How Active Is Your Fund Manager? A New Measure That Predicts Performance*

Martijn Cremers
International Center for Finance
Yale School of Management

Antti Petajisto†
International Center for Finance
Yale School of Management

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Abstract

To quantify active portfolio management, we introduce a new measure we label Active Share. It describes the share of portfolio holdings that differ from the portfolio's benchmark index. We argue that to determine the type of active management for a portfolio, we need to measure it in two dimensions using both Active Share and tracking error. We apply this approach to the universe of all-equity mutual funds to characterize how much and what type of active management they practice. We test how active management is related to characteristics such as fund size, expenses, and turnover in the cross-section, and we look at the evolution of active management over time. We also find that active management predicts fund performance: the funds with the highest Active Share significantly outperform their benchmark indexes both before and after expenses, while the non-index funds with the lowest Active Share underperform. The most active stock pickers tend to create value for investors while factor bets and closet indexing tend to destroy value.

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†Corresponding author: Antti Petajisto, Yale School of Management, P.O. Box 208200, New Haven, CT 06520-8200, tel. +1-203-436-0666, antti.petajisto@yale.edu.

1 Introduction

An active equity fund manager can attempt to generate a positive alpha (i.e., risk-adjusted return) in two different ways: either by stock selection or by factor timing (or both). Stock selection involves picking individual stocks that the manager expects to outperform their peers. Factor timing involves time-varying bets on systematic risk factors such as entire industries, sectors of the economy, or more generally any systematic risk relative to the benchmark index. Because many funds favor one approach over the other, it is not clear how to quantify active management across all funds.

Tracking error volatility (hereafter just "tracking error") is the traditional way to measure active management. It represents the volatility of the difference between a portfolio return and its benchmark index return. However, the two distinct approaches to active management contribute very differently to tracking error, despite the fact that *either* of them could produce a higher alpha.

For example, the T. Rowe Price Small Cap fund is a pure stock picker which hopes to generate alpha with its stock selection *within* industries, but it simultaneously aims for high diversification *across* industries. In contrast, the Morgan Stanley American Opportunities fund is a "sector rotator" which focuses on actively picking entire sectors and industries that outperform the broader market while holding mostly diversified (and thus passive) positions within those sectors. The tracking error of the diversified stock picker is substantially lower than that of the sector rotator, suggesting that the former is much less active. But this would be an incorrect conclusion – its tracking error is lower simply because there are many more stocks than sectors of the economy, thus allowing stock pickers to be better diversified than sector rotators.

Instead, we can compare the portfolio *holdings* of a fund to its benchmark index. When a fund overweights a stock relative to the index weight, it has an active long position in it, and when a fund underweights an index stock or does not buy it at all, it implicitly has an active short position in it. In particular, we can decompose any portfolio into a 100% position in its benchmark index plus a zero-net-investment long-short portfolio on top of that. For example, a fund might have 100% in the S&P 500 plus 40% in active long positions and 40% in active short positions.[1]

We propose the size of this active long-short portfolio (40% in the previous example) as a new measure of active management, and we label this measure the Active Share of a

[1] Asness (2004) discusses the same decomposition, albeit from the point of view of tracking error alone.

portfolio. Since mutual funds almost never take actual short positions, they will always have an Active Share between zero and 100%. Active Share can thus be easily interpreted as the "fraction of the portfolio that is different from the index."

We argue that Active Share should be used in conjunction with tracking error to gain a comprehensive picture of active management, as illustrated in Figures 1 and 2. Given a fund's tracking error and Active Share, we can plot the fund in these two dimensions. A diversified stock picker (e.g. T. Rowe Price Small Cap) can actually be very active despite its low tracking error, because its stock selection within industries can still lead to large deviations from the index portfolio. In contrast, a fund taking *systematic* factor bets can generate a large tracking error even without large deviations from index holdings (e.g. Investment Company of America, which also invests in foreign stocks and tries to time the US market; or Morgan Stanley American Opportunities, which would place right next to it in the picture due to its sector bets). A concentrated stock picker (e.g. Fidelity Low Price) combines the two approaches, thus taking positions in individual stocks as well as systematic risk. A "closet indexer" (e.g. Fidelity Magellan) scores low on both dimensions of active management while still claiming to be active.[2] Finally, a pure index fund (e.g. Vanguard 500) has almost zero tracking error and Active Share.

We apply our methodology to the data to characterize active management in all-equity mutual funds in the US. First, we determine *how much* and *what type* of active management each fund practices. We also test how active management is related to other variables such as fund size, fees, flows, and prior returns. Second, we examine time series data from 1980 to 2003 to understand the evolution of active management over this period of time. Third, we investigate fund performance to find out whether more active managers have more skill and whether that skill survives their fees and expenses. Our methodology allows us to focus on the performance of the *truly active* funds as well as the different *types* of active funds, complementing the existing mutual fund literature which has largely treated all mutual funds as one homogeneous group.

In the cross section of funds, we find wide dispersion along both dimensions of active management. For example, a tracking error of 4-6% can be associated with an Active Share anywhere between 30% and 100%, thus including both closet indexers as well as very active funds. Furthermore, the Active Share of an individual fund is extremely persistent over time.

Consistent with the popular notion, small funds are indeed more active than large funds.

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[2] E.g. *The Wall Street Journal*, 5/28/2004, "Magellan's Manager Has Regrets."

However, for large-cap funds the inverse relationship between fund size and Active Share shows up only after about $1bn in assets. Expense ratios are much lower for index funds, but for all other funds expenses have surprisingly little to do with active management, which makes closet indexers disproportionately expensive.

The fraction of pure index funds has grown substantially over the 1990s, from about 1% to 13% of mutual fund assets. But more than that, the fraction of passive funds which claim to be active has also increased significantly: funds with low Active Share (20%-60%) had about 30% of all assets in 2003, compared with almost zero in the 1980s. This trend has dragged down the average Active Share of non-index large-cap funds from about 80% to 60% over the same period. Furthermore, the aggregate Active Share of such funds is even lower at about 30% at the end of the period, which means that half of all active positions of individual mutual funds cancel out *within* the mutual fund sector, thus producing no aggregate benefit to mutual fund investors.

Fund performance is significantly related to active management, as revealed by a two-dimensional sort of non-index funds by Active Share and tracking error. Funds with the highest Active Share exhibit some skill and pick portfolios which outperform their benchmarks by 2.00-2.71% per year. After fees and transaction costs, this outperformance decreases to 1.49-1.59% per year. In contrast, funds with the lowest Active Share have poor benchmark-adjusted returns and alphas before expenses (between 0.06% and -0.66%) and do even worse after expenses, underperforming by -1.41% to -1.76% per year. The difference in performance across the top and bottom Active Share groups is also statistically significant.

Interestingly, tracking error by itself is *not* related to fund returns. If anything, higher tracking error predicts slightly poorer performance. Hence, not all dimensions of active management are rewarded in the market, but the dimension captured by Active Share is.

Economically, these results suggest that the most active diversified stock pickers and concentrated stock pickers have enough skill to generate alphas that remain positive even after fees and transaction costs. In contrast, funds focusing on factor bets seem to have zero to negative skill, which leads to particularly bad performance after fees. Hence, it appears that there are some mispricings in individual stocks that active managers can exploit, but broader factor portfolios are either too efficiently priced to allow any alphas or too difficult for the managers to predict. Closet indexers, unsurprisingly, exhibit zero skill but underperform because of their expenses.

Active Share is very significantly related to returns within the smallest 60% of funds,

while a weaker but still positive relationship exists for the largest 40% of funds. The most active funds in the smallest fund size quintile outperform their benchmarks by an economically very significant 4% per year before expenses and 3% per year after expenses.

There is performance persistence in fund returns especially among the highest Active Share quintile, although a large fraction of this persistence does not survive the four-factor model of Carhart (1997). The funds with the highest Active Share and highest prior-year return continue to outperform their benchmarks by 3.02-5.57% per year before expenses and 2.29-3.69% after expenses. Repeating this analysis for only the smallest quintile of funds produces *net* outperformance of 5.63-6.68% per year.

The current mutual fund literature has done little to investigate active management per se. Instead, a large volume of research has focused on fund performance directly.[3] For example, a comprehensive study by Wermers (2000) computes mutual fund returns before and after expenses; our results refine those performance results by dividing funds into various active management categories. Even more closely related, Wermers (2003) investigates active management and fund performance but uses only the S&P 500 tracking error as a measure of active management; we add the Active Share dimension, which turns out to be crucial, and we use a variety of actual stock market indexes rather than only the S&P 500.

Kacperczyk, Sialm, and Zheng (2005) ask a related question about whether industry concentration of mutual funds explains fund performance. This amounts to testing whether funds with concentrated stock picks or factor bets in industries perform better than other funds. Our performance results address a broader question about whether active stock picks *within* industries are reflected in fees and alphas, and whether *any* type of factor bets, including ones unrelated to specific industries, are similarly reflected in performance.

Another important feature separating our paper from many others in the literature is the data. First, we have holdings data for the most common benchmark indexes used in the industry over the sample period: the S&P 500, Russell 2000, Wilshire 5000, Wilshire 4500, S&P500/Barra Value, and S&P500/Barra Growth. This allows us to compute Active Share relative to a fund's *actual* benchmark index as opposed to picking just one index for all funds. Second, we use *daily* data on mutual fund returns. This is crucial for the accurate

[3] Various performance measures have been developed and applied by Jensen (1968), Grinblatt and Titman (1989, 1993), Gruber (1996), Daniel, Grinblatt, Titman, and Wermers (1997), Wermers (2000), Pastor and Stambaugh (2002), Cohen, Coval, and Pastor (2005), and many others. Studies focusing on performance persistence include, for example, Brown and Goetzmann (1995), Carhart (1997), Bollen and Busse (2004), and Mamaysky, Spiegel, and Zhang (2006).

calculation of tracking error, especially when funds do not keep their styles constant over the years or when funds have only short return histories.

The paper proceeds as follows. Section 2 examines our definition and measures of active management. Section 3 describes the data sources and sample selection criteria. The empirical results for active management are presented in Section 4 and for fund performance in Section 5. Section 6 concludes. All tables and figures are in the appendix.

2 Definition and Measures of Active Management

"Passive management" of a portfolio is easy to define: it consists of replicating the return on an index with a strategy of buying and holding all (or almost all) index stocks in the official index proportions.[4]

"Active management" can then be defined as any deviation from passive management. Measuring active management thus means measuring the "degree of deviation" from passive management. However, there are also different *types* of active management, and this is where the difficulties arise: how to measure the deviation depends on what aspect of active management we want to capture.

2.1 Tracking Error

Tracking error (or more formally the tracking error volatility) is defined as the time-series standard deviation of the difference between a fund return ($R_{fund,t}$) and its benchmark index return ($R_{index,t}$):[5]

$$\text{Tracking error} = Stdev\left[R_{fund,t} - R_{index,t}\right].$$

A typical active manager aims for an expected return higher than the benchmark index, but at the same time he wants to have a low tracking error (volatility) to minimize the risk of significantly underperforming the index. Mean-variance analysis in this excess-return framework is a standard tool of active managers (e.g. Roll (1992) or Jorion (2003)).

Note that the definition of tracking error effectively assumes a beta equal to one with respect to the benchmark index, and thus any deviation from a beta of one will generate

[4] Without transaction costs, passive managers could just sit on their portfolios and trade only when the benchmark index changes, and if there are fund inflows or outflows, they could simply scale the exact same portfolio up or down. In reality they have to perform some fine-tuning at the margin in order to minimize their transaction costs, and this leads to small deviations from the index.

[5] See e.g. Grinold and Kahn (1999).

tracking error. We focus on this definition mainly because it is the convention practitioners have adopted for performance evaluation and we specifically want to measure active management as perceived by the fund managers themselves.[6]

2.2 Active Share

Our new and simple way to quantify active management is to compare the holdings of a mutual fund with the holdings of its benchmark index. We label this measure the Active Share of a fund, and we define it as:

$$\text{Active Share} = \frac{1}{2}\sum_{i=1}^{N} \left| w_{fund,i} - w_{index,i} \right|,$$

where $w_{fund,i}$ and $w_{index,i}$ are the portfolio weights of asset i in the fund and in the index, and the sum is taken over the universe of all assets.[7]

This measure has an intuitive economic interpretation. We can decompose a mutual fund portfolio into a 100% position in the benchmark index, plus a zero-net-investment long-short portfolio. The long-short portfolio represents all the active bets the fund has taken. Active Share then measures the size of that long-short position as a fraction of the total portfolio of the fund. We divide the sum of portfolio weight differences by 2 so that a fund that has zero overlap with its benchmark index gets a 100% Active Share (i.e., we do not count the long side and the short side of the positions separately).

As an illustration, let us consider a fund with a $100 million portfolio benchmarked against the S&P 500. Imagine that the manager starts by investing $100 million in the index, thus having a pure index fund with 500 stocks. Assume the manager only likes half of the stocks, so he eliminates the other half from his portfolio, generating $50 million in cash, and then he invests that $50 million in those stocks he likes. This produces an Active

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[6] Another justification for this approach arises from the fact that investors cannot observe a fund's beta in real time. Hence, any time-variation in beta represents a conscious decision by the manager either to time the index or simply to disregard this additional tracking error. In either case, his actions create additional risk for the investors in the fund as well as additional career risk for the manager himself.

[7] In this paper we compute the sum across stock positions as we apply the measure exclusively to all-equity portfolios. However, in general we should sum up across *all* positions, including cash and bonds, which may also be part of the portfolio (or part of the index).

If a portfolio contains derivatives, Active Share becomes a trickier but still feasible concept. Then we would have to decompose the derivatives into implied positions in the underlying securities (e.g., stock index futures would be expressed as positions in stocks and cash) and compute Active Share across those underlying securities. Because mutual funds tend to have negligible derivative positions, this is not a concern for us.

Share of 50% (i.e. 50% overlap with the index). If he invests in only 50 stocks out of 500 (assuming no size bias), his Active Share will be 90% (i.e. 10% overlap with the index). According to this measure, it is equally active to pick 50 stocks out of a relevant investment universe of 500 or 10 stocks out of 100 – in either case you choose to exclude 90% of the candidate stocks from your portfolio.

For a mutual fund that never shorts a stock and never buys on margin, Active Share will always be between zero and 100%. In other words, the short side of the long-short portfolio never exceeds the long index position. In contrast, the Active Share of a hedge fund can significantly exceed 100% due to its leverage and net short positions in individual stocks.

2.3 Combining Active Share with Tracking Error

So why do we need to know the Active Share of a fund if we already know its tracking error? The main problem with tracking error is that different *types* of active management will contribute differently to tracking error.

There are two distinct ways an active manager can outperform his benchmark index. First, he can try to predict the returns on large portfolios of correlated stocks (such as industry portfolios, value stocks, or the benchmark index itself) and then optimize his performance by taking time-varying positions in these portfolios. This practice is also known as tactical asset allocation, and these managers can be called "market timers" or "sector rotators." Second, a manager can analyze individual stocks and try to pick those that will outperform other stocks in their industries. These managers hope to create value with stock selection, even when their market beta and industry weights exactly match those of the index. (Of course a fund can also combine both approaches.) In terms of tracking error, the key difference between the two types of active management is that the sector rotators and market timers will bear systematic risk relative to the index, while stock pickers may bear only idiosyncratic risk. Hence, the former will generate a relatively high tracking error, while the latter can largely diversify away their idiosyncratic risk and thus achieve a relatively low tracking error.

Tracking error therefore understates the active management of diversified stock pickers, even though their stock selection skills could potentially generate large alphas. Conversely, tracking error overstates active management when a manager only places bets on a few large portfolios but does not make any effort to pick individual stocks.

Our solution is not to abandon tracking error completely, but to use it together with

Active Share (Figure 1). A high Active Share can identify a diversified stock picker even when his tracking error is low. Tracking error identifies bets on systematic risk factors – for a given Active Share it is clearly more "active" to pick all stocks from the same industry than from diversified industries. These two dimensions together cover all the main types of active management. Diversified stock pickers are in one corner with high Active Share and low tracking error. Funds playing pure factor bets are in the opposite corner with low Active Share and high tracking error. Funds combining the two approaches can be called concentrated stock pickers, and they have both high Active Share and high tracking error. Funds not doing much of either will end up with low Active Share and low tracking error, and if they still claim to be active, they can be labeled closet indexers. Finally, funds with essentially zero Active Share and zero tracking error are pure index funds.

Our empirical results (Section 4) confirm the previous conjectures. For most levels of tracking error, there is significant variation in Active Share across funds, and thus it can be important to use both measures of active management.

3 Empirical Methodology

3.1 Data on Holdings

In order to compute Active Share, we need data on the portfolio composition of mutual funds as well as their benchmark indexes.

The stock holdings of mutual funds are from the CDA/Spectrum mutual fund holdings database maintained by Thomson Financial. The database is compiled from mandatory SEC filings as well as voluntary disclosures by mutual funds. It starts in 1980, and it reports most mutual fund holdings quarterly. Wermers (1999) describes the database in more detail.

As benchmark indexes we pick the ones that are most commonly used by the funds themselves over the sample period. This includes three families of indexes: the S&P/Barra,[8] Russell, and Wilshire indexes.

The S&P/Barra indexes we pick are the S&P 500, S&P500/Barra Growth, and S&P500/Barra Value. The S&P 500 is the most common large-cap benchmark index, consisting of approximately the largest 500 stocks. It is further divided into a growth and value style,

[8] The Barra indexes ceased to be the official S&P style indexes as of December 16, 2005, but this is irrelevant for our sample.

with equal market capitalization in each style, and this forms the Barra Growth and Value indexes which together sum up to the S&P 500.

The index constituent data for the S&P/Barra indexes are directly from Barra. We have month-end index constituents for the large-cap style indexes from 1/1981 to 2/2004; for the S&P 500 we have the entire history of the index.

From the Russell family we pick the Russell 2000 index. It is the most common small-cap benchmark, consisting of the 2,000 largest US stocks *after* the largest 1,000 have been excluded. The index constituent data are from Frank Russell Co. and extend from 12/1986 to 6/2003.

The most popular Wilshire indexes (now owned by Dow Jones) are the Wilshire 5000 and Wilshire 4500. The Wilshire 5000 covers essentially the entire U.S. equity market, with about 5,000 stocks in 2004 and peaking at over 7,500 stocks in 1998. The Wilshire 4500 is equal to the Wilshire 5000 minus the 500 stocks in the S&P 500 index, which makes it a mid-cap to small-cap index.

The Wilshire index constituent data are from Wilshire Associates. The data contain month-end index constituents from 1/1979 to 12/2004.

All stock holdings, both for funds and benchmark indexes, are matched with the CRSP stock return database.

3.2 Data on Returns

Monthly returns for mutual funds are from the CRSP mutual fund database. These are net returns, i.e. after fees, expenses, and brokerage commissions but before any front-end or back-end loads. Monthly returns for benchmark indexes are from Ibbotson Associates. We always pick the "total return" series which includes dividends.

Daily returns for mutual funds are from multiple sources. Our main source is Standard and Poor's which maintains a comprehensive database of live mutual funds.[9] We use their "Worths" package which contains daily per-share net asset values (assuming reinvested dividends) starting from 1/1980.

Because the S&P data does not contain dead funds, we supplement it with two other data sources. The first one is the CRSP mutual fund database which also contains daily returns for live and dead funds but only starting in 1/2001. The second one is a database used by Goetzmann, Ivkovic, and Rouwenhorst (2001) and obtained from the Wall Street Web. It is free of survivorship bias and it has daily returns (assuming reinvested dividends)

[9] This is also known as the Micropal mutual fund data.

from 1/1968 to 1/2001, so we use it to match dead funds earlier in our sample. Whenever available, we use the S&P data because it appears slightly cleaner than the latter two sources.

Daily returns for benchmark indexes are from a few different sources. The S&P 500 (total return) is from CRSP. The Wilshire index returns (total return) are from Wilshire Associates. The remaining daily index returns are from Yahoo Finance.

3.3 Sample Selection

We start by merging the CRSP mutual fund database with the CDA/Spectrum holdings database. The mapping is a combined version of the hand-mapping used in Cohen, Coval, and Pastor (2005) and the algorithmic mapping used in Frazzini (2005), where we manually resolve any conflicting matches.

For funds with multiple share classes in CRSP, we compute the sum of total net assets in each share class to arrive at the total net assets in the fund. For the expense ratio, loads, turnover, and the percentage of stocks in the portfolio we compute the value-weighted average across the share classes. For all other variables such as fund name, we pick the variables from the share class with the highest total net assets.

We want to focus on all-equity funds, so we require each fund to have a Wiesenberg objective code of growth, growth and income, equity income, growth with current income, maximum capital gains, small capitalization growth, or missing.[10] We also require an ICDI fund objective code of aggressive growth, growth and income, income, long-term growth, or missing.[11] Finally, we require that the investment objective code reported by Spectrum is aggressive growth, growth, growth and income, unclassified, or missing. All these criteria most notably exclude any bond funds, balanced and asset allocation funds, international funds, precious metals, and sector funds.[12]

We then look at the percentage of stocks in the portfolio as reported by CRSP, compute its time series average for each fund, and select the funds where this average is at least 80%

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[10] CRSP also has a variable which indicates the type of securities mainly held by a fund, but the data for it is so incomplete as to render the variable much less useful.

[11] The Wiesenberg objective code is generally available up to 1991 and missing in the later part of the sample, while the ICDI objective code is generally available starting in 1992 and missing in the earlier part of the sample.

[12] Many studies exclude sector funds because they may appear very active while in reality they simply invest according to their sector focus, perhaps even passively tracking a sector index. In our study we could include them, but this would require data on all the various sector indexes.

or missing.[13] Because this value is missing for many legitimate all-equity funds, we also separately compute the value of the stock holdings and their share of the total net assets of the fund.[14] Then for each fund we compute the time-series average of the equity share and require this to be at least 80%.[15] This confirms the all-equity focus of the remaining funds, in particular the ones with missing data items.

To compute Active Share, the report date of fund holdings has to match the date of index holdings. For virtually all of our sample this is not a problem: our index holdings are month-end but so are the fund holdings. However, we still drop the few non-month-end observations from our sample.[16]

Following Kacperczyk, Sialm, and Zheng (2006), we also address the incubation bias in fund returns by eliminating observations before the starting year reported by CRSP as well as the observations with a missing fund name in CRSP.

We require at least 100 trading days of daily return data for each fund in the 6 months immediately preceding its holdings report date. This is necessary for reasonably accurate estimates of tracking error, but it does decrease the number of funds in our sample by 5.4%. Naturally a larger fraction of funds is lost in the 1980s than in the later part of the sample.

Finally, we include only funds with equity holdings greater than $10 million.

After the aforementioned screens, our final sample consists of 2,650 funds in the period 1980-2003. For each year and each fund, the stock holdings are reported for an average of three separate report dates (rdate); the total number of such fund-rdate observations in the sample is 48,373.

3.4 Selection of Benchmark Index

Determining the benchmark index for a large sample of funds is not a trivial task. Since 1998, the SEC has required each fund to present a benchmark index in its prospectus. However, this information is not part of any publicly available mutual fund database, and

[13] Several all-equity funds have zeros for this variable, so we treat all zeros as missing values.

[14] We include only the stock holdings we are able to match to the CRSP stock files. Total net assets is preferably from Spectrum (as of the report date), then from CRSP mutual fund database (month-end value matching the report date); if neither value is available, we drop the observation from the sample.

[15] To reduce the impact of data errors, we first drop the observations where this share is less than 2% or greater than 200%. For example, some fund-rdates have incorrectly scaled the number of shares or the total net assets by a factor of 0.001.

[16] We require that the reported holdings date is within the last 4 calendar days of the month. This eliminates about 0.01% of the sample.

reading thousands of fund prospectuses is not a viable research strategy for us, so we need to estimate the benchmark from the data.[17]

Our solution is to compute the Active Share of a fund with respect to various benchmark indexes and to pick the index with the *lowest* Active Share. This index therefore has the greatest amount of overlap with the stock holdings of the fund.

Besides being intuitive, our methodology has a few distinct advantages. It cannot be completely off – if it assigns an incorrect benchmark, it happens only because the fund's portfolio actually does resemble that index more than any other index.[18,19] It also requires no return history and can be determined at any point in time as long as we know the portfolio holdings. Thus we can even use it to track a fund's style changes over time.[20]

4 Results: Active Management

In this section we present the empirical results for active management. We start with a cross-sectional analysis of fund characteristics for various types of funds, using the two dimensions of Active Share and tracking error. We then proceed to investigate the determinants of Active Share in a more general multivariate case. Finally, we discuss the time-series evolution of active management.

The benchmark indexes are selected from four large-cap indexes consisting of the S&P

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[17] These self-declared benchmarks might even lead to a bias: some funds could intentionally pick a misleading benchmark to increase their chances of beating the benchmark by a large margin. This is discussed in Sensoy (2006).

[18] We pick a handful of funds and manually compare our benchmark index assignments with the self-declared benchmark indexes in the funds' prospectuses. We find that our index selection process works reasonably well, although the most active funds of course will occasionally fluctuate between two overlapping indexes such as the S&P 500 and the Wilshire 5000.

[19] Contrast this to an alternative estimation method of regressing fund returns on various index returns and seeing which index has the highest correlation with the fund. Because the regression approach is based on noisy returns, we might by chance pick a benchmark index that has nothing to do with the fund's investment policy. Furthermore, we cannot run the regression for new funds with short return histories, or for funds that change their benchmark index over time.

For example, the 2002 Morningstar database uses the regression method and assigns the MSCI Europe index to Fidelity Fifty and MSCI Pacific index to CGM Focus, even though the funds are US equity funds with regional exposures of 98% and 100%, respectively, to the U.S. and Canada.

[20] An interesting alternative for defining a benchmark (or style) is presented by Brown and Goetzmann (1997).

500, Wilshire 5000, S&P500/Barra Growth, and S&P500/Barra Value, as well as two small-to-midcap indexes consisting of the Russell 2000 and Wilshire 4500.

4.1 Two-Dimensional Distribution of Funds

We first compile the distribution of all funds in our sample along the two dimensions of Active Share and tracking error, and then investigate how various fund characteristics are related to this distribution. The most recent year for which we have complete data is 2002, so we start our analysis with a snapshot of the cross-section of all funds that year. Table 1 presents the number of funds (Panel A) and the percentage of wealth invested (Panel B) as bivariate distributions and also as univariate marginal distributions along each dimension.

The distribution of funds clearly reveals a positive correlation between the two measures of active management. Yet within most categories of Active Share or tracking error, there is still considerable variation in the other measure. For example, a tracking error of 4-6% can be associated with an Active Share anywhere between 30% and 100%; and an Active Share of 70-80% can go with a tracking error ranging from 4% to over 16%.

4.1.1 Labeling the Types of Active Management

Different parts of the two-dimensional distribution of funds can be labeled according to the type of active management they represent, as illustrated in Figure 1. The boundaries of the regions are not clear-cut – only the pure index funds stand out as a rather disjoint group. However, we can come up with a rough approximation for the cutoffs with some back-of-the-envelope calculations. Individual fund prospectuses provide further evidence consistent with these approximate labels.

For example, if a fund has an equal-weighted portfolio of 50 stocks, each with annual idiosyncratic volatility of 30%, and its index beta is 1 but it has no other systematic risk, then it will have a tracking error of $\frac{30\%}{\sqrt{50}} = 4.2\%$. A similar portfolio of 100 stocks would produce a tracking error of $\frac{30\%}{\sqrt{100}} = 3.0\%$. These numbers represent essentially the lower bound for the tracking error of a diversified stock picker, so the cutoff should be set higher to allow for imperfect hedging of systematic risk. We suggest 8% as a reasonable boundary between a "diversified stock picker" and a "concentrated stock picker."

In terms of Active Share, the two aforementioned stock pickers, assuming that their investment universe was the S&P 500, would have Active Shares of about 90% and 80%.[21]

[21] This of course assumes for simplicity that the fund invests roughly according to the index proportions (the market capitalization of all shares or that of the public float).

For a small-stock fund, picking 200 stocks out of the Russell 2000 universe would still produce an Active Share of about 90%. Thus for an active stock picker, it seems that Active Share should be at least 80% or higher. To be conservative, we label a non-index fund a "closet indexer" only if its Active Share is less than 60% and its tracking error is less than 6%. Finally, a fund may be taking "factor bets" if its tracking error is greater than 6% while its Active Share remains below 80%.

For a fund to be classified as an "index fund," we require an Active Share of less than 20%.[22] Especially with a small-stock index such as the Russell 2000, a pure index fund can legitimately allow its holdings to deviate from the index by several percent in order to maintain low trading costs.

4.1.2 Are Smaller Funds More Active?

Funds with high Active Share indeed tend to be small while funds with low Active Share tend to be larger. Panel A in Table 2 shows that average fund size varies from less than $500 million for high Active Share funds to $2 billion and above for low Active Share funds. The relationship is generally monotonic when going from the most active funds to closet indexers: fund size is indeed negatively correlated with active management. Panel B confirms the same pattern in median fund size, although the magnitude is less pronounced. This suggests that the negative correlation between fund size and active management is stronger for large funds.

Figure 3 shows a scatter plot of Active Share as a function of fund size in 2002. Index funds have been eliminated from the graph. It also shows the average Active Share and the Active Share of a marginal dollar added to a fund's portfolio, both computed from a nonparametric kernel regression of Active Share on log fund size.[23]

The most interesting finding from the figure concerns the Active Share of a marginal dollar given to a fund. The Active Share of that marginal dollar stays constant at roughly 70% for all the way from a $10 million fund to a $1 billion fund, meaning that these small-to-medium-sized active funds tend to index approximately 30% of their assets. Above $1 billion in assets Active Share starts to fall more rapidly, first close to 60% at $10 billion and

[22] All funds with the word "index" (or "idx") in the CRSP fund name are also grouped as index funds. This takes into account those remaining index funds that track less common benchmark indexes.

[23] We use the Nadaraya-Watson kernel estimator with a Gaussian kernel and a bandwidth equal to 0.7. Other bandwidths give similar results.

then to anywhere between 50% and 60% for the largest funds, implying that the largest funds index about one half of their new assets.

However, we should be somewhat cautious when interpreting these results for an individual fund. There is substantial dispersion in Active Share for all fund sizes, so while the mean is descriptive of the entire population, many individual funds still deviate from it significantly in either direction.

By and large, these numbers confirm the conventional wisdom about smaller funds being more active. But for funds with a large-cap benchmark, size is not meaningfully related to active positions until the fund reaches about $1 billion in assets. Perhaps beyond this size, a fund begins to feel its own price impact and thus it tends to be slightly less aggressive in its active positions.

Figure 3 is based only on funds with a large-cap benchmark, thus excluding funds with small-cap and mid-cap benchmarks (Russell 2000 and Wilshire 4500). A similar plot for small-cap funds[24] reveals that their tendency to reduce Active Share starts already at smaller fund sizes. This is consistent with a larger price impact funds have in small-cap stocks.

4.1.3 Fund Size and Active Share: Testing Berk and Green (2004)

The theoretical model of Berk and Green (2004) predicts a strong relationship between fund size and active management. In the model, an active manager typically starts with the ability to generate a positive alpha. However, the manager also faces a linear price impact[25] which reduces his initial alpha. The manager chooses the size of his active portfolio to maximize his dollar alpha (which will be fully captured by the manager himself through fees). *All* the remaining assets in the fund will be indexed.

Our calculations for Active Share allow us to directly test this feature of the model. It implies that once a fund has reached some minimum size, the active share of a marginal dollar should be *zero*.

Figure 3 shows that marginal Active Share is instead almost equal to the average Active Share, about 70% for most funds. Even if we interpret the model loosely so that the additional "indexed" assets are actually half as active as the initial "active" assets, the marginal Active Share should still be no greater than 35% for large funds if it starts at 70%

[24] Available upon request.

[25] This in turn generates a quadratic dollar cost.

for small funds. *Qualitatively* it is still true that Active Share decreases with fund size, but *quantitatively* it is very hard to reconcile this result with the model.

The regression evidence in Section 4.2 further shows that recent inflows of assets similarly fail to have any economically meaningful impact on the Active Share of a fund.

In fact, Figure 3 suggests an alternative story: When a fund receives inflows, instead of indexing all the new assets, it simply scales up its existing positions. This too is a simplification, but it would match the data on active positions much better than Berk and Green (2004).

4.1.4 Fees and Closet Indexing

Table 3 shows the expense ratio of all funds across Active Share and tracking error in 2002. The expense ratio includes operating expenses and 12b-1 fees, where both items are obtained from CRSP. The equal-weighted expense ratio (Panel A) across all funds in the sample is 1.43% per year, while the value-weighted expense ratio (Panel B) is lower at 1.05%.

Index funds in particular tend to have low expense ratios. The equal-weighted average of the lowest Active Share and tracking error group is 0.55% per year while the value-weighted average is only 0.23%, which indicates that especially the largest index funds have low fees.

Correspondingly, active (non-index) funds have higher fees than the entire population. The funds with the highest Active Share charge an average expense ratio of 1.59%, or 1.47% with value weights. The other active fund groups exhibit slightly lower fees for lower Active Shares, but the differences are economically small for these intermediate ranges of Active Share. For example, the value-weighted expense ratio for funds with Active Share between 30% and 60% is about 1% per year, which is much closer to the 1.23% of the second-highest Active Share group than the 0.24% of the purest index funds.

In fact, if fees are a proxy for how much effort a manager claims to put into the active management of his portfolio, then these results support the hypothesis about the existence of closet indexing. In other words, active funds seem to charge similar fees regardless of their Active Share, so the ones that actually tend to hug the benchmark index are most likely doing it without acknowledgement to their investors.

4.1.5 Portfolio Turnover

Portfolio turnover[26] for the average mutual fund is 95% per year (Table 4, Panel A). Average turnover for fund groups varies from 13% for index funds to 195% for one of the highest Active Share groups. The value-weighted turnover (Panel B) is consistently lower and has a population mean of 61%.

The table reveals a surprisingly weak positive correlation between Active Share and turnover. Almost all non-index fund groups have roughly comparable turnover averages, while the index funds clearly stand out from the crowd with their lower turnover. This would be consistent with closet indexers masking their passive strategies with portfolio turnover, i.e. a relatively high frequency of trading their small active positions.

Tracking error turns out to predict turnover better than Active Share, implying that the strategies generating high tracking error also involve more frequent trading. For example, a sector rotator who tries to time different sectors of the economy and who switches across sectors several times a year would generate both high tracking error and high portfolio turnover.

4.1.6 Industry Concentration and Industry-Level Active Share

So far we have computed Active Share at the level of individual stocks. However, we can just as easily compute Active Share at the level of industry portfolios. This "industry-level Active Share" indicates the magnitude of active positions in entire industries or sectors of the economy. If we contrast this measure with Active Share, we can see how much each fund takes bets on entire industries relative to its bets on individual stocks.

We assign each stock to one of ten industry portfolios. The industries are defined as in Kacperczyk, Sialm, and Zheng (2005).

Table 5 shows the industry-level Active Share across the Active Share and tracking error groups. Within a tracking error group (e.g., 4-6% or 8-10%), industry-level Active Share is relatively constant even as stock-level Active Share varies from 50% to 100%. Within an Active Share group (e.g., 60-70% or 80-90%), industry-level Active Share increases significantly with tracking error.

This confirms our conjecture that high tracking error often arises from active bets on industries, whereas active stock selection without industry exposure allows tracking error to remain relatively low.

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[26] CRSP defines the "turnover ratio" of a fund over the calendar year as the "minimum of aggregate purchases of securities or aggregate sales of securities, divided by the average Total Net Assets of the fund."

4.2 Determinants of Active Share

To complement the univariate results, we run a panel regression of Active Share on a variety of explanatory variables (Table 6). Since some variables are reported only annually, we pick the fund-year as an observation; when a fund has multiple holdings report dates during the year, we choose the last one.

As independent variables we use tracking error, turnover, expense ratio, and the number of stocks, which are all under the fund manager's control, as well as fund size, fund age, manager tenure, prior inflows,[27] prior benchmark returns, and prior benchmark-adjusted returns, which are beyond the manager's direct control. We also include year dummies to capture any fixed effect within the year. Because both Active Share and many of the independent variables are persistent over time, we cluster standard errors by fund.

We find that tracking error is by far the strongest predictor of Active Share: it explains about 16-20% of the variance in Active Share (the year dummies explain about 4%). Economically this means that a 5% increase in annualized tracking error increases Active Share by about 7%. This is significant, but it still leaves a great deal of unexplained variance in Active Share.

Fund size also matters for Active Share, although the relationship is not linear. The expense ratio is statistically significant, but the effect is economically small: a 1% increase in expense ratio increases Active Share by only 1.8%. In a similar fashion, turnover has some statistical but no economic significance. Interestingly, fund age and manager tenure act in opposite directions, where long manager tenure is associated with higher Active Share.

Fund inflows over the prior one to three years do not matter for Active Share. This may appear surprising, but it only means that when managers get inflows, they quickly reach their target Active Share, and thus prior fund flows add no explanatory power beyond current fund size. This result is not affected by the presence of control variables (such as prior returns) in the regression.

Benchmark-adjusted returns over the prior three years significantly predict Active Share. Later on (Section 5) we will also find the reverse, i.e. that Active Share predicts future returns, and furthermore that Active Share is highly persistent over time (Section 4.3.3). Hence, the regression result here could simply mean that skilled fund managers choose high Active Share and persistently perform well.

The return on the benchmark index from year $t-3$ to $t-1$ predicts lower Active Share.

[27] Cumulative percentage inflow over the prior one year, and the preceding two years, winsorized at the 1st and 99th percentiles.

In other words, funds are most active when their benchmark index has gone down in the past few years *relative* to the other indexes. Note that the regression includes year dummies, so the effect is truly cross-sectional and not explained by an overall market reaction.[28]

At a more general level, the regression results reveal that Active Share is not easy to explain with other variables – even the broadest specification produced an R^2 of only 34%. Hence, it is indeed a new dimension of active management which should be measured separately and cannot be conveniently subsumed by other variables.

4.3 Active Management over Time

4.3.1 Active Share

Table 7 shows the time-series evolution of active management from 1980 to 2003, as measured by Active Share, and it is illustrated in Figure 4. There is a clear trend toward lower Active Share. For example, the percentage of assets under management with Active Share less than 60% went up from 1.5% in 1980 to 40.7% in 2003. Correspondingly, the percentage of fund assets with Active Share greater than 80% went down from 58% in 1980 to 28% in 2003.

The fraction of index funds before 1990 tends to be less than 1% of funds and of their total assets but grows rapidly after that. Similarly, there are very few non-index funds with Active Share below 60% until about 1987, but since then we see a rapid increase in such funds throughout the 1990s, reaching over 20% of funds and over 30% of their assets in 2000-2001. This suggests that closet indexing has only been an issue since the 1990s – before that, almost all mutual funds were truly active.

4.3.2 Fund-Level Active Share vs. Aggregate Active Share

Figure 5 shows three measures of average Active Share across funds. The first two measures are the equal-weighted Active Share and the value-weighted Active Share across funds. The third measure aggregates all the stock positions across individual funds into one large aggregate fund and computes the Active Share of that aggregate portfolio. To keep this aggregation meaningful, we cannot mix funds with different benchmark indexes, so we only use funds for which the S&P 500 is the closest benchmark.

[28] In fact the t-statistics on the benchmark index returns are likely to be somewhat overstated because the benchmark index returns (common to all stocks with the same benchmark) will also capture some benchmark-specific differences in Active Share.

If funds never take active positions against each other, the value-weighted average Active Share should equal the aggregate Active Share. If instead they only trade against each other, e.g. if these funds were the only investors in the market, the aggregate Active Share should sum up to zero. The figure shows that about one half of those active positions actually cancel out each other: in the 1980s, the aggregate Active Share falls to about 40% from a value-weighted average of 80%, while in the most recent years the aggregate value has been about 30% out of a fund-level average of 60%.

This means that an investor randomly selecting an active mutual fund can expect to get a "useful" Active Share of no more than 30%. The remaining active bets are just noise between funds which will not contribute to an average alpha – such active bets are worth paying for only if some funds systematically earn a positive alpha at the expense of other funds *and* if an investor can actually identify such funds. But the aggregate value to all investors in actively managed mutual funds can only arise from their *aggregate* Active Share.[29]

4.3.3 Persistence of Fund-Level Active Share

The Active Share of a fund seems to be highly persistent. Figure 6 uses the sample of all non-index funds from 1990 to 2003. Each year we rank all funds into Active Share deciles. For all the stocks in each decile, we compute the average decile rank one to five years later. The decile ranking does not change much from year to year: the top decile ranking falls from 10 to 9.69 and the bottom decile rises from 1 to 1.27. Even over five years, the top decile rank falls only to 8.88 from 10 while the bottom decile rank rises to 1.97 from 1. A decile transition matrix over one year tells a similar story with the diagonal elements ranging from about 40% to 75%. Hence, Active Share this year is a very good predictor of Active Share next year and thereafter.

5 Results: Fund Performance

We now turn to an analysis of how active management is related to benchmark-adjusted fund returns. We look at both "net returns," which we define as the investors' returns after all fees and transaction costs, and "gross returns," which we define as the hypothetical

[29] Equilibrium asset pricing implications due to the presence of financial institutions such as mutual funds have been explored in a theoretical model by Petajisto (2005). Our empirical estimate for aggregate Active Share can also be used to calibrate that model and to confirm its current parameter selection as reasonable.

returns on the disclosed portfolio holdings.[30] The gross returns help us identify whether any categories of funds have skill in selecting portfolios that outperform their benchmarks, and the net returns help us determine whether any such skill survives the fees and transaction costs of those funds.

From prior studies, we know that the average fund slightly outperforms the market before expenses and underperforms after expenses. Since outperformance can only arise from active management, we hypothesize that there are cross-sectional differences in fund performance: the more active the fund, the higher its average gross return. While this may sound obvious, it is *not* clear how this performance relationship shows up across the two dimensions of active management (i.e., whether Active Share matters more than tracking error), nor is it clear that the relationship is linear. For net returns the relationship is even more ambiguous a priori because we do not know how fees and transaction costs are related to the two dimensions of active management.

We pick 1990-2003 as our sample period. This is motivated by Table 7, which confirms that almost all funds were very active in the 1980s. In contrast, starting around 1990 we begin to see some heterogeneity in the distribution, with a meaningful mass of active (non-index) funds having a modest Active Share of 60% or less. It is this cross-sectional dispersion in active management that we conjecture will show up as dispersion in fund performance.

Because pure index funds are conceptually different from active funds, we conduct the entire performance analysis only for active (non-index) funds.

5.1 Fund Performance: Active Share vs. Tracking Error

The sample consists of monthly returns for each fund. A fund is included in the sample in a given month if it has reported its holdings in the previous six months. Each month we sort funds first into Active Share quintiles and then further into tracking error quintiles. We compute the equal-weighted benchmark-adjusted return within each of the 25 fund portfolios and then take the time series average of these returns over the entire sample period.[31]

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[30] The same conventions were followed by e.g. Wermers (2000).

[31] Since we have so many portfolios of funds, we do not use value weights. In some years the largest funds each account for about 4% of all fund assets, so a value-weighted portfolio return could end up being essentially the return on just one fund.

To address questions about small funds driving the results, we later sort funds explicitly on size.

Panel A in Table 8 shows the average benchmark-adjusted net returns on these fund portfolios. When we regress the monthly benchmark-adjusted returns on the four-factor model of Carhart (1997), thus controlling for exposure to size, value, and momentum, we obtain the alphas shown in Panel B.

The average fund loses to its benchmark index by 0.33% per year, and the loss increases to 0.91% when controlling for the four-factor model. Tracking error does not help us much when picking funds: the marginal distribution across all tracking error quintiles shows consistently negative benchmark-adjusted returns and alphas. If anything, going from low to high tracking error actually *hurts* performance, although the effect is not statistically significant.

In contrast, Active Share *does* help us pick funds. The difference in benchmark-adjusted return between the highest and lowest Active Share quintiles is 2.81% per year ($t = 2.90$), which further increases to 3.26% ($t = 3.66$) with the four-factor model. This difference is positive and economically significant within all tracking error quintiles. An investor should clearly avoid the lowest three Active Share quintiles and instead pick from the highest Active Share quintile. Funds in the highest Active Share quintile beat their benchmarks by 1.39% (1.49% with the four-factor model) which is an economically significant point estimate but just falls short of being statistically significant.

Panels A and B in Table 9 report the corresponding results for gross returns. Again the high Active Share funds outperform the low Active Share funds with both economical and statistical significance. The benchmark-adjusted returns indicate that the lowest Active Share funds essentially match their benchmark returns while the highest Active Share funds beat their benchmarks by 2.71% per year ($t = 2.37$). The four-factor model reduces the performance of all fund portfolios but does not change the difference in returns across Active Share and still leaves an economically significant 2.00% outperformance for the highest Active Share funds. Tracking error again reveals, if anything, a negative relationship to fund performance.

The evidence in these two panels suggests that the funds with low Active Share and high tracking error tend to do worst, both in terms of net and gross returns, which implies that factor bets are not rewarded in the market and actually tend to *destroy* value for fund investors. Closet indexers (low Active Share, low tracking error) also exhibit no ability and tend to lose money after fees and transaction costs.

The best performers are concentrated stock pickers (high Active Share, high tracking error), followed by diversified stock pickers (high Active Share, low tracking error). Both

groups appear to have stock-picking ability, and even after fees and transaction costs the most active of them beat their benchmarks.

If we reverse the order of sorting, the results are essentially unchanged: Active Share is related to returns even within tracking error quintiles, while tracking error does not have such predictive power. A separate subperiod analysis of 1990-1996 and 1997-2003 produces very similar point estimates for both seven-year periods, so the results seem consistent over the entire sample period.

Our results complement the work of Kacperczyk, Sialm, and Zheng (2005) who find that mutual funds with concentrated industry bets tend to outperform. When we compute their Industry Concentration Index, we see that it is highest among the concentrated stock pickers and lowest among the closet indexers, with the diversified stock picks and factor bets in the middle. As our paper adds a second dimension of active management, we can further distinguish between these middle groups of funds. This is important for performance because the diversified stock picks outperform and factor bets underperform; consequently, Active Share turns out to be the dimension of active management that best predicts performance. We discuss the comparison in more detail in section 5.6.

Table 10 shows some sample statistics for the portfolios of funds. The median fund size for each portfolio, averaged across the 168 months in the sample, ranges from about $100M to $400M.

We also compute the four-factor betas for the portfolios when their benchmark-adjusted returns are regressed on the market excess return, SMB, HML, and UMD (momentum portfolio).[32] All four betas are small on average (0.02, 0.11, 0.02, and 0.02, respectively), which means that funds collectively do not exhibit a tilt toward any of the four sources of systematic risk. Across Active Share groups, the only pattern seems to be a very slight bias against momentum in the highest Active Share funds. However, across tracking error groups there is more variation in systematic risk: funds with high tracking error tend to be more exposed to market beta, small stocks, and growth stocks, with no preference for momentum. This exposure seems natural because systematic risk is precisely what produces a high tracking error for a fund.

5.2 Fund Performance: Univariate Sort on Active Share

Table 11 shows the results of a finer sort by Active Share into fund deciles. We report gross and net benchmark-adjusted returns as well as their alphas relative to the CAPM,

[32] Results available upon request.

the Fama-French three-factor model, and the four-factor model. In terms of gross returns, the top two deciles consistently outperform their benchmarks, the top decile by about 2-3% per year, while the bottom three deciles consistently underperform by about 0-1% per year. Almost all the top decile point estimates and the differences between the top and bottom deciles are statistically significant. Net returns exhibit a similar pattern but are about 1% lower throughout the table, and the differences between the top and bottom deciles are all statistically significant.

5.3 Fund Size and Active Share

Since fund size is related to both active management and fund returns, we next investigate how size interacts with Active Share when predicting fund returns. We sort funds into quintiles first by fund size and then by Active Share. The results are reported in Tables 12 and 13.

Controlling for size, Active Share again predicts both net and gross fund returns. Within the smallest fund size quintile, the difference between the top and bottom Active Share quintiles ranges from 4.29% to 5.46% per year. Even within the next two size quintiles it varies from 2.32% to 3.52% and maintains its statistical significance. For the largest two fund quintiles the difference ranges from 0.78% to 1.64% per year but is no longer statistically significant.

Excluding the largest 40% of funds, the highest Active Share funds exhibit economically significant stock-picking ability: their stock picks outperform their benchmarks by about 2-4% per year. Net of fees and transaction costs, they still outperform by about 1-3% per year. In contrast, among largest 40% of funds even the most active do not add value to their investors, at least after fees and transaction costs.

Fund size alone is also related to fund returns: going from the smallest to the largest size quintile decreases returns by 0.95% to 1.70% with some statistical significance. This is consistent with the findings of Chen, Hong, Huang, and Kubik (2004). However, fund size is helpful mostly in identifying the funds that underperform (the largest funds); even the smallest funds on average still do not create value for their investors. To identify funds that actually outperform, we also need to look at Active Share.

5.4 Active Share and Performance Persistence

If some managers have skill, we would expect persistence in their performance. This persistence should be strongest among the most active funds. To investigate this, we sort

funds into quintiles first by Active Share and then by each fund's benchmark-adjusted gross return over the prior one year. We report the results in tables 14 and 15.

The benchmark-adjusted returns of the most active funds show remarkable persistence: the spread between the prior-year winners and losers is 5.69% per year in net and 6.80% in gross returns. In contrast, the least active funds have a spread of only 2.63% in net and 2.85% in gross returns. However, controlling for the four-factor model, much of this persistence goes away: the spread between prior-year winners and losers is now only 1.96% to 2.48% for the most active funds and 1.53% to 1.90% for the least active funds. This is consistent with the results of Carhart (1997), where some but not all return persistence disappears with the four-factor adjustment. In contrast, the return spread across Active Share quintiles is not diminished at all by the four-factor model.

From an investor's point of view, the prior one-year winners within the highest Active Share quintile seem very attractive, with a benchmark-adjusted 3.69% net return and a 2.29% alpha with respect to the four-factor model. In terms of gross returns, the funds perform even better, with a benchmark-adjusted return of 5.57% and a four-factor alpha of 3.02%. The performance of this small subset of funds is also statistically significant, supporting the existence of managerial skill.

If we run the same analysis for only the bottom size quintile of funds, the top managers emerge as even more impressive.[33] Their benchmark-adjusted net returns are 6.68% ($t = 3.76$), or 5.63% ($t = 3.66$) after controlling for the four-factor model. This suggests that investors should pick active funds based on all three measures: Active Share, fund size, and prior one-year return.

5.5 Fund Performance in a Multivariate Regression

To better isolate the effect of each variable on returns, we run a pooled panel regression of fund returns on all the explanatory variables (Table 16). The values for the independent variables are chosen at the end of each year, while the dependent variable is the benchmark-adjusted net return on a fund over the following year.[34]

The list of explanatory variables includes Active Share, tracking error, turnover, expense ratio, the number of stocks, fund size, fund age, manager tenure, prior inflows, prior benchmark returns, and prior benchmark-adjusted returns. Since we are explain-

[33] The full table of results available upon request.

[34] Using the gross return instead of the net return yields very similar results. We use the net return primarily because it is a cleaner measure.

ing benchmark-adjusted returns where the benchmark return has already been subtracted, we do not include year dummies in the regression. Because our previous results suggest persistence in both fund returns and the explanatory variables, we cluster standard errors by fund. The last specification also shows standard errors clustered by year.

Active Share comes up as a highly significant predictor of future fund returns, with t-statistics ranging from 7.28 to 8.29. Controlling for other variables, a 10% increase in Active Share increases fund net returns by 0.66% over the following year, which is also economically significant. Rather than being subsumed by other variables, the predictive power of Active Share actually goes up when those other variables are added.

Unlike Active Share, tracking error produces a statistically insignificant and small negative effect on returns.

Size and past returns emerge as the most significant other predictors of returns. Size enters in a nonlinear but economically significant way, showing that larger funds tend to underperform. Prior one-year benchmark-adjusted return predicts higher future returns, with a 10% outperformance producing a 0.93% outperformance the following year. However, it is somewhat startling that benchmark-adjusted returns two and three years ago predict returns *negatively* today.

However, the t-statistics on prior returns are likely to be overstated – when standard errors are clustered by year, the t-statistics decrease dramatically. This could arise from correlated *active* exposures by funds – e.g., if two funds both have a persistent growth bias relative to their benchmark index, then they will tend to underperform or outperform their index at the same time, creating a similar time-series pattern of returns. As a result, their error terms in the return regression will be correlated. Hence, clustering by year (the last column in the table) is likely to be more appropriate when investigating the impact of prior returns.

For Active Share, it is much less likely that the error terms are correlated across funds, especially since the four-factor betas of funds do not show any meaningful factor bias across the different Active Share groups. Therefore it seems reasonable not to cluster errors by year when Active Share is the only explanatory variable.

Fund age is a slight negative predictor of returns, but only if the manager is new. Controlling for other characteristics, a fund that ages together with the manager does not suffer from lower returns.

5.6 Comparison of All Measures of Active Management

Table 17 shows a comparison of Active Share with other measures of active management. We compare Active Share with tracking error, industry-level Active Share, Industry Concentration Index, stock concentration index, and turnover. Industry-level Active Share is computed similarly to Active Share, except that it replaces individual stocks with 10 industry portfolios (as in Section 4.1.6). The Industry Concentration Index is computed as in Kacperczyk, Sialm, and Zheng (2005) (also Section A.1 of this paper), except that the benchmark index is selected following the methodology of our paper. The stock concentration index is just like the Industry Concentration Index, except that it uses individual stocks rather than industry portfolios. Standard errors are clustered by fund.

In the univariate regressions without control variables, Active Share, industry-level Active Share, and Industry Concentration Index all come up as significant, while tracking error, stock concentration index, and turnover are not significant. When all the variables are included in the same regression, Active Share dominates the other variables, especially after we add the control variables of Table 16. In fact, Active Share is the only variable that is highly significant and remains so in all the regression specifications.

6 Conclusions

Traditionally the degree of active management is quantified along just one dimension: tracking error relative to a benchmark index. This paper points out that active management should instead be measured in *two* dimensions: tracking error and Active Share. Tracking error measures the volatility of portfolio *return* around a benchmark index, whereas Active Share measures the deviation of portfolio *holdings* from the holdings of the benchmark index. This new methodology also allows us to identify different *types* of active management: diversified stock picks, concentrated stock picks, factor bets, closet indexing, and pure indexing.

Applying this methodology to all-equity mutual funds, we find significant dispersion along both dimensions of active management. We also confirm the popular belief that small funds are more active, while a significant fraction of large funds are closet indexers. However, for funds with large-cap benchmarks this pattern emerges only gradually after $1bn in assets – before that, fund size does not matter much for the fraction of active positions in the portfolio.

There has been a significant shift from active to passive management over the 1990s.

Part of this is due to index funds, but an even larger part is due to closet indexers and a general tendency of funds to mimic the holdings of benchmark indexes more closely. Furthermore, about half of all active positions at the fund level cancel out *within* the mutual fund sector, thus making the aggregate mutual fund positions even less active.

Active management, as measured by Active Share, significantly predicts fund performance. Funds with the highest Active Share significantly outperform their benchmarks both before and after expenses, while funds with the lowest Active Share underperform after expenses. In contrast, active management as measured by tracking error does *not* predict higher returns – if anything, using this traditional measure makes active funds seem to perform worse.

The relationship between Active Share and fund returns exists for all fund sizes but it is stronger within the bottom three fund size quintiles than within the top two quintiles. There is also some persistence in fund returns, particularly within the funds with the highest Active Share. From an investor's point of view, funds with the highest Active Share, smallest assets, and best one-year performance seem very attractive even after fees and transaction costs, outperforming their benchmarks by about 6% per year.

A possible explanation for the performance results is that there are enough small inefficiencies in the pricing of individual stocks to allow the most active stock pickers to generate a positive alpha, and this is the dimension captured by Active Share. In contrast, fund managers in general do not seem to have timing ability with larger factor portfolios, so the high tracking-error funds (with factor bets and concentrated stock picks) do not add value relative to the low tracking-error funds (diversified stock pickers and closet indexers).

The general reason why we can find strong performance results seems clear: our methodology allows us to distinguish between different *types* of active funds as well as to focus on the ones that are *truly active*. Most existing literature has treated all non-index funds as one homogeneous group, so our methodology could help researchers refine and potentially improve their existing results. Furthermore, our approach will allow researchers to investigate the risk-taking and incentives of mutual fund managers from a new and economically meaningful perspective.

References

[1] Asness, C., 2004, "An Alternative Future," *Journal of Portfolio Management*, 30th Anniversary Issue, 94-103.

[2] Berk, J.B. and R.C. Green, 2004, "Mutual Fund Flows and Performance in Rational Markets," *Journal of Political Economy*, vol. 112, no. 6, 1269-1295.

[3] Bollen, N.P.B. and J.A. Busse, 2004, "Short-Term Persistence in Mutual Fund Performance," *Review of Financial Studies*, vol. 18, no. 2, 569-597.

[4] Brown, S.J. and W.N. Goetzmann, 1995, "Performance Persistence," *Journal of Finance*, vol. 50, no. 2, 679-698.

[5] Brown, S.J. and W.N. Goetzmann, 1997, "Mutual Fund Styles," *Journal of Financial Economics*, vol. 43, 373-399.

[6] Carhart, M., 1997, "On Persistence in Mutual Fund Returns," *Journal of Finance*, vol. 52, no. 1, 57-82.

[7] Chen, J., H. Hong, M. Huang, and J.D. Kubik, 2004, "Does Fund Size Erode Performance? Organizational Diseconomies and Active Money Management," *American Economic Review*, forthcoming.

[8] Cohen, R.B., J.D. Coval, and L. Pastor, 2005, "Judging Fund Managers by the Company They Keep," *Journal of Finance*, vol. 60, no. 3, 1057-1096.

[9] Daniel, K., M. Grinblatt, S. Titman, and R. Wermers, 1997, "Measuring Mutual Fund Performance with Characteristic-Based Benchmarks," *Journal of Finance*, vol. 52, no. 3, 1035-1058.

[10] Frazzini, A., 2005, "The Disposition Effect and Underreaction to News," *Journal of Finance*, forthcoming.

[11] Goetzmann, W.N., Z. Ivkovic, and K.G. Rouwenhorst, 2001, "Day Trading International Mutual Funds: Evidence and Policy Solutions," *Journal of Financial and Quantitative Analysis*, vol. 36, no. 3, 287-309.

[12] Grinblatt, M. and S. Titman, 1989, "Mutual Fund Performance: An Analysis of Quarterly Portfolio Holdings," *Journal of Business*, vol. 62, no. 3, 393-416.

[13] Grinblatt, M. and S. Titman, 1993, "Performance Measurement without Benchmarks: An Examination of Mutual Fund Returns," *Journal of Business*, vol. 66, no. 1, 47-68.

[14] Grinold, R.C. and R.N. Kahn, 1999, *Active Portfolio Management*, 2nd Edition, McGraw-Hill.

[15] Gruber, M.J., 1996, "Another Puzzle: The Growth in Actively Managed Mutual Funds," *Journal of Finance*, vol. 51, no. 3, 783-810.

[16] Jensen, M.C., 1968, "The Performance of Mutual Funds in the Period 1945-1964," *Journal of Finance*, vol. 23, no. 2, 389-416.

[17] Jorion, P., 2003, "Portfolio Optimization with Tracking-Error Constraints," *Financial Analysts Journal*, vol. 59, no. 5, 70-82.

[18] Kacperczyk, M.T., C. Sialm, and L. Zheng, 2005, "On Industry Concentration of Actively Managed Equity Mutual Funds," *Journal of Finance*, vol. 60, no. 4, 1983-2011.

[19] Kacperczyk, M.T., C. Sialm, and L. Zheng, 2006, "Unobserved Actions of Mutual Funds," working paper.

[20] Mamaysky, H., M. Spiegel, and H. Zhang, 2006, "Improved Forecasting of Mutual Fund Alphas and Betas," Yale ICF working paper.

[21] Pastor, L. and R.F. Stambaugh, 2002, "Mutual Fund Performance and Seemingly Unrelated Assets," *Journal of Financial Economics*, vol. 63, 315–349.

[22] Petajisto, A., 2005, "Why Do Demand Curves for Stocks Slope Down?" Yale ICF working paper.

[23] Roll, R., 1992, "A Mean/Variance Analysis of Tracking Error," *Journal of Portfolio Management*, vol. 18, no. 4, 13-22.

[24] Sensoy, B.A., 2006, "Incentives and Mutual Fund Benchmarks," working paper.

[25] Wermers, R., 1999, "Mutual Fund Herding and the Impact on Stock Prices," *Journal of Finance*, vol. 54, no. 2, 581-622.

[26] Wermers, R., 2000, "Mutual Fund Performance: An Empirical Decomposition into Stock-Picking Talent, Style, Transactions Costs, and Expenses," *Journal of Finance*, vol. 55, no. 4, 1655-1695.

[27] Wermers, R., 2003, "Are Mutual Fund Shareholders Compensated for Active Management 'Bets'?," working paper.

Appendix A: Other Measures of Active Management

A.1 Industry Concentration Index

Kacperczyk, Sialm, and Zheng (2005) investigate a related question about the industry concentration of mutual funds. They call their measure the Industry Concentration Index, which they define as

$$\text{Industry Concentration Index} = \sum_{i=1}^{I} \left(w_{fund,i} - w_{index,i}\right)^2,$$

where $w_{fund,i}$ and $w_{index,i}$ are the weights of industry i in the fund and in the index, and they sum up across I industry portfolios (instead of N individual stocks). They also use the CRSP value-weighted index as their only benchmark. A more fundamental difference between Active Share and the Industry Concentration Index arises from the fact that the latter uses squared weights. For our study, we prefer to use Active Share for three reasons.

First, Active Share has a convenient economic interpretation: it immediately tells us the percentage of a fund that is different from the benchmark index. If the weights are squared, the numerical value loses this interpretation, and its main purpose is then just to rank funds relative to each other.

Second, different funds have different benchmark indexes, yet Active Share can still be easily applied when comparing any two funds: a 90% Active Share means essentially the same thing whether the benchmark is the S&P 500 (with 500 stocks) or the Russell 2000 (with 2,000 stocks). If we square the weights, we lose the ability to make such easy comparisons across indexes because the number of stocks begins to matter. For example, if a fund with the Russell 2000 as a benchmark is likely to have more stocks in its portfolio than a fund with the S&P 500 as a benchmark because the Russell 2000 investment universe contains four times as many stocks, then the typical active weight in a stock will be smaller and thus the sum of squares will be smaller.[35]

Third, the squared weights make the Industry Concentration Index something of a

[35] As an illustration, assume that the Russell 2000 and S&P 500 are equal-weighted indexes. Assume we have an S&P 500 fund which leaves out one half of the index stocks (the "bottom half") and doubles the its portfolio weight on the other half. Assume we have a Russell 2000 fund that does the same thing with its benchmark. Both of these funds have an active share of 50%, but the concentration index is $\sum_{i=1}^{500}\left(\frac{1}{500}\right)^2 = \frac{1}{500}$ for the former and $\sum_{i=1}^{2000}\left(\frac{1}{2000}\right)^2 = \frac{1}{2000}$ for the latter. Hence, scaling the number of stocks in the benchmark by a factor of 4 also scaled up the concentration index by a factor of 4.

hybrid between Active Share and tracking error.[36] However, to get a more complete picture of active management, we need to quantify it along *two* separate dimensions. We therefore pick two measures which are as different from each other as possible, and here Active Share and tracking error seem to satisfy that objective.

A.2 Turnover

Portfolio turnover has also been suggested as a measure of active management. For our purposes it has some significant shortcomings and plays only a minor role in our tests. First, turnover heavily depends on many other things besides the degree of active management. For example, stock pickers with a long holding period will have a low turnover, whereas stock pickers who predict short-term stock returns will have a high turnover. Even index funds may have significant turnover if the underlying index has significant turnover – this is a concern for example with the Russell 2000 index funds. Second, fund inflows and outflows can generate additional turnover which does not tell us anything about the active management of the fund. Third, a fund manager could hypothetically generate unnecessary trades to increase his portfolio turnover and thus appear more active. If turnover is widely used as a measure of active management, a closet indexer may have incentives to engage in such behavior, thus rendering the measure less informative.

Appendix B: Tables

[36] Assume a fund has no systematic risk except for an index beta of 1. Its tracking error is then given by

$$\sigma\left(R_{fund}-R_{index}\right)=\sigma\left(\sum_{i=1}^{N}\left(w_{fund,i}-w_{index,i}\right)R_i\right)=\sqrt{\sum_{i=1}^{N}\left(w_{fund,i}-w_{index,i}\right)^2\sigma_{\varepsilon_i}^2}.$$

If the stocks (or industry portfolios) have a similar idiosyncratic volatility $\sigma_{\varepsilon_i}^2$, then tracking error will be approximately proportional to the square root of the Industry Concentration Index.

Table 1: **All-equity mutual funds in the US in 2002**, sorted by the two dimensions of active management. Active share is defined as the percentage of a fund's portfolio holdings that differ from the fund's benchmark index. It is computed based on Spectrum mutual fund holdings data and index composition data for S&P500, Russell 2000, Wilshire 5000, Wilshire 4500, BARRA Growth, and BARRA Value indexes. Tracking error is defined as the annualized standard deviation of a fund's return in excess of its benchmark index return. It is computed based on daily fund returns and daily index returns over a six-month period before the corresponding portfolio holdings are reported. To include only all-equity funds, every fund classified by CRSP as balanced or asset allocation has been removed from the sample. Also sector funds have been eliminated. If a cell has less than 5 observations (fund-dates), it is shown as empty.

Panel A: Number of mutual funds

	Tracking error (% per year)									
Active share (%)	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	>16	All
90-100			26	147	177	99	56	27	40	573
80-90			34	73	57	37	19	5	17	243
70-80		2	49	83	52	21	7	5	9	228
60-70		30	91	78	29	8	2		2	241
50-60		52	52	41	12	3	2			161
40-50	3	43	31	12	2					92
30-40	9	14	15							42
20-30	3	4	5							13
10-20	10									11
0-10	67	6								74
All	93	153	303	437	329	168	87	37	70	1678

Panel B: Wealth invested in mutual funds ($bn)

	Tracking error (% per year)									
Active share (%)	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	>16	All
90-100			16.7	60.5	73.7	31.9	26.3	8.9	12.1	230.1
80-90			26.1	57.7	58.6	30.5	10.0	5.3	12.7	201.8
70-80		0.4	40.6	84.0	64.5	15.6	15.2	1.2	3.4	224.9
60-70		16.5	135.9	76.6	34.7	16.1	0.9		0.9	281.6
50-60		83.0	84.0	56.7	22.4	8.6	3.3			258.5
40-50	2.1	71.0	80.6	13.3	0.5					167.5
30-40	42.1	43.7	20.7							121.4
20-30	0.9	3.9	2.0							6.8
10-20	9.2									9.3
0-10	214.5	10.7								226.5
All	269.1	230.1	406.6	363.9	255.0	102.6	56.2	15.5	29.1	1,728.2

Table 2: **Net asset values for all-equity mutual funds in 2002**, sorted by the two dimensions of active management. The measures of active management are computed as before. To include only all-equity funds, every fund classified by CRSP as balanced or asset allocation has been removed from the sample. Also sector funds have been eliminated. To be reported in the table, a statistic must be based on at least 5 funds.

Panel A: Mean of net asset value ($M)										
	Tracking error (% per year)									
Active share (%)	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	>16	All
90-100			631	412	415	322	468	331	305	402
80-90			760	790	1,038	818	531	1,138	727	829
70-80			837	1,012	1,238	745	2,150	265	362	987
60-70		553	1,493	980	1,208	2,052				1,170
50-60		1,613	1,628	1,392	1,843					1,602
40-50		1,635	2,607	1,139						1,821
30-40	4,675	3,051	1,417							2,885
20-30										
10-20	924									861
0-10	3,190	1,887								3,044
All	2,897	1,500	1,344	833	774	610	643	420	416	1,030
Panel B: Median of net asset value ($M)										
	Tracking error (% per year)									
Active share (%)	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	>16	All
90-100			242	177	156	120	128	92	91	144
80-90			285	182	166	122	104	148	50	168
70-80			189	205	187	180	405	148	42	178
60-70		249	298	226	303	190				248
50-60		402	166	225	85					234
40-50		406	280	147						263
30-40	877	384	267							286
20-30										
10-20	119									119
0-10	647	459								601
All	534	380	236	193	169	137	130	96	72	190

Table 3: **Total expense ratios for all-equity mutual funds in 2002**, sorted by the two dimensions of active management. The measures of active management are computed as before. Total expense ratio is defined as the sum of operating expenses and 12b-1 fees. To include only all-equity funds, every fund classified by CRSP as balanced or asset allocation has been removed from the sample. Also sector funds have been eliminated. To be reported in the table, a statistic must be based on at least 5 funds.

Panel A: Equal-weighted total expense ratio (%)										
	Tracking error (% per year)									
Active share (%)	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	>16	All
90-100			1.42	1.55	1.55	1.67	1.65	1.65	1.75	1.59
80-90			1.28	1.59	1.57	1.54	1.70	1.80	1.96	1.57
70-80			1.50	1.51	1.62	1.71	1.75	1.87	1.86	1.58
60-70		1.10	1.22	1.36	1.51	1.59				1.31
50-60		1.24	1.28	1.46	1.34					1.32
40-50		1.30	1.36	1.33						1.31
30-40	1.02	1.17	1.05							1.13
20-30										
10-20	0.61									0.63
0-10	0.55	0.36								0.55
All	0.62	1.18	1.29	1.50	1.55	1.63	1.67	1.70	1.82	1.43
Panel B: Value-weighted total expense ratio (%)										
	Tracking error (% per year)									
Active share (%)	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	>16	All
90-100			1.40	1.50	1.38	1.59	1.48	1.61	1.55	1.47
80-90			1.13	1.31	1.19	1.28	1.28	1.33	0.97	1.23
70-80			1.31	1.25	1.24	1.60	1.11	1.35	1.06	1.27
60-70		1.09	0.97	1.21	1.36	1.04				1.10
50-60		1.07	0.99	1.24	0.85					1.06
40-50		1.12	1.25	1.67						1.22
30-40	0.87	0.86	0.94							0.86
20-30										
10-20	0.43									0.44
0-10	0.23	0.23								0.24
All	0.35	1.00	1.09	1.28	1.25	1.37	1.29	1.49	1.25	1.05

Table 4: **Annual portfolio turnover for all-equity mutual funds in 2002**, sorted by the two dimensions of active management. The measures of active management are computed as before. Turnover is defined by CRSP as the maximum of annual stock purchases and annual stock sales, divided by the fund's total net assets. To include only all-equity funds, every fund classified by CRSP as balanced or asset allocation has been removed from the sample. Also sector funds have been eliminated. To be reported in the table, a statistic must be based on at least 5 funds.

Panel A: Equal-weighted turnover (%)

	Tracking error (% per year)									
Active share (%)	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	>16	All
90-100			107.2	106.0	117.7	123.3	128.6	194.9	141.3	121.6
80-90			69.0	105.4	95.8	122.1	155.3	158.1	139.3	107.7
70-80			67.6	82.5	93.0	137.5	64.6	87.9	100.1	87.1
60-70		55.6	71.1	83.0	85.7	78.3				75.5
50-60		63.0	74.9	92.8	77.3					77.2
40-50		70.6	64.5	65.1						66.2
30-40	63.9	99.9	53.2							98.3
20-30										
10-20	40.0									39.4
0-10	13.1	30.0								14.5
All	23.7	65.6	71.8	94.9	105.4	121.9	126.5	175.2	154.1	94.8

Panel B: Value-weighted turnover (%)

	Tracking error (% per year)									
Active share (%)	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	>16	All
90-100			72.9	83.5	86.3	102.0	86.3	110.5	92.5	88.0
80-90			48.8	72.5	50.2	75.1	103.9	86.4	123.7	68.5
70-80			56.9	62.0	83.0	86.6	118.9	36.3	27.2	72.1
60-70		54.7	62.3	98.5	85.4	60.4				74.6
50-60		60.4	60.0	84.6	35.6					63.6
40-50		86.2	50.5	80.4						68.0
30-40	24.0	37.5	53.9							36.2
20-30										
10-20	12.6									13.0
0-10	7.3	30.8								8.5
All	10.7	61.9	58.0	78.0	72.5	82.3	95.4	96.3	103.5	61.3

Table 5: **Industry-level Active Share for all-equity mutual funds in 2002**, sorted by the two dimensions of active management. The measures of active management are computed as before. All stocks are assigned into 10 industry portfolios derived from the 49 Fama-French industry portfolios, and industry-level Active Share is computed using these portfolios (instead of individual stocks) as assets. To include only all-equity funds, every fund classified by CRSP as balanced or asset allocation has been removed from the sample. Also sector funds have been eliminated. To be reported in the table, a statistic must be based on at least 5 funds.

Panel A: Equal-weighted industry-level Active Share (%)

	Tracking error (% per year)									
Active share (%)	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	All
90-100			19.3	22.2	25.8	30.1	33.4	36.7	43.4	27.8
80-90			16.6	21.9	27.2	28.4	30.4	33.8	39.4	25.5
70-80			17.3	21.5	24.4	25.7	25.6	27.0	37.1	22.4
60-70		11.8	15.4	19.9	22.1	23.9				17.7
50-60		9.3	13.7	18.2	20.7					14.2
40-50		7.4	13.7	16.0						10.9
30-40	4.8	7.2	11.5							8.6
20-30										
10-20	2.7									2.7
0-10	0.8	0.7								0.8
All	1.8	8.7	15.4	21.0	25.2	28.7	31.4	35.0	40.3	21.0

Panel B: Value-weighted industry-level Active Share (%)

	Tracking error (% per year)									
Active share (%)	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	All
90-100			22.2	22.9	27.4	31.9	37.2	33.1	39.7	28.5
80-90			18.9	24.6	28.5	26.9	31.0	30.0	33.3	26.3
70-80			20.2	22.0	23.3	29.1	21.0	30.2	35.8	22.7
60-70		11.4	17.2	19.3	23.3	20.0				18.4
50-60		9.2	14.9	18.9	17.7					14.7
40-50		9.6	13.0	17.4						11.8
30-40	9.4	11.2	12.4							10.8
20-30										
10-20	1.9									1.9
0-10	0.8	1.1								0.8
All	2.2	9.4	16.2	20.9	25.1	27.5	30.7	31.8	35.9	17.1

Table 6: **Determinants of Active Share for all-equity mutual funds in 1992-2003.** The dependent variable is Active Share for each fund-year observation. All the variables are computed as before. Turnover and expense ratio are annualized values. Fund age and fund manager tenure are measured in years. Fund inflows and returns are all cumulative percentages. Index return represents the benchmark assigned to each fund, and return over the index represents a fund's net return (after all expenses) in excess of its benchmark index. Index funds are excluded from the sample. Since the expense ratio and manager tenure are missing before 1992, we limit all specifications to the same time period. Year fixed-effects are included in all specifications. The t-statistics (in parentheses) are based on standard errors clustered by fund.

	(1)	(2)	(3)	(4)	(5)	(6)
Tracking error	1.6039	1.5209	1.4114	1.3633	1.3082	
	(20.18)	(19.51)	(18.06)	(16.91)	(16.11)	
Turnover			0.0060		0.0066	
			(2.08)		(2.37)	
Expenses			1.8005	1.9717	1.7522	3.3569
			(4.29)	(4.63)	(4.00)	(7.74)
log_{10}(TNA)		0.0764	0.0721	0.0532	0.0646	0.0419
		(3.84)	(3.62)	(2.51)	(3.09)	(1.88)
$(log_{10}(\text{TNA}))^2$		-0.0215	-0.0203	-0.0170	-0.0185	-0.0176
		(-5.57)	(-5.24)	(-4.28)	(-4.69)	(-4.05)
Number of stocks					-0.0001	
					(-1.97)	
Fund age					-0.0005	-0.0003
					(-2.55)	(-1.08)
Manager tenure					0.0026	0.0032
					(5.10)	(5.02)
Inflow, t-1 to t					0.0001	-0.0030
					(0.03)	(-1.05)
Inflow, t-3 to t-1					0.0015	0.0012
					(2.00)	(2.38)
Return over index, t-1 to t				0.1023	0.1017	-0.0395
				(8.61)	(7.90)	(-3.34)
Return over index, t-3 to t-1				0.1082	0.1010	0.1521
				(8.91)	(7.92)	(15.40)
Index return, t-1 to t					-0.0156	0.2864
					(-1.07)	(16.32)
Index return, t-3 to t-1				-0.2043	-0.2055	-0.2382
				(-20.78)	(-20.21)	(-24.57)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
N	11,082	11,082	10,150	8,810	8,701	8,770
R^2	0.225	0.250	0.263	0.324	0.336	0.200

Table 7: **All-equity mutual funds in the US in 1980-2003**, sorted by Active Share. Active Share is computed as before. To include only all-equity funds, every fund classified by CRSP as balanced or asset allocation has been removed from the sample. Also sector funds have been eliminated.

Panel A: Percentage of all-equity mutual funds for given level of Active Share

	Active share (%)					Total number
Year	0-20	20-40	40-60	60-80	80-100	of funds
2003	4.1	2.8	13.3	26.7	53.2	2,028
2002	5.1	3.3	15.1	27.9	48.6	1,678
2001	5.3	3.2	15.3	27.2	49.0	1,657
2000	4.9	4.7	16.2	26.6	47.6	1,501
1999	4.0	2.0	14.0	26.8	53.2	1,402
1998	4.0	1.2	9.2	26.2	59.5	1,286
1997	3.9	0.7	6.7	26.8	61.9	1,171
1996	3.9	0.7	5.5	28.2	61.8	974
1995	4.1	0.9	4.6	29.7	60.7	872
1994	4.6	0.6	3.2	26.2	65.5	768
1993	4.3	0.6	2.8	18.7	73.6	650
1992	3.0	0.7	2.3	21.6	72.5	500
1991	2.3	0.9	3.7	24.6	68.6	428
1990	1.2	1.5	3.9	23.9	69.5	340
1989	0.9	1.2	2.4	17.5	78.2	348
1988	1.0	1.2	2.2	15.8	79.8	300
1987	0.7	0.4	1.7	15.8	81.5	285
1986	0.4		0.4	12.5	86.7	252
1985	0.5		1.0	13.7	84.8	219
1984	0.6		1.7	17.3	80.5	181
1983	0.6		1.8	17.9	79.6	163
1982	0.7		2.6	21.2	75.5	139
1981	0.8		2.3	21.3	75.6	132
1980	0.8		1.3	18.6	79.3	126

Panel B: Percentage of all-equity mutual fund assets for given level of Active Share

	Active share (%)					Total assets
Year	0-20	20-40	40-60	60-80	80-100	($bn)
2003	13.4	7.2	20.2	31.8	27.5	1,954
2002	13.6	7.4	24.7	29.3	25.0	1,728
2001	13.9	9.6	21.5	32.4	22.7	1,973
2000	13.0	10.8	18.8	36.6	20.8	2,335
1999	13.5	6.1	24.3	34.0	22.3	1,996
1998	11.3	3.1	22.6	33.4	29.6	1,505
1997	9.2	0.4	16.7	39.8	33.9	1,121
1996	7.7	0.4	10.8	41.8	39.3	774
1995	5.7	0.5	5.9	49.2	38.8	540
1994	5.4	0.5	5.0	44.4	44.7	370
1993	5.4	0.4	5.0	36.8	52.4	311
1992	4.7	0.9	2.9	42.2	49.3	216
1991	3.6	0.9	4.2	44.0	47.3	166
1990	2.3	1.3	9.2	40.5	46.8	119
1989	1.3	1.2	11.0	34.0	52.5	119
1988	1.1	1.1	9.6	33.3	54.9	96
1987	0.9	0.2	5.2	35.8	58.0	108
1986	0.6		0.1	31.3	68.0	82
1985	0.6		0.5	29.1	69.8	61
1984	0.5		1.0	34.5	64.0	47
1983	0.4		1.0	35.0	63.5	44
1982	0.4		2.4	44.2	53.1	26
1981	0.4		2.4	45.6	51.7	27
1980	0.4		1.1	40.4	58.1	25

Table 8: **Net equal-weighted alphas for all-equity mutual funds in 1990-2003**, sorted by the two dimensions of active management. The measures of active management are computed as before. Net fund returns are the returns to a fund investor after fees and transaction costs. Index funds are excluded from the sample. The table shows annualized returns, followed by t-statistics (in parentheses) based on White's standard errors.

Panel A: Benchmark-adjusted return

Active Share	Tracking error quintile						
quintile	Low	2	3	4	High	All	High-Low
High	1.20	0.60	1.45	2.04	1.63	1.39	0.42
	(1.06)	(0.53)	(1.40)	(1.56)	(0.75)	(1.51)	(0.16)
4	1.00	0.83	0.44	-0.31	0.02	0.39	-0.98
	(1.16)	(1.01)	(0.46)	(-0.21)	(0.01)	(0.40)	(-0.34)
3	0.44	-0.54	-0.85	-0.93	-1.31	-0.64	-1.75
	(0.64)	(-0.67)	(-0.93)	(-0.73)	(-0.57)	(-0.67)	(-0.71)
2	-1.17	-0.39	-1.18	-1.44	-2.73	-1.38	-1.56
	(-2.24)	(-0.51)	(-1.36)	(-1.28)	(-1.77)	(-1.73)	(-1.02)
Low	-1.20	-1.13	-0.91	-1.62	-2.21	-1.41	-1.01
	(-4.49)	(-2.71)	(-1.65)	(-2.44)	(-2.40)	(-2.88)	(-1.23)
All	0.05	-0.12	-0.21	-0.45	-0.92	-0.33	-0.97
	(0.10)	(-0.22)	(-0.33)	(-0.47)	(-0.54)	(-0.48)	(-0.51)
High-Low	2.40	1.73	2.36	3.67	3.84	2.81	
	(2.06)	(1.38)	(1.94)	(2.90)	(2.10)	(2.90)	

Panel B: Four-factor alpha of benchmark-adjusted return

Active Share	Tracking error quintile						
quintile	Low	2	3	4	High	All	High-Low
High	1.64	0.69	1.35	2.26	1.49	1.49	-0.15
	(1.76)	(0.72)	(1.50)	(1.74)	(0.72)	(1.60)	(-0.07)
4	0.45	0.18	-0.52	-1.29	-1.50	-0.54	-1.95
	(0.59)	(0.22)	(-0.53)	(-0.97)	(-0.88)	(-0.59)	(-1.12)
3	-0.19	-1.08	-1.67	-2.40	-2.83	-1.63	-2.64
	(-0.28)	(-1.43)	(-2.21)	(-2.39)	(-1.97)	(-2.21)	(-1.75)
2	-1.46	-0.70	-1.78	-2.72	-3.93	-2.12	-2.48
	(-2.57)	(-1.01)	(-2.37)	(-3.03)	(-3.36)	(-3.28)	(-2.30)
Low	-1.36	-1.33	-1.31	-2.08	-2.72	-1.76	-1.35
	(-5.33)	(-3.92)	(-2.95)	(-3.65)	(-3.63)	(-4.47)	(-2.05)
All	-0.19	-0.45	-0.79	-1.25	-1.89	-0.91	-1.71
	(-0.38)	(-0.86)	(-1.35)	(-1.48)	(-1.59)	(-1.47)	(-1.54)
High-Low	3.01	2.03	2.67	4.34	4.21	3.26	
	(3.28)	(2.09)	(2.72)	(3.49)	(2.14)	(3.66)	

Table 9: **Gross equal-weighted alphas for all-equity mutual funds in 1990-2003**, sorted by the two dimensions of active management. The measures of active management are computed as before. Gross fund returns are the returns on a fund's portfolio and do not include any fees or transaction costs. Index funds are excluded from the sample. The table shows annualized returns, followed by t-statistics (in parentheses) based on White's standard errors.

Panel A: Benchmark-adjusted return							
Active Share	Tracking error quintile						
quintile	Low	2	3	4	High	All	High-Low
High	1.92	1.69	3.28	3.04	3.59	2.71	1.66
	(1.71)	(1.46)	(2.95)	(1.93)	(1.40)	(2.37)	(0.62)
4	2.20	2.02	1.59	0.61	1.13	1.51	-1.07
	(2.19)	(2.00)	(1.40)	(0.34)	(0.37)	(1.16)	(-0.34)
3	2.01	1.38	0.86	1.10	-0.01	1.08	-2.02
	(2.74)	(1.59)	(0.82)	(0.76)	(0.00)	(0.98)	(-0.76)
2	0.56	0.77	0.54	0.29	-1.30	0.17	-1.87
	(1.06)	(1.10)	(0.59)	(0.25)	(-0.78)	(0.20)	(-1.15)
Low	0.12	0.43	0.44	0.15	-0.84	0.06	-0.96
	(0.45)	(1.04)	(0.82)	(0.22)	(-0.86)	(0.12)	(-1.08)
All	1.36	1.26	1.34	1.03	0.51	1.11	-0.85
	(2.31)	(1.97)	(1.71)	(0.88)	(0.25)	(1.26)	(-0.41)
High-Low	1.80	1.26	2.85	2.89	4.43	2.65	
	(1.66)	(1.04)	(2.55)	(2.21)	(2.22)	(2.71)	
Panel B: Four-factor alpha of benchmark-adjusted return							
Active Share	Tracking error quintile						
quintile	Low	2	3	4	High	All	High-Low
High	1.30	0.96	2.40	2.26	3.03	2.00	1.74
	(1.31)	(0.91)	(2.35)	(1.55)	(1.44)	(1.88)	(0.87)
4	0.77	0.53	-0.14	-1.17	-0.93	-0.20	-1.70
	(0.87)	(0.54)	(-0.13)	(-0.80)	(-0.49)	(-0.18)	(-0.93)
3	0.72	0.19	-0.85	-1.11	-2.17	-0.64	-2.89
	(0.93)	(0.23)	(-0.96)	(-1.03)	(-1.47)	(-0.77)	(-1.85)
2	-0.31	-0.22	-0.69	-1.67	-3.11	-1.20	-2.80
	(-0.50)	(-0.33)	(-0.83)	(-1.87)	(-2.83)	(-1.78)	(-2.66)
Low	-0.29	-0.18	-0.32	-0.64	-1.89	-0.66	-1.60
	(-1.05)	(-0.47)	(-0.65)	(-1.05)	(-2.78)	(-1.58)	(-2.65)
All	0.43	0.26	0.08	-0.47	-1.01	-0.14	-1.45
	(0.74)	(0.41)	(0.11)	(-0.50)	(-0.82)	(-0.19)	(-1.28)
High-Low	1.59	1.14	2.72	2.90	4.93	2.66	
	(1.72)	(1.11)	(2.78)	(2.30)	(2.62)	(2.91)	

Table 10: **Sample statistics for portfolios used in the performance analysis in 1990-2003.** Each month funds are sorted into quintiles by Active Share and tracking error (sequentially and in that order). For each portfolio of funds we compute the mean statistic across the 168 months in the sample. We only include domestic all-equity mutual funds, thus excluding e.g. balanced and asset allocation funds. Also sector funds and index funds are excluded from the sample.

Panel A: Number of funds							Panel B: Median of net asset value ($M)						
Active Share	Tracking error quintile						Active Share	Tracking error quintile					
quintile	Low	2	3	4	High	All	quintile	Low	2	3	4	High	All
High	36	36	36	36	36	181	High	137	100	92	83	97	97
4	36	36	36	36	36	181	4	268	196	210	183	171	195
3	36	36	36	36	36	181	3	195	215	207	216	202	189
2	36	36	36	36	36	181	2	280	286	248	245	271	251
Low	36	36	36	36	36	180	Low	360	426	423	324	251	312
All	179	182	182	182	180	904	All	214	193	183	172	171	184
Panel C: Mean of Active Share (%)							Panel D: Mean of tracking error (%)						
Active Share	Tracking error quintile						Active Share	Tracking error quintile					
quintile	Low	2	3	4	High	All	quintile	Low	2	3	4	High	All
High	97	97	97	98	97	97	High	6.4	7.9	9.3	11.2	16.6	10.3
4	93	93	93	93	93	93	4	5.4	6.9	8.2	10.0	14.6	9.0
3	85	85	86	86	86	85	3	5.0	6.3	7.4	9.0	14.0	8.4
2	75	75	76	76	76	76	2	4.2	5.2	6.1	7.4	11.2	6.8
Low	50	60	62	63	63	60	Low	2.5	3.5	4.3	5.3	9.1	4.9
All	80	82	83	83	83	82	All	4.7	6.0	7.1	8.6	13.1	7.9

Table 11: **Equal-weighted alphas for all-equity mutual funds in 1990-2003**, sorted by active management as measured by Active Share. Active Share is computed as before. Gross fund returns are the returns on a fund's portfolio and do not include any fees or transaction costs. Net fund returns are the returns to a fund investor after fees and transaction costs. Index funds are excluded from the sample. The table shows annualized returns, followed by t-statistics (in parentheses) based on White's standard errors.

	Gross returns				Net returns			
Active Share	Benchmark-	CAPM	3-factor	4-factor	Benchmark-	CAPM	3-factor	4-factor
decile	adjusted	alpha	alpha	alpha	adjusted	alpha	alpha	alpha
High	2.97	2.44	1.73	2.87	1.34	1.58	1.02	2.11
	(2.53)	(2.18)	(1.58)	(2.70)	(1.25)	(1.53)	(1.01)	(2.19)
9	2.46	1.29	1.36	1.11	1.58	1.17	1.24	0.97
	(1.88)	(1.18)	(1.30)	(0.95)	(1.59)	(1.24)	(1.37)	(0.95)
8	1.53	0.28	0.78	-0.20	0.64	0.07	0.55	-0.40
	(1.18)	(0.27)	(0.83)	(-0.19)	(0.64)	(0.08)	(0.66)	(-0.43)
7	1.59	0.43	0.56	-0.12	0.12	-0.36	-0.20	-0.77
	(1.22)	(0.40)	(0.59)	(-0.11)	(0.12)	(-0.38)	(-0.25)	(-0.86)
6	0.89	0.01	-0.54	-0.96	-0.85	-1.11	-1.60	-1.93
	(0.75)	(0.01)	(-0.67)	(-1.08)	(-0.87)	(-1.16)	(-2.23)	(-2.42)
5	1.25	0.72	-0.12	-0.30	-0.37	-0.36	-1.17	-1.26
	(1.22)	(0.74)	(-0.17)	(-0.36)	(-0.39)	(-0.39)	(-1.77)	(-1.69)
4	0.37	-0.07	-0.84	-1.23	-1.26	-1.16	-1.88	-2.15
	(0.41)	(-0.08)	(-1.20)	(-1.68)	(-1.48)	(-1.37)	(-2.85)	(-3.11)
3	-0.01	-0.44	-0.81	-1.10	-1.53	-1.45	-1.81	-2.07
	(-0.01)	(-0.60)	(-1.35)	(-1.77)	(-2.06)	(-1.95)	(-3.02)	(-3.31)
2	0.13	-0.19	-0.43	-0.75	-1.40	-1.31	-1.55	-1.85
	(0.22)	(-0.33)	(-0.87)	(-1.46)	(-2.44)	(-2.33)	(-3.36)	(-3.99)
Low	0.08	-0.22	-0.14	-0.42	-1.36	-1.37	-1.23	-1.48
	(0.20)	(-0.64)	(-0.42)	(-1.32)	(-3.43)	(-3.45)	(-3.59)	(-4.40)
All	1.13	0.43	0.16	-0.11	-0.31	-0.43	-0.66	-0.88
	(1.30)	(0.57)	(0.24)	(-0.15)	(-0.46)	(-0.65)	(-1.22)	(-1.43)
High-Low	2.90	2.67	1.87	3.29	2.70	2.95	2.24	3.60
	(2.55)	(2.41)	(1.72)	(3.32)	(2.26)	(2.55)	(2.05)	(3.57)

Table 12: **Net equal-weighted alphas for all-equity mutual funds in 1990-2003**, sorted by fund size and Active Share (sequentially and in that order). Active Share is computed as before. Net fund returns are the returns to a fund investor after fees and transaction costs. Index funds are excluded from the sample. The table shows annualized returns, followed by t-statistics (in parentheses) based on White's standard errors.

Panel A: Benchmark-adjusted return							
Active Share	Fund size quintile						
quintile	Low	2	3	4	High	All	High-Low
High	2.72	0.96	1.17	0.19	-0.31	0.95	-3.03
	(1.98)	(0.89)	(1.30)	(0.18)	(-0.37)	(1.11)	(-1.94)
4	2.87	0.59	1.12	-0.12	-0.78	0.73	-3.65
	(2.98)	(0.50)	(0.94)	(-0.11)	(-0.64)	(0.74)	(-3.18)
3	0.28	0.50	-0.65	-1.10	-1.32	-0.46	-1.60
	(0.29)	(0.51)	(-0.56)	(-1.12)	(-1.34)	(-0.50)	(-2.28)
2	-1.79	-1.67	-1.77	-0.72	-1.03	-1.40	0.76
	(-1.97)	(-2.14)	(-1.96)	(-0.77)	(-1.45)	(-1.83)	(1.11)
Low	-1.72	-1.61	-1.58	-1.27	-1.24	-1.48	0.48
	(-2.78)	(-3.09)	(-2.96)	(-2.27)	(-2.61)	(-2.96)	(1.31)
All	0.48	-0.25	-0.34	-0.60	-0.94	-0.33	-1.41
	(0.70)	(-0.34)	(-0.47)	(-0.78)	(-1.23)	(-0.48)	(-2.28)
High-Low	4.44	2.57	2.75	1.46	0.93	2.43	
	(2.80)	(2.29)	(2.90)	(1.44)	(1.29)	(2.73)	
Panel B: Four-factor alpha of benchmark-adjusted return							
Active Share	Fund size quintile						
quintile	Low	2	3	4	High	All	High-Low
High	3.67	0.99	1.57	-0.11	-0.78	1.07	-4.46
	(3.14)	(0.91)	(1.74)	(-0.11)	(-0.97)	(1.23)	(-4.02)
4	1.60	-0.48	0.43	-1.14	-1.82	-0.29	-3.41
	(1.69)	(-0.40)	(0.39)	(-1.08)	(-2.23)	(-0.32)	(-3.81)
3	-0.71	-0.50	-1.87	-2.20	-2.01	-1.46	-1.30
	(-0.91)	(-0.59)	(-2.03)	(-2.45)	(-2.69)	(-1.96)	(-1.89)
2	-2.18	-2.27	-2.78	-1.63	-1.77	-2.12	0.41
	(-2.69)	(-3.38)	(-3.93)	(-1.95)	(-3.24)	(-3.38)	(0.70)
Low	-1.79	-1.77	-1.95	-1.71	-1.56	-1.75	0.23
	(-3.21)	(-3.76)	(-4.49)	(-3.57)	(-3.98)	(-4.20)	(0.61)
All	0.12	-0.81	-0.92	-1.35	-1.59	-0.91	-1.70
	(0.18)	(-1.17)	(-1.41)	(-1.88)	(-2.79)	(-1.46)	(-3.84)
High-Low	5.46	2.76	3.52	1.60	0.78	2.82	
	(4.32)	(2.40)	(4.03)	(1.66)	(1.04)	(3.32)	

Table 13: **Gross equal-weighted alphas for all-equity mutual funds in 1990-2003**, sorted by fund size and Active Share (sequentially and in that order). Active Share is computed as before. Gross fund returns are the returns on a fund's portfolio and do not include any fees or transaction costs. Index funds are excluded from the sample. The table shows annualized returns, followed by t-statistics (in parentheses) based on White's standard errors.

Panel A: Benchmark-adjusted return							
Active Share	Fund size quintile						
quintile	Low	2	3	4	High	All	High-Low
High	3.95	2.42	2.59	1.61	1.80	2.48	-2.15
	(2.85)	(1.76)	(2.31)	(1.21)	(1.53)	(2.25)	(-1.39)
4	3.32	1.38	1.84	1.42	0.94	1.78	-2.38
	(2.72)	(0.91)	(1.23)	(1.00)	(0.63)	(1.35)	(-2.10)
3	1.96	1.97	0.68	0.76	0.51	1.18	-1.45
	(1.84)	(1.66)	(0.49)	(0.68)	(0.46)	(1.08)	(-1.94)
2	-0.34	-0.17	-0.11	0.70	0.30	0.08	0.64
	(-0.37)	(-0.21)	(-0.12)	(0.73)	(0.40)	(0.09)	(0.99)
Low	-0.33	0.10	0.00	-0.02	0.27	0.00	0.61
	(-0.55)	(0.19)	(-0.01)	(-0.04)	(0.58)	(0.01)	(1.62)
All	1.72	1.13	1.01	0.90	0.77	1.11	-0.95
	(2.12)	(1.21)	(1.07)	(0.94)	(0.83)	(1.26)	(-1.57)
High-Low	4.29	2.32	2.60	1.64	1.53	2.47	
	(2.97)	(1.91)	(2.62)	(1.52)	(1.67)	(2.68)	
Panel B: Four-factor alpha of benchmark-adjusted return							
Active Share	Fund size quintile						
quintile	Low	2	3	4	High	All	High-Low
High	3.74	1.82	2.30	0.64	0.52	1.81	-3.22
	(2.93)	(1.54)	(2.12)	(0.57)	(0.54)	(1.81)	(-2.79)
4	1.32	-0.57	0.26	-0.13	-0.90	0.00	-2.22
	(1.22)	(-0.42)	(0.21)	(-0.10)	(-0.95)	(0.00)	(-2.58)
3	0.15	0.29	-1.28	-1.04	-0.97	-0.57	-1.12
	(0.18)	(0.30)	(-1.17)	(-1.05)	(-1.20)	(-0.69)	(-1.57)
2	-1.39	-1.41	-1.70	-0.96	-0.97	-1.29	0.42
	(-1.65)	(-1.94)	(-2.37)	(-1.27)	(-1.61)	(-1.93)	(0.72)
Low	-0.80	-0.55	-0.67	-0.79	-0.37	-0.64	0.42
	(-1.41)	(-1.24)	(-1.46)	(-1.64)	(-0.92)	(-1.49)	(1.05)
All	0.61	-0.10	-0.22	-0.45	-0.54	-0.14	-1.15
	(0.84)	(-0.12)	(-0.28)	(-0.55)	(-0.81)	(-0.19)	(-2.58)
High-Low	4.54	2.37	2.97	1.44	0.90	2.44	
	(3.48)	(2.14)	(3.01)	(1.49)	(1.10)	(2.79)	

Table 14: **Net equal-weighted alphas for all-equity mutual funds in 1990-2003**, sorted by Active Share and prior one-year return (sequentially and in that order). The prior return on a fund is measured as its benchmark-adjusted gross return over the previous 12 months. Only funds with at least 9 months of such returns are included. Active Share is computed as before. Net fund returns are the returns to a fund investor after fees and transaction costs. Index funds are excluded from the sample. The table shows annualized returns, followed by t-statistics (in parentheses) based on White's standard errors.

Panel A: Benchmark-adjusted return							
Active Share	Prior 1-year return quintile						
quintile	Low	2	3	4	High	All	High-Low
High	-2.00	1.07	1.40	2.53	3.69	1.34	5.69
	(-0.93)	(0.73)	(1.17)	(2.30)	(2.31)	(1.39)	(1.79)
4	-2.10	-1.51	-0.18	0.59	3.54	0.08	5.64
	(-1.11)	(-1.16)	(-0.17)	(0.44)	(1.71)	(0.08)	(1.72)
3	-2.27	-2.69	-0.60	-0.22	1.80	-0.80	4.07
	(-1.58)	(-2.55)	(-0.64)	(-0.21)	(0.95)	(-0.86)	(1.63)
2	-2.64	-2.16	-1.33	-0.69	0.54	-1.25	3.17
	(-2.47)	(-2.55)	(-1.42)	(-0.71)	(0.37)	(-1.54)	(1.81)
Low	-2.46	-1.74	-1.41	-1.08	0.17	-1.30	2.63
	(-3.45)	(-3.58)	(-3.05)	(-1.98)	(0.19)	(-2.66)	(2.39)
All	-2.29	-1.41	-0.43	0.23	1.95	-0.39	4.25
	(-1.77)	(-1.70)	(-0.65)	(0.28)	(1.34)	(-0.58)	(1.89)
High-Low	0.46	2.80	2.81	3.61	3.52	2.64	
	(0.25)	(1.88)	(2.19)	(3.28)	(2.86)	(2.59)	
Panel B: Four-factor alpha of benchmark-adjusted return							
Active Share	Prior 1-year return quintile						
quintile	Low	2	3	4	High	All	High-Low
High	0.33	1.67	1.01	1.54	2.29	1.36	1.96
	(0.18)	(1.33)	(0.86)	(1.45)	(1.87)	(1.43)	(0.83)
4	-1.37	-1.42	-1.47	-1.34	1.10	-0.90	2.46
	(-0.71)	(-1.03)	(-1.56)	(-1.48)	(0.82)	(-0.99)	(0.97)
3	-2.46	-2.84	-1.68	-1.45	-0.67	-1.83	1.79
	(-1.78)	(-2.74)	(-2.06)	(-1.82)	(-0.56)	(-2.47)	(0.90)
2	-2.94	-2.77	-1.77	-1.75	-1.01	-2.04	1.93
	(-2.79)	(-3.06)	(-2.05)	(-2.40)	(-1.13)	(-3.15)	(1.37)
Low	-2.32	-2.01	-1.82	-1.61	-0.79	-1.71	1.53
	(-3.30)	(-4.38)	(-4.85)	(-3.55)	(-1.31)	(-4.45)	(1.60)
All	-1.75	-1.48	-1.15	-0.92	0.19	-1.02	1.94
	(-1.38)	(-1.71)	(-1.83)	(-1.56)	(0.21)	(-1.64)	(1.14)
High-Low	2.65	3.68	2.83	3.15	3.09	3.08	
	(1.80)	(3.08)	(2.51)	(2.97)	(2.54)	(3.43)	

Table 15: **Gross equal-weighted alphas for all-equity mutual funds in 1990-2003**, sorted by Active Share and prior one-year return (sequentially and in that order). The prior return on a fund is measured as its benchmark-adjusted gross return over the previous 12 months. Only funds with at least 9 months of such returns are included. Active Share is computed as before. Gross fund returns are the returns on a fund's portfolio and do not include any fees or transaction costs. Index funds are excluded from the sample. The table shows annualized returns, followed by t-statistics (in parentheses) based on White's standard errors.

Panel A: Benchmark-adjusted return							
Active Share	Prior 1-year return quintile						
quintile	Low	2	3	4	High	All	High-Low
High	-1.23	2.23	3.02	4.02	5.57	2.73	6.80
	(-0.51)	(1.35)	(2.45)	(3.12)	(2.71)	(2.30)	(1.91)
4	-0.91	0.11	1.36	2.12	4.81	1.51	5.72
	(-0.43)	(0.08)	(1.09)	(1.32)	(1.95)	(1.19)	(1.58)
3	-0.75	-0.77	1.13	1.36	3.60	0.91	4.35
	(-0.47)	(-0.67)	(1.08)	(1.12)	(1.67)	(0.85)	(1.60)
2	-1.36	-0.63	-0.25	0.95	2.58	0.26	3.94
	(-1.16)	(-0.71)	(-0.30)	(0.96)	(1.70)	(0.31)	(2.13)
Low	-1.15	-0.40	-0.02	0.49	1.70	0.13	2.85
	(-1.56)	(-0.75)	(-0.05)	(0.90)	(1.93)	(0.25)	(2.55)
All	-1.08	0.11	1.04	1.79	3.66	1.11	4.74
	(-0.73)	(0.11)	(1.31)	(1.85)	(2.13)	(1.27)	(1.92)
High-Low	-0.09	2.63	3.04	3.53	3.86	2.60	
	(-0.04)	(1.73)	(2.58)	(3.19)	(2.50)	(2.56)	
Panel B: Four-factor alpha of benchmark-adjusted return							
Active Share	Prior 1-year return quintile						
quintile	Low	2	3	4	High	All	High-Low
High	0.55	2.22	1.98	2.07	3.02	1.97	2.48
	(0.27)	(1.59)	(1.65)	(1.74)	(2.03)	(1.81)	(0.93)
4	-0.56	-0.38	-0.52	-0.78	1.05	-0.23	1.62
	(-0.27)	(-0.25)	(-0.48)	(-0.76)	(0.73)	(-0.22)	(0.60)
3	-1.43	-1.54	-0.63	-0.80	0.25	-0.83	1.68
	(-0.95)	(-1.37)	(-0.70)	(-0.93)	(0.20)	(-1.02)	(0.80)
2	-1.99	-1.67	-1.39	-0.72	0.14	-1.12	2.12
	(-1.86)	(-1.79)	(-1.91)	(-1.01)	(0.15)	(-1.68)	(1.50)
Low	-1.31	-1.03	-0.74	-0.39	0.26	-0.65	1.56
	(-1.87)	(-2.12)	(-1.74)	(-0.83)	(0.41)	(-1.56)	(1.64)
All	-0.95	-0.48	-0.26	-0.12	0.95	-0.17	1.90
	(-0.69)	(-0.50)	(-0.36)	(-0.18)	(0.96)	(-0.24)	(1.04)
High-Low	1.85	3.26	2.73	2.47	2.76	2.62	
	(1.18)	(2.61)	(2.60)	(2.26)	(2.04)	(2.83)	

Table 16: **Predictive regression for benchmark-adjusted net returns in 1992-2003.** The dependent variable is the benchmark-adjusted cumulative net return (after all expenses) over calendar year t, while the independent variables are measured at the end of year $t-1$. All the variables are computed as before. Turnover and expense ratio are annualized values. Fund age and fund manager tenure are measured in years. Fund inflows and returns are all cumulative percentages. Index return represents the benchmark assigned to each fund, and return over the index represents a fund's net return in excess of its benchmark index. Index funds are excluded from the sample. Since the expense ratio and manager tenure are missing before 1992, we limit all specifications to the same time period. The t-statistics (in parentheses) are based on standard errors clustered by fund, except for the last specification where they are clustered by year.

	(1)	(2)	(3)	(4)	(5)
Active Share	0.0381	0.0438	0.0566	0.0657	0.0657
	(7.28)	(7.93)	(8.84)	(8.29)	(2.13)
Tracking error		-0.0536	-0.0227	-0.0129	-0.0129
		(-1.53)	(-0.65)	(-0.34)	(-0.08)
Turnover				0.0029	0.0029
				(1.23)	(0.32)
Expenses				-0.6363	-0.6363
				(-2.76)	(-1.62)
log_{10}(TNA)			-0.0258	-0.0239	-0.0239
			(-2.83)	(-2.41)	(-2.87)
$(log_{10}(\text{TNA}))^2$			0.0046	0.0044	0.0044
			(2.80)	(2.46)	(3.00)
Number of stocks				0.00003	0.00003
				(2.53)	(3.01)
Fund age				-0.0004	-0.0004
				(-4.66)	(-2.70)
Manager tenure				0.0007	0.0007
				(3.01)	(1.60)
Inflow, t-1 to t				-0.0128	-0.0128
				(-3.97)	(-2.22)
Inflow, t-3 to t-1				0.0025	0.0025
				(3.48)	(2.03)
Return over index, t-1 to t			0.0847	0.0930	0.0930
			(6.94)	(6.81)	(1.52)
Return over index, t-3 to t-1			-0.1226	-0.1468	-0.1468
			(-14.41)	(-15.01)	(-3.15)
Index return, t-1 to t				-0.0143	-0.0143
				(-2.06)	(-0.52)
Index return, t-3 to t-1				-0.0057	-0.0057
				(-1.53)	(-0.25)
Errors clustered by	Fund	Fund	Fund	Fund	Year
N	10,868	10,868	9,338	8,558	8,558
R^2	0.003	0.003	0.059	0.077	0.077

Table 17: **Predicting returns with different measures of active management in 1992-2003.** The dependent variable is the benchmark-adjusted cumulative net return (after all expenses) over calendar year t, while the independent variables are measured at the end of year $t-1$. Active Share and tracking error are computed as before. Industry-level Active Share is computed similarly to Active Share, except that it replaces individual stocks with 10 industry portfolios. The Industry Concentration Index is computed as in Kacperczyk, Sialm, and Zheng (2005), except that the benchmark index is selected by following the same methodology as elsewhere in this paper. The stock concentration index is computed just like the Industry Concentration Index, except that it uses individual stocks rather than industry portfolios. Turnover is an annualized value. The control variables include all the remaining variables in Table 16. Index funds are excluded from the sample. Since the expense ratio and manager tenure are missing before 1992, we limit all specifications to the same time period. The t-statistics (in parentheses) are based on standard errors clustered by fund.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Active Share	0.0381						0.0473	0.0658
	(7.28)						(7.33)	(7.76)
Tracking error		-0.0019					-0.0747	-0.0388
		(-0.06)					(-2.00)	(-0.93)
Industry-level Active Share			0.0284				-0.0430	-0.0418
			(2.66)				(-1.49)	(-0.87)
Industry Concentration Index				0.0517			0.0831	0.1475
				(2.22)			(1.74)	(1.26)
Stock concentration index					0.1710		0.0821	-0.0320
					(1.24)		(0.44)	(-0.12)
Turnover						0.0017	0.0014	0.0028
						(0.81)	(0.67)	(1.13)
Control variables	No	No	No	No	No	No	No	Yes
N	10,868	10,868	10,868	10,868	10,868	10,724	10,724	8,558
R^2	0.0029	0.0000	0.0008	0.0008	0.0005	0.0002	0.0043	0.0779

Appendix C: Figures

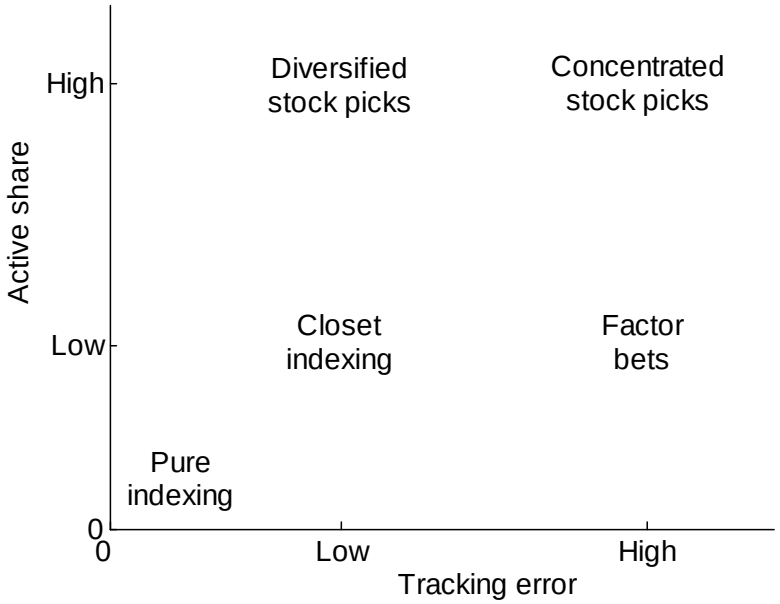

Figure 1: Different types of active and passive management.

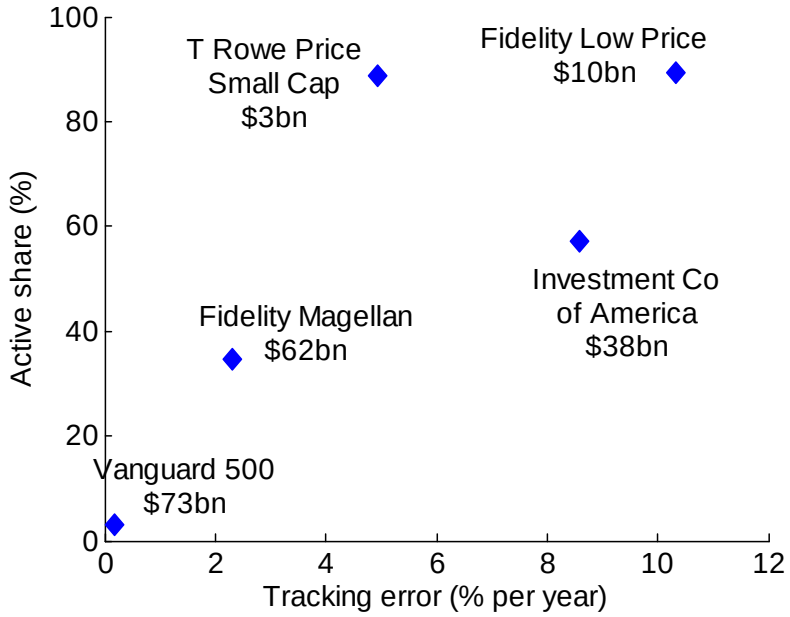

Figure 2: Examples of each type of active and passive management in 2002. Each fund is shown with its average equity assets during the year.

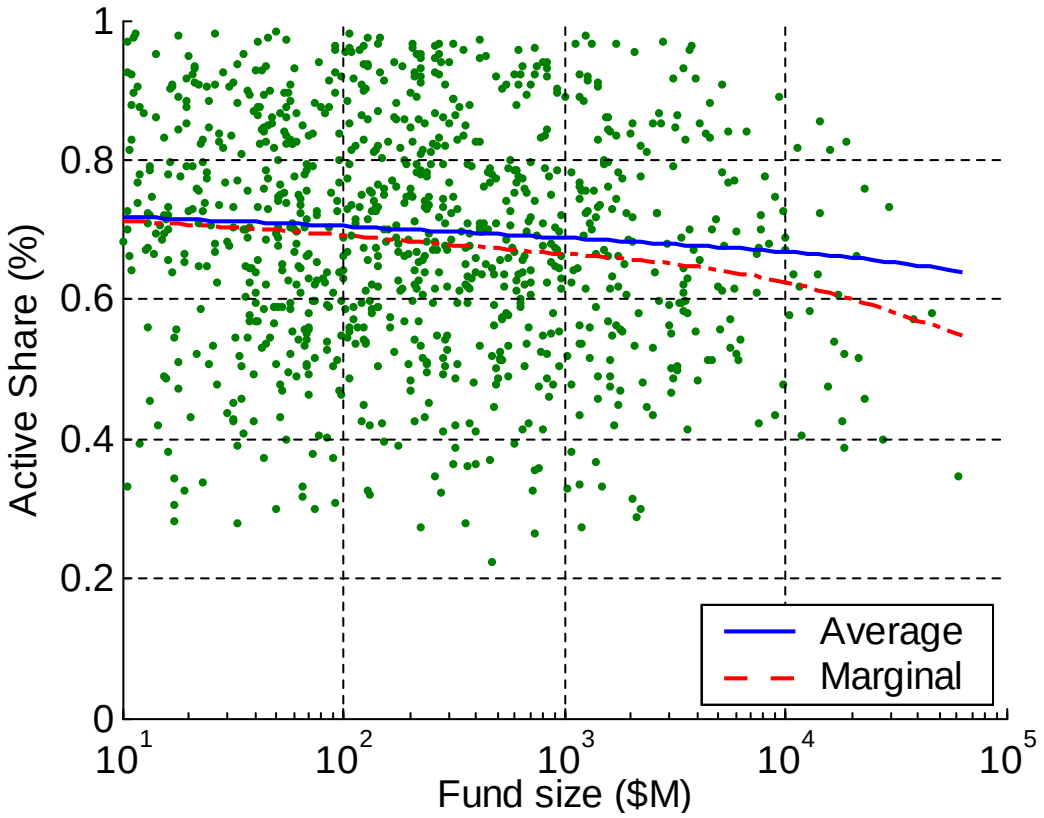

Figure 3: Average active share for US all-equity mutual funds and the active share of a marginal dollar in 2002. Fund size is total net assets expressed in millions of dollars. We want to include actively managed large-cap funds, so we exclude all index funds (active share less than 20%), funds with a small-cap or mid-cap benchmark index (Russell 2000 or Wilshire 4500), and funds with less than $10M in stock holdings. The average active share is estimated from a nonparametric kernel regression with a Gaussian kernel and bandwidth equal to 0.7.

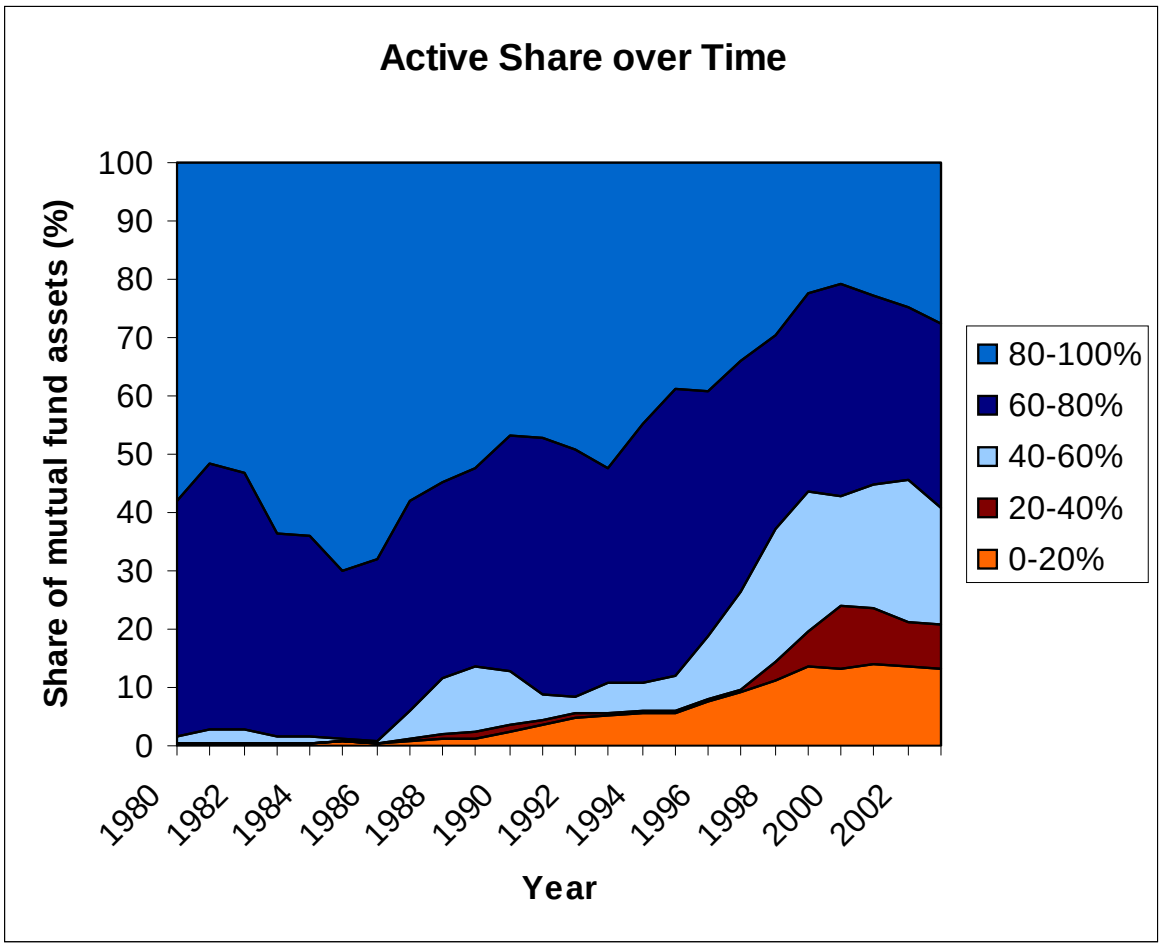

Figure 4: The share of mutual fund assets in each Active Share category in the US in 1980-2003. This is an illustration of Table 7.

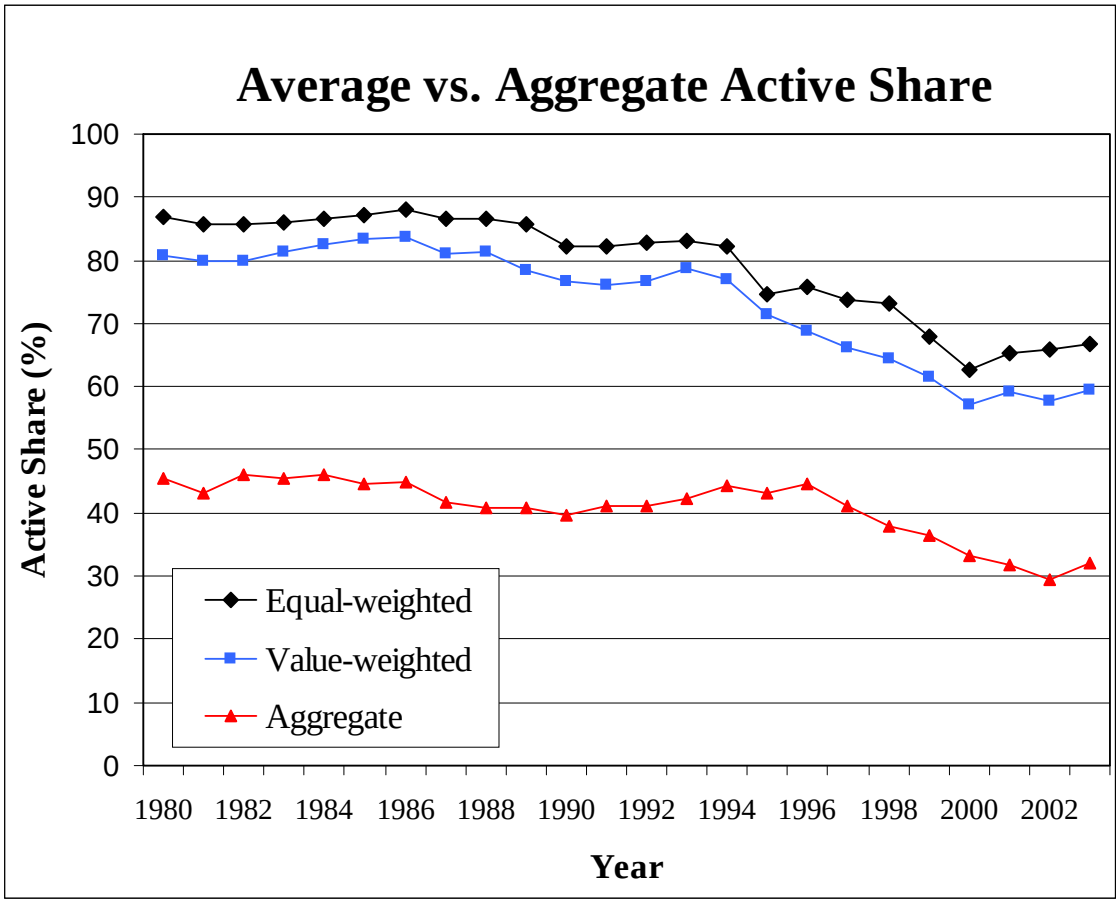

Figure 5: **Aggregate-level and fund-level Active Share** for active funds with S&P 500 as the benchmark index. Each year we compute the equal-weighted and value-weighted (by fund size) Active Share across the funds. We also aggregate the funds' portfolios into one aggregate portfolio and compute its Active Share. Index funds are excluded from the sample.

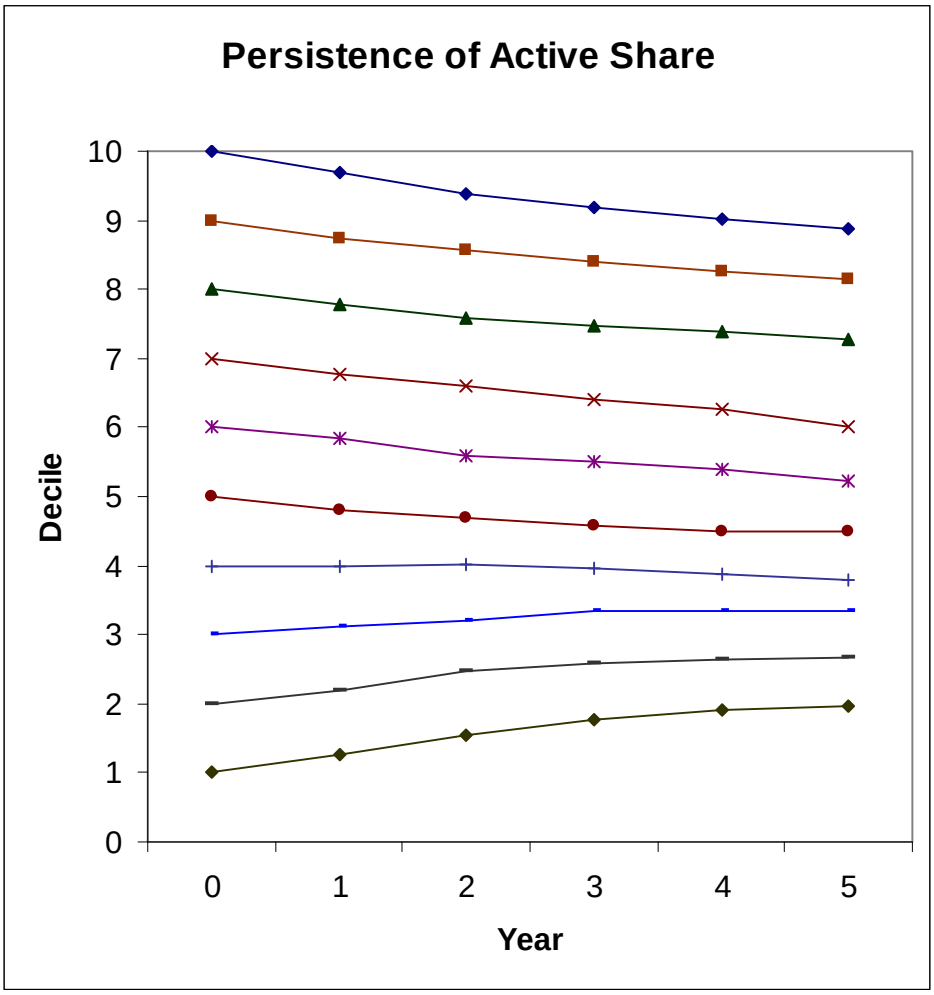

Figure 6: **Persistence of Active Share over one-to-five-year horizons in 1990-2003.** For each initial Active Share decile, the table shows the average future decile of the funds. Index funds are excluded from the sample.