period into four portfolios according to the lagged market values (small versus large cap) and the lagged book-to-market ratios (growth versus value) of their holdings. Funds in each of these style portfolios are further divided into deciles according to the lagged Industry Concentration Index. The Industry Concentration Index is defined as $ICI = \sum(w_{F,i} - w_{M,i})^2$, where $w_{F,i}$ is the weight of the mutual fund holdings in industry i and $w_{M,i}$ is the weight of the market in industry i. The returns are expressed at a monthly frequency and the portfolios are rebalanced monthly. The abnormal returns before expenses using the Carhart (1997) four-factor model are summarized for different portfolios of mutual funds for the period of 1984 to 2003. The standard errors of the regressions are given in parentheses. The table includes the differences in the abnormal returns along with their standard errors between the top and the bottom deciles.

	Abnormal Return (in % per month)			
	Small Growth	Small Value	Large Growth	Large Value
Average ICI (in %)	10.16	8.51	5.78	4.94
Range of Average Decile ICI (in %)	2.24 – 31.51	1.53 – 31.34	0.97 – 20.85	0.54 – 21.79
All Funds	0.024	0.018	0.038	0.010
	(0.081)	(0.064)	(0.044)	(0.042)
Diversified	-0.078	-0.029	0.007	0.048*
Decile	(0.072)	(0.059)	(0.038)	(0.028)
2nd Decile	0.002	0.041	0.006	0.019
	(0.078)	(0.064)	(0.043)	(0.032)
3rd Decile	-0.016	0.007	-0.003	0.036
	(0.081)	(0.068)	(0.048)	(0.034)
4th Decile	0.027	-0.050	0.008	0.061
	(0.081)	(0.071)	(0.057)	(0.043)
5th Decile	0.094	0.151**	0.021	-0.026
	(0.090)	(0.076)	(0.052)	(0.049)
6th Decile	-0.033	-0.065	0.024	-0.020
	(0.086)	(0.080)	(0.060)	(0.060)
7th Decile	0.093	-0.011	0.047	0.010
	(0.095)	(0.086)	(0.058)	(0.059)
8th Decile	-0.048	0.001	0.093	-0.056
	(0.109)	(0.088)	(0.060)	(0.071)
9th Decile	0.004	-0.023	0.027	-0.011
	(0.119)	(0.101)	(0.075)	(0.076)
Concentrated Decile	0.196	0.164*	0.146	0.038
	(0.140)	(0.100)	(0.107)	(0.074)
Concentrated –	0.273**	0.194**	0.139	-0.010
Diversified	(0.134)	(0.097)	(0.114)	(0.073)

*** 1% significance; ** 5% significance; * 10% significance

Consistent with our earlier findings, mutual funds with a higher industry concentration tend to generate higher abnormal returns before expenses within style categories, unless they specialize in large-value stocks. Nevertheless, the effect is only statistically significant for small-growth and small-value funds. The least concentrated decile of small-growth mutual funds has an abnormal return before expenses of -0.078% per month, while the most concentrated decile has an abnormal return of 0.196% per month. On the other hand, the least concentrated decile of large-value mutual funds has an abnormal return before expenses of 0.048% per month, while the most concentrated decile has an abnormal return of 0.038% per month.

4 Conclusions

Mutual fund managers may deviate from the passive market portfolio by concentrating their holdings in specific industries. We investigate whether mutual fund managers hold concentrated portfolios because they have investment skills that are linked to specific industries.

Using U.S. mutual fund data from 1984 to 2003, we find that mutual funds differ substantially in their industry concentration and that concentrated funds tend to follow distinct investment styles. In particular, managers of more concentrated funds overweigh growth and small stocks, whereas managers of more diversified funds hold portfolios that closely resemble the total market portfolio. We find that funds with most concentrated portfolios perform better than funds with diversified portfolios. This finding is robust to various risk-adjusted performance measures, including the commonly used four-factor model of Carhart (1997).

In summary, this paper finds that investment ability is more evident among managers who hold portfolios concentrated in a few industries. The evidence lends support to the value of active fund management.

Appendix A: Industry Classification

Industry Classification: This table describes the detailed composition of the ten industries used in calculating the ICI index.

10-Industry Classification	48-Industry French Classification
1. Consumer Non-Durables	1. Agriculture 2. Food Products 3. Candy and Soda 4. Beer and Liquor 5. Tobacco Products 7. Entertainment 8. Printing and Publishing 10. Apparel 16. Textiles 33. Personal Services
2. Consumer Durables	6. Toys 9. Consumer Goods 23. Automobiles and Trucks
3. Healthcare	11. Healthcare 12. Medical Equipment 13. Pharmaceutical Products
4. Manufacturing	14. Chemicals 15. Rubber and Plastic Products 17. Construction Materials 18. Construction 19. Steel Works 20. Fabricated Products 21. Machinery 22. Electrical Equipment 24. Aircraft 25. Shipbuilding and Railroad Equip. 26. Defense 38. Business Supplies 39. Shipping Containers 40. Transportation 48. Miscellaneous
5. Energy	27. Precious Metals 28. Mining 29. Coal 30. Oil
6. Utilities	31. Utilities
7. Telecom	32. Communications
8. Business Equipment and Services	34. Business Services 35. Computers 36. Electronic Equipment 37. Measuring and Control Equip.
9. Wholesale and Retail	41. Wholesale 42. Retail 43. Restaurants, Hotels, and Motels
10. Finance	44. Banking 45. Insurance 46. Real Estate 47. Trading

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