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Abstract

In this paper we examine the differences in aggregate ownership of stocks held by passive equity funds and active equity funds and in the characteristics of stocks held by these funds. We find that holdings of passive funds do not mirror the holdings of active funds. There are systematic differences in the holdings between the two groups with active funds more likely to hold smaller stocks, growth stocks, and stocks with higher momentum, higher turnover and more recent IPOs. We also find evidence that the holdings of passive and active funds have trended closer together over time, consistent with the significant inflows into passive funds across all size groups. These systematic differences in holdings suggest that passive funds do not enjoy an intrinsic advantage in *after fee* performance over active funds. We find that the relative performance of passive and active funds is sensitive to the period over which returns are measured. We show that this time varying relative performance of active and passive funds could be attributable to style differences in aggregate portfolio holding between the two groups.

Aggregate Mutual Fund Holdings and Fund Performance

1. Introduction

The last two decades have seen a seismic shift in the mutual fund landscape with the growth of passive investing. Of the roughly $7.5 trillion held by domestic equity mutual funds and ETFs at the end of 2015, nearly $1.5 trillion are held in index mutual funds and $1.2 trillion in ETFs (ICI Factbook (2016)). In the 10 years ending 2015, equity index mutual funds and ETFs have seen assets under management (AUM) inflows of nearly $1 trillion, while active mutual funds have seen outflows of over $800 billion (ICI Factbook (2016)). The primary reason for the explosive growth in passive investment vehicles is the belief that the average active asset manager has no skill (Fama (1970), Carhart (1997)) and cannot outperform passive asset managers net of fees (French (2008)). Sharpe (1991) argues that simple arithmetic requires that at the aggregate level before costs, passive and active management will generate equal returns. This is because if passive vehicles, in aggregate, buy and hold the market portfolio, it has to be true that the active vehicles, in aggregate, should also hold the market portfolio. Given that passive management has a lower fee structure, this implies that on an after-fee basis, passive managers will outperform active ones. Consistent with this argument, prior work has found that passive vehicles outperform active vehicles by approximately 70-80 bps per year (Gruber (1996), French (2008), Guercio and Reuter (2014)), which roughly approximates the fees charged by active managers. Sharpe's (1991) argument and the supporting empirical evidence are cited by supporters of passive investing as an argument against active management.[1]

While the framework is elegant and simple in theory, in reality, several factors introduce frictions in Sharpe's (1991) argument of parity in gross performance. Implicit in

[1] It is also used in the hotly debated current issue on whether the outflow from active to passive management is perpetuating a mispricing of equities (Haghani (2017)).

Sharpe's (1991) argument are two assumptions: that passive vehicles own the entire market in proportion to the market weights and/or passive vehicles do not need to trade. As regards the latter assumption, Pedersen (2018) provides several examples of reasons why passive vehicles need to rebalance. While acknowledging the important role of passive management, he makes the case for active management by arguing that the need to rebalance due to corporate events (e.g., IPOs, SEOs, repurchases and index additions) causes passive vehicles to trade with active managers, thereby putting the passive vehicles at a disadvantage. As regards the former assumption, there is little evidence on the aggregate holdings profile of passive and active funds and the effect they have on their relative performance.[2] This paper attempts to address this issue by examining the extent to which portfolio holdings of passive funds mirror the universe of stocks as well as the holdings of active mutual funds and the effect that any difference in holdings could have on the widely documented superiority in the performance of passive mutual funds. Using this foundation, we examine factors that influence the spread between the aggregate performance of active and passive funds. In doing so, we shed light on the extent to which a fundamental tenet of Sharpe's (1991) arithmetic holds in the economically very significant world of mutual funds and thereby contribute to the important debate on active and passive investing.[3]

We compare the *aggregate* holdings of passive and active funds to the universe of stocks using an active share approach. Active share, as a measure of active portfolio management, "represents the share of portfolio holdings that differ from the benchmark

[2] It is a mathematical truism that the proportion of the aggregate universe that is not held by passive vehicles will have to be held by active vehicles. What is not clear is the extent to which this truism holds within the universe of mutual funds (including ETFs), given that other participants including sovereign wealth funds, individuals, pensions and insurance companies also hold positions in the same stocks.

[3] In this study we limit passive and active vehicles to include Investment Companies registered under the Investment Companies Act of 1940 (Mutual Funds and ETFs) that focus on domestic equity securities. While most passive vehicles tend to be "40 Act" entities, active vehicles can take on many forms. We focus on active '40 Act' entities i.e., mutual funds and ETFs and exclude other investors including hedge funds, pension funds, family offices and individual investors who directly invest in equities. However, as discussed earlier, mutual funds control a large piece of the investable universe and are therefore a very important part of the investment management universe.

holdings" (Cremers and Petajisto (2009)). The idea is simply to identify how different the holdings are relative to a benchmark. Using the CRSP universe of domestic U.S stocks as the benchmark, we first compare the aggregate holdings of passive funds to this universe. We find that passive funds have experienced a significant drop in active share over time, with a larger drop in the small and mid-capitalization space. The 1990s were characterized by passive funds that were heavily weighted towards large cap stocks. This means that, in the aggregate, the performance of passive funds was heavily influenced by the performance of large cap stocks. The drop in active share of passive funds suggests an increasing similarity in portfolio holdings between the stocks held by passive funds in aggregate and the universe of stocks. This is consistent with more money flowing into passive small and mid-capitalization funds, making it more competitive for active funds to attract investors in this space.

Similarly, we also compare the aggregate holdings of active funds to the CRSP universe. The result of this analysis suggests that while active funds also experienced a decrease in active share, it is not as dramatic as that observed for passive funds. Unlike passive funds, active funds were already well represented in all market cap groups in the early sample period. However, active funds display a preference for small and mid-cap stocks through the entire sample period. Nonetheless, we find that the active share of both active and passive funds relative to the universe is still high, suggesting that a discrepancy between the universe and the stocks held by these funds, in the aggregate, is not trivial. Further, when comparing aggregate holdings between passive and active funds (by calculating the active share of passive funds using the stocks in active funds as the benchmark), we find that there is a significant difference in the share of portfolio holdings between the two groups, although again the difference has decreased over time particularly in the small and mid-capitalization space.

While our analysis suggests that firm size is an important characteristic that differentiates positions held by passive and active investors, we also examine other characteristics that distinguish the aggregate holdings between the two groups when compared to each other. For this analysis, we measure, for each stock, the difference in aggregate portfolio weight, i.e., the signed difference in the portfolio weight that the stock takes in the value of entire holdings of portfolios between passive versus active mutual funds as a whole. This difference represents the extent to which the aggregate passive holdings are overweight (if positive) or underweight (if negative) the aggregate active holdings. Consistent with our prior findings, the signed difference in aggregate portfolio weight (i.e., passive minus active) is significantly positively associated with firm size, suggesting that active investors prefer to invest in smaller stocks when compared with passive funds. Active funds also display a slight preference for growth stocks (lower book-to-market ratio) and stocks with higher turnover, and a strong preference for stocks with higher momentum, and recent IPOs as compared with passive funds.

The above results suggest that *aggregate* active funds holdings do not mirror those of passive funds and differ across multiple dimensions. This difference in holdings, therefore, suggests that it may not be inevitable that passive funds outperform active funds by the dint of Sharpe's (1991) arithmetic.[4] While prior work suggests that passive funds on average outperform active funds and this has been taken as evidence of the applicability of Sharpe's (1991) arithmetic to the mutual fund universe, we delve deeper into this issue. We first start by examining the time-series mean of the cross-sectional average of monthly returns of passive and active vehicles in our sample, as done in prior work. When returns are equally weighted cross-sectionally each month (i.e., equal-weighted average of monthly fund

[4] It must be noted that while Sharpe's (1991) arithmetic encompasses all investable asset classes (public equities, fixed income, derivatives, commodities, and real estate etc.) across the globe, our paper focuses on a subset of this universe (albeit a large and important subset). Our analysis focuses on investment funds registered under the Investment Companies Act, 1940 that invest in US public equities.

returns), we find that consistent with prior work (e.g., French (2008)), passive vehicles on average outperform active ones by about 5bps per month in our sample period of 1992 to 2017. When using value-weighted average of monthly fund returns (with fund size as a weight), we find that the difference is larger with passive funds outperforming active funds by 10 bps a month.[5] However, given our findings on the significant difference in holdings between passive and active funds in the early nineties, we carry out a more careful time series analysis which suggests a more nuanced picture of the outperformance. We find that the average performance is heavily influenced by a large outperformance in the early years of the sample period, particularly the 1990s. Passive funds outperform active funds by a significant 24 bps per month in the period 1992-1998 using equal-weighted returns and roughly the same amount using value-weighted returns. When examining the subsequent nineteen years from 1999-2017, we find little difference in the average performance of active and passive funds using equal weighted returns and a more modest 3 bps per month using value-weighted returns (this difference is not statistically significant).[6] The significant outperformance of passive funds in the early nineties is heavily influenced by the fact that passive funds were primarily focused on large cap stocks while active funds were underweight in these stocks. Large cap stocks performed extremely well during this period significantly outperforming small-cap and mid-cap stocks.

We also examine the aggregate performance of passive and active funds after adjusting for the Fama and French's (2014) five risk factors and the momentum factor. We find that passive funds generate an alpha of 11 bps per month over the entire sample period

[5] We examine both equal-weighted and value-weighted fund returns. Using active funds' equal-weighted returns, past research has shown that fund size is related to fund performance with smaller active funds outperforming larger active funds (e.g., Chen et al. (2004)). Consistent with the past research, we use equal-weighted returns to compare the aggregate performance between the passive and active groups. However, we also use value-weighted returns because it should better reflect the aggregate performance of passive or active vehicles as a whole. However, this approach makes the comparison more tilted towards larger funds.

[6] As discussed later in the paper, our results based on the entire sample period using equal-weighted and value-weighted returns together suggest that larger active funds have had greater difficulty in outperforming larger passive funds although the difference in the later sample period is not as large as generally believed.

(1992-2017).[7] During this period (1992-2017), active funds also generate a significant alpha of 9 bps per month. Unlike passive funds, however, the only risk factors that load for active funds are the market and size factor. After controlling for difference in exposures to risk factors, we find no significant difference in alpha between passive and active funds in this period. However, consistent with our analysis on aggregate holdings, we do find that active funds are more like to have greater exposure to small stocks, growth stocks, and momentum stocks, as compared with passive funds. Surprisingly, when compared with passive funds, active funds are more likely to own weak stocks in their operating profitability and stocks with more aggressive investment portfolios.

We then parse the overall sample period into two sub-periods. Our analysis of the early period (1992-1998) suggests that the above results from the entire period are primarily driven by the 1990s. To be more specific, after controlling for risk factors, we find that both passive and active funds generated significantly large alphas. However, we also find that there is no difference in alpha across the two groups during this period using both types of returns. In contrast, when examining the more recent sample period (1999-2017), we find that both active and passive funds fail to generate significant alpha using equal weighted returns. However, using value-weighted returns, we find that both groups generated significant alpha with no significant difference between the two groups.

This paper informs the debate on active vs. passive investing. Our evidence suggests that passive and active funds in aggregate hold positions that are different from each other as well as when compared with the universe of stocks. We also find that the holdings differ between the groups along systematic dimensions. This raises the possibility that returns across the two groups could vary at any point in time. For example, active funds' greater

[7] The alpha is attributable to the way the Fama-French factors are constructed (Cremers, Petajisto, and Zitzewitz (2013) and our findings that passive funds are more likely to hold larger firms.

exposure to small/mid cap stocks and momentum stocks and their lower exposure to value stocks suggests that active funds are likely to outperform during the periods when small, value and momentum stocks perform well. Consistent with this possibility, we find that the relative performance of active and passive funds varies over time. Further, once we control for systematic factors, passive funds and active funds do not differ from each other in terms of *after fee* performance.

The paper contributes to the extensive literature on whether active managers display skill in performance (Barras, Scaillet, and Wermers (2010), Fama and French (2010), Berk and van Binsbergen (2015)).[8] A significant part of the literature suggests that skill is tough to find amongst active managers. However, more recent papers suggest that there are groups of active managers that do generate returns not just to cover their fees but in excess of fees (Kosowski et al. (2006), Guercio and Reuter (2014)). Our results indicate that, in the aggregate, active managers can generate returns net of fees, which are comparable to net returns to passive funds, suggesting that active managers do display skill in the aggregate. Further, if many of active managers underperform after fees, our findings would suggest that there are a group of active managers that significantly outperforming after fees, consistent with the more recent theoretical literature (Berk and Green (2004), Pástor and Stambaugh (2012), Gârleanu and Pedersen (2018)).

The paper is also related to the literature on mutual fund size and mutual fund performance. Focusing on active funds with equal-weighted fund returns, prior work has found that fund size is negatively associated with fund performance (Chen et al. (2004), Pástor, Stambaugh, and Taylor (2015)). However, we find that value-weighted returns are higher than equal-weighted returns for passive funds, but not for active funds, during our

[8] Other papers include Grinblatt and Titman (1994), Wermers (2000), Kacperczyk, Sialm, and Zheng (2008), Kacperczyk, Nieuwerburgh, and Veldkamp (2014)

sample period from 1992 to 2017, suggesting that unlike active funds, passive funds perform better with a larger AUM possibly due to lower fees. We also find that large-sized passive funds outperformed large-sized active funds, while there is no difference in the performance between small-sized passive and active funds. Thus, our results overall indicate that mutual fund size plays a role even in the relative performance between passive and active funds. More specifically, large-sized active funds seem to have greater difficulty in outperforming their passive counterparts, while smaller active funds are able to hold their own against their passive counterparts.

The rest of the paper is organized as follows. Section 2 reports the analysis of active share, and Section 3 discusses the analysis of aggregate portfolio weight. Section 4 examines the return spread between passive and active funds, and Section 5 discusses additional analyses. Finally, Section 6 concludes the paper.

2. Analysis of Active Share

2.1 Active Share of Passive and Active Funds compared with the Universe

To learn about the difference in relative performance of active and passive funds, we examine the underlying holdings of these funds and the extent to which they overlap with the universe and each other. To do so, we focus on *Active Share* for passive and active funds in aggregate. *Active Share* is used as a measure of active portfolio management and "represents the share of portfolio holdings that differ from the benchmark holdings" (Cremers and Petajisto (2009)). In other words, it is the proportion of the assets held in a mutual funds' portfolio that differ from a benchmark portfolio, capturing the overall extent to which a fund's portfolio is different from the benchmark. More specifically, for mutual fund i at time t, *Active Share* relative to a benchmark portfolio which holds stocks from $s = 1$ to N is calculated as:

$$Active\ Share_{i,t} = \frac{1}{2}\sum_{s=1}^{N(t)} |w_{i,t,s} - w_{b,t,s}| \quad (1)$$

where $w_{i,t,s}$ is the portfolio weight of stock *s* for mutual fund *i* at time *t*, and $w_{b,t,s}$ is the portfolio weight of stock *s* for a benchmark portfolio at time *t*.

Since the analysis of *Active Share* requires us to know specific stocks held by mutual funds, we use CDA/Spectrum S12 to identify their portfolio holdings, and link this data to CRSP Mutual Fund Database to obtain fund characteristics (e.g., passive or active) using MFLINKS. We classify a fund as passive if the index fund flag provided by the database indicates that the fund is an index fund, or if the fund name includes "index", "indx" or "idx". All other funds are classified as active funds. We include all firms covered by CRSP/Compustat Merged Database as the universe of stocks investable by mutual funds except for those whose market value of common equity is smaller than the bottom quintile of NYSE firms. Unlike the prior work (Cremers and Petajisto (2009)), because our interest lies in the aggregate difference between passive and active funds (rather than the difference between an individual mutual fund and a certain benchmark), we aggregate holdings in every individual mutual fund as reported last each calendar year for passive and active funds separately. As such, we create two aggregate mutual funds: One is aggregate passive, and the other is aggregate active.

Panels A and B of Table 1 show *Active Share* for aggregate passive and active funds, respectively, relative to the universe of stocks investable by mutual funds as covered by CRSP/Compustat Merged Database. In addition to showing aggregate *Active Share*, we also calculate *Active Share* for subsets of the universe based on size. The universe of stocks is partitioned into three groups based on size. We define small-, mid-, large-cap stocks as those whose market value of common equity belongs to the lowest 40%, the middle 40%, and the highest 20% of the stock universe each year, respectively. Panel A shows that passive funds

at the aggregate level have experienced a steady decline in *Active Share* from a peak of around 0.45 to 0.47 in the early 1990s to approximately 0.25 in the 2016. Small-cap stocks have the highest *Active Share* followed by mid-cap and then large-cap stocks. A decrease in *Active Share* over time is clearly observed for small-, mid-, and large-cap stocks, but with the largest drop in *Active Share* for small-cap stocks. This finding is consistent with AUM (assets under management) flowing into passive funds across all size groups with an emphasis on flows into small and mid-cap funds, thus resulting in passive funds getting closer to mimicking the overall market. However, despite the decline of *Active Share* for passive funds, it is still at a significant level of 0.25 or higher recently. This could be because there are firms in the universe that are not part of the indices (e.g., ADRs, MLPs or stocks that do not meet index inclusion criteria like recent IPOs etc.) or are part of indices in proportions other than their market capitalization (e.g., float weighted or style weighted indices).

A similar analysis for active funds yields interesting results in Panel B. As with passive funds, *Active Share* has also been dropping for active funds since the start of the sample period, with an active share of 0.44 in 1990 and 0.31 in 2016. Note that *Active Share* is higher for active funds than that for passive funds. Active fund managers are less constrained by indices and can invest wherever they choose. While some of the high value of *Active Share* for active funds could be mechanical (e.g., inability to own significant interests in firms with large minority or insider ownerships), it is also driven by active managers taking on aggregate active bets. Unlike with passive funds, the active share of small cap firms has not changed much over time with the *Active Share* hovering around 0.50. That said, the *Active Share* of small cap stocks, which was higher in the early years of the sample for passive funds as compared with active funds, have become similar for both groups in recent years. *Active Share* for mid-cap stocks are also similar for both groups in recent years.

Interestingly, *Active Share* for large-cap stocks is still higher for active funds as compared with passive funds even in recent years.

Figures 1, 2 and 3 provide data on the proportion of overall AUM invested in small, mid and large cap stocks. The evidence is consistent with the results in Table 1. In particular, historically, a greater proportion of aggregate AUM has been invested in mid-cap stocks for active funds relative to the universe, with the reverse being true of passive funds (Figure 2). Passive funds' exposure to large cap stocks have been higher than the universe, while the active funds' exposure has been lower than the universe (Figure 3). It is interesting to note that both active and passive funds have been slightly underweight small cap stocks (Figure 1). This is likely to be mechanical with small cap stocks potentially being harder for funds to invest in due to limited float, liquidity and other issues. These figures overall depict a notable trend of an increasing proportion of passive AUM being invested in small- and mid-cap stocks with a decreasing proportion in large-cap stocks. Active funds on the other hand have been relatively stable in their exposure to the three size buckets. The exposures across all capitalization groups are getting closer to overall universe proportions. The persistent under-exposure of active funds to large cap stocks is consistent with these funds having a higher *Active Share* than passive funds.

2.2 Active Share of Passive Funds compared with Active Funds

While the above analysis examines *Active Share* of passive and active funds separately relative to the entire universe, in Table 2, we also compare *Active Share* of passive funds relative to their active counterparts. That is, we calculate *Active Share* of passive funds in aggregate using the aggregate portfolio held by active funds as a benchmark portfolio. The advantage of this approach is that it provides information on how much passive holding deviates from active holdings in the aggregate. We find that *Active Share* of passive funds has dropped considerably from around 0.34 in 1990 to 0.23 in 2016. We also provide information

on *Active Share* broken up by market capitalization. We find that for the smallest firms, *Active Share* has dropped from 0.64 in 1990 to 0.26 in 2016, while for mid-cap firms it has dropped from 0.47 to 0.23. The group with the largest firms has been the most stable with *Active Share* dropping from 0.28 to 0.23. One explanation for this finding is that in the early years, most passive fund AUM was invested in large capitalization indices (e.g., SPY or Vanguard S&P 500 fund) while in recent years passive AUM is more balanced in covering indices across firm size groups (e.g., Russell 2000 funds and ETFs). This would suggest a more competitive environment for small and mid-cap active funds in the recent years as compared with the early years.

However, despite the compression in *Active Share*, it continues to be large at the aggregate level (e.g., between 0.23 and 0.26 in 2016). This suggests that active and passive funds still differ in the positions they own at an aggregate level, thus allowing for performance to differ (both before and after fees). Sharpe's arithmetic, while often relied upon, is not necessarily valid in the narrow but very economically significant debate of comparing performance of active and passive mutual funds, thereby raising the possibility that performance difference between the two groups is not simply a function of fees.

3. Style Differences in Passive and Active Fund Aggregate Holdings

Section 2 documents active share differences between passive and active mutual funds and shows that firm size is a significant factor that accounts for these differences both over time as well as cross-sectionally. In this section, we examine other factors, such as the firm's book-to--market ratio, momentum, turnover, volatility, and firm age that could explain the difference in the aggregate holdings between passive and active funds. The purpose of this analysis is to understand the systematic aggregate level behavior of passive managers and compare them to the active universe.

To carry out this analysis, we run the following regression year by year and estimate the average coefficient:

$$\begin{aligned} \textit{Portfolio Weight Difference}_{s,t} = \quad & \alpha_1 + \alpha_2 \, \textit{Log(Mktval)}_{s,t} + \alpha_3 \, \textit{BTM}_{s,t} \\ & + \alpha_4 \, \textit{Momentum}_{s,t} + \alpha_5 \, \textit{Turnover}_{s,t} + \alpha_6 \, \textit{Volatility}_{s,t} \\ & + \alpha_7 \, \textit{NewFirm}_{s,t} + \varepsilon_{s,t} \end{aligned} \tag{1}$$

For each firm-year (for stock *s* in time *t*), the dependent variable is the difference in the portfolio weight between passive funds and the stock universe (in Panel A of Table 3), between active funds and the stock universe (in Panel B of Table 3), or between passive funds and active funds (in Panel C of Table 3). A firm's portfolio weight in passive (active) funds is calculated as the value of the firm's stock held by all passive (active) funds divided by the total value of all stocks held by the same passive (active) funds as reported in CDA/Spectrum S12 last each calendar year.[9] Log(Mktval) is the natural logarithm of the firm's market value of equity as of the last fiscal year-end before the end of the calendar year. BTM is the firm's book-to-market ratio as of the last fiscal year-end before the end of the calendar year. Momentum is the firm's market-adjusted stock returns over the 6-month period before the end of the calendar year. Turnover is the average turnover (i.e., daily trading volume divided by the number of shares) over the 6-month period before the end of the calendar year. Volatility is the standard deviation of the firm's daily returns over the 6-month period before the end of the calendar year. NewFirm is an indicator variable that equals one if the firm's age is less than or equal to three, and zero otherwise. We use this

[9] To illustrate, suppose that there are five passive funds, A, B, C, D, and E, and the total value of their portfolio holdings is $100, $200, $300, $400, and $500, respectively. If stock X is held by funds A and B for $10 and $50, respectively, the stock's portfolio weight in passive funds is calculated as (10+50+0+0+0) / (100+200+300+400+500) = 4%. Similarly, assume that there are five active funds, F, G, H, I and J, and the total value of their portfolio holding is $100, $200,$300, $400, and $500, respectively. If stock X is held by fund F and G for $20 and $100, respectively, the stock's portfolio weight in active funds is (20+100+0+0+0)/ (100+200+300+400+500) = 8%. Then, for stock X, the portfolio difference between passive and active funds is -4%.

measure as a proxy for firms that have recently gone public. A firm's age is calculated as the calendar year minus the year the firm first appeared in the CRSP Database. Passive funds usually do not invest in recent IPOs and therefore are likely to be underweight these stocks.

The results of this analysis are presented in Table 3. Panel A of Table 3 provides the results when the dependent variable is the portfolio weight difference of stock *s* in year *t* between passive funds and the stock universe, calculated as the portfolio weight in passive funds minus the portfolio weight in the stock universe. The stock universe is the same portfolio of stocks used in *Active Share* calculation in Table 1, i.e., those covered by CRSP/Compustat Merged Database excluding firms whose market value of common equity is smaller than the bottom quintile of NYSE firms. As reported at the bottom of the table, the average coefficient on Log(Mktval) is significantly positive, consistent with larger firms having a higher weight in the holdings of passive funds relative to the stock universe. The results also show that the average coefficients on BTM and NewFirm are significantly negative, suggesting that passive funds in aggregate have a lower weight in stocks with the higher book-to-market ratio and in those with IPOs in recent years when compared with the stock universe.

In Panel B of Table 3, however, when the dependent variable is the portfolio weight difference of stock *s* in year *t* between active funds and the stock universe, the average coefficient on Log(Mktval) is significantly negative, consistent with active funds being under-exposed to large cap stocks (as in Figure 3). In addition, the result show that the average coefficients on BTM, Volatility, and NewFirm are significantly negative, suggesting that when compared to the stock universe, active funds in aggregate have a lower weight in stocks with the higher book-to-market ratio, higher volatility, and more recent IPOs. In contrast, the average coefficient on Turnover is significantly positive, suggesting that active

funds in aggregate have a higher weight in stocks with higher turnover characteristics relative to the stock universe.

In Panel C of Table 3, the dependent variable is the portfolio weight difference of stock *s* in year *t* between passive funds and active funds, i.e., the portfolio weight in passive funds as a whole minus the portfolio weight in active funds as a whole. Thus this difference represents the extent to which the aggregate passive holdings are overweight (if positive) or underweight (if negative) the aggregate active holdings. Consistent with the findings in the previous section, the average coefficient on Log(Mktval) is significantly positive, suggesting that passive funds have a higher proportion of large cap stocks as compared with active funds. Unlike the result reported in Panel A of Table 3, the average coefficient on BTM is significantly positive, suggesting that passive funds have more of a value tilt in their portfolio when compared with active managers who seem to more prefer growth firms. The average coefficients on Momentum and Turnover are significantly negative, suggesting that passive fund holdings are weighted less towards stocks with higher momentum and higher turnover as compared with active funds. Analysis of year-by-year coefficients also produces interesting results. For example, while the coefficient on book-to-market has flip-flopped in early 1990s, it has stayed reliably positive and high over the sample period later in the sample period. Moreover, while passive funds had significant exposure to large cap stocks and lower turnover stocks early in the sample period, this has been trending downwards. More recently, the coefficient on Turnover is almost zero.

4. Active and Passive Fund Returns

The above analyses in Sections 2 and 3 suggest that there are systematic differences in the holdings between passive and active mutual funds. One of the much discussed and marketed advantage of passive funds is that they outperform active funds after fees. Sharpe (1991) argues that simple arithmetic requires that at the aggregate level before costs, passive

and active management will generate equal returns. Given that passive management has a lower fee structure, this implies that on an after-fee basis, passive managers will outperform active ones. However, the results in Sections 2 and 3 show that there have been, and still are, systematic differences in the aggregate holdings of active and passive funds. Therefore, it is not a mathematical truism that passive funds are predetermined to outperform active funds by the extent of the fee differential. However, past work does indicate that passive funds have outperformed active funds, and the outperformance is approximately the fee differential (Gruber (1996), French (2008), Guercio and Reuter (2014)). In this section, we delve deeper into the aggregate performance of these funds to examine drivers of holdings and performance differentials between these funds.

4.1 Sample Selection and Description

For the analyses involving fund returns, we use CRSP Mutual Fund Database as our primary source of data, which provides various fund characteristics along with monthly fund returns (MRET) and monthly asset under management (AUM). We restrict our analysis to domestic equity mutual funds including both active and passive funds, but excluding foreign funds, fixed income funds, mixed fixed income and equity funds, and funds with hedge and short styles based on CRSP's fund objective funds. Same as before, we classify a mutual fund as a passive fund if the index fund flag provided by the database indicates that the fund is an index fund, or if the fund name includes "index", "indx" or "idx". All other funds are classified as active funds. Prior studies on mutual funds suggest that the performance of smallest funds (with less than $15 million in AUM) tends to be upwardly biased (e.g., Elton et al. 2001; Chen et al. 2004). Therefore, we exclude fund-month observations from our

analyses if their monthly total net assets belong to the bottom quartile of the universe each month.[10]

Table 4 provides descriptive information on passive and active funds used in our analyses from 1992 to 2017.[11] It reports the yearly means of variables measured each month, including the number of mutual funds, monthly AUM per fund, and monthly AUM aggregated across all funds for passive and active funds, separately. The number of passive funds has steadily increased since the beginning of the sample period from 26 in 1992 to 1,347 in 2017.[12] The number of active funds has also grown during this period from 748 to 8,460. This is accompanied by an explosive growth in AUM for both active and passive funds during the sample period. The aggregate AUM of passive funds in the sample has risen from $11 billion in 1992 to $3.68 trillion in 2016. During the same period, active funds in the sample have seen their aggregate AUM rise from $334 billion to $5.57 trillion. Therefore, the total AUM of both groups in the sample is roughly $9.25 trillion as of the end of our sample period.[13]

Active funds represent approximately 97 percent of the total mutual fund AUM in 1992 and 83 percent of total mutual fund AUM in 2005, which are similar to the numbers documented in Pástor and Stambaugh (2012). Since 2005, which is the last year examined by Pástor and Stambaugh (2012), passive funds have experienced explosive growth in AUM. As of 2017, active funds represented only 60 percent of total mutual fund AUM. One could

[10] Considering the effect of inflation over time, we exclude the smallest funds based on the sample distribution of fund AUM as opposed to directly dropping funds with AUM less than $15 million.
[11] Unlike the above analysis on aggregate holdings with the sample period spanning from 1990 to 2016, our analysis involving fund returns starts with 1992 because this is the first year when we have at least 20 passive funds with non-missing monthly fund returns. Also, we extend the sample period to 2017 because data on fund returns are additionally available for mutual funds in 2017.
[12] While passive funds existed prior to 1992, they were a minor part of the mutual fund AUM. Pástor and Stambaugh (2012) find that the fraction of mutual funds that were actively managed was 1.00 till 1976 and was .976 as of 1991.
[13] This coverage is quite comprehensive given that ICI's 2017 Handbook states that the domestic equity mutual fund and ETF AUM was $ 8 trillion as of the end of 2016. In comparison, our sample has a total AUM of $ 7.9 trillion as of the end of 2016.

argue that this shrinkage in active AUM is faster than the 20 years, as predicted by Pástor and Stambaugh (2012), that it would take to reach the 60 percent mark. It must be noted, however, that these numbers do not paint the full picture of total active AUM. The total market capitalization of the US domestic equities at the end of 2017 was approximately $30 trillion. The total AUM of passive funds was about 4 trillion which represents about 13 percent of the total market capitalization. In addition to active mutual funds, the rest are held by other entities like insurance companies, individual investors, pension funds and sovereign wealth funds. While it is possible that many of these larger institutional entities are themselves internally indexing their assets, making it difficult to exactly estimate how much is passively managed, one could argue that active AUM is still the dominant asset management paradigm as predicted in Pástor and Stambaugh (2012).

4.2 Analysis of Equal-Weighted Average Monthly Fund Returns (EMRET)

To assess the difference in aggregate fund performance net of fees between passive and active funds, we calculate the average fund returns for each of group of passive and active funds separately. More specifically, each month, we compute the average fund returns as the equal-weighted average of monthly returns to individual funds across entire passive or active funds over the period from 1992 to 2017. This procedure results in 312 monthly return observations for each group of mutual funds. We call this average monthly fund returns EMRET. (The value-weighted average returns, VMRET, are discussed later in Section 4.3.)

Table 5 begins with reporting the average of EMRET in each year. For example, in 1992, the means of EMRET over the 12-month period are 0.0053 and 0.0069 for passive and active funds, respectively, suggesting that active funds outperformed passive ones by 16bps per month on average. However, when the average monthly fund returns (EMRET) are averaged across 312 months in our entire sample period (i.e., 1992 to 2017), the mean of this variable is 0.0081 for passive funds, suggesting that passive funds on average generate 81bps

a month which annualizes to roughly 9.4%. Active funds during the same period generate 76bps per month on average, implying that passive funds outperform active ones by 5bps a month. This is consistent with prior work that finds that passive funds outperform active ones by 65bps to 85bps per year (Gruber, 1996; French 2008; Guercio and Reuter 2014). In examining the proportion of months in which passive funds outperforms active ones, we find that they do so in approximately 54% of the 312 months (untabulated).

Figure 4 plots the difference in the equal-weighted average monthly fund returns (EMRET) between passive and active funds (averaged again by calendar year). The finding from this figure is that passive funds significantly outperformed active funds in the 1990s. In particular, the period from 1994 to 1998 saw a sustained and abnormal outperformance of passive relative to active funds. More specifically, the difference in the average fund returns between passive and active funds started to be positive from 1994, peaking at an astonishing 105bps per month in 1997 followed by 57bps per month in 1998. However, the outperformance does not seem robust to other periods. For example, when EMRET is averaged over the early period from 1992 to 1998, passive funds outperformed active ones by a substantial 24bps per month (i.e., 145bps per month and 121bps per month for passive and active funds, respectively, in Table 5). However, in the later sample period from 1999 to 2017, there is parity in performance between the two groups (i.e., 58bps per month and 60bps per month for passive and active funds, respectively, in Table 5).

To provide further insight into the spread in performance between passive and active funds, we run a time-series regression of average monthly fund returns (EMRET) on Fama-French 5 factors and the Carhart momentum factor based on 312 monthly observations from 1992 to 2017. More specifically, we estimate the following regression equation:

$$EMRET_t = \alpha_1 + \alpha_2 MKT\text{-}RF_t + \alpha_3 SMB_t + \alpha_4 HML_t + \alpha_5 RMW_t + \alpha_6 CMA_t + \alpha_7 MOM_t + \varepsilon_t \quad (2)$$

As defined above, EMRET is the average monthly fund returns, i.e., equal-weighted average of monthly fund returns measured each month across entire passive or active mutual funds. MKT-RF, SMB, HML, RMW, and CMA are Fama-French's monthly 5 factors and MOM is the Carhart momentum factor.[14]

In Panel A of Table 6, we present the results from the above regression based on our entire sample period, i.e., over 312 months from 1992 to 2017. In Column (1) when the dependent variable is EMRET calculated across passive funds, we find that the coefficient on MKT-RF is 1.0059 and significant, suggesting that the returns to passive funds have the similar market risk profile as the overall market. The coefficients on SMB, HML, and RMW are 0.0466, 0.0559, and 0.0358, respectively, and all significant, consistent with passive funds having a slightly positive exposure to the SMB, HML and RMW factors. We also find that the portfolio returns to passive funds have a slightly negative but significant exposure to the momentum factor. Finally, after controlling for risk factors, passive funds generate an alpha of 11bps over the entire sample period.[15] However, in Column (2) when examining active funds' EMRET, we find that active funds in aggregate have slightly lower market exposure than passive funds. Compared to passive funds, the positive exposure to the SMB factor is much greater, which continues to reinforce the aggregate size bias (towards small cap) of active fund managers. Unlike passive funds, however, active funds seem neutral to HML, RMW, CMA, and MOM factors. After controlling for risk factors, active funds generate an alpha of 9 bps a month.

In Column (3), when we replace the dependent variable with the spread in the average monthly returns between passive and active funds (i.e., EMRET from passive funds –

[14] All of these factors are defined in and downloaded from Ken French's Website, http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/det_mom_factor.html.
[15] Cremers, Petajisto, and Zitzewitz (2013) find that passive benchmark indices generate non-zero alpha using Fama-French and Carhart factors because of the way the factors are constructed. We are not interested in the passive funds alpha per se but rather as a benchmark for comparison with active funds alpha.

EMRET from active fund returns), the coefficient on MKT-RF is 0.0411, positive and significant, suggesting that passive funds have a larger exposure to the market as compared with the active funds. Column (3) also reveals that over the entire sample period, passive funds have greater exposure to large cap stocks, value stocks and quality stocks as compared with active funds. They are also less exposed to the momentum factor as compared with active funds. It is interesting to note that after controlling for risk factors, there is no difference in the after-fee performance of passive and active funds i.e., the alpha is not significantly different from zero. These results suggest that the differences in characteristics of holdings observed in Table 3 play a significant role in explaining difference in performance between active and passive funds over the entire sample period.

The sustained and unusually high outperformance of passive funds in the 1990s documented in Table 5 and Figure 4 far exceeded the fee differential. This difference in performance could be due to the difference in the factor exposures resulting from different holdings between active and passive funds. For example, one factor could be the high exposure of passive funds to large cap stocks during that period and the limited exposure to small stocks (see analysis and discussion in Section 5 below). There were very few passive small- and mid-cap funds in the 1990s and most of the passive AUM was concentrated in S&P 500 funds. In an untabulated analysis, we find that from 1994 to 1998, large cap stocks outperformed small cap stocks by a surprisingly large average of 78bps per month (based on the difference between the top 20% and bottom 20% of the Fama-French ME returns).[16] We thus delve deeper into this sub-sample period performance differences between passive and active funds by estimating equation (2) again for the following two sub-periods: 1992-1998 and 1999-2017. The results are reported in Panels B and C of Table 6.

[16] This result is based on the pure size sort (ME sort) downloaded from Ken French's website.

In Panel B of Table 6, when we examine the early sample period of 1992-1998, we find that the exposure to market risk is quite different between the two groups, with passive funds having market beta close to 1 (MKT-RF coefficient of 0.99 in Column (1)) while active funds have significantly lower beta (MKT-RF coefficient of 0.91 in Column (2)). In addition, the result shows that passive funds have significantly negative exposure to the size factor (SMB coefficient of -0.06 in Column (1)) while active funds have a significantly large positive size exposure (SMB coefficient of 0.23 in Column (2)), consistent with passive funds focusing more on large cap stocks in 1990s. After controlling for the risk factors, the passive funds generated an alpha of 30bps in Column (1) while active funds generated an alpha of 26bps in Column (2) during this period. When the dependent variable is the difference in average monthly returns between passive and active funds in Column (3), the alpha is not significant, suggesting that after accounting for factor exposure, passive funds and active funds generate similar risk-adjusted returns even in the period wherein the raw returns are significantly different.

In Panel C of Table 6 where we examine the remaining sample period of 1999-2017, we find that the exposure to the market factor is still close to 1 for passive funds in Column (1) while active funds during this period exhibit a slightly lower beta of 0.97 in Column (2). In addition, in Column (1), passive funds exhibit positive exposure to the size (SMB), which is interesting to note because the coefficient on SMB was negative for passive funds during the earlier period in Panel B but turns positive during the later period in Panel C. This result is consistent with more money flowing into passive small and mid-capitalization funds as shown earlier in our analysis of *Active Share*. Column (1) further shows that passive funds have positive exposures to value (HML) and quality (RMW) factors as well and negative exposure to the momentum factor. The passive funds' alpha is about 3bps per month and is not significant. In Column (2), active funds also have significant exposure to small stocks,

consistent with the evidence in the prior sections, and generate an alpha of 6bps a month (which is not significant) and is not different from that of passive funds. In Column (3), where the dependent variable is the spread in the average monthly returns between passive and active funds, the alpha is -0.0003, suggesting that passive funds underperformed active funds by 3bps a month after controlling for risk factors (though the difference is not significant). Examining the factors that explain the differences in average returns between the two groups, in Column (3), we find that passive funds have greater relative exposure to market risk, lower relative exposure to the size and momentum factors and slightly greater exposure to the value and quality factors. Overall, the results in this analysis suggest that relative performance of active and passive vehicles is highly sensitive to sample period examined, in particular due to their differential exposures to large vs. small stocks.

The results in this section have significant implications for the debate on the performance of active vs. passive vehicles. While passive investments have an important role to play in financial markets, our results suggest that the widely held (and often widely marketed) belief that they are universally superior to active funds is premature and questionable. Passive vehicles are important in that they improve the competitive environment, thereby potentially having a significant positive effect of quality of active managers and the fees that they charge.[17] However, our results suggest that, depending on the period while returns are measured, after-fee active fund performance can be comparable to passive funds and in certain period is better. What is also noteworthy is that the performance advantage is not consistent and goes through cycles similar to cycles observed in with large cap vs. small cap stocks and value vs. growth stocks.

4.3 Analysis of Value-Weighted Average Monthly Fund Returns (VMRET)

[17] The 2015 Investment Company Institute report finds that expense ratios for actively managed equity funds have dropped by over 20% from 2000 to 2014, while front-end sales load has dropped from an average of 4% in 1990 to under 1% in 2014.

In this section, for each of group of passive and active funds, we calculate each month the value-weighted average of monthly fund returns with using fund size (i.e., beginning AUM each month) as a weight. We call this value-weighted average monthly fund returns as VMRET. Table 7 reports that the average of VMRET over the 312 months from 1992 to 2017 is 85bps per month for passive funds, which is higher than 81 bps per month of EMRET in Table 5. Thus the mean returns to passive funds seem slightly larger when the returns are cross-sectionally value-weighted as compared when equally weighted. This result is consistent with larger passive vehicles having a fee advantage as compared with smaller passive vehicles, thus enjoying better performance.[18] However, for active funds, the average of VMRET is 75 bps per month over the period of 1992 to 2017, a decrease of 1 bps per month relative to the equal-weighted average returns as reported in Table 5. This is despite the fact that larger active funds have lower expense ratios than smaller funds, suggesting that smaller funds generate enough additional returns to offset their higher fees. This result is consistent with the finding of prior research that fund size is negatively associated fund performance of active funds (Chen et al. (2004), Pástor, Stambaugh, and Taylor (2015)). However, our result seems to indicate that the negative effect of fund size does not extend to passive funds. Thus, when compared with large passive funds, large active funds seem to have greater difficulty in outperforming their passive counterparts.

Figure 5 provides a time series plot of the difference in VMRET between passive and active funds. The pattern is similar to that observed using EMRET in Figure 4, with one exception. Unlike equal-weighted returns, the period from 2011-2016 has seen value-weighted returns of passive vehicles consistently outperform active vehicles. We examine this issue separately in the additional analysis section.

[18] Data from the ICI shows that the simple average of the passive fund expense ratio in 2014 was 70bps per year while the AUM weighted expense ratio is 11bps year. It is likely that the smaller passive vehicles are more of a niche product or are specialized industry and sector funds and therefore charge higher fees.

In Table 8, we carry out time-series regression analyses similar to those in Table 6. More specifically, we again estimate equation (2) but the dependent variable is now the value-weighted average monthly fund returns (i.e., VMRET). In Panel A of Table 8, we provide results for the entire sample period. The results using VMRET for the entire sample period are similar to the results using the equal-weighted average monthly fund returns (i.e., EMRET), except that the exposure to SMB for passive funds is significantly negative in Column (1). This result suggests that larger-sized passive funds tend to take a greater position in large cap stocks and therefore are more likely to be influenced by the performance of large cap stocks. Similar to the results in Table 6, Column (3) reveals that once we control for the Fama-French factors and the momentum factor, there is no discernible difference in the after-fee returns between passive and active funds. Focusing on the 1992-1998 period in Panel B of Table 8, the results are very similar to the equal-weighted results, except that passive funds outperform active funds by a statistically insignificant 9bps a month in Column (3). Panel C of Table 8 yield results from 1999-2017 that are also similar to those observed for equal-weighted fund returns. However, again, unlike the result in Panel C of Table 6, the exposure to SMB is significantly negative for passive funds in Column (1). There is no difference in alpha between active and passive funds in Column (3) once risk factors are controlled. It is important to note however that this alpha is using the after-fee returns and therefore it implies that active funds in the aggregate are likely to be generating enough excess returns to offset their fees.

5. Additional Analysis & Discussion

5.1 Outperformance of S&P 500 Passive Funds in Recent Years and Fund Size

The recent six years of the sample period has seen value-weighted returns of passive vehicles consistently outperform active vehicles. This could occur either because larger active

funds are underperforming their passive counterparts after fees and/or because smaller passive funds are underperforming their active counterparts. To get further insight into this issue, we sort funds into three groups based on their AUM and examine the equal-weighted average monthly fund returns (EMRET) for passive and active funds within each size group. We classify a mutual fund as a small-, mid-, and large-sized mutual fund if its AUM belongs to the lowest 40%, the middle 40%, and the highest 20% of the sample distribution each month in each group of passive and active funds.

Table 9 provides results from this analysis. Focusing on the period from 2011 to 2016 (reported on bottom of Table 9) when passive funds have outperformed active funds on a value weighted basis, we find that small active funds on average outperformed small passive funds by 2bps per month (i.e., 74bps and 76bps of small passive and active funds, respectively), while mid-sized passive funds on average outperform mid-sized active funds by 5bps per month (i.e., 85bps and 80bps of mid-sized passive and active funds, respectively). The large difference in performance is in the larger funds. During the period of 2011-2016, larger active funds on average underperformed larger passive funds by 12bps per month (i.e., 93bps and 81bps of large passive and active funds, respectively). The active funds' underperformance cannot be simply explained by fee differential as fees have compressed considerably in the recent past. However, when focusing on the preceding 6 years ending in 2010 (i.e., 2005 to 2010), larger active funds performed similarly to larger passive funds (i.e., 45bps and 43bps per month of large passive and active funds, respectively), raising the question of whether there have been structural changes in the last 6 years that have caused larger passive vehicles to outperform their active counterparts.

To understand the reason for the underperformance of large-sized active funds in the last 6 years, it must first be noted that when examining value-weighted returns for passive funds and focusing on larger passive funds, the emphasis is primarily on the S&P 500 index.

This is because the larger passive funds and ETFs are primarily S&P 500 tracking. This is unlike large active funds which could focus on value, growth, small and mid cap stocks etc. So understanding the difference in performance between larger active funds and the S&P 500 index will help shed light on the issue. The S&P 500 index can be viewed as a fund wherein position sizes are based on the market capitalization of stocks. While much is made of the diversification benefits of investing in passive funds (with a large number of holdings), the top 10 positions (2% of the number of stocks) in the S&P 500 account for 20% of the portfolio and the top 50 positions (10% of the number of stocks) account for approximately half of the index as of the end of 2017. Therefore the performance of the S&P 500 and the associated index funds and ETFs are heavily driven by the relatively small subset of stocks that make up the bulk of the index weights.[19]

We therefore carry out a simple analysis wherein we examine the extent to which the spread in returns between the largest stocks and other stocks explains the outperformance of S&P 500 in the last several years (untabulated). To do so, we use the returns based on univariate sorts on size downloaded from Kenneth French's website (http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html#Research). We create a variable defined as the difference between the returns for top 10% of stocks and average returns for the bottom four quintiles. The correlation between this spread and the difference between value-weighted passive and active fund returns is an astonishing 0.85. In the period from 2011 to 2016, the largest stocks generated a cumulative return of 101% compared to the cumulative average return of 87% for the rest of the stocks (an outperformance of 13%). In the period from 1994 to 1998 (the other stretch of outsized consistent passive fund outperformance), the cumulative average return for the largest 10% of

[19] It must be noted that given that the S&P 500 constituents comprise 70%-80% of the market as a whole, these stocks play a disproportionately large role in driving market performance as well.

stocks was 190% compared with 81% for the rest of the stocks (an astonishing outperformance of over 100%). Taken together, these results suggest the performance of the S&P 500 tracking passive funds is heavily dependent on the performance of a subset of stocks (as with any concentrated active fund).[20] This raises the issue of what would happen when this subset of stocks underperform. Bhojraj and Cho (2018) and Easley et al. (2018) provide evidence that investors in passive funds, particularly ETFs, are not necessarily passive and therefore a reversal in performance of these funds could have significant implications for the investors in these funds as well as the stock market.[21]

5.2 Outperformance of S&P 500 Passive Funds in Recent Years and Fund Flows

There is an ongoing debate in industry on whether the recent performance of the large S&P 500 tracking passive funds has been fueled by the inflows of AUM into these funds and outflows from active managers (see Haghani (2017) for a discussion). Our findings provide some evidence useful in this debate. Passive funds have a lot of inherent advantages. The most commonly discussed strength of passive funds is the low fee structure. Another significant strength of passive funds is their simplicity and low search costs. Active funds vary in investing style and strategy, making it hard to separate between good and bad managers resulting high search costs (Gârleanu and Pedersen (2018)). Passive funds, on the other hand, are uniform in their holdings, making the investing decision relatively simple. Index funds and ETFs that track an index are essentially the same irrespective of the sponsor

[20] This idea also applies to passive funds that track other indices (e.g., Russell 1000, 2000 etc.). Even though they might hold several positions, they are primarily exposed to the top holdings in the index.

[21] In Table 9, we also examine the difference in returns of larger funds relative to smaller funds within each group of active and passive funds. On average, over the entire sample period from 1992 to 2017, larger passive funds outperform smaller ones by 9bps a month (i.e., 85bps vs. 76bps of large and small passive funds, respectively), while active funds show no discernable difference in overall performance (i.e., 75bps vs. 76bps of large and small active funds, respectively). However, looking more closely at sub-periods, we find that larger active funds enjoyed most of their advantage in the early part of the sample period. Larger active funds outperformed smaller active funds on average by 7bps per month in the 1990s (untabulated) while underperforming on average by 3bps per month subsequently (untabulated). This finding adds to prior work documenting that larger fund families enjoyed an information advantage in the pre-Reg FD period which has mostly disappeared in the post-Reg FD period (Bhojraj, Cho, and Yehuda (2012)).

and the advisor.[22] This essentially translates into one enormous fund tracking a particular index. In the case of passive funds, about half the AUM tracks the S&P 500.[23] So regardless of whether moneys flow into the SPY ETF or the VOO ETF or the Vanguard S&P 500 Index Fund, they are all buying and selling the same positions in the same proportion.[24] One could argue that the same could be said of active funds at the aggregate level, based on Sharpe's (1991) arithmetic. However, as seen already above, that is not quite the case. There is considerable variation in size and style holdings between active and passive funds. The findings in Figure 3 show that passive AUM invested in large cap stocks is in line with the universe in recent years while active AUM is underweight in these stocks, which suggests that smaller stocks are likely to face higher selling pressure in the event of active fund outflows. Similarly, active funds have a greater weight on momentum stocks, which suggests that they are more likely to sell losers and keep their winners in response to fund outflows (Lou (2012)). Therefore, a dollar exiting active funds in the aggregate that is invested into passive funds will have a disproportionately higher positive effect on returns for these large stocks and for winner stocks and negative effect on smaller stocks and loser stocks. This supports the possibility that the unusually persistent outperformance observed is driven by the coincidental large flows into S&P 500 passive funds and out of active funds in the last few years.

6. Conclusion

The goal of this paper is to examine systematic differences in aggregate holdings of passive and active funds and the effect they might have on the after-fee aggregate

[22] This advantage is fast disappearing with the enormous proliferation of index tracking funds and ETFs. There are funds and ETFs for industries and sectors as well as levered and other forms of ETFs.
[23] In addition, total market passive funds are also closely linked to the S&P 500 index.
[24] Passive funds linked to popular indices (e.g., S&P 500 or Russell 2000) enjoy a significant advantage because marketing for all these funds benefit from each other's marketing as they all have exactly the same investment strategy and positions.

performance of these funds. We find that the holdings of passive funds do not mirror the holdings of active funds. There are significant systematic differences in the holdings between the two groups with passive funds more likely to hold larger stocks, value stocks, and stocks with lower momentum and lower turnover, but less likely to hold positions in younger firms. While holdings of passive and active funds have trended closer together over time consistent with the significant inflows into passive funds across all size groups, there are still significant differences between the two groups. The systematic differences in holdings suggest that passive funds do not necessarily enjoy an intrinsic advantage in after-fee performance over active funds. While prior studies generally document that passive funds outperform active funds net of fees, we find that the superior performance of passive funds is very sensitive to the period over which returns are measured. Our results suggest that, depending on the period over which returns are measured, aggregate active fund performance can be comparable to passive funds and in certain periods is better. We show that this time varying relative performance of active and passive funds is attributable to style differences in aggregate portfolio holding between the two groups. In doing so, we shed light on the extent to which the Sharpe (1991) arithmetic holds within the economically very significant space of active and passive domestic equity funds.

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Figure 1 Investment in Small Cap Stocks

This figure shows the time-series changes in the proportion of investment in small cap stocks out of total value of the portfolios held by the stock universe, passive funds, and active funds. The stock universe consists of all firms covered by CRSP/Compustat Merged Database except for those whose market value of common equity is smaller than the bottom quintile of NYSE firms. We define small-, mid-, large-cap stocks as those whose market value of common equity belongs to the lowest 40%, the middle 40%, and the highest 20% of the stock universe each year, respectively.

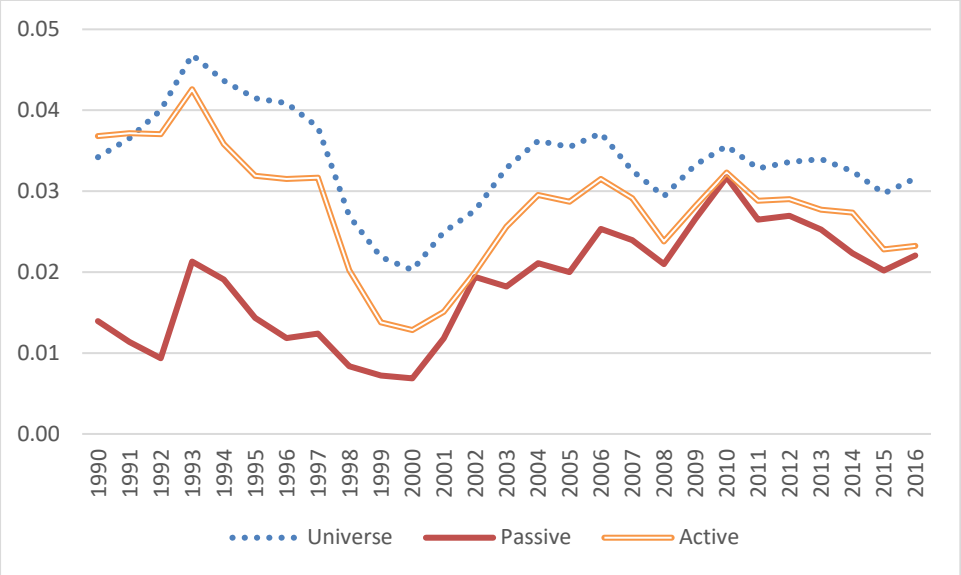

Figure 2 Investment in Mid Cap Stocks

This figure shows the time-series changes in the proportion of investment in mid cap stocks out of total value of the portfolios held by the stock universe, passive funds, and active funds. The stock universe consists of all firms covered by CRSP/Compustat Merged Database except for those whose market value of common equity is smaller than the bottom quintile of NYSE firms. We define small-, mid-, large-cap stocks as those whose market value of common equity belongs to the lowest 40%, the middle 40%, and the highest 20% of the stock universe each year, respectively.

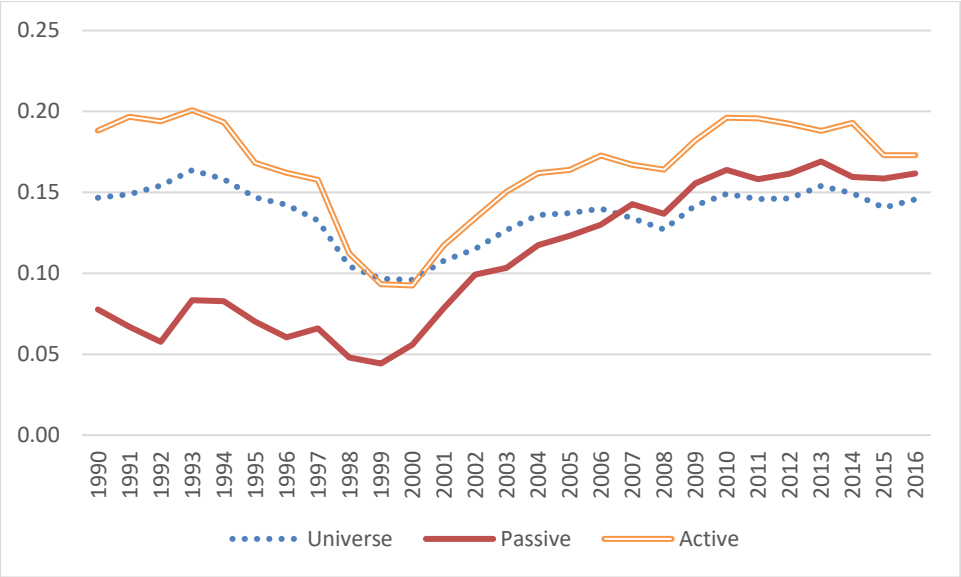

Figure 3 Investment in Large Cap Stocks

This figure shows the time-series changes in the proportion of investment in large cap stocks out of total value of the portfolios held by the stock universe, passive funds, and active funds. The stock universe consists of all firms covered by CRSP/Compustat Merged Database except for those whose market value of common equity is smaller than the bottom quintile of NYSE firms. We define small-, mid-, large-cap stocks as those whose market value of common equity belongs to the lowest 40%, the middle 40%, and the highest 20% of the stock universe each year, respectively.

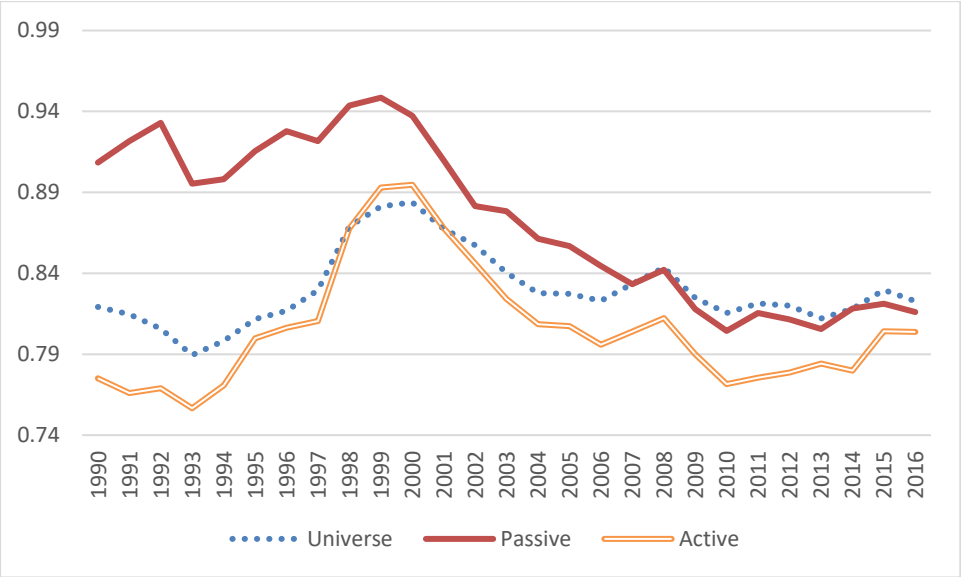

Figure 4 Difference in Equal-Weighted Average Monthly Fund Returns (EMRET) between Passive and Active Funds

This figure shows the time-series changes in the difference in the yearly means of equal-weighted average monthly fund returns (i.e., EMRET) between passive and active funds (i.e., passive minus active).

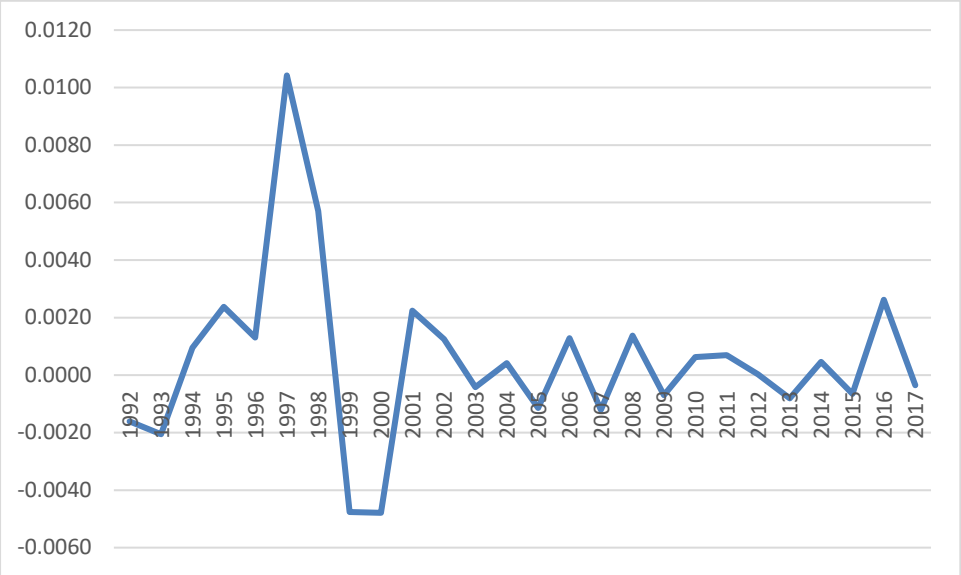

Figure 5 Difference in Value-Weighted Average Monthly Fund Returns (VMRET) between Passive and Active Funds

This figure shows the time-series changes in the difference in the yearly means of value-weighted average monthly fund returns (i.e., VMRET) between passive and active funds (i.e., passive minus active).

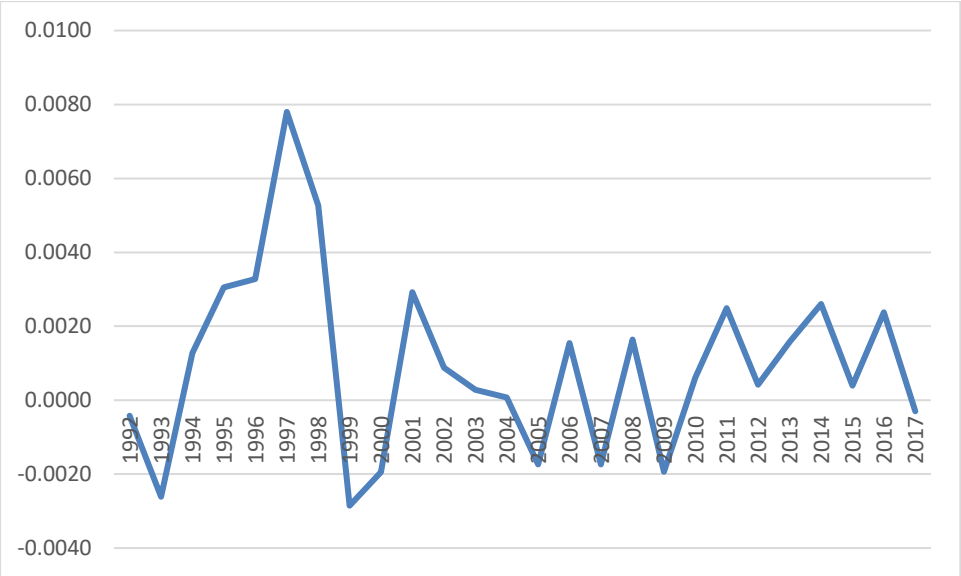

Table 1 Active Share of Passive and Active Funds

This table reports *Active Share* of passive and active funds based on mutual fund holdings database. Panels A and B report passive and active funds' *Active Share*, respectively, calculated using as a benchmark portfolio a universe of stocks in CRSP/Compustat Merged Database excluding firms whose market value of common equity is smaller than the bottom quintile of NYSE firms. We define small-, mid-, large-cap stocks as those whose market value of common equity belongs to the lowest 40%, the middle 40%, and the highest 20% of the stock universe each year, respectively.

Panel A Passive Funds' Active Share Relative to Stock Universe

Year	All	Small Cap	Mid Cap	Large Cap
1990	0.4466	0.7283	0.5261	0.3978
1991	0.4571	0.7431	0.5376	0.4005
1992	0.4728	0.6996	0.5424	0.4070
1993	0.4558	0.6075	0.5076	0.4106
1994	0.4307	0.6171	0.4668	0.3878
1995	0.4306	0.6361	0.4509	0.3904
1996	0.4299	0.6125	0.4454	0.3838
1997	0.4064	0.5752	0.4394	0.3674
1998	0.3744	0.5642	0.4264	0.3402
1999	0.3787	0.5423	0.4402	0.3486
2000	0.3411	0.5406	0.3974	0.3176
2001	0.2856	0.4954	0.3619	0.2602
2002	0.2586	0.4584	0.3549	0.2348
2003	0.2551	0.4444	0.3578	0.2258
2004	0.2615	0.4486	0.3620	0.2304
2005	0.2673	0.4389	0.3602	0.2397
2006	0.2741	0.4344	0.3552	0.2505
2007	0.2802	0.4607	0.3658	0.2591
2008	0.2589	0.4688	0.3421	0.2385
2009	0.2654	0.4623	0.3458	0.2435
2010	0.2734	0.4447	0.3419	0.2538
2011	0.2492	0.4624	0.3246	0.2276
2012	0.2444	0.4621	0.3239	0.2217
2013	0.2541	0.4584	0.3224	0.2324
2014	0.2447	0.4742	0.3248	0.2205
2015	0.2794	0.5028	0.3510	0.2591
2016	0.2483	0.4728	0.3349	0.2236

Table 1 Continued

Panel B Active Funds' Active Share Relative to Stock Universe

Year	All	Small Cap	Mid Cap	Large Cap
1990	0.4428	0.5411	0.4745	0.4297
1991	0.4392	0.5011	0.4717	0.4248
1992	0.4325	0.4945	0.4561	0.4208
1993	0.4313	0.5034	0.4491	0.4195
1994	0.4159	0.4971	0.4447	0.4033
1995	0.4159	0.5138	0.4444	0.4049
1996	0.3927	0.4943	0.4268	0.3808
1997	0.3795	0.4804	0.4173	0.3672
1998	0.3575	0.5000	0.4140	0.3462
1999	0.3567	0.5235	0.4225	0.3461
2000	0.3305	0.5271	0.3995	0.3188
2001	0.3055	0.4999	0.3663	0.2920
2002	0.2823	0.4786	0.3436	0.2662
2003	0.2851	0.4549	0.3479	0.2657
2004	0.2939	0.4455	0.3561	0.2737
2005	0.2823	0.4340	0.3278	0.2648
2006	0.2778	0.4266	0.3318	0.2573
2007	0.2775	0.4501	0.3385	0.2558
2008	0.2774	0.4815	0.3225	0.2581
2009	0.2739	0.4625	0.3183	0.2542
2010	0.2913	0.4541	0.3239	0.2714
2011	0.2850	0.4787	0.3058	0.2655
2012	0.2893	0.4725	0.3223	0.2666
2013	0.3188	0.4788	0.3335	0.3044
2014	0.2912	0.4942	0.3327	0.2689
2015	0.3130	0.5222	0.3581	0.2946
2016	0.3088	0.5012	0.3453	0.2920

Table 2 Passive Funds' Active Share Relative to Stocks Held by Active Funds

This table reports passive funds' *Active Share* calculated using as a benchmark portfolio stocks held by active funds excluding firms whose market value of common equity is smaller than the bottom quintile of NYSE firms. We define small-, mid-, large-cap stocks as those whose market value of common equity belongs to the lowest 40%, the middle 40%, and the highest 20% of the stock universe each year, respectively.

Year	All	Small Cap	Mid Cap	Large Cap
1990	0.3369	0.6355	0.4724	0.2810
1991	0.3802	0.6274	0.5066	0.3224
1992	0.3819	0.5797	0.5084	0.3220
1993	0.3839	0.5220	0.4631	0.3391
1994	0.3551	0.5302	0.4427	0.3070
1995	0.3559	0.5307	0.4128	0.3132
1996	0.3521	0.5303	0.4211	0.3049
1997	0.3256	0.4963	0.3981	0.2868
1998	0.3054	0.4531	0.3627	0.2792
1999	0.3001	0.4414	0.3630	0.2817
2000	0.2892	0.4593	0.3558	0.2731
2001	0.2581	0.3974	0.3136	0.2413
2002	0.2355	0.3177	0.3015	0.2195
2003	0.2343	0.3155	0.2633	0.2167
2004	0.2245	0.2915	0.2639	0.2051
2005	0.2378	0.2878	0.2632	0.2219
2006	0.2225	0.2703	0.2512	0.2061
2007	0.2143	0.2683	0.2368	0.2030
2008	0.2171	0.2583	0.2325	0.2082
2009	0.2088	0.2469	0.2310	0.1993
2010	0.2098	0.2428	0.2291	0.1988
2011	0.2195	0.2364	0.2284	0.2119
2012	0.2194	0.2473	0.2387	0.2096
2013	0.2213	0.2486	0.2296	0.2165
2014	0.2206	0.2515	0.2335	0.2115
2015	0.2037	0.2624	0.2197	0.1985
2016	0.2277	0.2643	0.2296	0.2252

Table 3 Regression of Portfolio Weight Difference

This table reports the results of yearly regressions of the portfolio weight difference. In Panel A, the dependent variable is the difference in the portfolio weight between passive funds and the stock universe, calculated as the firm's portfolio weight in passive funds minus its portfolio weight in the stock universe. The stock universe is a portfolio of stocks in CRSP/Compustat Merged Database excluding firms whose market value of common equity is smaller than the bottom quintile of NYSE firms. A firm's portfolio weight in passive funds is calculated as the value of the firm's stock held by entire passive funds divided by the total value of all stocks held by the same passive funds as reported in CDA/Spectrum S12 last each calendar year. In Panel B, the dependent variable is the difference in the portfolio weight between active funds and the stock universe, calculated as the firm's portfolio weight in active funds minus its portfolio weight in the stock universe. A firm's portfolio weight in active funds is calculated as the value of the firm's stock held by entire active funds divided by the total value of all stocks held by the same active funds as reported in CDA/Spectrum S12 last each calendar year. In Panel C, the dependent variable is the difference in the portfolio weight between passive and active funds, calculated as the firm's portfolio weight in passive funds minus its portfolio weight in active funds. In Panels A through C, the independent variables are defined as follows: Log(Mktval) is the natural logarithm of the firm's market value of equity as of the last fiscal year-end before the end of the calendar year. BTM is the firm's book-to-market ratio as of the last fiscal year-end before the end of the calendar year. Momentum is the firm's market-adjusted stock returns over the 6-month period before the end of the calendar year. Turnover is the average turnover (i.e., daily trading volume divided by the number of shares) over the 6-month period before the end of the calendar year. Volatility is the standard deviation of the firm's daily returns over the 6-month period before the end of the calendar year. NewFirm is an indicator variable that equals one if the firm's age is less than or equal to three, and zero otherwise. A firm's age is calculated as the calendar year minus the year the firm first appeared in the CRSP Database. To avoid undue influence of outliers, all variables are winsorized at the first and ninety-ninth percentiles. The average coefficients are reported at the bottom of each Panel, and t-statistics are calculated after adjusting for serial correlation using Newey-West (1987) lags of order three.

Table 3 Continued

Panel A Regression of Portfolio Weight Difference between Passive Funds and Stock Universe

Year	Intercept	Log(Mktval)	BTM	Momentum	Turnover	Volatility	NewFirm
1990	-0.0419	0.0059	-0.0014	-0.0005	-0.0001	0.2902	-0.0078
1991	-0.0580	0.0079	0.0002	-0.0015	-0.0004	0.5445	-0.0071
1992	-0.0553	0.0077	0.0016	0.0041	-0.0005	0.3919	-0.0063
1993	-0.0415	0.0062	-0.0011	-0.0001	-0.0004	0.2950	-0.0067
1994	-0.0338	0.0055	-0.0043	0.0028	-0.0003	0.1922	-0.0052
1995	-0.0392	0.0061	-0.0020	-0.0007	-0.0003	0.2100	-0.0021
1996	-0.0371	0.0055	-0.0003	0.0031	-0.0005	0.1882	-0.0019
1997	-0.0314	0.0047	-0.0014	0.0002	-0.0002	0.1196	-0.0031
1998	-0.0223	0.0037	-0.0030	0.0046	-0.0003	0.0502	-0.0024
1999	-0.0214	0.0034	-0.0020	-0.0028	-0.0003	0.1176	-0.0045
2000	-0.0187	0.0034	-0.0020	-0.0006	-0.0005	0.0609	-0.0077
2001	-0.0160	0.0030	-0.0026	0.0029	-0.0003	0.0302	-0.0062
2002	-0.0088	0.0021	-0.0040	-0.0001	0.0000	-0.0323	-0.0056
2003	-0.0186	0.0032	-0.0041	0.0007	0.0000	0.0888	-0.0080
2004	-0.0108	0.0026	-0.0065	-0.0014	0.0001	-0.1462	-0.0080
2005	-0.0089	0.0021	-0.0067	-0.0040	0.0003	-0.1557	-0.0049
2006	-0.0041	0.0015	-0.0033	-0.0012	0.0004	-0.3149	-0.0026
2007	0.0059	0.0004	-0.0060	-0.0059	0.0003	-0.2624	-0.0044
2008	-0.0024	0.0005	-0.0019	0.0030	0.0004	-0.0522	-0.0044
2009	0.0047	0.0005	-0.0026	0.0028	0.0004	-0.2578	-0.0040
2010	0.0077	0.0002	-0.0020	-0.0007	0.0003	-0.3088	-0.0059
2011	0.0071	0.0003	-0.0025	0.0117	0.0004	-0.2659	-0.0062
2012	0.0099	0.0001	-0.0040	-0.0022	0.0005	-0.4166	-0.0072
2013	0.0106	-0.0002	-0.0045	-0.0029	0.0003	-0.2884	-0.0072
2014	-0.0038	0.0017	-0.0013	0.0127	0.0003	-0.3611	-0.0042
2015	-0.0068	0.0024	-0.0053	0.0143	0.0003	-0.2520	-0.0050
2016	-0.0005	0.0015	-0.0050	0.0032	0.0002	-0.2719	-0.0062
Average	-0.0161	0.0030	-0.0029	0.0015	-0.000001	-0.0299	-0.0054
t-stat	-2.25	3.51	-5.20	1.50	-0.01	-0.33	-10.79
P-value	0.033	0.002	0.000	0.145	0.992	0.742	0.000

Table 3 Continued

Panel B Regression of Portfolio Weight Difference between Active Funds and Stock Universe

Year	Intercept	Log(Mktval)	BTM	Momentum	Turnover	Volatility	NewFirm
1990	0.0088	-0.0025	0.0031	-0.0046	0.0029	-0.0584	-0.0027
1991	0.0124	-0.0031	0.0023	-0.0007	0.0016	-0.0017	-0.0022
1992	0.0146	-0.0026	0.0022	0.0066	0.0017	-0.1782	-0.0025
1993	0.0261	-0.0037	-0.0018	0.0029	0.0019	-0.3593	-0.0016
1994	0.0170	-0.0026	-0.0015	-0.0030	0.0019	-0.2352	-0.0014
1995	0.0057	-0.0010	-0.0024	-0.0036	0.0011	-0.0803	-0.0003
1996	0.0086	-0.0008	-0.0045	0.0004	0.0010	-0.1716	-0.0006
1997	0.0055	-0.0003	-0.0025	-0.0035	0.0006	-0.1121	-0.0011
1998	0.0059	0.0000	-0.0034	0.0031	0.0004	-0.1071	-0.0012
1999	-0.0024	0.0010	-0.0026	-0.0010	0.0003	-0.0566	-0.0028
2000	-0.0016	0.0002	-0.0039	0.0045	0.0004	0.0360	-0.0037
2001	0.0043	0.0000	-0.0041	0.0004	0.0007	-0.1062	-0.0037
2002	0.0070	-0.0004	-0.0043	-0.0004	0.0008	-0.1162	-0.0057
2003	0.0066	-0.0003	-0.0043	0.0000	0.0007	-0.1748	-0.0049
2004	0.0163	-0.0012	-0.0071	0.0005	0.0008	-0.3213	-0.0049
2005	0.0106	-0.0008	-0.0077	0.0024	0.0007	-0.1962	-0.0023
2006	0.0080	-0.0006	-0.0082	-0.0043	0.0006	-0.1247	-0.0016
2007	0.0140	-0.0013	-0.0077	0.0001	0.0006	-0.1587	-0.0032
2008	0.0170	-0.0017	-0.0049	0.0010	0.0007	-0.1456	-0.0023
2009	0.0240	-0.0020	-0.0047	0.0048	0.0007	-0.3800	-0.0026
2010	0.0251	-0.0023	-0.0055	0.0029	0.0007	-0.3513	-0.0050
2011	0.0214	-0.0019	-0.0073	0.0039	0.0007	-0.1876	-0.0057
2012	0.0295	-0.0026	-0.0091	0.0062	0.0007	-0.2905	-0.0064
2013	0.0315	-0.0030	-0.0087	0.0038	0.0005	-0.2980	-0.0058
2014	0.0116	-0.0004	-0.0086	0.0120	0.0005	-0.2015	-0.0035
2015	0.0095	0.0001	-0.0100	0.0068	0.0006	-0.2297	-0.0037
2016	0.0150	-0.0011	-0.0084	0.0070	0.0007	-0.2479	-0.0036
Average	0.0130	-0.0013	-0.0047	0.0018	0.0009	-0.1798	-0.0031
t-stat	4.75	-3.39	-3.93	1.68	4.77	-6.50	-5.78
P-value	0.000	0.002	0.001	0.106	0.000	0.000	0.000

Table 3 Continued

Panel C Regression of Portfolio Weight Difference between Passive and Active Funds

Year	Intercept	Log(Mktval)	BTM	Momentum	Turnover	Volatility	NewFirm
1990	-0.0424	0.0075	-0.0090	-0.0028	-0.0040	0.3608	-0.0064
1991	-0.0637	0.0099	-0.0042	-0.0066	-0.0023	0.5421	-0.0080
1992	-0.0654	0.0095	-0.0022	-0.0078	-0.0027	0.6339	-0.0056
1993	-0.0625	0.0090	-0.0004	-0.0074	-0.0026	0.6927	-0.0062
1994	-0.0454	0.0072	-0.0025	0.0070	-0.0026	0.4440	-0.0052
1995	-0.0395	0.0063	0.0009	-0.0001	-0.0017	0.2709	-0.0026
1996	-0.0458	0.0060	0.0074	0.0009	-0.0016	0.3378	-0.0014
1997	-0.0298	0.0037	0.0024	0.0015	-0.0009	0.2277	-0.0022
1998	-0.0191	0.0021	0.0013	-0.0011	-0.0007	0.1255	-0.0017
1999	-0.0088	0.0008	0.0002	-0.0030	-0.0007	0.1526	-0.0023
2000	-0.0121	0.0024	0.0023	-0.0055	-0.0010	0.0247	-0.0042
2001	-0.0106	0.0015	0.0012	0.0011	-0.0010	0.1298	-0.0022
2002	-0.0060	0.0008	0.0006	-0.0011	-0.0008	0.0794	0.0004
2003	-0.0154	0.0021	0.0011	0.0000	-0.0007	0.1873	-0.0029
2004	-0.0204	0.0029	0.0026	-0.0029	-0.0007	0.1189	-0.0025
2005	-0.0090	0.0015	0.0017	-0.0066	-0.0002	-0.0936	-0.0024
2006	0.0004	0.0006	0.0051	0.0031	-0.0002	-0.3208	-0.0017
2007	0.0013	0.0004	0.0013	-0.0066	-0.0001	-0.1440	-0.0022
2008	-0.0116	0.0007	0.0037	0.0013	-0.0002	0.1037	-0.0022
2009	-0.0052	0.0005	0.0019	-0.0018	-0.0002	0.0242	-0.0018
2010	0.0002	0.0001	0.0030	-0.0038	-0.0001	-0.1007	-0.0014
2011	0.0008	0.0001	0.0050	0.0051	-0.0001	-0.1470	-0.0009
2012	-0.0054	0.0007	0.0052	-0.0092	0.0000	-0.2011	-0.0015
2013	-0.0088	0.0011	0.0042	-0.0083	0.0000	-0.0666	-0.0018
2014	-0.0032	0.0004	0.0075	-0.0001	0.0000	-0.2517	-0.0001
2015	-0.0012	0.0003	0.0050	0.0052	-0.0001	-0.1131	-0.0018
2016	-0.0051	0.0011	0.0036	-0.0051	-0.0002	-0.0901	-0.0021
Average	-0.0198	0.0029	0.0018	-0.0020	-0.0009	0.1084	-0.0027
t-stat	-2.64	2.59	1.79	-2.96	-2.63	1.20	-4.43
P-value	0.014	0.015	0.085	0.007	0.014	0.242	0.000

Table 4 Descriptive Information on Sample Funds from Mutual Fund Return Database

This table reports the yearly means of the monthly number of funds, beginning-of-month AUM, and aggregate beginning-of-month AUM (i.e., the number of funds times beginning-of-month AUM) for passive and active funds in our sample from mutual fund return database.

	Passive Funds			Active Funds		
Year	Average No. Funds	Average AUM ($)	Aggregate AUM ($)	Average No. Funds	Average AUM ($)	Aggregate AUM ($)
1992	26	422	11,126	748	446	334,074
1993	37	465	17,274	938	483	453,621
1994	44	500	22,005	1,230	461	565,127
1995	49	627	30,969	1,596	451	723,154
1996	58	938	54,687	1,902	531	1,012,254
1997	86	1,124	96,994	2,373	577	1,372,729
1998	122	1,254	153,059	2,984	589	1,756,886
1999	172	1,401	241,099	3,609	601	2,169,150
2000	218	1,387	302,101	4,139	667	2,761,730
2001	332	838	278,235	4,857	492	2,384,231
2002	359	741	265,714	5,192	397	2,063,915
2003	385	953	366,476	5,262	360	1,893,731
2004	444	1,125	499,398	5,457	445	2,426,055
2005	458	1,295	592,555	5,531	491	2,717,830
2006	518	1,346	698,033	5,854	528	3,088,129
2007	674	1,276	860,534	6,395	555	3,549,069
2008	797	1,096	865,264	7,061	453	3,159,244
2009	812	926	747,991	7,276	340	2,461,798
2010	920	1,074	988,703	7,449	425	3,167,123
2011	1,031	1,207	1,243,507	7,569	489	3,700,401
2012	1,113	1,270	1,412,984	7,611	492	3,747,493
2013	1,113	1,615	1,801,391	7,778	553	4,306,070
2014	1,149	2,001	2,297,968	8,200	621	5,091,632
2015	1,164	2,271	2,643,413	8,457	624	5,273,478
2016	1,225	2,325	2,849,676	8,461	598	5,063,068
2017	1,347	2,727	3,676,342	8,460	658	5,569,691

Table 5 Equal-Weighted Average Monthly Fund Returns (EMRET) of Passive and Active Funds

This table reports the yearly means of equal-weighted average monthly fund returns (EMRET) for passive and active funds in our sample from mutual fund return database. At the bottom of the table, we report the sample mean of EMRET for our entire sample period (1992 to 2017), and two sub-sample means of EMRET from 1992 to 1998 and from 1999 to 2017.

	Passive Funds		Active Funds	
Year	Average No. Funds	Average EMRET	Average No. Funds	Average EMRET
1992	26	0.0053	770	0.0069
1993	38	0.0094	968	0.0114
1994	46	-0.0005	1,297	-0.0015
1995	51	0.0248	1,626	0.0224
1996	59	0.0165	1,941	0.0152
1997	87	0.0281	2,438	0.0176
1998	130	0.0181	3,070	0.0124
1999	174	0.0160	3,652	0.0208
2000	218	-0.0043	4,156	0.0004
2001	332	-0.0070	4,888	-0.0093
2002	360	-0.0183	5,246	-0.0196
2003	385	0.0242	5,313	0.0246
2004	444	0.0105	5,506	0.0101
2005	458	0.0054	5,566	0.0065
2006	526	0.0117	5,937	0.0105
2007	688	0.0042	6,524	0.0054
2008	821	-0.0365	7,211	-0.0379
2009	890	0.0247	7,815	0.0254
2010	973	0.0162	7,623	0.0155
2011	1,062	-0.0003	7,774	-0.0010
2012	1,135	0.0116	7,830	0.0116
2013	1,138	0.0213	8,028	0.0221
2014	1,176	0.0071	8,388	0.0067
2015	1,189	-0.0017	8,612	-0.0010
2016	1,250	0.0114	8,622	0.0088
2017	1,377	0.0139	8,658	0.0142
1992-2017	578	0.0081	5,364	0.0076
1992-1998	62	0.0145	1,730	0.0121
1999-2017	768	0.0058	6,703	0.0060

Table 6 Time-Series Regression of Equal-Weighted Average Monthly Fund Returns (EMRET)

This table reports the results from the time-series regressions of equal-weighted average monthly fund returns (EMRET) on Fama-French 5 factors and momentum. Panels A, B and C show the results based on 312 monthly observations over the period of 1992 to 2017, 84 monthly observations over the period 1992 to 1998, and 228 monthly observations over the period of 1999 to 2017, respectively. In Column (1), the dependent variable is EMRET of passive funds. In Column (2), the dependent variable is EMRET of active funds. In Column (3), the dependent variable is the signed difference in EMRET between passive and active funds (i.e., passive returns minus active returns). The independent variables are the Fama-French 5 factors and momentum factor each month. MKT-RF is the excess return on the market. SMB (Small Minus Big) is the average return on the small stock portfolio minus the average return on the big stock portfolio. HML (High Minus Low) is the average return on the value portfolio minus the average return on the growth portfolio. RMW (Robust Minus Weak) is the average return on the robust operating profitability portfolio minus the average return on the weak operating profitability portfolio. CMA (Conservative Minus Aggressive) is the average return on the conservative investment portfolio minus the average return on the aggressive investment portfolio. MOM is the average return on the two high prior return portfolios minus the average return on the two low prior return portfolios.

Panel A Analyses Based on 1992 to 2017

	(1)	(2)	(3)
	Passive Funds	Active Funds	Passive - Active
Intercept	0.0011***	0.0009**	0.0002
	(3.12)	(2.51)	(0.55)
MKT-RF	1.0059***	0.9649***	0.0411***
	(98.03)	(91.83)	(4.03)
SMB	0.0466***	0.1821***	-0.1355***
	(3.67)	(14.01)	-(10.74)
HML	0.0559***	0.0136	0.0423**
	(3.36)	(0.80)	(2.56)
RMW	0.0358**	-0.0172	0.0530***
	(2.09)	-(0.98)	(3.12)
CMA	0.0174	-0.0383	0.0556**
	(0.74)	-(1.59)	(2.38)
MOM	-0.0246***	0.0074	-0.0320***
	-(3.22)	(0.95)	-(4.22)
N	312	312	312
Adj. R2	0.9794	0.9788	0.4888

Table 6 Continued

Panel B Analyses Based on 1992 to 1998

	(1) Passive Funds	(2) Active Funds	(3) Passive - Active
Intercept	0.0030***	0.0026***	0.0004
	(2.91)	(5.02)	(0.36)
MKT-RF	0.9940***	0.9145***	0.0795**
	(32.62)	(59.41)	(2.51)
SMB	-0.0637*	0.2274***	-0.2911***
	-(1.84)	(12.97)	-(8.08)
HML	0.0451	0.0146	0.0305
	(0.82)	(0.52)	(0.53)
RMW	-0.0529	-0.1063***	0.0534
	-(0.74)	-(2.96)	(0.72)
CMA	0.0187	-0.1158**	0.1345
	(0.22)	-(2.64)	(1.49)
MOM	-0.0047	0.0407**	-0.0454
	-(0.14)	(2.47)	-(1.34)
N	84	84	84
Adj. R2	0.9596	0.9897	0.5849

Panel C Analyses Based on 1999 to 2017

	(1) Passive Funds	(2) Active Funds	(3) Passive - Active
Intercept	0.0003	0.0006	-0.0003
	(0.80)	(1.33)	-(1.16)
MKT-RF	0.9998***	0.9735***	0.0263***
	(101.19)	(73.81)	(3.18)
SMB	0.0945***	0.1633***	-0.0688***
	(7.55)	(9.76)	-(6.55)
HML	0.0380**	0.0062	0.0318**
	(2.44)	(0.30)	(2.44)
RMW	0.0671***	-0.0143	0.0814***
	(4.15)	-(0.66)	(6.00)
CMA	0.0080	-0.0168	0.0248
	(0.38)	-(0.61)	(1.42)
MOM	-0.0368***	0.0067	-0.0435***
	-(5.35)	(0.73)	-(7.54)
N	228	228	228
Adj. R2	0.9870	0.9773	0.6036

Table 7 Value-Weighted Average Monthly Fund Returns (VMRET) of Passive and Active Funds

This table reports the yearly means of value-weighted average monthly fund returns (VMRET) for passive and active funds in our sample from mutual fund return database. At the bottom of the table, we report the sample mean of VMRET for our entire sample period (1992 to 2017), and two sub-sample means of VMRET from 1992 to 1998 and from 1999 to 2017.

	Passive Funds		Active Funds	
Year	Average No. Funds	Average VMRET	Average No. Funds	Average VMRET
1992	26	0.0061	748	0.0065
1993	37	0.0089	938	0.0115
1994	44	0.0004	1,230	-0.0009
1995	49	0.0264	1,596	0.0233
1996	58	0.0174	1,902	0.0141
1997	86	0.0269	2,373	0.0191
1998	122	0.0216	2,984	0.0163
1999	172	0.0170	3,609	0.0198
2000	218	-0.0071	4,139	-0.0051
2001	332	-0.0082	4,857	-0.0111
2002	359	-0.0185	5,192	-0.0194
2003	385	0.0233	5,262	0.0230
2004	444	0.0098	5,457	0.0098
2005	458	0.0050	5,531	0.0067
2006	518	0.0121	5,854	0.0106
2007	674	0.0046	6,395	0.0063
2008	797	-0.0367	7,061	-0.0384
2009	812	0.0230	7,276	0.0250
2010	920	0.0151	7,449	0.0145
2011	1,031	0.0016	7,569	-0.0009
2012	1,113	0.0124	7,611	0.0120
2013	1,113	0.0233	7,778	0.0217
2014	1,149	0.0100	8,200	0.0074
2015	1,164	0.0006	8,457	0.0002
2016	1,225	0.0105	8,461	0.0081
2017	1,347	0.0153	8,460	0.0156
1992-2017	564	0.0085	5,246	0.0075
1992-1998	60	0.0154	1,682	0.0129
1999-2017	749	0.0059	6,559	0.0056

Table 8 Time-Series Regression of Value-Weighted Average Monthly Fund Returns (VMRET)

This table reports the results from the time-series regressions of value-weighted average monthly fund returns (VMRET) on Fama-French 5 factors and momentum. Panels A, B and C show the results based on 312 monthly observations over the period of 1992 to 2017, 84 monthly observations over the period 1992 to 1998, and 228 monthly observations over the period of 1999 to 2017, respectively. In Column (1), the dependent variable is VMRET of passive funds. In Column (2), the dependent variable is VMRET of active funds. In Column (3), the dependent variable is the signed difference in VMRET between passive and active funds (i.e., passive returns minus active returns). The independent variables are the Fama-French 5 factors and the momentum factor each month. MKT-RF is the excess return on the market. SMB (Small Minus Big) is the average return on the small stock portfolio minus the average return on the big stock portfolio. HML (High Minus Low) is the average return on the value portfolio minus the average return on the growth portfolio. RMW (Robust Minus Weak) is the average return on the robust operating profitability portfolio minus the average return on the weak operating profitability portfolio. CMA (Conservative Minus Aggressive) is the average return on the conservative investment portfolio minus the average return on the aggressive investment portfolio. MOM is the average return on the two high prior return portfolios minus the average return on the two low prior return portfolios.

Panel A Analyses Based on 1992 to 2017

	(1)	(2)	(3)
	Passive Funds	Active Funds	Passive - Active
Intercept	0.0016***	0.0012***	0.0003
	(5.85)	(3.89)	(0.95)
MKT-RF	1.0134***	0.9570***	0.0563***
	(135.66)	(107.76)	(5.80)
SMB	-0.0633***	0.0634***	-0.1267***
	-(6.85)	(5.77)	-(10.55)
HML	0.0429***	0.0064	0.0364**
	(3.54)	(0.45)	(2.31)
RMW	0.0588***	-0.0506***	0.1094***
	(4.72)	-(3.42)	(6.75)
CMA	0.0185	-0.0441**	0.0626***
	(1.08)	-(2.17)	(2.82)
MOM	-0.0124**	0.0149**	-0.0273***
	-(2.24)	(2.26)	-(3.78)
N	312	312	312
Adj. R2	0.9886	0.9841	0.5650

Table 8 Continued

Panel B Analyses Based on 1992 to 1998

	(1) Passive Funds	(2) Active Funds	(3) Passive - Active
Intercept	0.0035***	0.0026***	0.0009
	(5.59)	(5.61)	(1.15)
MKT-RF	1.0114***	0.9124***	0.0989***
	(54.61)	(66.51)	(4.28)
SMB	-0.1469***	0.0805***	-0.2274***
	-(6.96)	(5.15)	-(8.63)
HML	-0.0034	0.0524**	-0.0558
	-(0.10)	(2.11)	-(1.33)
RMW	0.0055	-0.1016***	0.1071*
	(0.13)	-(3.17)	(1.98)
CMA	0.0894*	-0.1168***	0.2062***
	(1.69)	-(2.99)	(3.12)
MOM	-0.0218	0.0546***	-0.0764***
	-(1.10)	(3.72)	-(3.08)
N	84	84	84
Adj. R2	0.9849	0.9912	0.6556

Panel C Analyses Based on 1999 to 2017

	(1) Passive Funds	(2) Active Funds	(3) Passive - Active
Intercept	0.0008***	0.0007*	0.0001
	(2.86)	(1.82)	(0.17)
MKT-RF	1.0088***	0.9681***	0.0407***
	(131.45)	(87.37)	(3.86)
SMB	-0.0260***	0.0648***	-0.0908***
	-(2.67)	(4.61)	-(6.79)
HML	0.0350***	-0.0156	0.0506***
	(2.89)	-(0.89)	(3.04)
RMW	0.0807***	-0.0308*	0.1115***
	(6.42)	-(1.70)	(6.46)
CMA	0.0017	-0.0303	0.0320
	(0.11)	-(1.29)	(1.44)
MOM	-0.0191***	0.0102	-0.0293***
	-(3.57)	(1.33)	-(3.99)
N	228	228	228
Adj. R2	0.9917	0.9832	0.5862

Table 9 Equal-Weighted Average Monthly Fund Returns (EMRET) of Small-, Mid-, and Large-Sized Mutual Funds

This table reports the yearly means of equal-weighted average monthly fund returns (EMRET) for each of small, mid, and large-sized mutual funds, defined as those whose AUM belongs to the lowest 40%, the middle 40%, and the highest 20% of our sample mutual funds, respectively. At the bottom of the table, we report the sample mean of EMRET for our entire sample period (1992 to 2017), and two sub-sample means of EMRET from 2005 to 2010 and from 2011 to 2016.

	Passive			Active		
Year	Small	Mid	Large	Small	Mid	Large
1992	0.0047	0.0052	0.0070	0.0077	0.0065	0.0062
1993	0.0076	0.0109	0.0104	0.0115	0.0120	0.0107
1994	-0.0013	0.0003	-0.0009	-0.0015	-0.0013	-0.0011
1995	0.0237	0.0254	0.0261	0.0217	0.0227	0.0230
1996	0.0158	0.0171	0.0170	0.0158	0.0149	0.0142
1997	0.0229	0.0356	0.0238	0.0177	0.0170	0.0186
1998	0.0175	0.0183	0.0196	0.0114	0.0123	0.0144
1999	0.0158	0.0164	0.0162	0.0205	0.0208	0.0213
2000	-0.0035	-0.0042	-0.0062	0.0031	0.0002	-0.0043
2001	-0.0069	-0.0065	-0.0070	-0.0084	-0.0095	-0.0109
2002	-0.0185	-0.0185	-0.0177	-0.0203	-0.0195	-0.0204
2003	0.0244	0.0239	0.0243	0.0248	0.0248	0.0239
2004	0.0105	0.0103	0.0110	0.0100	0.0103	0.0100
2005	0.0052	0.0052	0.0060	0.0063	0.0067	0.0066
2006	0.0114	0.0118	0.0124	0.0103	0.0107	0.0106
2007	0.0042	0.0041	0.0044	0.0050	0.0055	0.0061
2008	-0.0367	-0.0367	-0.0359	-0.0379	-0.0379	-0.0382
2009	0.0262	0.0239	0.0236	0.0254	0.0256	0.0254
2010	0.0160	0.0159	0.0162	0.0156	0.0159	0.0150
2011	-0.0014	-0.0003	0.0012	-0.0011	-0.0009	-0.0010
2012	0.0112	0.0118	0.0122	0.0113	0.0118	0.0119
2013	0.0198	0.0223	0.0224	0.0217	0.0226	0.0225
2014	0.0057	0.0075	0.0092	0.0062	0.0069	0.0073
2015	-0.0027	-0.0015	0.0000	-0.0014	-0.0009	-0.0005
2016	0.0116	0.0114	0.0109	0.0090	0.0088	0.0084
2017	0.0136	0.0139	0.0145	0.0136	0.0144	0.0150
1992 to 2017	0.0076	0.0086	0.0085	0.0076	0.0077	0.0075
2005 to 2010	0.0044	0.0040	0.0045	0.0041	0.0044	0.0043
2011 to 2016	0.0074	0.0085	0.0093	0.0076	0.0080	0.0081