Are Actively Managed Mutual Funds *Per Se* Imprudent Choices for 401(k) Plans?

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Abstract

Many corporations and financial institutions have recently faced lawsuits in which plaintiffs have alleged harm to 401(k) plan participants by the inclusion of high-fee actively managed mutual funds in plan offerings, instead of low-cost index funds. The goal of our study is to compare the performance of actively managed and passive index funds. Using a large dataset of more than 11,000 mutual funds, we find that, on average, actively managed funds do have higher fees than their index fund counterparts. However, a portfolio of active funds chosen based on a combination of certain key characteristics, such as low expense ratio, low turnover, high Sharpe ratio etc., have better net-of-fees returns than passive index funds in the categories of U.S. equity, international equity, fixed income, and mixed assets. The findings in our study suggest that inclusion of a higher-fee active fund in a 401(k) plan does not *necessarily* imply an inferior choice, but could be a prudent one if the plan fiduciaries were to select active funds based on past performance and other key fund characteristics.

Key words: ERISA litigation, actively managed funds, passive index funds

JEL Codes: G1, G110, G170

1. INTRODUCTION

In the last few years, many multinational corporations and financial institutions have faced lawsuits under the ERISA[1] statutes. In these lawsuits, plaintiffs typically allege that fiduciaries of the 401(k) plans of the defendant firms, selected inferior mutual funds for inclusion in plan offerings. Since 2015, more than twenty financial institutions and corporations have been sued under the ERISA statutes. The crux of the plaintiffs' allegations in these matters is: 401(k) plan fiduciaries who control and manage plan assets breached their fiduciary duties and caused harm to the plan participants by including proprietary or affiliated mutual funds as investment options in the plans and failed to consider lower-fee options, typically passively managed index funds.

For example, in bringing a class action lawsuit against Putnam, the plaintiffs conclude that the plan suffered millions of dollars in damages by comparing the fees of "the portfolio of actively managed Putnam funds … to a portfolio of passively managed Vanguard funds."[2] Similarly, in a suit against Citi, the plaintiffs claimed that due to the defendants' "failure to … remove and replace imprudent investments, the Plan and its participants incurred 'millions of dollars' in losses through the high fees of nine particular proprietary funds."[3] Plaintiffs have brought analogous allegations in many other ERISA matters.[4] The defendants in these ERISA lawsuits include both financial firms as well as large multinational corporations, such as Putnam, T. Rowe Price, Kraft Foods, Delta Airlines, Caterpillar, to name a few.

Our study examines the premise at the heart of the plaintiffs' allegations: actively managed high-fee mutual funds are inferior to lower-cost passively managed index funds, and thus, inclusion of actively managed funds in 401(k) plan offerings, when low-cost index funds were available, is necessarily

[1] The Employees Retirement Income Security Act of 1974 is a federal law that sets minimum standards for most voluntarily established retirement and health plans in the private industry to provide protection for individuals in these plans. ERISA provides fiduciary responsibilities for those who manage and control plan assets. U.S. Dept. of Labor.

[2] *Brotherston v. Putnam Invs., LLC*, No. 17-1711 (1st Cir. Oct. 15, 2018)

[3] *Leber et al. v. CitiGroup 401(k) Plan Inv. Comm.*, 07-Cv-9329 (SHS) S.D.N.Y. Nov 27, 2017, Opinion & Order.

[4] A few examples of 'excessive fee' ERISA-related cases include:
Feinberg v. T. Rowe Price Grp., Inc., CIVIL ACTION NO. MJG-17-0427 (D. Md. Aug. 20, 2018);
George v. Kraft Foods Global, Inc., 270 F.R.D. 355 (N.D. Ill. 2010);
Johnson v. Delta Airlines, Case No. 2:14-cv-00696-DAK-PMW (D. Utah Sep. 19, 2016);
Martin v. Caterpillar, Inc., Case No. 07-cv-1009. (C.D. Ill. Aug. 12, 2010);
Taylor v. United Tech. Corp., 354 Fed. Appx. 525 (2d Cir. 2009)

imprudent. The goal of our study is to compare the performance of actively managed and passive index funds.

For this comparison, we use a large dataset of more than 11,000 mutual funds and over 120,000 fund-year observations on actively managed and passive index funds, across different asset classes, including U.S. equity and international equity, and fixed income. Our sample period covers 2000-2018, a period that spans different market environments, including the post dotcom bear market years, the severe market downturn in 2008, and the decade-long bull market since then. We find that, on average, actively managed funds do have higher fees than their index fund counterparts; this is not surprising given the costs of research required to actively manage a fund rather than passively track an index. Consistent with many prior studies, we also find that *on average* active U.S. equity funds do underperform index funds. However, a key finding of our study is that a portfolio of active funds chosen based on certain key characteristics, such as low expense ratio, low turnover, high Sharpe ratio etc., have better net-of-fees returns than passive index funds in the respective asset classes. This result holds for various categories of funds including U.S. equity, international equity, fixed income, and mixed assets (i.e., funds that hold both equities and fixed income assets). The portfolio of chosen active funds not only outperforms its asset class-matched index fund counterparts in terms of average net-of-fee returns, it also provides considerably higher risk-adjusted returns. In the 'excessive-fee' ERISA complaints, since Vanguard funds have often been cited as the funds that should have been chosen because they typically have the lowest fees, we also compared the performance of the portfolio of chosen active funds to Vanguard index funds in the respective asset classes. We find that the portfolio of active funds chosen based on certain key characteristics provide superior returns than the asset class-matched Vanguard index funds. In both cases, when the performance of the chosen active funds is compared to the asset-class-matched average passive fund or the Vanguard index fund, the active funds are selected without any hindsight bias.

The findings in our study imply that inclusion of a higher-fee active fund in a 401(k) plan does not *necessarily* imply an inferior or imprudent choice. A higher-fee active fund's gross (i.e., before-fees) performance can be high enough to more than compensate for its higher-fees, thereby delivering a higher net-of-fee performance. In that case, the plan would not be harmed, but would rather benefit from inclusion of actively managed funds.

2. REVIEW OF THE PRIOR LITERATURE ON MUTUAL FUND PERFORMANCE

Since at least the mid-1900s, academic studies have been assessing whether better-performing active mutual fund managers' superior returns demonstrate skill or chance. One of the earliest studies in this area was Jensen (1968) who analyzed mutual fund returns for the period 1945-1964. He found that "there is very little evidence that any individual fund was able to do significantly better than that which we expected from mere random chance."[5] Barras, Scaillet and Wermers (2010) developed a model to account for luck, and found that the percent of skilled active managers is indistinguishable from zero. Fama and French (2010) used a three-factor model to distinguish between luck and skill. Their results suggest that the returns of active mutual funds with positive alpha are largely offset by active funds with negative alpha, which they attribute to the high costs of active management.

Many prior studies have examined the performance of actively managed funds relative to the broad market. Malkiel (1995) examined equity mutual funds over the period 1971–1991, comparing their performance to the Wilshire 5000 and the S&P 500 market indices. He found that actively managed funds underperformed these benchmarks both *before* and after expenses, thus concluding that high fees alone cannot explain their underperformance. Wermers (2000) analyzed the stock selection acumen of fund managers using data for the period 1975–1994 and found that, on average, these managers' selections outperformed the market benchmark by 1.3 percent annually. However, the funds' net of fees returns underperformed the market by 1 percent. Grinblatt and Titman (1989, 1992) showed that certain active fund managers outperformed benchmarks before expenses, especially managers of aggressive growth funds. However, these funds also had the highest expenses; as a result, their performance, net of expenses, lagged their benchmarks. For many years the Standard and Poor's corporation has published (SPIVA) studies, which show in most years between more than half (and some years more than two-third) active fund managers are outperformed by their passive benchmarks.

Even amongst those who conclude active funds perform no better than market benchmarks, some acknowledge that there may exist a small group of skilled mutual fund managers capable of outperforming the market. For example, Kowsowki, Timmerman and Wermers (2006) used a four-factor model to estimate alpha and a bootstrapping method to test for statistical significance of excess

[5] Jensen (1968): 34.

returns. Their findings indicate that "the performance of these best and worst managers is not solely due to luck, that is, it cannot be explained solely by sampling variability." [6]

If there does, indeed, exist skilled fund managers, one should see persistence of their returns over time. One of the earliest studies examining this issue is Grinblatt & Titman (1992), who found that the differences in performance between funds persisted over time. Hendricks, Patel, and Zeckhauser (1993) also found that "portfolios of recent poor performers do significantly worse than standard benchmarks; those of recent top performers do better, though not significantly so." [7] Elton, Gruber and Blake (1996b) found that past performance is predictive of future risk-adjusted performance. Additionally, they were able to form an actively managed fund portfolio with the same risk as a portfolio of passive funds, but with higher average return.

Taking a different approach, Cremers and Petajisto (2009) argued that the categorization of "active" and "passive" funds was inaccurate. They presented a new measure of active portfolio management, which they termed "Active Share." It represents the share of a fund's portfolio holdings that differ from the benchmark index holdings, thus capturing the true degree of asset selection by active managers. Their results were clear: "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." [8]

Bollen and Busse (2005) tested the duration and extent of performance persistence in mutual funds between 1985-1995. They divided funds into deciles based on returns, and found that "the top decile of funds generates a statistically significant abnormal return … of 25-39 basis points across the performance models." [9] Since they found that the abnormal return disappeared when funds were evaluated over longer periods, they concluded that superior performance is likely short-lived. By contrast, other researchers, such as Gruber (1996) and Berk and van Binsbergen (2015), suggested mutual fund performance may persist as long as ten years.

[6] Kowsowki et al. (2006): 29.
[7] Hendricks Et al. (1993): 93.
[8] Cremers and Petajisto (2009): 28.
[9] Bollen and Busse (2005): 594.

Many prior studies have examined the various fund characteristics that predict superior mutual fund performance. Numerous prior studies have shown that the most important characteristic in predicting returns is expense ratio. Sharpe (1966) found that funds with high returns also have high expenses and the expenses negate the alpha these funds could generate. Grinblatt and Titman (1989) also found that, on average, transaction costs and fund expenses completely erode abnormal returns. Elton, Gruber, and Blake (1996a) segmented firms based on excess returns, and compared the top and bottom decile funds. To determine whether the differences in returns were driven by differences in funds' expenses, they eliminated the funds with the highest expenses. They found that, for the top decile, eliminating high-expense funds had an ambiguous effect on future performance. However, for the bottom decile, eliminating high-expense funds conclusively enhanced returns.

Fama and French (1993) developed a three-factor (beta, size, value) model to predict returns. Fama and French (2015) further enhance their model by including profitability and investment. Likewise, Carhart (1997) built on the Fama and French (1993) three-factor model by adding momentum. His results showed that the model "almost completely explains persistence in equity mutual funds' mean and risk-adjusted returns," and that "expense ratios, portfolio turnover, and load fees are significantly and negatively related to performance." [10]

Another fund characteristic that has received considerable attention is fund size. The findings on the effect of fund size on returns are rather mixed. Perold and Salomon (1991) suggested an inverse relationship exists because an increase in assets under management compels a fund to increases the size of its positions. Since transaction costs increase with size, portfolio returns decrease correspondingly. Using a data set of 683 U.S. equity funds from 1993-1995, Indro, Jiang, Hu, and Lee (1999) found diminishing marginal returns to information acquisition and trading. They observed that, after a certain size, marginal returns become negative. Chen, Hong, Huang, and Kubik (2004) also found that returns decline with fund size, both before and after fees and expenses. They suggested factors such as hierarchical costs, organizational diseconomies, and liquidity could possibly explain the inverse relationship between size and returns. Conversely, Berk and Van Binsbergen (2016), have argued that size is indicative of skilled management, a result of money flowing toward skilled managers with outsized returns. Elton, Gruber and Blake (1996a) find, when controlling for survivorship bias, smaller funds perform much worse than larger funds. They attribute their results to the fact that, of the funds

[10] Carhart (1997): 80.

that fail to survive, a larger percentage are small funds as opposed to large ones, and funds fail to survive due to poor performance.

The impact of net flow of assets on fund returns has also been examined by prior studies. Gruber (1996) found that the risk-adjusted returns of funds with positive cash flows are higher than the returns of average funds. Building on this research, Bu & Lacey (2008) examined the relationship between mutual fund returns and net flow of assets. Initially, they used a four-factor CAPM model and found that a strategy of investing in the positive cash flow funds yielded significantly better returns. However, they conducted a Granger causality test and concluded that better fund performance *caused* positive cash flows and not the other way around.

Webster (2002) examined the relationship between fund returns and age. This study used a sample of long-established mutual funds to compare raw returns and market adjusted returns at different fund age brackets. The results showed no significant relationship between fund age and raw returns. However, Webster (2002) did find a statistically significant negative correlation between fund age and market-adjusted returns for growth funds.

A handful of prior studies have examined the performance of fixed income mutual funds. Cici and Gibson (2012) examined holdings of corporate bond mutual funds and their returns. They found no evidence that active bond fund managers, on average, were able to select corporate bonds that outperform other bonds with similar characteristics. They concluded that the benefits of active management do not outweigh the costs. Blake, Elton and Gruber (1993) found similar results. Using linear and nonlinear regression models, they conclude that, "on average, a percentage-point increase in expenses leads to a percentage-point decrease in performance." [11] Philpot, Hearth, Rimbey and Schulman (1998) examined persistence of fixed income mutual fund performance and found past returns do not predict future bond fund performance, and that bond fund managers are generally ineffective in generating higher risk-adjusted returns. However, they did see a positive relationship between size and return, leading them to conclude that bond funds benefit from economies of scale.

A relatively recent study that has examined funds in other countries is by Cremers, Ferreira, Matos and Starks (2016). They analyzed active versus passive mutual funds across 32 countries. They found a strong correlation between the number of passive funds and the returns of active funds, and offered a

[11] Blake et al. (1993): 402.

potential explanation: markets with more competition from index funds induce active funds to pursue more differentiated product strategies to deliver alpha and to charge lower fees.

Fortin and Michelson (2002) compared the performance of actively managed funds to Vanguard index funds that they deemed to be the appropriate counterparts. They found that international stock funds outperformed the corresponding Vanguard index funds. Interestingly, they also found that actively managed funds tend to outperform index funds when the economy is transitioning into or out of a recession; in particular, this outperformance was most pronounced during the years 1979-82, 1991-93, and 1999-2000. Based on this finding they concluded: "It appears that active fund management is better than index funds at guiding portfolios through rough times." [12] Similarly, Holmes (2007) found that actively managed funds in the asset categories of international mid/small cap blend outperformed their respective index funds.

This paper contributes to prior literature in several ways. While we find, consistent with a handful of prior studies, that selected active funds can outperform their index counterparts, our finding is based on an analysis of a large dataset of over 15,000 mutual funds in four asset classes, U.S. equity, international equity, fixed income, and a blend of fixed-income and equity funds. For funds in each of these categories, we form active fund portfolios without any hindsight bias to examine how well various fund characteristics predict performance. We undertook this approach because the primary focus of our paper is to examine whether plan fiduciaries, who typically select funds based on past performance and other characteristics, could have reasonably picked better-performing active funds.

Unlike many prior studies, we do not find expense ratio to be the most important predictor of fund performance, although higher expense ratios do adversely affect fund returns. We show that Sharpe ratio, a key measure of risk-adjusted returns, is one of the most important predictors of mutual fund performance; also important are fund characteristics such as turnover, and the age of funds. Furthermore, unlike the findings in some prior studies, we demonstrate that size is not a drag on fund returns. Finally, the key conclusion unique to our study is that active funds chosen based on a combination of characteristics can generate considerably higher average returns and higher risk-adjusted returns than the average passive fund. Of course, to avoid any hindsight bias, this comparison

[12] Fortin and Michelson (2002): 93.

is made in any given year by examining the performance of active funds that were chosen based on their characteristics in the preceding year.

3. THE DATASET AND SUMMARY STATISTICS

Morningstar, a financial data and information provider, is the main source of data for the analyses in this paper. We started with the universe of U.S. domiciled funds in Morningstar's *Direct* Open-End Market Funds database. To ensure that the dataset is free from survivorship bias we downloaded data for both existing funds and funds that are no longer in existence. The following fields were downloaded from the database: FundId, SecId, Name, Inception Date, Expense Ratio, Net Assets (i.e., AUM), Turnover, Net Cash Flow and Returns, for the period 2000-2018. The data on returns on funds are net returns, that is net of expenses.

When a fund had multiple share classes, we combined the data on the relevant variables into a single datapoint per fund. This was calculated using the fields FundId (one per fund) and SecId (more than one per fund with multiple share classes). When a fund had more than one share class, we took the average return across the fund's share classes to compute a single monthly return per fund.[13] We used the monthly returns data to compute an annual Sharpe ratio for each fund. In calculating the Sharpe ratios, we computed the fund's excess return by using the 3-month T-bill rate.[14] After computing the annual Sharpe ratios for each fund, we collapsed the monthly dataset into annual data on returns.[15] In this conversion, we deleted all funds that had less than 12 contiguous months of data on returns. In instances where the expense ratio for a fund was missing for any particular year, we filled the gap by using either the preceding or subsequent non-missing value, based on whichever was closer to the missing data point.

[13] We considered the option of computing a weighted average return per fund using the AUM of each SecId (i.e., share class) as weights. We decided against it because we found that for many SecIds (in more than 50% of cases), data on either returns or AUM were missing; thus, computing a weighted average return using only the non-missing AUM and returns data could have introduced a bias.

[14] Data on the 3-month T-bill rate were downloaded from the St. Louis Federal Reserve website.

[15] We recognize that collapsing monthly to annual data results in a loss of some information. However, our decision was motivated by the lack of availability of data on the various variables of interest. While monthly data on returns were generally available for all funds, data on the two key fund characteristics, expense ratio and turnover, were available only on an annual basis.

The categories, U.S. Equity, International Equity, Fixed Income,[16] and Allocation are derived from their respective Morningstar Category field. The funds in the category 'Allocation' have equity and fixed income assets in different proportions, ranging between 15% and 85% in equity and the remainder in fixed income (which is evident from the names of these funds; but the data on the exact asset allocation were not available for these funds).[17] Throughout this paper, we will call this category 'Mixed Assets.' The four categories of funds (U.S. Equity, International Equity, Fixed Income and Mixed Assets) included in our dataset constitute more than 88% of all funds in the Morningstar database. Excluded from our dataset are funds in the Morningstar categories of Alternative, Commodities, and Sector Equity. The key reason for their exclusion is that there are relatively few funds in these three categories in the early years of our dataset, i.e., in the period 2000-2005.

There are two reasons for choosing a relatively recent year as the start of our dataset. First, in the earlier years, especially before 2000, there were relatively few index funds in the non-U.S. equity categories. Second, and more importantly, the expense ratios of passive funds have shown a marked decline in recent years, particularly since 2000. We find that the average expense ratio for passive funds have dropped by 67% in the last 18 years; whereas in the same period, the active funds' average expense ratio has dropped only by 16%. Since low expense ratio is a key attraction of index funds, we wanted to limit our analysis to relatively recent years in undertaking a comparative analysis of the performance of active and passive funds. On the other hand, however, had we limited our analysis to a handful of the most recent years (for example, the last five years), we would have faced the risk of our paper's results being unrepresentative. As noted earlier, the last 18 years represents a variety of market environments, including a long bull-run as well as severe market dislocations.

The dataset analyzed in this paper has 11,300 actively-managed equity funds, with 116,663 fund-year observations, and 483 passively-managed funds (i.e., funds categorized as Index Funds by Morningstar), with 5,373 fund-year observations.

The summary statistics for active funds on the variables used in the analyses are contained in Table 1. The means and the standard deviations for the variables are for the pooled data, i.e., across the years and across funds. For the mean returns of the funds, we first computed the yearly returns of the funds

[16] This category includes Municipal Bond and Taxable Bond funds.
[17] This category includes also includes Target Date U.S. funds, with target years ranging from 2010 to 2060+.

by averaging the returns across all active funds in the respective categories; we then then averaged the yearly returns across the years 2000-2018.

Since our data period is 2000-2018, the dataset can contain a maximum of 19 observations for a fund. We find, however, the average number of observations per fund is around 11; this is evident from the last two rows of Table 1, which contain the total number of observations and the number of funds for each of the four Morningstar categories.

Table 1: Summary Statistics for Actively Managed Mutual Funds: 2000-2018

	U.S. Equity		Int. Equity		Fixed Income		Mixed Assets	
Variable	Mean	St. Dev	Mean	St. Dev	Mean	St. Dev	Mean	St. Dev
Annual Return (%)	5.84	19.95	4.62	23.11	4.03	7.01	4.19	12.48
Expense Ratio (%)	1.30	0.82	1.43	0.58	0.92	0.38	0.80	0.57
Turnover Ratio (%)	72.57	151.40	59.79	62.02	93.15	175.03	69.36	212.57
Size (AUM in $B)	1.25	5.20	1.22	5.31	1.05	4.62	1.33	5.67
NetFlow of Assets (in $B)	-0.03	1.64	0.03	0.75	0.05	2.82	0.04	0.77
Age of Funds (years)	13.64	12.53	10.80	8.36	14.97	9.62	10.28	11.00
Sharpe Ratio	0.20	2.04	0.18	0.68	0.25	0.76	0.29	1.22
No. of Obs.	43,634		17,687		35,409		19,933	
No. of Funds	3,931		1,739		3,137		2,010	
Aggregate Total:								
No. of Obs.				116,663				
No. of Funds				10,817				

4. THE EMPIRICAL ANALYSES AND OUR FINDINGS

In this section, we discuss the methods and the results of the following six areas of analyses:

(a) Comparison of the average returns and expenses of active and passive funds.

(b) Regression analysis of the relationship between active fund returns and their various characteristics.

(c) Examination of the predictive power of these characteristics; that is, we assess how active funds perform in any given year when they are chosen based on various characteristics in the

preceding year; in doing so, we also compare the returns of these chosen active funds to the category-matched index fund counterparts.

(d) Examination of the returns and risk-adjusted returns of active funds selected based on a *combination* of characteristics in the preceding year.

(e) Regression analysis to estimate the 'alpha's generated by these chosen active funds.

(f) Finally, constitution of portfolios of chosen active funds and index funds using allocation weights for funds in the three asset classes of U.S. equity, fixed income and international equity; portfolio construction is followed by examination of the annual and cumulative performance of the two portfolios of chosen active and passive funds.

A. RETURNS AND EXPENSE RATIOS OF ACTIVE AND PASSIVE FUNDS

In Table 2 we compare the average returns and expense ratios of active and passive funds. We also report whether the differences in the averages for returns and expense ratios are statistically significant.

Table 2: Returns and Expense Ratios for Actively & Passively Managed Funds: 2000-2018

	U.S. Equity		Int. Equity		Fixed Income		Mixed Assets	
Variable	Active	Passive	Active	Passive	Active	Passive	Active	Passive
Annual Return (%)	5.84	6.04	4.62	3.12	4.03	4.35	4.19	4.56
Expense Ratio (%)	1.30	0.64 **	1.43	0.65 **	0.92	0.34 **	0.80	0.85
No. of Funds	3,931	317	1,739	88	3,137	67	2,010	11

Note:

*** denotes statistically significant difference at 99% level of confidence.*

Consistent with the findings in numerous prior studies, we find that for active funds in the categories of U.S. Equity, International Equity and Fixed Income, expenses are higher than their passive counterparts, and the differences are statistically significant. The only exception is the Mixed Assets category, in which the active funds have lower expenses, but the difference is not statistically significant.

The average return (net of expenses) is lower for actively managed U.S. Equity, Fixed Income and Mixed Asset funds than their passive counterparts. However, that is not the case for International Equity funds, although the difference in average performance is not statistically significant for any of the four categories of funds. Our findings on expenses and returns suggest that the differences in the performance of active and passive funds are not necessarily explained by the lower expenses of index funds. However, as we shall discuss in the next subsection, higher expenses *do* have a detrimental effect on returns for active funds in all four asset categories.

In Appendix Table A1, we report the AUM-weighted average return and expense ratio for passive and active funds for the four categories. We find that the AUM-weighted average returns are generally higher relative to the simple average and the AUM-weighted average expense ratios are significantly lower than the simple average for both active and passive funds in all four categories. These results suggest that larger non-U.S. Equity funds generally have better returns and charge lower fees. We further explore the effect of fund size on returns next.

B. Regression Based Elasticity Estimates of Fund Characteristics

The goal of the analysis in this section is to examine the effect of various fund characteristics on returns. For this analysis, we deliberately use cross-sectional data, which was created by collapsing the pooled cross-sectional time series dataset into one that had the average values of fund returns and their characteristics; that is, we had a single observation for each fund.[18]

We estimated the following regression equation:

$$R^i = \alpha_0 + \sum_{j=1}^{J} \alpha_j X_j^i + \varepsilon^i, \quad X = \{Size, Exp.\ Ratio, Turnover, Net\ Flow, Age\} \tag{1}$$

[18] We chose to use cross-sectional data because several of the fund characteristics are affected by returns, creating a potential simultaneity problem. Consider, for example, the relationship between size of funds (i.e., AUM) and their returns. While fund size undoubtedly affects returns, the latter also affects size. If we were to estimate (1) using pooled time series cross-sectional data, we would find the sign of the coefficient of the variable 'size' to be negative and significant. However, this negative coefficient largely reflects the time-varying changes in AUM as a result of negative returns, particularly after bear-market years. The AUM for domestic and international equity funds experienced a marked decline in the years following the dot-com crash and also again in 2009. For example, the average AUM for U.S. Equity funds declined by20% in 2009; International Equity funds experienced a larger AUM drop of 26% in the same year. These AUM declines reflect the combined effect of negative returns and asset outflows in in the years that immediately follow, since fund flows lag returns. When we re-estimated (1) using pooled time series cross-sectional data only for the

where the superscript '*i*' denotes the i^{th} fund, and '*j*' denotes the j^{th} fund characteristic. Equation (1) was estimated using cross sectional data for the actively managed funds, with appropriate correction for heteroskedasticity and autocorrelation.

Table 3: Regression of Active Funds' Average Return on Fund Characteristics
Estimates of Elasticity of Each Characteristic Using Cross-sectional Data

	US Equity		Int. Equity		Fixed Income		Mixed Assets	
Characteristics	Elasticity Est.	T-stat	Elasticity Est.	T-stat	Elasticity Est.	T-stat	Elasticity Est.	T-stat
Size	0.0185	2.90	0.0047	0.41	0.0045	2.18	0.0126	2.98
Expense Ratio	-0.6302	-3.93	-1.8822	-5.52	-0.0501	-1.12	-0.3445	-12.97
Turnover	-0.0934	-3.01	-0.4469	-4.33	-0.0098	-2.03	-0.0180	-2.21
Net Flow	-0.0012	-0.80	0.0057	0.72	0.0010	2.24	0.0007	0.32
Age	0.0586	2.25	0.4200	4.63	0.1880	9.44	0.0852	4.95
Adjusted R-Squared	0.0898		0.1308		0.0454		0.1507	
No. of Observations	3,919		1,733		3,122		1,994	

The elasticity estimate of each regressor was computed as follows: $\hat{\alpha}_j \cdot \frac{\overline{X}_j}{\overline{R}}$, where $\hat{\alpha}_j$ denotes the *j-th* regressor's estimated coefficient. In Table 3, in the interest of brevity, we show only the elasticity estimates and not the estimated coefficients from equation (1). The coefficient estimates do not indicate the relative magnitudes of the effects of the variables on fund returns; whereas the elasticity estimates do.

Turning now to the results in Table 3, we find that across all four categories, the fund characteristic with generally large (in absolute value) negative elasticity is 'expense ratio', suggesting that a fund's expenses have a substantial negative effect on its return. With the exception of fixed income funds, the elasticity of 'expense ratio' is statistically significant for all fund categories.

For U.S. and International Equity funds, the fund characteristic with the second largest elasticity (in absolute value) is 'turnover.' This is consistent with prior studies which suggest that higher turnover

period 2009-2018, we found that the coefficient of the variable 'size' becomes statistically insignificant (and very close to zero) for all four categories of funds.

reduces fund returns. The effect of turnover is also negative for Fixed Income and Mixed Asset funds, but the magnitudes of the effect are generally smaller.

The only characteristic that is positive and statistically significant across all four categories is age of a fund. Our results suggest that older funds generally do better than younger ones. We shall see later in the paper that this characteristic does have good predictive power for returns, especially for fixed income and mixed asset funds.

The effect of the characteristic 'net Flow' is insignificant for all categories, except Fixed Income. One reason for this is the high degree of collinearity between size and asset flow; this is because larger (smaller) funds are the ones that have typically experienced positive (negative) asset flows.

The elasticity of the characteristic 'size' is positive for all four categories and significant for all categories except International Equity. Thus, our results do not support the conventional wisdom or the finding in several prior studies that size is a drag on fund return.

Based on the findings of the regression results contained in Table 3, we would expect that the fund characteristics 'expense ratio', 'turnover', 'size' and 'age' to have a meaningful impact on fund returns. However, the results in Table 3 do not directly provide information about the predictive power of these variables in estimating future performance. That is, these results do not answer the key question: do these fund characteristics allow an investor or a fiduciary to select better-performing funds? To answer that question, we turn next to the analysis of the performance when funds are chosen based on various characteristics in the preceding year.

C. Performance Predictions Based on Fund Characteristics

Table 4 contains the average annual returns of a subset of funds chosen based on different fund characteristics in the *preceding year*. These subsets are created by first segregating the funds by characteristic quartiles, and then choosing the funds that reside in the relevant quartile. We will call these funds, the 'chosen funds' or the 'best-quartile' funds. For example, for 'expense ratio', the funds labeled 'cheapest' are the ones that reside in the lowest 'expense ratio' quartile; similarly, the 'largest' funds are ones that belong to the highest 'size' quartile. In each year, we first choose funds based on their characteristics (i.e., cheapest, lowest turnover, largest, etc.), and then record the chosen funds' average performance *in the following* year; this process, which precludes any hindsight bias in fund

selection, was repeated for each of the years 2000 through 2018, which means that the portfolios of the chosen or best-quartile active funds were reconstituted each year.[19]

Table 4: Performance of Funds Chosen Based on Best Quartile in Prior Year
Annual Average Return (%) & Excess to Passive Funds' Returns 2001-2018

Active Funds Chosen Based On:	U.S. Equity	Int. Equity	Fixed Inc.	Mixed Assets
1. Expense Ratio				
Cheapest (1st Quartile)	6.60	6.06	3.85	5.11
Average of All Passives	6.67	4.13	4.03	4.95
Difference	-0.08	1.93 **	-0.17	0.16 **
2. Turnover				
Lowest Turnover (1st Quartile)	6.84	6.58	3.78	5.00
Average of All Passives	6.67	4.13	4.03	4.95
Difference	0.17	2.45 **	-0.25	0.04 **
3. Size				
Largest AUM (4th Quartile)	6.17	5.61	4.03	4.96
Average of All Passives	6.67	4.13	4.03	4.95
Difference	-0.50 **	1.48 **	0.01	0.01 **
4. Net Flow				
Largest Net Flow (4th Quartile)	6.11	5.96	3.77	4.74
Average of All Passives	6.67	4.13	4.03	4.95
Difference	-0.56 **	1.84 **	-0.25	-0.21 **
5. Age				
Oldest (4th Quartile)	6.22	5.33	3.93	5.02
Average of All Passives	6.67	4.13	4.03	4.95
Difference	-0.46	1.20 **	-0.10	0.07 **
6. Sharpe Ratio				
Highest (4th Quartile)	7.14	6.71	4.01	4.78
Average of All Passives	6.67	4.13	4.03	4.95
Difference	0.47	2.58 **	-0.02	-0.17 **

Note:

** denotes statistically significant difference at 95% level of confidence;*

*** denotes statistically significant difference at 99% level of confidence.*

[19] The portfolio reconstruction would entail transaction costs and tax implications. Thus, if these costs are accounted for, the average returns of the active funds would be lower, particularly if the chosen active funds change considerably from year to year. However, we do find that many of the chosen active funds do appear from one year to the next; which implies that the transaction costs each year would be limited to instances when one or more active funds are switched out for different ones based on changing quartile rankings of the funds.

The average returns of the chosen active funds for 2001-2018 are shown in Table 4.[20] For points of comparison, we also show the average returns of passive funds in the respective category. The row labeled "Difference" shows the difference in average annual returns between the best-quartile funds (meaning cheapest, lowest turnover, largest, etc.) and all passive index funds in the respective Morningstar category. Thus, the figures in this row show, relative to an average index fund, how much better (or worse) on average investors would have fared if the active funds were chosen based on a particular characteristic in the preceding year. We tested the statistical significance of these differences in means using a t-test. The * or ** next to the differences in means denote whether the difference is statistically significant at the 95% or the 99% level of confidence.

The subset of active funds chosen based on highest Sharpe ratio in the preceding year outperforms passives in the U.S. and International Equity categories. Since there is a strong correlation between fund's return and its Sharpe ratio, our findings suggest that equity funds which do better one year generally do well the next. Thus, consistent with prior studies, we find that active funds' returns show persistence. In fact, our results in Table 4 remain virtually the same if we were to choose active funds that were in the top quartile of returns in the preceding year (instead of top quartile of Sharpe ratio in the preceding year).

The performance of the subset of active funds chosen based on lowest turnover in the preceding year also outperforms passives in all categories, except fixed income; although the outperformance is only significant for International Equity and Mixed Assets categories. Active funds in the lowest expense ratio quartile outperform in two of the four categories; the exceptions being U.S. equity and fixed income. The same holds true also for funds in top size quartile; they outperform the passive funds in all categories except U.S. equity. These results might appear to be inconsistent with the findings from the regression analysis, where we found expense ratio and size to be important characteristics. However, one must recognize that the two analyses ask related but slightly different questions. In Table 4, we are examining which characteristic does a better job of predicting active funds' average return *relative to the return of passive funds.* By contrast, in Table 3, we examined how the various characteristics, on average, affect an active fund's *own return.*

[20] We lose the year 2000 in computing the average because that is the first year in our dataset; and the earliest year in which the best-quartile (based on the preceding year's characteristic) funds' performance can be observed is 2001.

The characteristic 'age' appears to have strong predictive power for International Equity and Mixed Assets funds and this result is consistent with the regression results. Active funds that are in the top age quartile in the preceding year outperform passive funds in these two categories of funds.

Based on the average figures in the "Difference" row (i.e., by taking the average "Difference" across the four categories), we can rank the predictive power of the characteristics as follows: first, 'turnover'; second, 'Sharpe ratio', and third, 'expense ratio.' The predictive power of the characteristics 'age and 'size' are similar and quite strong.

One key observation from the results in Table 4 is that it does not matter which characteristic is used to choose active funds in the International Equity or the Mixed Assets categories: best-quartile funds chosen based on *any* of the characteristics, expense ratio, turnover, size age, or Sharpe ratio, do better than their index fund counterparts. For U.S. equity, however, the characteristics that allow choice of better-performing active funds are turnover and Sharpe ratio. Unlike many prior studies, we do not find expense ratio to be an important predictor of returns for U.S. equity funds.

D. Predictive Power of the Combination of Characteristics

401(k) plan fiduciaries typically consider multiple fund characteristics in selecting funds for inclusion in the plans. In this subsection, we examine the predictive power of a combination of fund characteristics.

While Table 4 shows each *individual* characteristic's predictive power for next years' fund return, in Table 5 we demonstrate that the predictive power can be enhanced when funds are chosen based on a combination of various characteristics in the preceding year. Since we consider six characteristics (expense ratio, turnover, size, net flow, age and Sharpe ratio), there are 20 different ways[21] of creating a portfolio of funds based on any three characteristics. In Table 5, we show the average returns of portfolios of active U.S. equity funds that were the best in all three characteristic quartiles simultaneously in the preceding year.

For example, in Table 5, the first row shows the average performance of a portfolio of active funds that were the cheapest (i.e., in the lowest expense ratio quartile) *and* had the lowest turnover *and* were the

[21] Note: $C_3^6 = 20$.

largest (i.e., in the highest size quartile) in the preceding year. Obviously, the same set of funds might not have been the chosen funds each year. Across the 18 years, we find that on average 78 U.S. equity funds were chosen per year based on the combination of expense ratio and turnover and size. Over the period 2001-2018, these funds yielded an annual average return of 7.2%, which is 0.53% better than the average return of U.S. equity index funds over the same period. As in the preceding table, the statistical significance of the "Excess to Passives" is tested using a t-test.

Table 5

Performance of Portfolios of Chosen Active Funds (Based on Combination of Characteristics of Prior Year)
Annualized Average Return of Active All US Equity Funds & Excess to All US Equity Passives: 2001-2018

	Criteria	No. Of Funds	Portfolio's Return	Excess to Passives	Portfolio's Sharpe	Excess to Passives' Sharpe
1	Exp. ratio+Turnover+Size	78	7.20	0.53	0.29	0.11
2	Exp. ratio+Turnover+Age	58	7.29	0.62	0.32	0.14
3	Exp. ratio+Turnover+Sharpe	55	7.81	1.14 **	0.34	0.16
4	Exp. ratio+Size+Age	94	6.87	0.20	0.27	0.09
5	Exp. ratio+Size+Sharpe	64	7.44	0.77 *	0.30	0.12
6	Exp. ratio+Age+Sharpe	40	7.61	0.93	0.32	0.14
7	Turnover+Size+Age	93	7.12	0.44 *	0.30	0.12
8	Turnover+Age+Sharpe	51	7.95	1.28 **	0.35	0.17
9	Turnover+Size+Sharpe	53	7.49	0.82 **	0.32	0.14
10	Size+Age+Sharpe	72	7.12	0.45	0.29	0.11
11	Net Flow+Turnover+Size	71	6.61	-0.06	0.26	0.08
12	Net Flow+Turnover+Age	46	6.93	0.26 **	0.29	0.11
13	Net Flow+Turnover+Sharpe	66	7.63	0.96 **	0.33	0.15
14	Net Flow+Size+Age	79	6.09	-0.58	0.23	0.04
15	Net Flow+Size+Sharpe	69	6.55	-0.12	0.25	0.07
16	Net Flow+Age+Sharpe	40	7.24	0.56 **	0.29	0.11
17	Net Flow+Turnover+Exp. ratio	57	6.79	0.12	0.27	0.09
18	Net Flow+Exp. ratio+Age	34	6.45	-0.22	0.24	0.06
19	Net Flow+Exp. ratio+Sharpe	62	7.17	0.50 **	0.29	0.11
20	Net Flow+Exp. ratio+Size	80	6.53	-0.14 *	0.24	0.06

Note:
** denotes statistically significant difference at 95% level of confidence;*
*** denotes statistically significant difference at 99% level of confidence.*

Going down the various rows of Table 5, it is clear that the combination of multiple characteristics can have a "multiplier effect" on return. Consider, for example, the effects of 'expense ratio', 'turnover'

and 'Sharpe ratio.' In Table 4, we saw that portfolios chosen based on these three *individual* characteristics yielded an annual average return of 6.60%, 6.84% and 7.14% respectively for U.S. equity funds. Yet, the third row of Table 5 shows that when these characteristics overlap, that is, when active funds are chosen based on the prior year's lowest expense ratio *and* lowest turnover *and* highest Sharpe ratio (creating a portfolio of 55 funds per year on average), they generate an annual average return of 7.81%. Thus, the portfolio returns of funds chosen based on the combined characteristics are considerably higher than the portfolio returns of U.S. equity funds based on a single characteristic, either cheapest, lowest-turnover, or highest Sharpe ratio. Further, these chosen funds' average return translates to a 1.14% excess to the average returns of all passive U.S. equity funds, and this difference is significant at the 99% level of confidence. Additionally, these active funds yield a far superior risk-adjusted return: their Sharpe ratio is 0.34, considerably higher than that of the index funds.

Two combinations emerge as the best performing both in terms of returns and risk-adjusted returns: (a) expense ratio + turnover + Sharpe-ratio, shown on row 3; (b) turnover + age + Sharpe-ratio, shown on row 8. However, it is important to recognize that most other combinations generate superior returns as well; out of the 20 possible combinations, 15 yield better average returns for chosen active funds than passive U.S. equity funds. This underscores the 'multiplier effect' of the combination of characteristics. It demonstrates that, while the performance of the *average* active U.S. equity fund is inferior to their passive counterparts (as shown in Table 2), one can create a portfolio by selecting active funds based on multiple key characteristics and, more likely than not, that portfolio would perform better than passive funds.

Table 5 highlights the predictive power of the various combinations of characteristics for U.S. equity funds. Similar analysis was undertaken for each of the other three categories: International Equity, Fixed Income and Mixed Assets, and tables similar to Table 5 were created for each.[22] Our results show that the best performing combinations are very similar for U.S. Equity, International Equity funds and Fixed Income funds. For Mixed Assets funds, the combinations which performed the best were somewhat different. For this asset class, the highest return combinations are: (a) turnover + age +

[22] They are available from the authors.

Sharpe ratio; and (b) size + age + Sharpe ratio. The performance of active funds based on these combinations of characteristics is discussed next.

In Table 6, we focus on the two best combinations for active funds in each of the four categories of funds. We find that the combination of expense ratio + turnover + Sharpe-ratio is common to all three categories of funds, the exception being Mixed Assets funds. For the latter funds, the combination turnover + age + Sharpe ratio yields the best performance. The outperformance of the chosen active funds to the average passive funds is statistically significant for active funds in all four categories; it ranges between 0.14% for Fixed Income and 3.33% for International Equity funds. These chosen active funds also yield considerably better risk-adjusted returns.

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Table 6: Performance of Portfolios of Active Funds Chosen Based on Prior Year's Best Quartile Characteristics

Annual Average Return & Excess Over Category-Matched Average Passive Funds' Return (%); Sharpe Ratio & Excess Sharp Ratios for 2001-2018

	U.S. Equity				
Funds Chosen Based on:	**No. of funds**	**Portfolio's Return (%)**	**Excess to Passives (%)**	**Portfolio's Sharpe**	**Excess to Passives' Sharpe**
Expense Ratio + Turnover + Sharpe	55	7.81	1.14 **	0.34	0.06
Turnover + Age + Sharpe	51	7.95	1.28 **	0.35	0.07

	International Equity				
Funds Chosen Based on:	**No. of funds**	**Portfolio's Return (%)**	**Excess to Passives (%)**	**Portfolio's Sharpe**	**Excess to Passives' Sharpe**
Expense Ratio + Turnover + Sharpe	23	7.46	3.33 **	0.25	0.12
Expense Ratio + Size + Sharpe	21	7.37	3.24 **	0.24	0.12

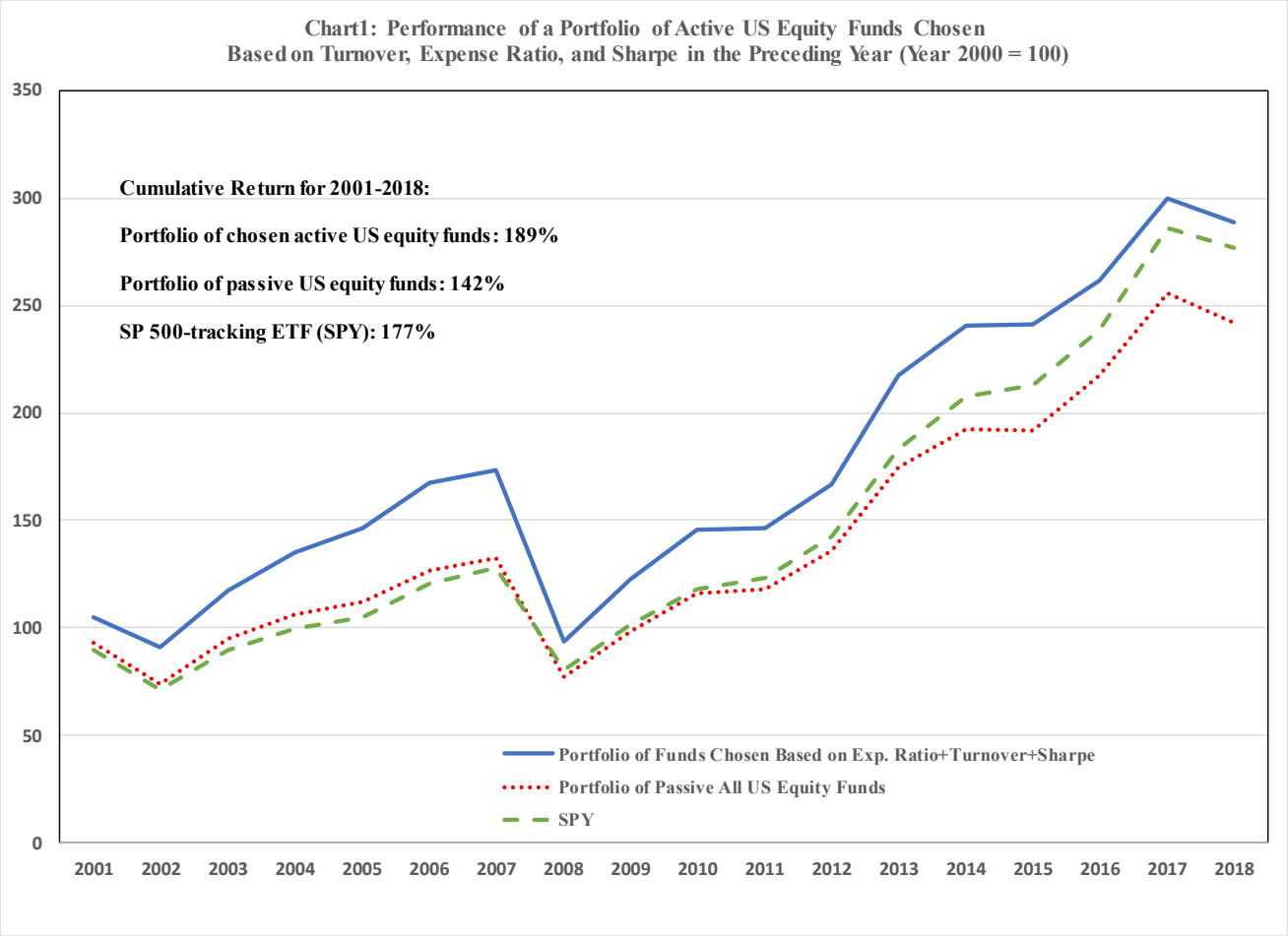
	Fixed Income				
Funds Chosen Based on:	**No. of funds**	**Portfolio's Return (%)**	**Excess to Passives (%)**	**Portfolio's Sharpe**	**Excess to Passives' Sharpe**
Expense Ratio + Turnover + Sharpe	29	4.29	0.26 *	0.97	0.51
Expense Ratio + Turnover + Size	31	4.17	0.14 **	0.57	0.11

	Mixed Assets				
Funds Chosen Based on:	**No. of funds**	**Portfolio's Return (%)**	**Excess to Passives (%)**	**Portfolio's Sharpe**	**Excess to Passives' Sharpe**
Turnover + Age+Sharpe	18	6.55	1.60 **	0.52	0.24
Size+ Age + Sharpe	35	5.94	0.99 **	0.37	0.10

Note:
** denotes statistically significant difference at 95% level of confidence;*
*** denotes statistically significant difference at 99% level of confidence.*

Appendix Table A2, is akin to Table 6; here the chosen active funds' performance is compared to Vanguard passive (index) funds for the U.S. Equity, International Equity and Fixed Income categories. The returns of these Vanguard funds account for dividend reinvestment. As noted earlier, Vanguard funds are known to have very low expense ratios and thus using them as a benchmark raises the bar for comparison. Appendix Table A2 shows, for the categories International Equity, Fixed Income and Mixed Assets, the chosen active funds generate higher average returns than the Vanguard index funds in the respective categories. However, the degree of outperformance is smaller than in Table 6, where the benchmark for comparison is the *average* passive fund.

Chart 1 is a visual depiction of some of the information contained in Table 6. Chart 1 shows that, over the 18-year period (2001-2018), a portfolio of 55 U.S. equity funds chosen based on the combination of characteristics of 'expense ratio' and 'turnover' and 'Sharpe ratio', yields a cumulative return of 189%, which is 47% higher than the performance of passive funds in the same category. Importantly, the portfolio of chosen active funds also outperforms the overall market, proxied by the ETF SPY, which tracks the S&P 500.



E. The Alpha of Active Funds Chosen Based on a Combination of Characteristics

In this subsection of the paper, we examine whether active funds, particularly active funds chosen based on the key characteristics, generate positive 'alpha'. Instead of regressing the returns of active funds on market benchmarks (such as S&P 500), we regress the returns of active funds on the returns of category-matched index funds to estimate the active funds' beta and alpha. This was undertaken because it might be challenging to identify the correct benchmark for funds in the various categories (especially for Fixed Income and Mixed Assets); our approach has the advantage of using the *category-matched index* fund returns, which are obvious benchmarks for the active funds in the respective

categories. Thus, the 'alpha' we are estimating is the excess returns of the active funds over their passive counterparts. In particular, we estimated the following equation:

$$r_{it}^{a} = \alpha + \beta \overline{r}_{t}^{p} + \varepsilon_{it} \qquad (2)$$

where the subscript 'i' denotes the i^{th} fund, and 't' denotes the t^{th} year. In equation (2) r_{it}^{a} denotes the annual return of the i^{th} active fund in the t^{th} year; whereas, $\overline{r}_{t}^{p}$ denotes the annual average return of all passive funds in the same category in the t^{th} year. Equation (2) was estimated using regression technique for pooled time-series cross sectional data, with appropriate correction for heteroskedasticity and autocorrelation. This equation was estimated separately for each of the four categories: U.S. Equity, International Equity, Fixed Income and Mixed Assets.

Equation (2) was first estimated using all active funds; and then estimated using only the subset of chosen active funds. These chosen active funds in the U.S. Equity and International Equity categories are selected based on the combination of characteristics: expense + turnover + Sharpe. For Fixed Income and Mixed Assets categories, the chosen active funds are selected based on the combination: size + age + Sharpe. Table 7 contains the results of the regression analysis.

Table 7: Alpha of All Active and Chosen Active Funds Relative to Category-Matched Passive Funds

	U.S. Equity				International Equity			
	All Active Funds		Only Chosen Active Funds		All Active Funds		Only Chosen Active Funds	
Variable	Coeff. Est.				Coeff. Est.			
Passive Fund's Return (Beta)	1.0272	427.64	0.9516	69.16	1.02	268.26	1.0316	38.98
Intercept (Alpha)	-1.1530	-14.92	1.2387	4.97	1.27	10.25	3.2457	5.68
No. Observations	39,703		912		15,948		399	
R-Squared	0.811		0.840		0.81		0.79	

	Fixed Income				Mixed Assets			
	All Active Funds		Only Chosen Active Funds		All Active Funds		Only Chosen Active Funds	
Variable	Coeff. Est.				Coeff. Est.			
Passive Fund's Return (Beta)	0.2714	23.61	0.3176	4.22	1.01	212.30	0.6589	16.50
Intercept (Alpha)	2.7567	45.47	2.7222	7.59	-1.20	-18.31	1.7830	3.50
No. Observations	32,272		822		17,923		572	
R-Squared	0.017		0.089		0.711		0.6542	

Table 7 contains several expected findings. First, with the exception of Fixed Income funds, the estimated 'beta's are very close to one, particularly when data for all active funds are used. This implies that the returns of active funds generally move quite similarly to index funds in the respective categories.[23] Fixed Income active funds' returns appear to behave differently from their index counterparts; this is also evident from the low R-squared for this category of funds. Second, when data for all funds are used, the 'alpha's for active funds in the U.S. Equity and Mixed Assets categories is negative and statistically significant; yet, when the analysis is restricted to the chosen active funds, the 'alpha's switch from being negative to positive and significant. For the International Equity and Fixed Income categories, the 'alpha's are significantly positive regardless of whether one uses all active funds or the chosen subset in these two categories. Our finding that, the active funds chosen based on a combination of characteristics generate positive alphas, is consistent with our earlier results in Tables 4, 5 and 6.

F. Performance of Fund Portfolios Formed Using Asset Allocation Weights

Up to this point, we have examined the relative performance of active and passive funds that reside in the four Morningstar categories. However, an average investor typically holds a diversified portfolio of equity and fixed income assets. With that in mind, in this subsection we compare the relative performance of active and passive fund portfolios comprised of three asset classes: U.S. Equity, International Equity, and Fixed Income. The constitution of these portfolios for active and passive funds involved the following three steps. First, for active fund in these three categories we started with the funds chosen based on expense ratio + turnover + Sharpe. These choices yielded an average of 55 funds in U.S. Equity; 23 funds in International Equity; and 29 funds in the Fixed Income category. We chose not to include the category Mixed Assets because these funds are themselves a combination of equity and fixed income assets, and their relative performance has been shown in Table 6.

Second, we combined the *next year's* returns of these chosen active funds in the three asset classes using allocation weights. These weights were computed as follows:

[23] Statistical test show that the estimated betas for all funds in these three categories are not significantly different from one.

$$w_t^i = \frac{AUM_t^i}{\sum_{i=1}^{3} AUM_t^i}, \; i = \{U.S.\ Equity,\ International\ Equity,\ Fixed\ Income\} \tag{3}$$

That is, the asset allocation weights are based on the observed aggregate AUMs for all funds in each of the three asset classes: U.S. Equity, International Equity and Fixed Income. We used the same allocation weights for active and passive funds. The weights for the years 2001-2018 are shown in Table 8.

Finally, we computed the allocation-weighted annual returns of the chosen active fund portfolio and the passive fund portfolio as follows:

$$\overline{R}_t^a = \sum_{i=1}^{3} \left(w_t^i \cdot r_t^{ai} \right) \tag{4a}$$

$$\overline{R}_t^p = \sum_{i=1}^{3} \left(w_t^i \cdot r_t^{pi} \right) \tag{4b}$$

In equations (4a) and (4b), $\overline{R}_t^a$ and $\overline{R}_t^p$ denote the annual average returns of the portfolio of chosen active funds (where the active funds were chosen in year t-1) and the passive funds, respectively; r_t^{ai} denotes the annual returns for the chosen active funds in the i^{th} asset category, where i = {*U.S. Equity, International Equity, Fixed Income*}. Similarly, r_t^{pi} denotes the annual returns of passive funds in the i^{th} asset category.

Table 8 shows the allocation-weighted annual returns for the portfolio of the chosen active and passive funds. We find that in 11 of the 18 years in the sample period, the portfolio of chosen active funds does better than the passive fund portfolio. On average, over these 18 years, the active funds generate an annual return of 6.3% and a Sharpe ratio of 0.36, both of which are considerably superior to those of the passive funds' portfolio. For comparison, we have also displayed the average returns of the portfolios over the last decade; the active fund portfolio still does better, although outperformance is less pronounced.

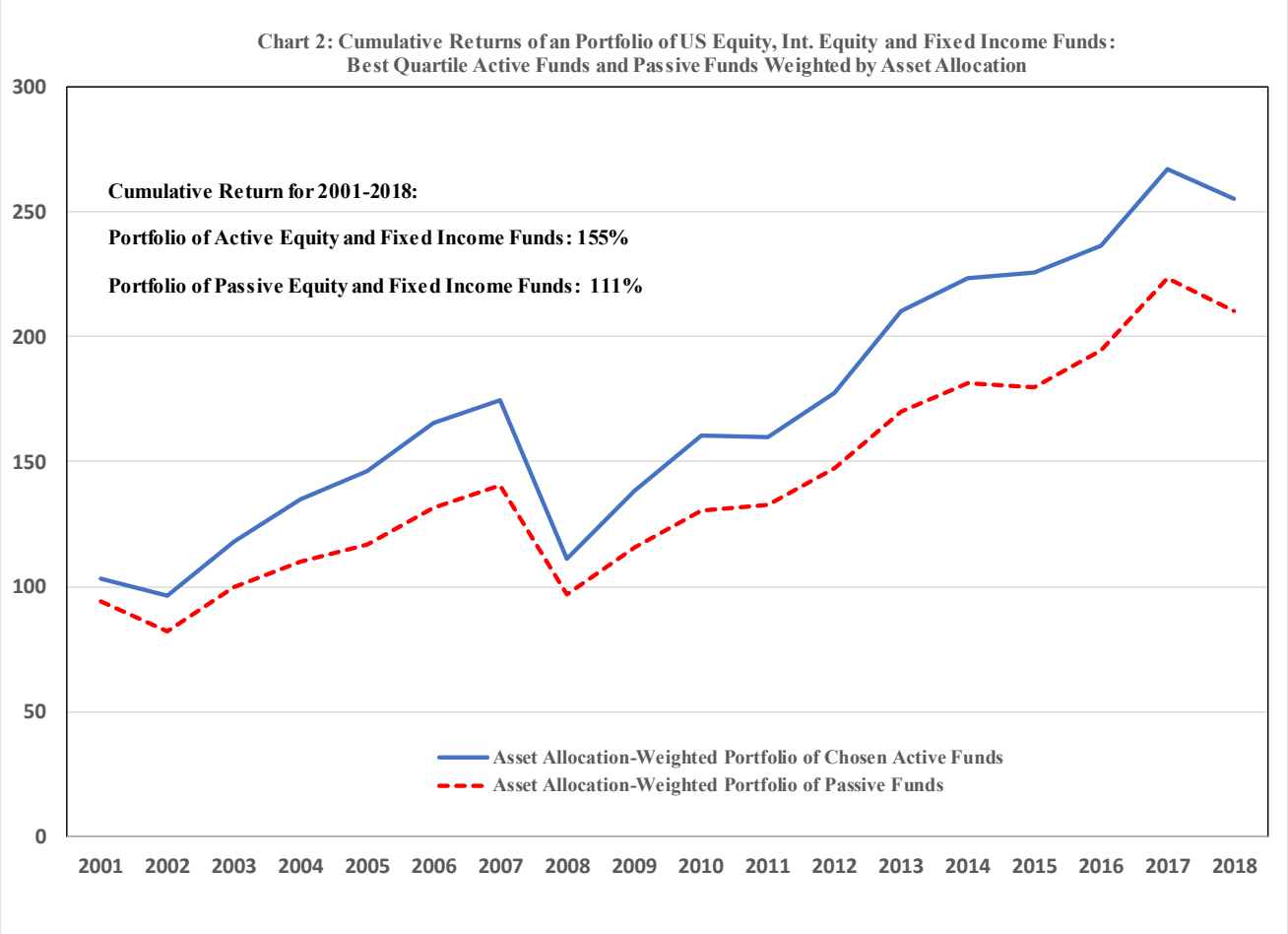
Table 8: Asset Allocation Weights and Annual Returns of Asset-Allocation-Weighted Portfolios

	Asset Allocation Weights				Returns (%)	
Year	U.S. Equity	Int. Equity	Fixed Income	Year	Portfolio of Best-Quartile Active Funds	Portfolio of Passive Funds
2001	65%	12%	23%	2001	3.2	-6.1
2002	61%	11%	28%	2002	-6.7	-12.4
2003	58%	11%	31%	2003	22.4	21.4
2004	61%	13%	26%	2004	14.5	10.5
2005	60%	15%	25%	2005	8.2	5.8
2006	58%	19%	23%	2006	13.2	12.8
2007	56%	22%	22%	2007	5.8	6.8
2008	52%	22%	26%	2008	-36.3	-31.2
2009	47%	19%	34%	2009	24.4	19.3
2010	46%	19%	35%	2010	15.8	13.0
2011	46%	19%	35%	2011	-0.5	1.6
2012	45%	17%	38%	2012	11.1	11.3
2013	47%	18%	35%	2013	18.5	15.3
2014	50%	19%	31%	2014	6.3	6.6
2015	50%	19%	31%	2015	1.1	-0.8
2016	49%	18%	32%	2016	4.7	8.4
2017	50%	19%	31%	2017	12.9	14.6
2018	51%	20%	30%	2018	-4.4	-5.7
Average	**53%**	**17%**	**30%**			
				Average (%) 2001-2018	**6.34**	**5.06**
				Average (%) 2009-2018	**8.99**	**8.36**
				Sharpe Ratio	**0.362**	**0.290**

Note: The chosen active funds were selected based on the best-quartile characteristics in the preceding year.

One possible criticism of this analysis could be that we are comparing the relative performance of the portfolio of *chosen* active funds to *all* passive funds, which might be deemed an unfair comparison. To address this issue, in Appendix Table A3, we report the results where the asset weighted active fund portfolio's returns are compared the asset weighted portfolio of the cheapest *and* the largest passive funds. Appendix Table A3 shows that the performance of the passive funds improves, but the portfolio of chosen active funds still outperforms.

In Chart 2, we depict the cumulative returns of the two portfolios shown in Table 8. As is evident from Chart 2, in every year, the cumulative returns of the chosen active fund portfolio of equity and fixed income assets are higher than the returns of the corresponding passive fund portfolio.



We repeated this exercise using Vanguard index funds in lieu of the average passive funds. The asset allocation-weighted average returns of the portfolios of the chosen active and the Vanguard funds are shown in Table A2. We find that the allocation-weighted portfolio of the chosen active funds outperforms allocation-weighted Vanguard funds' portfolio.

G. AREAS OF FURTHER RESEARCH

As noted earlier, the outperformance of the active funds will be somewhat lower if transactions costs are accounted for. This is particularly because the chosen active fund portfolios are reconstituted each

year, resulting in portfolio turnover. This turnover would entail not only transaction costs, but would also have potential tax implications. The size of these costs will, in turn, depend on the extent to which funds in the portfolios get shuffled each year, with some funds exiting and others replacing them.

Recall from Table 6, the average outperformance of the chosen active funds for U.S. Equity, International Equity and Mixed Assets Funds ranges between 0.99% to 3.33% per year. Even if one assumes that the entire chosen active fund portfolio is turned over each year (which is not the case), one has to assume fairly high transaction costs to erode this level of outperformance. For fixed income funds the outperformance is lower, around 0.2%. However, our analysis shows that portfolio turnover for fixed income funds is quite small; that is, the same funds often repeat themselves in the best-quartiles. Thus, for the fixed income portfolio the transaction costs would also be lower.

Estimation of transaction costs for mutual funds is challenging since it is difficult to obtain detailed transaction-level data for mutual funds. Furthermore, these costs will vary greatly by fund family and the sizes of the portfolios being reconstituted. An important area of future research could be the quantification of these transactions costs so that one can get a more accurate estimate of the relative performance of chosen active and passive funds.

5. CONCLUDING COMMENTS

Our findings call into question the plaintiffs' claims in most ERISA litigation matters that higher-fee actively managed funds are *per se* unsuitable. However, each ERISA case is fact specific and an individualized inquiry would be required to reach any specific view in a particular matter. For example, there are a few cases where the plaintiffs have alleged that the plan fiduciaries chose a higher-fee share class of a mutual fund, when a lower-fee share class of the *same* fund was available for inclusion in the plan.[24] Assuming the plaintiffs' assertion is true, in these types of instances, it would be difficult to justify the inclusion of the high-fee share class in the plan offerings. But in most 'excessive-fee' ERISA matters, the thrust of plaintiffs' argument is that high-fee actively managed funds are necessarily

[24] *White v. Chevron Corp.*, Case No. 16-cv-0793-PJH (N.D. Cal. Aug. 29, 2016);
Andrus v. New York Life Insurance Company et. al., Case No. 1:16-cv-05698 (S.D.N.Y., Jul. 18, 2016);
Ramsey et. al. v. Philips North America LLC, CIVIL ACTION NO. 3:18-cv-1099 (S.D.Ill., May 10, 2018)

inferior to lower-fee passive index funds. In this study we find, while *on average*, actively managed funds do underperform their passive counterparts, it is not axiomatic that all active funds do, as our research clearly demonstrates. Prudent plan fiduciaries typically consider various features of funds, in addition to fees, such as past performance, assets under management, return volatility, manager reputation, years in existence etc., in making their fund selection. Our results show that active funds chosen based on several of these characteristics simultaneously can provide significantly superior returns to passive index funds.

Indeed, in this regard the 7th Circuit's opinion in an ERISA matter is instructive:

"The fact that it is possible that some other funds might have had even lower expense ratios is beside the point; nothing in ERISA requires every fiduciary to scour the market to find and offer the cheapest possible fund (which might, of course, be plagued by other problems)."[25]

In other words, a fund can have low fees but also low returns and thus be an imprudent choice; conversely a high fee fund can yield superior net-of-fee returns. In fact, as our research suggests, a choice based on various fund characteristics can lead to the selection of actively managed funds that yield superior performance relative to their passive counterparts. We believe our study will provide defendants in ERISA matters further ammunition to argue, as some have, that they did not breach their "fiduciary duty to retirement plan participants by failing to employ a passive-management strategy …because using an active-management strategy made more sense."[26]

[25] *Loomis v. Exelon Corp.*, 658 F.3d 667 (7th Cir. 2011)

[26] Brill, Emily. "Northrop Grumman Seeks Quick Win in ERISA Fee Suit." *Law360 - The Newswire for Business Lawyers*, Law360, 4 Feb. 2019, www.law360.com/articles/1125398/northrop-grumman-seeks-quick-win-in-erisa-fee-suit.

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Table A1: AUM-Weighted Average Returns and Expense Ratios for Actively & Passively Managed Funds: 2000-2018

	U.S. Equity		Int. Equity		Fixed Income		Mixed Assets	
Variable	Active				Active			
AUM Weighted Average Annual Return (%)	5.84	6.15	4.98	4.41	4.36	4.18	5.80	5.34
AUM Weighted Average Expense Ratio (%)	1.01	0.18 **	1.16	0.22 **	0.81	0.17 **	0.66	0.24 **

Note:

*** denotes statistically significant difference at 99% level of confidence.*

Table A2: Performance of Portfolios of Active Funds Chosen Based on Prior Year's Best Quartile Characteristics

Annual Average Return & Excess Over Category-Matched Vanguard Index Funds' Return (%): 2001-2018

	Portfolio's Return (%)	Return of Vanguard Index Fund (%)
U.S. Equity	7.95	8.14
Int. Equity	7.46	5.91
Fixed Income	4.29	4.24
Allocation-weighted Portfolio Return	**6.34**	**6.19**

Note:
The Vanguard index funds were:
Vanguard Total Stock Market ETF (VTI) for US Equity category
Vanguard Total International Stock Index Inv (VGTSX) for International Equity category
Vanguard Total Bond Market Index Inv (VBMFX) for Fixed Income Category

Table A3: Asset Allocation Weights and Annual Returns of Asset-Allocation-Weighted Portfolios

	Asset Allocation Weights				Returns (%)	
Year	U.S. Equity	Int. Equity	Fixed Income	Year	Portfolio of Best-Quartile Active Funds	Portfolio of Cheapest & Largest Passive Funds
2001	65%	12%	23%	2001	3.3	-6.3
2002	61%	11%	28%	2002	-6.7	-12.0
2003	58%	11%	31%	2003	22.1	21.7
2004	61%	13%	26%	2004	14.5	11.5
2005	60%	15%	25%	2005	8.1	6.7
2006	58%	19%	23%	2006	13.3	13.8
2007	56%	22%	22%	2007	5.3	7.5
2008	52%	22%	26%	2008	-36.5	-31.3
2009	47%	19%	34%	2009	23.8	20.6
2010	46%	19%	35%	2010	15.9	13.2
2011	46%	19%	35%	2011	-0.8	1.6
2012	45%	17%	38%	2012	10.9	11.9
2013	47%	18%	35%	2013	18.2	15.8
2014	50%	19%	31%	2014	6.5	6.7
2015	50%	19%	31%	2015	1.0	-0.2
2016	49%	18%	32%	2016	4.8	8.6
2017	50%	19%	31%	2017	13.7	15.1
2018	51%	20%	30%	2018	-4.4	-5.0
Average	**53%**	**17%**	**30%**			
				Average (%) 2001-2018	**6.28**	**5.55**
				Average (%) 2009-2018	**8.96**	**8.82**
				Sharpe Ratio	**0.359**	**0.322**