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Actively managed mutual funds holding passive investments: What do ETF positions tell us about mutual fund ability?

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ABSTRACT

We provide the first in-depth examination of exchange-traded funds (ETFs) within actively managed mutual fund (AMMF) portfolios to better understand why AMMFs make substantial investments in passive ETFs. We examine the association between holding ETF positions and AMMF performance, as well as indirect measures of performance, including market timing, flow management, and cash holdings. We find that over one-third of AMMFs take an ETF position between 2004 and 2015. Our results indicate that AMMFs allocating large portions of their portfolio to ETFs perform worse, by between 0.41% and 1.63% annually using various performance measures. These AMMFs also exhibit worse market timing and hold more cash. In contrast, AMMFs that hold ETFs in small amounts have similar characteristics to non-user AMMFs. Therefore, the act of holding an ETF does not signal inferior ability, however, taking large ETF positions does.

1. Introduction

Actively managed mutual funds (hereafter AMMFs) are well known for attempting to pick undervalued securities in an effort to generate excess returns. While equity AMMFs typically focus on picking stocks, AMMFs frequently hold positions in passively managed exchange-traded funds (ETFs). Between 2004 and 2015, we find that 37.88% of AMMFs held an ETF in their portfolio. Despite ETF-user AMMFs accounting for over one trillion dollars under management and almost one out of every five dollars managed by AMMFs, current literature has yet to examine the impact that holding a passive investment, such as an ETF, has on performance.[1]

With the intense competition for new money within the AMMF industry (Berk and Green, 2004), the literature observes countless strategies designed to increase AMMF performance or inflows. These strategies include incubation (Evans, 2010), changing AMMF names (Cooper et al., 2005), making concentrated industry bets (Kacperczyk et al., 2005), and switching between market timing and stock picking strategies (Kacperczyk et al., 2014), among others. Additional research has focused on AMMF ability managing specific assets or position types. Chen et al. (2013) examines AMMF short selling and finds an association between short positions and improved AMMF performance. Koski and Pontiff (1999) provide the first detailed look at how AMMFs utilize derivative positions. Frino et al. (2009) find improved flow management associated with index futures positions, and Cici and Palacios (2015) find options use is associated with income generation and hedging motives.

We examine the impact of a strategy where actively managed portfolios hold substantial ETF positions. The potential benefits of this type of strategy can range from purely increasing performance, to improved cash and flow management, to the ability to time markets by moving into or out of an ETF position. As such, we examine if AMMFs utilizing ETF positions have improved performance, thus justifying holding large proportions of an actively managed portfolio in passive investments.

An AMMF's most visible and well documented characteristic is performance.[2] Through the examination of risk-adjusted performance and excess returns, we find that holding an ETF is associated with significantly lower performance over the subsequent 12 month period. To further our analysis, we follow

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[1] Within our sample of diversified domestic equity AMMFs, ETF-user AMMF's control $1.13 trillion and non-user AMMFs control $4.6 trillion.

[2] See Chen et al. (2000), Wermers (2000), and Chen et al. (2013) among others, for support of AMMF ability. See Jensen (1968), Carhart (1997) and French (2008), among others, for support of a lack of ability among AMMFs.

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Cici and Palacios (2015) and divide our sample into low- and high-ETF-user groups at the median proportion of a portfolio invested in ETFs over 12 month periods. We find high-user AMMFs drive our results, generating the lowest performance and subsequently underperforming non-ETF-user AMMFs by between 0.41% and 1.63% per year.[3] These results hold after controlling for fund, style, family, and objective characteristics.

Our findings suggest that large ETF positions provide a strong indicator of subsequent AMMF underperformance. This result, in conjunction with high-ETF-users allocating an average of 12.81% of their portfolios to ETFs, brings into question an AMMF's decision to hold large ETF positions. Utilizing alternative methodologies for robustness such as a tercile ranking, a style-based ranking, a lifetime cross-sectional ranking, a 24 month ranking with monthly returns, and a matched sample approach, we find quantitatively similar results, and oftentimes stronger evidence and greater magnitude of the underperformance associated with large ETF positions among AMMF portfolios.[4]

To better understand the source of this underperformance, we decompose performance measures into an ETF portion and a non-ETF portion. We find that both ETF and non-ETF portions significantly contribute to the underperformance of high-ETF-user AMMFs. In contrast, we find that ETF positions do not make a meaningful or significant contribution to the performance of low-ETF-user AMMFs. The negative returns of the ETF portfolio provide evidence that the high-ETF-user AMMF's lack of skill extends beyond directly selecting securities and into picking indices tracked by ETFs. This indicates that high-user-AMMFs may be unskilled in multiple facets of portfolio management rather than just lacking the ability to select securities.

Next we examine the direct, contemporaneous impact that holding an ETF has on AMMF performance. We find that low-user AMMFs experience no meaningful difference in performance during periods they hold an ETF relative to periods they do not hold an ETF. Among high-user AMMFs we observe a significant decrease in style excess, objective excess, and benchmark excess performance measures during months they hold an ETF, further suggesting that high-user AMMFs lack the ability to utilize ETF holdings in a manner that improves performance.

We determine the impact that various levels of ETF activeness have on AMMF performance. Using a measure of Active Share calculated for an AMMF's ETF portfolio, we find that more active ETF positions have a marginal association with decreased performance. Those high-user-AMMFs that make more active ETF bets, thus using ETFs as part of an active investment strategy, generate lower performance. We then examine the impact of ETF type on AMMF performance and find that high-user AMMFs holding traditional index tracking ETFs, though not necessarily tracking the assigned benchmark of the AMMF, generate the majority of our observed underperformance. This is consistent with the result of our ETF Active Share analysis, indicating that AMMFs taking large, index ETF bets outside of their assigned benchmark are the AMMFs generating the lowest performance.

Although high-ETF-user AMMFs significantly underperform, ETFs can provide value through indirect sources of performance. To examine if AMMFs increase market exposure during up markets and decrease market exposure during down markets, we employ the market timing methodologies of Henriksson and Merton (1981) and Treynor and Mazuy (1966). We find that, in general, AMMFs have poor market timing ability. However, high-ETF-user AMMFs are the poorest market timing funds. Relative to non-ETF-users, low-ETF-user AMMFs exhibit similar market timing ability. These results support the association between large ETF positions and a lack of AMMF ability.

To determine if AMMFs use ETFs for liquidity management, we look at fund flows and cash held. If AMMFs can improve flow management, they can reduce the performance drag associated with liquidity motivated trading (Edelen, 1999). Following methods employed by Frino et al. (2009), we find that ETF-holding AMMFs, regardless of group of usage, possess no additional ability to manage flows. The ability to better manage cash holdings results in a decreased cash drag on performance (Wermers, 2000). Following the work of Yan (2006), we find mixed cash management ability related to ETF holdings. ETF-user AMMFs within the high-user group hold greater amounts of cash than other funds, while low-ETF-user AMMFs hold smaller cash positions. We find no evidence of decreased cash holdings during periods an AMMF holds an ETF versus periods they do not hold an ETF.

We organize the remainder of our paper as follows. Section 2 describes the data, our sample creation, and descriptive statistics. Section 3 examines AMMF performance under risk-adjusted and excess return measures. We then decompose performance into an ETF portion and a non-ETF portion to determine the source of AMMF performance. Section 4 examines the impact of different ETF characteristics and types on AMMF performance. Section 5 focuses on the indirect relation to AMMF performance through market timing and liquidity management. Section 6 contains robustness results for tercile rankings, style rankings, lifetime cross-sectional rankings, a matched sample analysis, using 24 month windows and monthly returns, and sub periods. Section 7 discusses our results and their implications.

2. Data, sample creation, and sample statistics

We construct our sample from multiple databases and examine AMMF and ETF characteristics associated with AMMF ownership and performance.

2.1. Data

We obtain, from the Center for Research in Security Prices Survivor-Bias-Free US Mutual Fund Database (CRSP MF), information on AMMF returns, holdings, characteristics, and family characteristics, from January 2004 through year-end 2015. We begin our sample in 2004, which is the first full year that CRSP MF reports holdings with consistency. CRSP MF reports most variables at the share class level. To avoid counting each share class as a unique mutual fund, we aggregate share classes belonging to the same mutual fund into one TNA-weighted portfolio observation.[5] The Morningstar Direct (Morningstar) database provides ETF and mutual fund characteristics such as identifier variables for inverse or leveraged ETFs. The CRSP US Stock database (CRSP US) provides ETF prices, returns, bid-ask spreads, shares outstanding, and volume traded. We retain returns at the daily level to allow for monthly calculations of risk-adjusted performance. All other mutual fund, ETF, and fund family variables are at monthly frequencies for analysis, unless otherwise noted. We merge ETF and mutual fund data from CRSP MF, Morningstar, and CRSP US by Com-

[3] Annualized underperformance of high-user AMMFs relative to non-user AMMFs amounts to 0.41% measured with a four-factor alpha, 1.27% measured with style excess returns, 1.36% measured with objective excess returns, and 1.63% measured with benchmark excess returns.

[4] Although the methods presented in our robustness section often provide stronger results, we choose to present the non-overlapping 12 month windows with daily returns methodology as our primary analysis due to the ability to calculate alpha across individual month periods, which is required for subsequent analyses.

[5] As detailed in the *CRSP Survivor-Bias-Free Mutual Fund Guide*, we utilize the CRSP Fund Header when aggregating to the portfolio level. If the portno is missing, we obtain it from the Portno Map file.

mittee on Uniform Security Identification Procedures (CUSIP) and remove portfolio observations with missing data.[6]

To construct our sample of diversified domestic equity AMMFs that hold passively managed ETFs, we retain funds classified as domestic equity and drop any fund identified as sector, hedged, or passively managed.[7] Due to the incubation bias discussed in Evans (2010), we remove fund observations prior to their first offer date as reported in CRSP MF. We then remove AMMFs with less than $15 million in total net assets. From our sample of AMMFs, we utilize the holdings information from CRSP MF to identify all passively managed ETF holdings, and drop those ETFs classified as actively managed. Like Chen et al. (2013), we use monthly holdings data to update our stock and ETF positions and assume a maximum holding period of six months. When monthly holdings are not available, we use quarterly holdings subject to the same six-month restriction. After six consecutive months (two quarters) with no updated holdings data, we set the fund's holdings to missing. As in Cici and Palacios (2015), we conduct our analyses on non-overlapping 12 month windows. ETF user ranks and control variables are calculated over each 12 month period, and we use ETF-user ranks in predictive and contemporaneous analyses. The resulting sample is 1,322 unique diversified domestic equity AMMFs with passive ETF positions and 2,168 unique AMMFs that never hold an ETF. The number of fund period (12 month) observations is 4,014 for ETF-user AMMFs and 16,354 for non-ETF-user AMMFs. As an additional methodology utilized for robustness, we construct a matched sample based on AMMF investment objective and total net assets.[8] We discuss these results in Section 6.

We require AMMF benchmarks for use in calculating benchmark excess return, Active Share, and tracking error, and utilize the 19 benchmarks in Cremers and Petajisto (2009).[9] To assign benchmarks to each AMMF, as in Cremers and Petajisto (2009), we calculate Active Share against all 19 indices,

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

where $w_{fund,i}$ and $w_{index,i}$ are the weight of asset i in the AMMF and the index, respectively. We assign AMMF benchmarks as the benchmark that generates the smallest Active Share. We apply this method of assigning benchmark indices for two reasons. First, while Morningstar does have benchmark data, this information is not available for all AMMFs in the database. Second, Sensoy (2009) finds that over 30% of equity AMMFs incorrectly specify their self-reported benchmarks. By assigning benchmarks based on minimizing Active Share, we incorrectly assign a benchmark only if the AMMF's holdings track the assigned index more closely than they track the other 18. We calculate tracking error as,

$$Tracking\ Error = stdev\left(R_{i,t} - R_{benchmark,t}\right), \tag{2}$$

where $R_{i,t}$ is the daily return of AMMF i and $R_{benchmark,t}$ is measured as the daily return of the benchmark assigned in Eq. (1).

As a result of the heterogeneity among AMMFs, many of our subsequent analyses control for the style of an AMMF's underlying holdings. Similar to the approach of Daniel et al. (1997) and Kacperczyk et al. (2005), we sort AMMFs into one of 25 style groups. We begin by assigning each equity position within an AMMF's portfolio with two values of 1 through 5 based on its size and value characteristics.[10] Utilizing these ranks, we calculate a measure of an AMMF's TNA-weighted size and value characteristics each month. These values represent the style control variables used throughout our regressions. To calculate style benchmarks, used for calculating style excess returns, we double sort AMMFs into one of five quintiles on the basis of their size and book-to-market characteristics. This results in 25 style groups that control for the size and book-to-market characteristics of the AMMF's underlying equity holdings.[11] The value weighted returns for each of the 25 style controlled portfolios are used as our style benchmark returns. As an additional methodology utilized for robustness, we construct annual user rankings based on style subsamples. We discuss this process and the results in Section 6.

Cici and Palacios (2015) find that 11% of AMMFs use an exchange-traded option at least one time between July 2003 and December 2010 and Chen et al. (2013) find that 7% of mutual funds engage in short positions as of 2009. We find that on average 20% of domestic equity AMMFs hold an ETF position in a given year and 37.88% of AMMFs hold an ETF at one point in time over our sample. The relatively large proportion of AMMFs using ETFs provides additional motivation for our analyses.

2.2. ETF and mutual fund characteristics

Panel A of Table 1 provides descriptive statistics on ETFs and compares the characteristics of ETFs held by AMMFs and ETFs never held by AMMFs. The ETFs never held by an AMMF are the smallest, youngest, most expensive, and least liquid ETFs. We do not use non-held ETFs in our subsequent analyses. Of the ETFs held by AMMFs, AMMFs prefer ETFs that are relatively large, with an average size of $2.63 billion. They also show preference for ETFs with lower expense ratios and for ETFs with greater liquidity as measured by volume traded and bid/ask spread. We examine the descriptive statistics of AMMFs by user-group in Panel B. Relative to non-ETF-user AMMFs, we find that user AMMFs are smaller ($852 million versus $1.48 billion), have greater portfolio turnover (89.54% versus 71.34%), are members of smaller fund families ($84.47 billion versus $111.25 billion), and experience lower amounts of flow (2.09% versus 2.70%).[12]

We further explore the use of ETFs by looking at the proportion of an AMMF's portfolio attributed to ETFs. Table 2 shows that when domestic equity AMMFs hold ETFs, they take average (median) long ETF positions of 7.43% (1.42%) of total net assets while holding 2.64 (1.00) separate ETFs. Cici and Palacios (2015) examine derivative use among AMMFs and show significantly different outcomes when looking at low- and high-user subsamples at the median derivative position size. Following their approach, we first

[6] We winsorize percent flows, turnover, performance, and expense ratios at the 1% and 99% level to remove the impact of outliers. Cash is winsorized at the 1% and 95% levels. Prior to winsorizing cash, we spot-check fund cash holdings above the 95% threshold within the Electronic Data Gathering, Analysis, and Retrieval (EDGAR) system and find that these are errors within the CRSP MF database. Winsorized cash holdings are consistent with results presented in Yan (2006).

[7] We identify equity domestic AMMFs as those with a CRSP MF objective code of "ED," sector mutual funds as mutual funds with a CRSP MF objective code of "EDS," and hedged mutual funds with a CRSP MF objective code of "EDYH." We identify index (passively managed) mutual funds from the CRSP MF index mutual fund indicator variable. Subsequent use of objective fixed effects utilizes the CRSP MF objective code at four digits.

[8] We employ objective fixed effects throughout our analyses to control for unobserved investment objective effects. However, the use of a matched sample allows us to further control for the investment objective among AMMFs by requiring a non-user AMMF follow the same objective as our user-AMMF. Further discussion of our matched sample results can be found in the robustness discussion.

[9] Standard & Poor's (S&P) 500, S&P 400, S&P 600, S&P 500 Value, S&P 500 Growth, Russell 1000, Russell 2000, Russell 3000, Russell Midcap, the eight Russell Value and Growth indices, Wilshire 5000, and Wilshire 4500. Index holdings are obtained directly from the index providers.

[10] We obtain book-to-market data from Compustat and market capitalization data from CRSP US.

[11] A more detailed description of this process is available in Daniel et al. (1997).

[12] Sherrill et al. (2016) provides a practical list of specific mutual funds that hold ETFs and which ETFs are held, though the paper is a descriptive analysis and does not attempt to explain characteristics associated with ETF use or the implications of holding ETF positions.

Table 1
Exchange-traded fund (ETF) and actively managed mutual fund (AMMF) sample descriptive statistics.

Panel A: Exchange-traded fund (ETF) sample statistics				
Variable	Not Held ETFs		Held ETFs	
	Mean	Median	Mean	Median
Total net assets (millions of dollars)	127.51	26.17	2627.03	515.68
Age (years)	2.87	2.03	6.09	5.37
Expense ratio (percent)	0.59	0.59	0.48	0.48
ETF family size (millions of dollars)	114,583	23,164	222,109	114,819
Monthly volume (thousands of shares)	2,770.93	228.42	58,193.70	3,920.30
Premium-to-NAV (percent)	0.08	0.02	0.06	0.01
Bid/Ask spread-to-price (percent)	0.52	0.28	0.16	0.10
Panel B: Actively managed mutual fund (AMMF) sample statistics				
Variable	Non-ETF-user AMMFs		ETF-user AMMFs	
	Mean	Median	Mean	Median
Total net assets (millions of dollars)	1479.38	288.88	852.41	203.57
Age (years)	13.45	11.20	12.05	10.21
Expense ratio (percent)	1.17	1.18	1.19	1.18
Portfolio turnover (percent)	71.34	62.00	89.54	62.00
Family size (millions of dollars)	111,249	10,069	84,471	,6038
Load indicator (percent with load)	55.44	100.00	54.44	100.00
Cash (percent of total net assets)	2.84	1.99	2.99	2.09
Flow (absolute value of percent TNA)	2.70	1.75	2.09	1.81
Value style (one to five)	2.41	2.41	2.49	1.11
Size style (one to five)	4.11	4.56	3.89	4.33

Panel A contains the descriptive statistics of ETFs held and not held by AMMFs. Panel B contains the descriptive statistics of our sample of AMMFs that have held an ETF and those that have not. Mean and median values are reported. *Total net assets* is the total net assets (TNA) of the fund, *Age* is the fund's age, *Expense ratio* is the fund's expense ratio. *ETF family size* (*family size*) is the sum of the TNA of all ETFs (AMMFs) managed by the same fund family. *Premium-to-NAV* is the premium (difference between the ETF trading price and net asset value (NAV)) relative to the ETF's NAV. *Bid/Ask spread-to-price* is the spread between the bid and ask prices for the ETF relative to the closing price of the ETF. *Portfolio turnover* is the AMMF turnover ratio. *Load Indicator* takes a value of one if the AMMF has a front or rear load and a value of zero otherwise. *Cash* is the percent of the AMMF's portfolio TNA held in cash. *Flow* is the absolute value of the percentage into an AMMF. *Value style* measures the book-to-market characteristics of the underlying portfolio holdings and *Size style* measures the size characteristics of the underlying portfolio holdings.

Table 2
Size of exchange-traded fund (ETF) positions in actively managed mutual fund (AMMF) portfolios.

Mutual fund objectives	Mean		Median	
	Percent	Number of ETFs held	Percent	Number of ETFs held
ETF-user				
All domestic equity	7.427	2.638	1.420	1.000
Domestic equity cap	2.338	1.623	1.210	1.000
Domestic equity style	10.771	3.304	1.586	1.000
Large growth	7.831	2.628	1.478	1.000
Large value	8.143	2.605	1.240	1.000
Small growth	6.238	2.500	1.507	1.000
Small value	6.570	2.636	1.380	1.000
Low-ETF-user group				
All domestic equity	0.699	1.271	0.620	1.000
Domestic equity cap	0.747	1.180	0.660	1.000
Domestic equity style	0.661	1.345	0.560	1.000
Large value	0.633	1.309	0.540	1.000
Large growth	0.665	1.295	0.548	1.000
Small value	0.765	1.240	0.690	1.000
Small growth	0.720	1.253	0.639	1.000
High-ETF-user group				
All domestic equity	12.813	3.774	3.103	2.000
Domestic equity cap	4.085	2.113	2.501	1.000
Domestic equity style	17.869	4.737	3.780	2.000
Large value	14.159	3.787	3.970	2.000
Large growth	15.744	3.937	2.974	2.000
Small value	10.482	3.477	2.907	1.000
Small growth	11.828	3.879	2.969	2.000

This table presents the mean and median total AMMF portfolio weight held in ETFs and the number of ETFs held for months in which a mutual fund reports holding an ETF. We retain only non-sector domestic equity AMMFs. We report results for all ETF-user AMMFs, Low-ETF-user AMMFs, and High-ETF-user AMMFs.

Table 3
Exchange-traded fund (ETF) positions.

	Low-user AMMF Percent	High-user AMMF Percent
ETF type		
Traditional index tracking ETFs	47.557	62.191
Smart Beta ETFs	50.758	34.606
Leveraged ETFs	0.548	1.318
Inverse ETFs	1.138	1.885
ETF objective		
Domestic equity sector ETFs	23.393	23.857
Domestic equity style ETFs	21.513	14.945
Domestic equity cap ETFs	49.900	43.935
Foreign equity ETFs	3.992	10.160
Fixed income ETFs	0.721	5.703
Mixed fixed income and equity ETFs	0.477	1.099
Other ETFs	0.003	0.303

This table reports the distribution of ETF positions by actively managed mutual funds (AMMFs), divided into low-user and high-user AMMFs. We first present the breakdown of ETF holding positions across traditional, smart beta, leveraged, and inverse ETFs. We then present the breakdown of ETF positions across ETF objectives. Both breakdowns sum to 100% of all ETF positions held by AMMFs.

rank all user AMMFs into two groups on the basis of the percentage of portfolio TNA attributed to ETF positions over the prior 12 month period. We assign those AMMF users attributing a fraction of portfolio assets greater than the median user allocation to the high-users group and those attributing lower than the median to the low-users group. Utilizing a low- and high-ETF-user group hierarchy reveals large differences in the proportion of a portfolio allocated to ETFs. Low-users have total average (median) positions of 0.70% (0.62%) of TNA compared to 12.81% (3.10%) of TNA for high-users.[13] We further explore allocation sizes across AMMF objective and style classifications. Among high-user AMMFs, we see that domestic cap based AMMFs allocate relatively smaller proportions of their portfolios to ETFs, totaling just 4.09% of TNA. Across portfolio styles, we see that high-user AMMFs, classified as large, hold larger ETF positions than AMMFs classified as small. Differing allocations to ETF positions can indicate that low-user and high-user AMMFs, and AMMFs across various style and objective classifications, use ETFs for different purposes. To explore this possibility further, we utilize low-user, high-user, and style subgroups in subsequent analyses.

To get a more detailed look at the types of ETFs held by AMMFs, we begin by examining the distribution of ETF positions by ETF style. Table 3 presents results for high- and low-ETF-user AMMFs across ETF type and objective. Results show that low-user AMMFs split the majority of their ETF positions among traditional index tracking and smart beta ETFs. In contrast, high-user AMMFs attribute just 34.61% of their ETF positions to smart beta and 62.19% to traditional index tracking ETFs. To further examine AMMF preferences for ETFs, we look at ETF allocations by ETF objective. Among both low- and high-user AMMFs, we see that domestic equity cap based ETFs make up the majority of the ETF portfolio, followed closely by domestic equity sector and style based ETFs. High-user AMMFs attribute meaningful portions of their ETF portfolios to foreign equity ETFs and fixed income ETFs as well, accounting for 10.16% and 5.70%, respectively. This indicates AMMFs also invest in ETFs outside of their stated objective.[14]

The results from Table 3 utilize a coarse classification of our AMMF sample, placing AMMFs into one of two groups based on the size of their ETF positions. It can be that different types of AMMFs have different motivations for holding ETF positions. To explore this possibility further, we follow Kacperczyk et al. (2005) and subdivide our user groups into four style based classifications: (1) large growth AMMFs, (2) large value AMMFs, (3) small growth AMMFs, and (4) small value AMMFs. To assign AMMFs to a style classification, we first divide our sample into large and small style AMMFs based on the size characteristics of the AMMF's portfolio. We then repeat this process using the value characteristics of the AMMF's portfolio. The result is a size and book-to-market sorted subsample of AMMFs. Table 4 presents the ETF allocation decisions of AMMFs by user group and AMMF style. In Panel A, we show that low-user AMMFs, regardless of style classification, hold a fairly even split between traditional index tracking and smart beta ETFs. Looking at ETF objectives shows that low-user AMMFs classified as large growth and large value primarily hold domestic equity style based ETFs, while small growth and small value AMMFs hold primarily domestic equity cap based ETFs. In Panel B, we examine high-user AMMFs and show that large growth and large value AMMFs attribute nearly two thirds of their ETF portfolios to traditional index tracking ETFs while small growth and small value AMMFs are more likely to split their positions among traditional index-tracking and smart beta ETFs. We also find that small growth and small value high-user AMMFs hold over half of their ETF positions in domestic equity cap based ETFs, while large growth and large value high-user AMMFs spread their positions out more evenly. The large variations in the types of ETFs held by the various subgroups further prompts us to look at user and style groups throughout our analysis.

Tables 3 and 4 establish that AMMFs hold ETF positions across various types and objectives. The effect of this brings into question the activeness of these AMMFs. Due to the passive nature of ETF positions and the value placed on active management (Kacperczyk et al., 2005; Cremers and Petajisto, 2009; Doshi et al., 2015), we examine AMMF activeness and closet indexing through the methodology of Cremers and Petajisto (2009) by calculating Active Share and Tracking Error. To fully understand the level of activeness among AMMF portfolios, we calculate Active Share and Tracking Error for non-user, low-user, and high-user AMMFs as well as by AMMF style. We calculate both measures of activeness for the overall AMMF portfolio, the ETF portfolio, and the non-ETF portfolio to gain an understanding of how ETF positions directly impact portfolio activeness.[15] Measures of Active Share presented in Table 5 show that regardless of user group, AMMFs classified as large are less active than AMMFs classified as small, though we see only marginal differences between non-, low-, and high-user AMMF portfolios. Among ETF-user AMMFs, we see that ETF portfolios have lower values of Active Share than the non-ETF portfolios, though ETF portfolios are still considered to be active investments outside of the AMMF's assigned benchmark (i.e. not closet indexing) using the classifications put forward in Cremers and Petajisto (2009). We observe a difference in portfolio activeness across ETF

[13] It can be the case that different style AMMFs have different motivations for holding ETFs. To control for this possible style bias, we examine an alternate ranking system which first ranks AMMFs into low- and high-user groups within their style and then aggregates ranks into one low-user and one-high user group. This method controls for any difference in ETF position sizes across AMMF styles. We find similar results under this methodology and discuss it in further detail in our robustness section.

[14] Appendix A.1 presents a more detailed breakdown of ETF positions held by examining low- and high-user ETF holdings sorted by ETF type and then further sorted by ETF objective. We find that low-user AMMFs primarily hold domestic equity ETFs among their traditional index tracking and smart beta positions. However, among their leveraged and inverse ETFs they tend to hold style based ETFs. Among high-user AMMFs the pattern is similar across smart beta, leveraged, and inverse ETFs. Among high-user traditional index tracking ETF positions, we see less concentrated positions among any one ETF objective.

[15] For the overall portfolio, we substitute the value weighted stock holdings of an ETF in the place of the ETF position held by an AMMF.

Table 4
Exchange-traded fund (ETF) positions by mutual fund style.

Panel A: Low-ETF-user by style (percent of ETF portfolio)				
ETF type	Large growth	Large value	Small growth	Small value
Traditional index tracking ETFs	45.240	53.516	44.850	46.076
Smart Beta ETFs	53.776	43.546	54.277	52.277
Leveraged ETFs	0.692	0.832	0.198	0.476
Inverse ETFs	0.292	2.106	0.675	1.171
ETF objective				
Domestic equity sector ETFs	25.658	28.206	22.941	18.809
Domestic equity style ETFs	47.989	41.410	4.877	2.556
Domestic equity cap ETFs	22.401	22.531	67.053	74.718
Foreign equity ETFs	3.556	5.963	3.825	2.855
Fixed income ETFs	0.169	1.444	0.407	0.682
Mixed fixed income and equity ETFs	0.227	0.433	0.898	0.380
Other ETFs	0.000	0.012	0.000	0.000
Panel B: High-ETF-user by style (percent of ETF portfolio)				
ETF type	Large growth	Large value	Small growth	Small value
Traditional index tracking ETFs	74.952	73.494	49.302	57.009
Smart beta ETFs	21.010	22.880	46.903	40.979
Leveraged ETFs	2.568	1.319	1.142	0.743
Inverse ETFs	1.470	2.307	2.653	1.269
ETF objective				
Domestic equity sector ETFs	31.665	26.774	19.884	20.453
Domestic equity style ETFs	26.656	25.979	7.368	6.603
Domestic equity cap ETFs	21.723	23.213	59.673	58.607
Foreign equity ETFs	9.114	14.906	8.337	8.938
Fixed income ETFs	7.376	7.583	4.145	4.660
Mixed fixed income and equity ETFs	2.940	1.363	0.482	0.341
Other ETFs	0.526	0.182	0.111	0.399

This table reports the distribution of ETF positions by actively managed mutual funds (AMMFs), divided into low-user and high-user AMMFs and then subdivided further into AMMF style. We first present the breakdown of ETF holding positions across traditional, smart beta, leveraged, and inverse ETFs. We then present the breakdown of ETF positions across ETF objectives. Both breakdowns sum to 100% of all ETF positions held by AMMFs.

Table 5
Portfolio activeness.

User group	Style	Active share			Tracking error		
		Overall	ETFs	Non-ETFs	Overall	ETFs	Non-ETFs
Non-user AMMF	All styles	78.795	–	–	6.041	–	–
	Large growth	72.164	–	–	5.707	–	–
	Large value	70.723	–	–	4.724	–	–
	Small growth	86.696	–	–	7.051	–	–
	Small value	86.404	–	–	6.720	–	–
Low-user AMMF	All styles	72.734	43.816	72.877	5.912	9.828	5.967
	Large growth	61.513	33.769	61.482	5.261	10.408	5.597
	Large value	62.316	39.914	62.486	4.631	10.086	4.667
	Small growth	80.868	44.684	81.066	7.260	10.277	7.473
	Small value	81.721	51.676	81.891	6.322	8.950	6.108
High-user AMMF	All styles	77.026	47.878	82.738	6.930	9.903	8.011
	Large growth	68.986	48.725	75.197	6.924	12.340	8.156
	Large value	64.262	45.833	74.035	5.186	8.955	6.498
	Small growth	83.722	46.213	87.188	8.195	10.326	9.318
	Small value	84.386	50.113	88.802	6.998	8.704	7.804

This table measures AMMF activeness as in Cremers and Petajisto (2009) with (1) with Active Share as:
$AS = \frac{1}{2}\sum_{i=1}^{N} |w_{fund,i} - w_{index,i}|$,
and (2) with tracking error as:
$Tracking\ Error = stdev(R_{i,t} - R_{benchmark,t})$.
We report Active Share and Tracking Error for non-user, low-user, and high-user AMMFs as well as by AMMF style. Across each type of mutual fund, we report the Active Share and Tracking Error for the overall portfolio, the ETF portfolio, and the non-ETF portfolios separately.

and non-ETF portfolios when comparing large low-user AMMFs to large high-user AMMFs, with low-user AMMFs having less active portfolios than high-user AMMFs. The observed differences in ETF portfolio activeness can indicate different uses of ETF positions. As such, we examine the association between ETF activeness and performance in Section 4.

2.3. Multivariate mutual fund characteristics and ETF positions

We further examine what AMMF characteristics are associated with holding an ETF following the methodology of Koski and Pontiff (1999) with a logistic regression defined as

$$ETF_{i,z} = \beta_0 + \sum_{j=1}^{n} \beta_j X_{i,z} + FE + \varepsilon_{i,z}, \quad (3)$$

where $ETF_{i,z}$ is an indicator variable that takes a value of one if AMMF i is an ETF-user over the 12 month period z and zero otherwise. We estimate low- and high-ETF-user funds versus non-user funds separately. We define control variables X as the log of total net assets (*Total net assets*) for the AMMF, the log of the age of the AMMF (*Age*), the expense ratio (*Expense ratio*), an indicator variable which takes on the value of one if an AMMF charges a load and zero otherwise (*Load indicator*), the average turnover (*Turnover*), cash held as a percentage of AMMF TNA (*Percent cash*), the activeness of an AMMF as calculated in Eq. (1) (*Active share*), the log of the AMMF family TNA (*Family TNA*), the size characteristics of the AMMF holdings from 1 to 5 (*Size style*), and the book-to-market characteristics of the AMMF holdings from 1 to 5 (*Value style*), all measured over the 12 month period *z*. *FE* represents objective and time fixed effects.

In Table 6, we report coefficients from our logistic regression. Relative to non-ETF-user AMMFs, high-ETF-user AMMFs are smaller, younger, more likely to charge a load fee, have higher turnover, hold more cash, are less active, are members of smaller fund families, and hold positions with higher book-to-market values. Low-ETF-user AMMFs tend to be larger, charge lower expenses, have greater turnover, hold less cash, are less active, are members of smaller fund families, and hold positions with smaller size characteristics and higher book-to-market values. Characteristics between ETF-user groups vary substantially and can indicate differences in the types of mutual funds utilizing ETFs, further motivating the use of subgroups among user-AMMFs in subsequent analyses.

Table 6
Actively managed mutual fund (AMMF) characteristics associated with exchange-traded fund (ETF) ownership.

Variables	Low-ETF-user (1)	High-ETF-user (2)
Total net Assets	0.067***	−0.135***
	(0.000)	(0.000)
Age	−0.044	−0.148***
	(0.152)	(0.000)
Expense ratio	−0.166**	0.098
	(0.046)	(0.214)
Load indicator	0.104*	0.311***
	(0.057)	(0.000)
Turnover	0.327***	0.500***
	(0.000)	(0.000)
Percent cash	−0.039***	0.033***
	(0.000)	(0.000)
Active share	−0.034***	−0.019***
	(0.000)	(0.000)
Family TNA	−0.032***	−0.106***
	(0.002)	(0.000)
Size style	−0.318***	−0.083*
	(0.000)	(0.075)
Value style	0.223***	0.129***
	(0.000)	(0.002)
Intercept	−8.122	0.750**
	(0.953)	(0.018)
Fixed effects	Yes	Yes
Observations	21,560	21,564
R^2	8.80%	11.27%

This table presents the relation between AMMF characteristics and ETF utilization from the logistic regression
$ETF_{i,z} = \beta_0 + \sum_{j=1}^{n} \beta_j X_{i,z} + FE + \varepsilon_{i,z}$.
The dependent variable is an indicator variable that takes a value of one if the AMMF is in the low-ETF (high-ETF) user group in column one (column two), and zero otherwise. *Total net assets* is the natural log of the total net assets (TNA) of the fund, *Age* is the natural log of the fund's age, *Expense ratio* is the fund's expense ratio, *Load indicator* takes a value of one if the AMMF has a load fee and a value of zero otherwise, *Turnover* is the AMMF turnover ratio, *Percent cash* is the percent of the AMMF's portfolio TNA held in cash, *Active share* measures the deviation in holdings from the AMMF's benchmark, *Family TNA* is the natural log of the AMMF's fund family, *Size style* measures the size characteristics of the underlying portfolio holdings, and *Value style* measures the book-to-market characteristics of the underlying portfolio holdings. *p*-values are in parentheses.
* indicate significance at the 10% level.
** indicate significance at the 5% level.
*** indicate significance at the 1% level.

3. Actively managed mutual fund performance

Performance is often the most visible characteristic of an AMMF. As such, we examine the association between holding an ETF and AMMF performance.

3.1. Performance of an actively managed mutual fund

In this section, we examine the association between holding an ETF and subsequent performance using daily AMMF returns with alpha from the four-factor model which includes lagged factors to account for nonsynchronous trading (Busse, 1999; Carhart, 1997; Fama and French, 1993), style excess, objective excess, and benchmark excess returns.[16] Following the methodology of Cici and Palacios (2015), we calculate performance measures across non-overlapping 12 month periods. To remove the concern of having an insufficient number of monthly observations for an accurate calculation of alpha, we utilize daily mutual fund returns.[17] As robustness, we conduct analyses utilizing various ranking methodologies, a matched sample, monthly returns over 24 month non-overlapping windows, and using sub periods. All results remain qualitatively unchanged and a detailed discussion of this and other robustness considerations are in Section 6.

In Table 7, we examine the relation between the average performance of ETF-user groups and non-ETF-user funds through a *t*-test. The top of the table presents performance measures and their significance from zero and the bottom portion of the table presents the differences between low-user and non-user AMMFs and between high-user and non-user AMMFs. We observe only marginal

[16] All return data, including performance factors are at daily frequencies. We obtain data for use in our four-factor model (Mkt-Rf, SMB, HML, and UMD) from Kenneth R. French's data library at http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html. We calculate style excess as the excess raw returns an AMMF earns above their style benchmark. We calculate style benchmarks by double sorting AMMFs into 5 size based portfolios and 5 book-to-market based portfolios, resulting in 25 style benchmarks. Sorts are based on an AMMF's underlying holding characteristics as in Daniel et al. (1997). The process is described in detail in Section 2.1. We calculate objective excess returns as the excess raw returns an AMMF earns above the value weighted objective average raw returns, and benchmark excess returns as the excess raw returns an AMMF earns above the benchmark assigned in Section 2.1.

[17] An additional benefit of using daily returns is observed in our subsequent decomposition analysis and our analysis comparing periods an ETF is held versus periods an ETF is not held.

Table 7
Performance comparison.

User group	Annualized performance			
	Four-factor alpha	Style excess	Objective excess	Benchmark excess
Non-user AMMF	−1.186***	0.092**	0.168***	−0.596***
Low-user AMMF	−1.181***	−0.065	−0.106	−0.986***
High-user AMMF	−1.592***	−1.181***	−1.195***	−2.229***
Low minus Non	0.005	−0.157	−0.273**	−0.390***
High minus Non	−0.406***	−1.274***	−1.362***	−1.633***

This table reports the risk-adjusted performance measures for our sample from 2004 to 2015, using net fund returns. The means presented are the cross-sectional means of the annualized alphas obtained from regressing one year of daily fund returns on the four-factor (Fama and French, 1993; Carhart, 1997) model plus the lagged values of each factor (Busse, 1999), and for style, benchmark, and objective excess returns. We compare measures of performance from zero, between low-user and non-user AMMFs, and between high-user and non-user AMMFs. Low-user AMMF $N = 2007$, high-user AMMF $N = 2007$, and non-user AMMF $N = 16{,}354$.
*indicate significance at the 10% level.
** indicate significance at the 5% level.
*** indicate significance at the 1% level.

Table 8
Performance comparison by mutual fund style.

Style	User group	Annualized performance			
		Four-factor alpha	Style excess	Objective excess	Benchmark excess
Large growth	Non-user AMMF	−1.690***	−0.037	0.466***	−0.410***
	Low-user AMMF	−0.966***	0.087	0.669***	−0.512**
	High-user AMMF	−2.259***	−1.513***	−1.370***	−2.186***
	Low minus Non	0.724***	0.123	0.202	−0.102
	High minus Non	−0.570**	−1.476***	−1.836***	−1.777***
Large value	Non-user AMMF	−1.028***	0.062	−0.040	−0.219***
	Low-user AMMF	−1.369***	−0.550***	−0.611***	−0.774***
	High-user AMMF	−1.580***	−1.304***	−1.543***	−2.290***
	Low minus Non	−0.341**	−0.612***	−0.571***	−0.555***
	High minus Non	−0.551***	−1.365***	−1.504***	−2.070***
Small growth	Non-user AMMF	−1.289***	0.089	0.486***	−0.787***
	Low-user AMMF	−1.301***	−0.005	0.324	−1.291***
	High-user AMMF	−1.304***	−0.979***	−0.488*	−2.109***
	Low minus Non	−0.011	−0.095	−0.162	−0.504*
	High minus Non	−0.014	−1.069***	−0.973***	−1.322***
Small value	Non-user AMMF	−0.703***	0.263***	−0.247***	−0.984***
	Low-user AMMF	−1.082***	0.172	−0.483**	−1.217***
	High-user AMMF	−1.455***	−1.078***	−1.143***	−2.309***
	Low minus Non	−0.379***	−0.091	−0.236	−0.233
	High minus Non	−0.752***	−1.342***	−0.897***	−1.325***

This table reports the risk-adjusted performance measures for our sample from 2004 to 2015, using net fund returns. The means presented are the cross-sectional means of the annualized alphas obtained from regressing one year of daily fund returns on the four-factor (Fama and French, 1993; Carhart, 1997) model plus the lagged values of each factor, and for style, benchmark, and objective excess returns. We sort AMMFs into four style groups based on the characteristics of their underlying portfolios. We compare measures of performance from zero, between low-user and non-user AMMFs, and between high-user and non-user AMMFs. Low-user AMMF $N = 2007$, high-user AMMF $N = 2007$, and non-user AMMF $N = 16{,}354$.
* indicate significance at the 10% level.
** indicate significance at the 5% level.
*** indicate significance at the 1% level.

differences between low-user AMMFs and non-user AMMFs when performance is measured with objective and benchmark excess. There is no significant difference between low-user and non-user AMMFs when measured with alpha or style excess returns. Among high-user AMMFs we observe significant underperformance across all measures of performance. The four-factor alpha (style excess) [objective excess] {benchmark excess} for high-ETF-user funds is −1.59% (−1.18%) [−1.20%] {−2.23%} per year and high-ETF-users underperform non-ETF-users by a significant 0.41% (1.27%) [1.36%] {1.63%} per year. The act of holding an ETF in low quantities is therefore not necessarily associated with negative performance, but holding ETF positions in larger quantities is.

Tables 3–5 show that ETF use can vary across mutual fund style. We examine if the relationship between ETF holdings and AMMF performance varies across AMMF style in Table 8. We begin with our sample of AMMFs by amount of ETF use and further divide AMMFs into four groups based on the size and style characteristics of their underlying portfolios: (1) large growth, (2) large value, (3) small growth, and (4) small value. Results in Table 8 show that performance varies by AMMF style, though the general pattern remains unchanged. We find strong and significant underperformance of high-user AMMFs relative to non-user AMMFs across all style groups. The only observed change from Table 7 is among small growth AMMFs. High-user AMMFs underperformance is significant when measured with style excess, objective excess, and benchmark excess, but is no longer significant when measured with a four-factor alpha. With the exception of large value low-user AMMFs, where low-user AMMFs significantly underperform non-user AMMFs, results generally hold when looking at low-user performance by AMMF style.

Table 9
Multivariate performance analysis.

Variables	Four-factor alpha (1)	Style excess (2)	Objective excess (3)	Benchmark excess (4)
Low-ETF-user	−0.031	−0.208*	−0.204*	−0.275**
	(0.761)	(0.075)	(0.100)	(0.031)
High-ETF-user	−0.330***	−1.022***	−1.101***	−1.223***
	(0.004)	(0.000)	(0.000)	(0.000)
Total net assets	−0.073***	−0.179***	−0.116***	−0.135***
	(0.003)	(0.000)	(0.000)	(0.000)
Age	−0.022	0.214***	0.170***	0.244***
	(0.565)	(0.000)	(0.000)	(0.000)
Expense ratio	−0.775***	−1.002***	−0.982***	−1.117***
	(0.000)	(0.000)	(0.000)	(0.000)
Load indicator	−0.128	−0.282***	−0.230**	−0.129
	(0.105)	(0.002)	(0.011)	(0.185)
Turnover	−0.480***	−0.258***	−0.173*	−0.109
	(0.000)	(0.009)	(0.090)	(0.270)
Percent cash	0.035***	−0.070***	−0.063***	−0.069***
	(0.001)	(0.000)	(0.000)	(0.000)
Active share	0.011***	0.002	0.009*	−0.006
	(0.000)	(0.617)	(0.013)	(0.103)
Family TNA	0.061***	0.089***	0.073***	0.076***
	(0.000)	(0.000)	(0.000)	(0.000)
ETF in family	−0.326	−0.803**	−0.877*	−0.791*
	(0.195)	(0.033)	(0.069)	(0.053)
Size style	0.038	0.165*	0.001	0.264***
	(0.662)	(0.091)	(0.992)	(0.007)
Value style	0.271***	0.264***	−0.654***	0.207***
	(0.000)	(0.000)	(0.000)	(0.003)
Index fund held	−2.088***	−3.513***	−3.523***	−1.536***
	(0.000)	(0.000)	(0.000)	(0.000)
Intercept	−5.393**	1.160*	4.584*	2.954
	(0.011)	(0.095)	(0.054)	(0.530)
Fixed effects	Yes	Yes	Yes	Yes
Observations	20,368	20,368	20,368	20,368
R^2	17.90%	2.35%	1.95%	8.69%

This table reports the relation between holding an exchange-traded fund (ETF) and actively managed mutual fund (AMMF) performance. We obtain coefficients from
$\alpha_{i,z} = \beta_0 + \beta_1 Low\,User_{i,z-1} + \beta_2 High\,User_{i,z-1} + \sum_{j=3}^{n} \beta_j X_{i,z-1} + FE + \varepsilon_{i,z}$.
The dependent variables are the four-factor alpha in column 1, style excess returns in column 2, objective excess returns in column 3, and benchmark excess returns in column 4. The coefficients of interest are *Low user* and *High user* which take a value of one if the AMMF is in the low or high group of AMMFs that use ETFs, respectively, and zero otherwise. *Total net assets* is the natural log of the total net assets (TNA) of the fund, *Age* is the natural log of the fund's age, *Expense ratio* is the fund's expense ratio, *Load indicator* takes a value of one if the AMMF has a load fee and a value of zero otherwise, *Turnover* is the AMMF turnover ratio, *Percent cash* is the percent of the AMMF's portfolio TNA held in cash, *Active share* measures the deviation of an AMMF portfolio from its benchmark. *Family TNA* is the natural log of the AMMF's fund family. *ETF in family* is an indicator variable that takes on the value of one if the AMMF holds an ETF position that is managed by the same fund family. *Size style* and *Value style* measure the underlying portfolio holding characteristics along size and book-to-market dimension, respectively. *Index fund held* is an indicator variable that takes on the value of one if the AMMF holds an index mutual fund. Error terms are clustered by AMMF, and *p*-values are in parentheses.
* indicate significance at the 10% level.
** indicate significance at the 5% level.
*** indicate significance at the 1% level.

We further examine the relation between holding an ETF and subsequent AMMF performance with a panel regression of non-overlapping 12 month periods:

$$\alpha_{i,z} = \beta_0 + \beta_1 Low\,User_{i,z-1} + \beta_2 High\,User_{i,z-1} + \sum_{j=3}^{n} \beta_j X_{i,z-1} + FE + \varepsilon_{i,z}, \quad (4)$$

where $\alpha_{i,z}$ is the risk-adjusted performance of a given AMMF from our four-factor model, style excess, objective excess, and benchmark excess returns, estimated over each 12 month period, *z*. The variable of interest is an indicator variable for the ETF-user group a mutual fund belongs ($Low\,User_{i,z-1}$ and $High\,User_{i,z-1}$) over the prior 12 months (*z-1*). We calculate all control variables, $X_{i,z-1}$, over the 12 month period (*z-1*) prior to the start of the performance calculation period (*z*), defined as *Total net assets*, *Age*, *Expense ratio*, *Load indicator*, *Turnover*, *Percent cash*, *Active share*, and *Family TNA* as calculated in Eq. (3). *Size style* and *Value style*, as calculated in Eq. (3), allow us to control for any observed differences in performance across AMMF styles as observed in Table 8. *ETF in Family* is an indicator variable that takes on the value of one if the AMMF holds an ETF managed by the same fund family as the AMMF and zero otherwise. *Index fund held* is an indicator variable that takes on the value of one if the AMMF holds an index mutual fund rather than an ETF, and zero otherwise. *FE* represents objective and time fixed effects, and we cluster error terms by AMMF (Petersen, 2009).

Table 9 reports the performance results from Eq. (4) using a four-factor alpha in column one, style excess returns in column two, objective excess returns in column three, and benchmark excess returns in column four. All columns contain control variables as well as objective and time fixed effects. Consistent with the univariate results, the largest underperforming subgroup is the high-ETF-user AMMFs, with significant coefficients representing annualized underperformance of 0.33%, 1.02%, 1.10%, and 1.22% on the four-factor alpha, style excess, objective excess, and benchmark excess returns, respectively. In contrast, AMMFs within the low-user group display only marginal significance at the 10% level for style and objective excess returns and at the 5% level for benchmark excess returns. Our results show that the low-user AMMFs do not drive the underperformance, even after controlling for AMMF, fam-

Table 10
Performance decomposition.

	Annualized four-factor alpha decomposition		
	ETF portfolio	Other securities portfolio	Mutual fund
Low-users	0.005%	−1.185%***	−1.181%***
High-users	−0.137%***	−1.455%***	−1.592%***
	Annualized style excess return decomposition		
	ETF portfolio	Other securities portfolio	Mutual fund
Low-users	−0.003%	−0.062%	−0.065%
High-users	−0.288%***	−0.893%***	−1.181%***
	Annualized objective excess return decomposition		
	ETF portfolio	Other securities portfolio	Mutual fund
Low-users	−0.001%	−0.105%	−0.106%
High-users	−0.293%***	−0.901%***	−1.195%***
	Annualized benchmark excess return decomposition		
	ETF portfolio	Other securities portfolio	Mutual fund
Low-users	−0.008%*	−0.978%***	−0.986%***
High-users	−0.429%***	−1.800%***	−2.229%***

In this table, we decompose the overall actively managed mutual fund (AMMF) performance into the performance of the exchange-traded fund (ETF) holdings and the performance of all other AMMF holdings. We calculate four-factor alpha, style excess, objective excess, and benchmark excess individually for ETF positions and for the remaining portfolio assets. We display results for low-, and high-user groups. $N = 4014$ fund period observations for all-ETF-user AMMFs, $N = 2007$ fund period observations for the low-ETF-user group, and $N = 2007$ fund period observations for the high-ETF-user group.

* indicate significance at the 10% level.
** indicate significance at the 5% level.
*** indicate significance at the 1% level.

ily, objective, and time characteristics.[18] Although we observe a strong relation between large ETF positions and subsequent AMMF underperformance, it can be that AMMFs underperform as a result of their ETF holdings, non-ETF holdings, or some combination of the two. To explore this possibility, we seek the source of AMMF underperformance.

3.2. Performance decomposition

Table 9 provides an overall measure of AMMF performance. However, it does not show if performance is attributable to ETF positions or the remaining securities. Utilizing AMMF data, we decompose AMMF performance into two components by directly calculating TNA-weighted performance for ETF holdings and for non-ETF holdings. An AMMF that can generate significant positive returns with ETF positions offers direct support for their use. If no evidence of outperformance exists, then their value within an AMMF portfolio is doubtful.

Table 10 presents the results of performance decomposition. Across all low-ETF-user AMMFs, we observe no meaningful contribution to total portfolio performance from ETF positions. However, when we focus on the decomposed performance of high-user AMMFs, we find a negative and significant contribution to overall AMMF performance from their ETF positions. The difference found between ETF contributions to low-user and high-user AMMF portfolios indicates that high-user AMMFs use ETF positions as a part of their active investment strategy rather than to just generate market-level returns. However, it appears that they do so in an ineffective way, as we observe negative ETF performance.

3.3. Periods ETFs held versus periods ETFs not held

Thus far we have examined the predictive power of ETF ownership among AMMFs, but we have not examined the contemporaneous impact of holding an ETF on performance. To compare the performance of AMMFs during periods they hold an ETF and periods they do not, we utilize contemporaneous ETF-user group ranks:

$$\alpha_{i,t,z} = \beta_0 + \beta_1 ETF\ Held_{i,t,z} + \sum_{j=2}^{n} \beta_j X_{i,t-1} + FE + \varepsilon_{i,z}, \quad (5)$$

where $\alpha_{i,t,z}$ is the measured as a four-factor alpha, style excess, objective excess, or benchmark in month t, during the 12 month ranking period z, for AMMF i. The variable of interest, $ETF\ Held_{i,t,z}$, is an indicator variable that takes on the value of one in months (t) that AMMF i holds an ETF and zero otherwise. We examine subgroups of low- and high-user AMMFs separately based on the user ranking from the 12 month period z. We calculate all control variables, $X_{i,t-1}$, as of the month prior (t-1), defined as *Total net assets*, *Age*, *Expense ratio*, *Load indicator*, *Turnover*, *Percent cash*, *Active share*, *Family TNA*, *ETF in family*, *Size style*, *Value style*, and *Index fund held*, as calculated in Eqs. (3) and (4). *Lag Flow* is calculated as the monthly percent flow to AMMF i over the prior month. *FE* represents objective effects, and we cluster error terms by AMMF.

We present results from Eq. (5) in Table 11. Under style excess, objective excess, and benchmark excess, results among high-ETF-user AMMFs indicate that ETF usage is associated with a decrease in monthly performance. The coefficient on *ETF Held* for high-user AMMFs is −0.61, −0.56, and −0.58 for style excess, objective excess, and benchmark excess, respectively. These coefficients indicate that high-user AMMFs perform worse during periods that they hold an ETF, a result which is consistent with the decomposition presented in Table 10 and which provides additional support for our findings that high-ETF-user AMMFs lack skill. In contrast, among low-user AMMFs, we find insignificant coefficients with the exception of objective excess returns which is positive and significant at the 10% level. This shows that low-user AMMFs on average perform no different in periods they hold an ETF compared to periods they do not hold an ETF. Our measure of four-factor alpha performance does not significantly change from periods held to periods not held for either group of ETF-user AMMFs.

4. Impact of ETF characteristics and type on performance

It can be that the observed underperformance found in Section 3 can differ by the characteristics or type of ETF held. In this section, we examine the extent to which our performance results relate to the activeness of an AMMF's ETF portfolio and to the various classifications of ETFs within our sample.

4.1. ETF active share

To determine if AMMF performance is associated with the activeness of an AMMF's ETF holdings, we explore the relationship between performance and ETF Active Share. In Table 12, we sort high- and low-user AMMFs into deciles based on the activeness of their ETF portfolios. By sorting on ETF portfolio Active Share we can determine if closet indexing or active management within ETF positions helps to explain the underperformance observed in Section 3. Across both high- and low-user AMMFs, we observe a significant inverse relationship between ETF portfolio Active Share and AMMF performance. These results indicate that more active ETF portfolios are associated with reduced AMMF performance;

[18] We include *Index Fund Held* to control for an AMMF holding other passive investments. Although we find a statistically large and significant coefficient on the *Index Fund Held* variable, the economic significance is less convincing. We observe only 86 AMMFs within our sample that hold an index mutual fund.

Table 11
Performance during periods with and without exchange-traded funds (ETFs).

Variables	Four-factor alpha		Style excess		Objective excess		Benchmark excess	
	Low-user (1)	High-user (2)	Low-user (3)	High-user (4)	Low-user (5)	High-user (6)	Low-user (7)	High-user (8)
ETF held	0.058	−0.098	0.079	−0.612**	0.335*	−0.563**	0.192	−0.581*
	(0.528)	(0.405)	(0.674)	(0.019)	(0.091)	(0.034)	(0.380)	(0.053)
Total net assets	0.078**	0.063	−0.163*	−0.336***	−0.146	−0.360***	−0.069	−0.363***
	(0.047)	(0.112)	(0.077)	(0.002)	(0.116)	(0.001)	(0.478)	(0.004)
Age	−0.024	−0.087	0.355**	0.592***	0.300**	0.574***	0.278*	0.645***
	(0.700)	(0.165)	(0.018)	(0.000)	(0.048)	(0.000)	(0.071)	(0.001)
Expense ratio	−0.131	−0.224	−0.928**	−1.841***	−0.714	−2.065***	−0.625	−2.104***
	(0.506)	(0.283)	(0.032)	(0.000)	(0.108)	(0.000)	(0.178)	(0.000)
Load indicator	−0.104	−0.005	−0.088	0.383	−0.253	0.296	0.465*	0.667*
	(0.330)	(0.970)	(0.702)	(0.228)	(0.285)	(0.358)	(0.073)	(0.061)
Turnover	−0.108	−0.227**	−0.049	−0.302	0.057	−0.302	−0.145	−0.044
	(0.290)	(0.015)	(0.851)	(0.212)	(0.824)	(0.213)	(0.635)	(0.862)
Percent cash	0.023	−0.043***	−0.107***	−0.102***	−0.086**	−0.083**	−0.027	−0.069**
	(0.177)	(0.001)	(0.005)	(0.002)	(0.027)	(0.012)	(0.477)	(0.048)
Active share	0.008***	0.005	0.000	−0.005	0.004	0.012	−0.013*	0.002
	(0.006)	(0.142)	(0.966)	(0.600)	(0.548)	(0.197)	(0.085)	(0.806)
Family TNA	0.001	0.000	0.124***	0.134**	0.134***	0.167**	0.150***	0.157**
	(0.969)	(0.996)	(0.010)	(0.040)	(0.007)	(0.012)	(0.004)	(0.030)
ETF in family	−0.016	−0.251	−0.128	−1.936**	−0.139	−2.360**	−0.229	−3.393***
	(0.945)	(0.307)	(0.783)	(0.049)	(0.755)	(0.019)	(0.683)	(0.001)
Lag flow	−0.759	0.178	−2.171	0.517	−1.219	1.991	−2.120	3.648**
	(0.413)	(0.788)	(0.250)	(0.723)	(0.476)	(0.167)	(0.290)	(0.029)
Size style	0.007	−0.014	0.268	0.299	−0.370	−0.063	0.063	0.159
	(0.956)	(0.903)	(0.310)	(0.370)	(0.175)	(0.854)	(0.806)	(0.643)
Value style	0.053	0.171	0.299	0.416*	−0.187	−0.038	−0.016	0.136
	(0.561)	(0.110)	(0.147)	(0.089)	(0.386)	(0.879)	(0.939)	(0.601)
Index fund held	0.941***	−1.758**	−0.750	6.739***	−3.245**	1.048	−2.857***	1.060*
	(0.001)	(0.038)	(0.589)	(0.000)	(0.044)	(0.203)	(0.000)	(0.054)
Intercept	−1.365	−0.707	−2.051	−1.936	1.726	0.957	−1.144	−2.067
	(0.115)	(0.367)	(0.284)	(0.383)	(0.359)	(0.668)	(0.576)	(0.377)
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	27,415	27,403	27,415	27,403	27,415	27,403	27,415	27,403
R^2	0.16%	0.28%	0.32%	0.98%	0.18%	0.66%	0.19%	0.57%

This table reports the relation between holding an ETF and actively managed mutual fund (AMMF) performance. We obtain coefficients from $\alpha_{i,t,z} = \beta_0 + \beta_1 ETF\ Held_{i,t,z} + \sum_{j=2}^{n} \beta_j X_{i,t-1} + FE + \varepsilon_{i,z}$.
The dependent variables are the four-factor alpha in columns 1 and 2, style excess in columns 3 and 4, objective excess in columns 5 and 6, and benchmark excess in columns 7 and 8. We examine low-ETF-user AMMFs in odd columns and high-ETF-user AMMFs in even columns. The coefficients of interest, *ETF held,* take a value of one during months the user-AMMF holds an ETF and zero otherwise. *Total net assets* is the natural log of the total net assets (TNA) of the fund, *Age* is the natural log of the fund's age, *Expense ratio* is the fund's expense ratio, *Load indicator* takes a value of one if the AMMF has a load fee and a value of zero otherwise, *Turnover* is the AMMF turnover ratio, *Percent cash* is the percent of the AMMF's portfolio TNA held in cash, *Active share* measures the deviation of an AMMF portfolio from its benchmark. *Family TNA* is the natural log of the AMMF's fund family. *ETF in family* is an indicator variable that takes on the value of one if the AMMF holds an ETF position that is managed by the same fund family. *Lag flow* is measured as the percent flow to an AMMF over the prior month. *Size style* and *Value style* measure the underlying portfolio holding characteristics along size and book-to-market dimension, respectively. *Index fund held* is an indicator variable that takes on the value of one if the AMMF holds an index mutual fund. Error terms are clustered by AMMF, and *p*-values are in parentheses.
* indicate significance at the 10% level.
** indicate significance at the 5% level.
*** indicate significance at the 1% level.

though we caution against two observations. First, the relationship is far from linear, as AMMF performance is substantially lower across the middle deciles as well as the most active deciles, and second, the performance of the least active decile of AMMFs primarily drives the findings of Table 12.

4.2. Type of ETF held

One possibility is that general ETF use does not drive the observed underperformance, but that use of a particular type of ETF does. To explore this possibility, we follow an approach similar to Cici and Palacios (2015) and classify user-AMMFs into four groups dependent on which type of ETF is most prevalent in their ETF portfolios: (1) Traditional Index ETF, (2) Smart Beta ETF, (3) Leveraged ETF, and (4) Inverse ETF. We begin by first classifying AMMF users into high- and low-user groups. Among these groups we create four indicator variables to distinguish between the types of ETFs held. We assign AMMFs to one of the four groups by determining which type of ETF makes up the largest position within the AMMF's portfolio. In Table 13, we rerun the analysis of Table 9, replacing *Low-ETF-User* and *High-ETF-User* with eight indicator variables, identifying AMMFs by low and high as well as by ETF type. We find that the underperformance found among high-ETF-user AMMFs is driven by those AMMFs that take large traditional index ETF and inverse ETF positions.

The funds using traditional index tracking and inverse ETFs in greater quantities, which generate the lowest performance, are the main source of ETF-user underperformance, thus giving rise to the question: what are the benefits of investing in an AMMF that allocates a large portion of its portfolio to ETFs?

5. Additional sources of performance

Although high-ETF-user AMMFs significantly underperform, ETFs can provide value through indirect sources of performance. As in Henriksson and Merton (1981) and Treynor and Mazuy (1966), we examine AMMFs' ability to time the market. Through the flow management methodology of Frino et al. (2009), we determine if AMMFs mitigate the reduction in performance associated with liquidity motivated trading. Finally, through the cash management

Table 12
Performance by ETF Active Share.

ETF portfolio active share	Annualized performance (percent)							
	High-ETF user AMMF				Low-ETF user AMMF			
	Alpha	Style	Objective	Benchmark	Alpha	Style	Objective	Benchmark
Decile 1 (Least active)	−0.076	0.607	0.698	−1.104	−0.494	0.628	0.959	−0.699
Decile 2	−1.099	−0.469	−0.976	−1.762	−1.802	0.051	−0.297	−1.325
Decile 3	−1.351	−1.135	−0.910	−2.182	−1.216	0.385	0.282	−0.406
Decile 4	−1.770	−1.103	−1.530	−2.420	−1.049	0.448	0.807	0.210
Decile 5	−2.187	−1.224	−1.491	−2.244	−1.147	0.137	−0.153	−0.950
Decile 6	−2.077	−2.486	−2.199	−3.181	−0.796	−0.181	−0.189	−1.045
Decile 7	−1.141	−0.568	−0.486	−1.139	−0.995	−0.500	−0.901	−1.684
Decile 8	−2.104	−0.961	−1.099	−1.899	−0.811	0.179	−0.151	−1.023
Decile 9	−1.835	−1.360	−1.172	−2.397	−1.192	−0.122	−0.714	−1.743
Decile 10 (Most active)	−2.418	−2.386	−2.067	−3.219	−1.596	−0.613	−0.105	−1.768
2nd half – 1st half	−0.618***	−0.887***	−0.563**	−0.425	0.064	−0.577***	−0.733***	−0.820***
10th decile – 1st decile	−2.342***	−2.993***	−2.765***	−2.115***	−1.102**	−1.241**	−1.064*	−1.070*
Spearman rank correlation	−0.099***	−0.102***	−0.077***	−0.058**	−0.010	−0.064***	−0.088***	−0.088***

This table summarizes performance measures across high- and low-ETF-user AMMFs. We first divide high-ETF-user AMMFs into deciles based on the Active Share value of their ETF portfolios. We then calculate the mean performance across AMMFs in each decile. This is repeated for the low-user-AMMFs. The means presented are the cross-sectional means of the annualized alphas obtained from regressing one year of daily fund returns on the four-factor (Fama and French, 1993; Carhart, 1997) model plus the lagged values of each factor, and for style, benchmark, and objective excess returns. We include the difference in performance measures between the top and bottom half of Active Share deciles and between the top and bottom deciles of Active Share. Spearman rank correlations are included with significance levels.

* indicate significance at the 10% level.
** indicate significance at the 5% level.
*** indicate significance at the 1% level.

methodology of Yan (2006), we examine if AMMFs reduce the cash drag on performance associated with holding cash (Wermers, 2000).

5.1. Market timing

ETFs allow AMMFs to quickly and inexpensively gain market exposure, making ETF positions potentially beneficial when market timing. To examine if ETF-holding AMMFs better time the market, we follow the methodologies put forth by Henriksson and Merton (1981) and Treynor and Mazuy (1966):

$$r_{i,d,z} - rf_d = \alpha_{i,z} + \sum_{j=1}^{n} \beta_j X_{i,d} + \gamma_{i,z} Z_{i,d} + \varepsilon_{i,z}, \quad (6)$$

where $r_{i,d,z} - rf_d$ measures the excess return AMMF i earns in day d over each ETF-user ranking period z, and $X_{i,d}$ represents factors in the one- and four-factor models, including lagged values of each factor to account for nonsynchronous trading (Busse, 1999). As in Bollen and Busse (2001), the size, book-to-market, and momentum factors are included as controls, but they do not measure market timing. $Z_{i,d}$ is measured as the value of excess market returns when excess market returns are positive and zero otherwise in the Henriksson and Merton specification and as squared excess market returns in the Treynor and Mazuy specification. $\gamma_{i,z}$ represents the amount of market timing ability an AMMF has over the 12 month period z. In a market with positive (negative) excess market returns, a fund's beta increases (decreases) by the value of γ. Thus, a positive (negative) coefficient on γ indicates positive (negative) market timing ability.

Table 14 reports the results from Eq. (6) by user group and between users and non-users. Consistent with prior literature, our sample of non-ETF-user AMMFs exhibit negative market timing ability. When we examine ETF-user funds by usage, we find significantly negative market timing ability across both groups. Among high-ETF-user AMMFs, we find negative market timing ability that is much larger in magnitude than for the low- and non-users. This is consistent with our prior findings relating large ETF positions to AMMF performance, with high-ETF use being associated with a decrease in market timing ability. Overall, an inverse relation exists between the size of ETF positions and market timing ability. We find no statistical difference in market timing ability between low-ETF-user AMMFs and non-user AMMFs. These results support our finding that large ETF positions are associated with reduced AMMF ability.

5.2. Liquidity management

We test the relation between holding an ETF and liquidity management through flow management (Frino et al., 2009) and cash management (Yan, 2006). Improved flow management removes the drag on performance associated with liquidity motivated trading, while improved cash management reduces the performance drag from large cash positions (Wermers, 2000).

5.2.1. Flow management

Holding an ETF position can allow fund managers to more easily deal with large inflows and outflows by removing the need to sell other securities during periods of outflows and the need to invest inflows in suboptimal investments, both of which create a drag on performance (Edelen, 1999). Based on the methodology of Frino et al. (2009), we test the impact of holding an ETF position on flow management with a two-stage least squares (2SLS) regression over each 12 month ranking period:

$$\alpha_{i,t,z} = \beta_0 + \beta_1 Absolute\ Flow_{i,t,z} + \sum_{j=2}^{n} \beta_j X_{i,t-1} + FE + \varepsilon_{i,z}. \quad (7)$$

where $\alpha_{i,t,z}$ is the month t four-factor alpha performance of AMMF i over ETF-user rank period z. Our variable of interest is *Absolute Flow*$_{i,t,z}$, measured as the absolute value of monthly percent flow to AMMF i. We calculate all control variables, $X_{i,t-1}$, as of the month prior (t-1) to the calculation of our dependent variable. As controls, we include *Total net assets*, *Age, Expense ratio*, *Load indicator*, *Turnover, Percent cash*, *Active share*, *Family TNA, Size style*, and *Value style* as calculated in Eq. (3). As stated in Frino et al. (2009), many studies document short-term serial correlation among fund performance, motivating the inclusion of nine lagged measures of performance. *FE* represents objective and time fixed effects, and we cluster error terms by AMMF.

Table 13
Performance by type and amount of ETF use.

Variables	Four-factor alpha 1	Style excess 2	Objective excess 3	Benchmark excess 4
Low traditional ETF	−0.091	−0.446***	−0.435**	−0.261
	(0.527)	(0.007)	(0.014)	(0.163)
Low smart beta ETF	0.011	0.045	−0.025	−0.270*
	(0.936)	(0.753)	(0.872)	(0.077)
Low leveraged ETF	0.833	1.209	2.154	1.193
	(0.679)	(0.562)	(0.269)	(0.634)
Low inverse ETF	0.100	−1.064	0.192	−1.395
	(0.855)	(0.324)	(0.856)	(0.221)
High traditional ETF	−0.453***	−1.401***	−1.569***	−1.597***
	(0.001)	(0.000)	(0.000)	(0.000)
High smart beta ETF	−0.021	−0.215	−0.153	−0.510***
	(0.906)	(0.235)	(0.462)	(0.010)
High leveraged ETF	−1.920*	−2.437*	−2.681**	−−1.681
	(0.074)	(0.090)	(0.043)	(0.195)
High inverse ETF	−1.334	−3.165**	−2.982**	−2.348*
	(0.129)	(0.011)	(0.020)	(0.071)
Total net assets	−0.072***	−0.179***	−0.116***	−0.135***
	(0.003)	(0.000)	(0.000)	(0.000)
Age	−0.025	0.208***	0.161***	0.237***
	(0.519)	(0.000)	(0.001)	(0.000)
Expense ratio	−0.769***	−0.986***	−0.965***	−1.099***
	(0.000)	(0.000)	(0.000)	(0.000)
Load indicator	−0.128	−0.284***	−0.234***	−0.135
	(0.105)	(0.002)	(0.009)	(0.164)
Turnover	−0.471***	−0.244**	−0.157	−0.101
	(0.000)	(0.015)	(0.129)	(0.310)
Percent cash	0.036***	−0.066***	−0.060***	−0.067***
	(0.001)	(0.000)	(0.001)	(0.000)
Active share	0.011***	0.002	0.009**	−0.006
	(0.000)	(0.551)	(0.011)	(0.106)
Family TNA	0.060***	0.087***	0.071***	0.074***
	(0.000)	(0.000)	(0.000)	(0.000)
ETF in family	−0.279	−0.712**	−0.730	−0.652*
	(0.268)	(0.043)	(0.107)	(0.098)
Size style	0.042	0.173*	0.008	0.268***
	(0.631)	(0.073)	(0.938)	(0.006)
Value style	0.270***	0.264***	−0.659***	0.204***
	(0.000)	(0.000)	(0.000)	(0.003)
Index fund held	−2.096***	−3.543***	−3.554***	−1.558***
	(0.000)	(0.000)	(0.000)	(0.000)
Intercept	−5.427**	1.028	4.505*	2.928
	(0.011)	(0.130)	(0.054)	(0.534)
Fixed effects	Yes	Yes	Yes	Yes
Observations	20,368	20,368	20,368	20,368
R^2	17.94%	2.53%	2.16%	8.80%

This table reports the relation between holding an exchange-traded fund (ETF) and actively managed mutual fund (AMMF) performance. We obtain coefficients from $\alpha_{i,z} = \beta_0 + \sum_{j=1}^{4} \beta_j Low\ User_{i,z-1} + \sum_{j=5}^{8} \beta_j High\ User_{i,z-1} + \sum_{j=9}^{n} \beta_j X_{i,t-1} + FE + \varepsilon_{i,z}$.
The dependent variables are the four-factor alpha in column 1, style excess returns in column 2, objective excess returns in column 3, and benchmark excess returns in column 4. The coefficients of interest are indicator variables indicating which type of ETF an AMMF primarily used over the prior year, categorized into four groups: (1) traditional ETF, (2) smart beta ETF, (3) leveraged ETF, and (4) inverse ETF. We additionally make each classification across groups of low-ETF-user AMMFs and high-ETF-user AMMFs. *Total net assets* is the natural log of the total net assets (TNA) of the fund, *Age* is the natural log of the fund's age, *Expense ratio* is the fund's expense ratio, *Load indicator* takes a value of one if the AMMF has a load fee and a value of zero otherwise, *Turnover* is the AMMF turnover ratio, *Percent cash* is the percent of the AMMF's portfolio TNA held in cash, *Active share* measures the deviation of an AMMF portfolio from its benchmark. *Family TNA* is the natural log of the AMMF's fund family. *ETF in family* is an indicator variable that takes on the value of one if the AMMF holds an ETF position that is managed by the same fund family. *Size style* and *Value style* measure the underlying portfolio holding characteristics along size and book-to-market dimension, respectively. *Index fund held* is an indicator variable that takes on the value of one if the AMMF holds an index mutual fund. Error terms are clustered by AMMF, and *p*-values are in parentheses.

* indicate significance at the 10% level.
** indicate significance at the 5% level.
*** indicate significance at the 1% level.

Sirri and Tufano (1998) find a positive relation between performance and inflows. As a result, our specification could suffer from endogeneity issues. To correct for this, we follow the methodology of Edelen (1999) and Frino et al. (2009) in calculating Eq. (7). Within our two-stage least squares regression, we regress the endogenous variable of absolute flow on the instrumental variable of lagged flow and nine lagged measures of monthly alpha in stage one. From this first stage, we obtain a predicted value of absolute flow which we use in the second stage. In the second stage, we replace the endogenous variable with the predicted value from the first stage. In using the predicted value of absolute flow in period *t*, we remove concerns over the endogenous relationship between flow and performance.

We test the difference in absolute flow coefficients between periods an ETF is held and periods an ETF is not held and find no significant difference among high- or low-user AMMFs.[19] Although ETF positions can provide an easy and cost effective method for

[19] We follow the methodology of Clogg et al. (1995) and test for a significant difference in regression coefficients using a *Z*-test.

Table 14
Market timing.

User group	Henriksson and Merton			Treynor and Mazuy		
	User mean	Non-user mean	Difference	User mean	Non-user mean	Difference
Low-user one-factor	−1.650***	−1.578***	−0.072	−0.480***	−0.393***	−0.086
Low-user four-factor	−0.976***	−1.277***	0.301	−0.187***	−0.208***	0.021
High-user one-factor	−2.176***	−1.578***	−0.598***	−0.599***	−0.393***	−0.205***
High-user four-factor	−1.642***	−1.277***	−0.365**	−0.342***	−0.208***	−0.134***

This table shows the market timing ability of actively managed mutual funds (AMMFs) based on two methods: the value of excess market returns in periods that market excess returns are positive, as in Henriksson and Merton (1981) and the squared market excess returns, as in Treynor and Mazuy (1966). We obtain coefficients from
$r_{i,d,z} - rf_d = \alpha_{i,z} + \sum_{j=1}^{n} \beta_j X_{i,d} + \gamma_{i,z} Z_{i,d} + \varepsilon_{i,z}$,
where $X_{i,d}$ represents the excess market return, high-minus-low, small-minus-big, and momentum. $Z_{i,d}$ is measured as the value of excess market returns in periods when excess market returns are positive or as the square of excess market return. γ represents the amount of market timing an AMMF has and is the reported value below. We report market timing by exchange-traded fund (ETF) user group. Columns titled "User mean and "Non-user mean" test significance from zero and "Difference" tests significance between ETF-user group and non-users. For low-ETF-users, $N = 2007$ and for high-ETF-users, $N = 2007$. For funds without ETFs, $N = 16{,}354$.
*indicate significance at the 10% level.
** indicate significance at the 5% level.
*** indicate significance at the 1% level.

managing large inflows and outflows, there is no evidence of this in our analysis. This is distinctly different from what the literature finds when examining how AMMFs utilize derivative positions to manage flow risk (Frino et al., 2009). In the interest of brevity, we do not present the insignificant flow results. Tables are available upon request.

5.2.2. Cash management

Wermers (2000) shows a performance drag from holding cash, which earns the risk-free rate of return. The relative ease of moving into and out of ETF positions provides AMMFs with a method for offsetting the drag of holding cash by providing instant exposure to the markets. To examine if ETF use is associated with reduced cash holdings within AMMF portfolios, we follow the methodology of Yan (2006), regressing the percent cash held by an AMMF on control variables and a contemporaneous indicator of ETF-holding AMMFs as:

$$Percent\,Cash_{i,z} = \beta_0 + \beta_1 Low\,User_{i,z} + \beta_2 High\,User_{i,z} + \sum_{j=3}^{n} \beta_j X_{i,z-1} + FE + \varepsilon_{i,z}, \qquad (8)$$

where the dependent variable, *Percent Cash*$_{i,z}$, is the average percent cash held by an AMMF over the 12 month period (z). The variables of interest, *Low User*$_{i,z}$ and *High User*$_{i,z}$, represent indicator variables taking the value of one if an AMMF is a low-ETF-user or high-ETF-user over each 12 month ETF-user estimation period (z), respectively, and zero otherwise. We calculate all control variables, $X_{i,z-1}$, over the 12 months prior to the ETF-user ranking period (z), defined as *Total net assets*, *Age*, *Expense ratio*, *Load indicator*, *Turnover*, *Active share*, *Family TNA*, *Size style*, *Value style*, and, as calculated in Eq. (3), and *ETF in family*, and *Index fund held* as in Eq. (4). *Flow Volatility* is measured as the standard deviation of fund flows over the prior 12 month period. *FE* represents objective fixed effects, and we cluster error terms by AMMF. To examine if ETFs are directly replacing cash holdings, as opposed to being associated with higher or lower average cash holdings, we run a panel regression over each period, z, with variables calculated monthly. Our variables of interest take on a value of one in months an AMMF holds an ETF and zero otherwise. We examine samples of low- and high-ETF-user AMMFs independently to determine if cash holdings vary between months an AMMF holds an ETF and months they do not.

We present the results in Table 15. Column one presents the coefficients on low- and high-ETF-users. We find strong support that low-user AMMFs hold significantly less cash overall, while high-ETF-user AMMFs hold more cash. This is indicative of AMMFs with large ETF positions managing cash poorly, if one assumes they are trying to avoid the established performance drag from large cash positions. In columns two and three, we identify specific months that an ETF-user-AMMF holds an ETF within each 12 month window in order to estimate cash changes directly related to holding an ETF. Despite the potential benefits of placing cash reserves into liquid ETF positions, we find no evidence of this occurring. Both low- and high-user AMMFs display no difference in cash holdings during periods they hold an ETF versus period they do not hold an ETF.

6. Robustness

As robustness, we examine our results utilizing a tercile ranking approach, ranking across mutual fund styles to control for any unobserved style bias, under a lifetime cross-sectional ranking framework, with a matched sample, using monthly return data over 24 month periods, and across various time sub periods. All performance results remain qualitatively unchanged from those presented throughout and are available upon request.

6.1. Tercile rankings

For robustness, we utilize a tercile ranking approach to classify user AMMFs. Within this approach we rank funds into one of three equally sized groups each year on the basis of their portfolio TNA invested in passive ETF positions. We drop the middle tercile from our analyses, leaving us with a low-user and high-user group that more distinctly separates the two groups. Under this ranking system we observe annualized underperformance of the high-user AMMFs relative to non-user AMMFs between 0.50% and 1.91%.

6.2. Style rankings

To confirm the robustness of our results we utilize an alternative ranking methodology which allows for cross-sectional differences in ETF use by mutual fund style. We begin by ranking all user-AMMFs into low- and high-user funds by median proportion of portfolio TNA allocated to ETF positions within each

Table 15
Cash management.

Variables	Yearly	Periods held	
		Low-user	High-user
	(1)	(2)	(3)
Low-ETF-user	−0.230**	0.059	–
	(0.037)	(0.574)	
High-ETF-user	0.564***	–	0.201
	(0.000)		(0.186)
Total net assets	0.125***	0.164**	0.189
	(0.000)	(0.031)	(0.104)
Age	−0.156***	−0.200*	−0.181
	(0.004)	(0.077)	(0.255)
Expense ratio	0.565***	0.308	1.893***
	(0.001)	(0.301)	(0.000)
Load indicator	0.158	0.125	−0.223
	(0.110)	(0.591)	(0.487)
Turnover	−0.041	0.088	0.686***
	(0.659)	(0.702)	(0.001)
Active share	0.022***	0.038***	0.020**
	(0.000)	(0.000)	(0.058)
Flow volatility	2.073***	2.190	0.894
	(0.004)	(0.134)	(0.679)
Family TNA	−0.142***	−0.074	−0.220***
	(0.000)	(0.149)	(0.001)
ETF in family	−0.617	−0.312	−1.976**
	(0.271)	(0.469)	(0.049)
Size style	−0.403***	−0.187	0.340
	(0.001)	(0.438)	(0.238)
Value style	0.527***	0.311	0.457**
	(0.000)	(0.109)	(0.039)
Index fund held	−1.182	3.922***	−2.183
	(0.137)	(0.000)	(0.121)
Intercept	1.006	−0.304	−2.233
	(0.400)	(0.854)	(0.290)
Fixed effects	Yes	Yes	Yes
Observations	22,201	27,415	27,403
R^2	8.07%	6.34%	10.62%

This table reports the relation between percentage of cash holdings and exchange-traded fund (ETF) usage from

$$Percent\,Cash_{i,z} = \beta_0 + \beta_1 Low\,User_{i,z} + \beta_2 High\,User_{i,z} + \sum_{j=3}^{n} \beta_j X_{i,z-1} + FE + \varepsilon_{i,z}.$$

The dependent variable is average percent cash held by an actively managed mutual fund (AMMF) in column (1) and monthly percent cash held in columns (2) and (3). The coefficients of interest in column (1), *Low user* and *High user,* take a value of one if the AMMF is in the respective user group, and zero otherwise. In columns (2) and (3) the coefficient of interest takes a value of one in months the ETF-user holds an ETF, and zero otherwise. *Total net assets* is the natural log of the total net assets (TNA) of the fund, *Age* is the natural log of the fund's age, *Expense ratio* is the fund's expense ratio, *Load indicator* takes a value of one if the AMMF has a load fee and a value of zero otherwise, *Turnover* is the AMMF turnover ratio, *Active share* measures the deviation of an AMMF portfolio from its benchmark, *Flow volatility* is measured as the standard deviation of flow over the prior period, *Family TNA* is the natural log of the AMMF's fund family, *ETF in family* is an indicator variable that takes on the value of one if the AMMF holds an ETF position that is managed by the same fund family, *Size style* and *Value style* measure the underlying portfolio holding characteristics along size and book-to-market dimension, respectively, and *Index fund held* is an indicator variable that takes on the value of one if the AMMF holds an index mutual fund. We calculate control variables as of the prior month in columns (2) and (3). We cluster errors by AMMF, and *p*-values are in parentheses.

* indicate significance at the 10% level.
** indicate significance at the 5% level.
*** indicate significance at the 1% level.

mutual fund style subgroup. We detail the formation of the four style subgroups in Sections 2.1 and 3.1. Style-ranked subgroups are then aggregated into a single group of low- and high-user AMMFs. This methodology ensures that we have an equal number of users across mutual fund style and that a single fund style does not drive our results. Under this ranking method, we observe underperformance by high-user AMMFs relative to non-user AMMFs amounting to an annualized underperformance range of 0.43% to 1.56%.

6.3. Lifetime cross-sectional results

For robustness, we examine our findings within a lifetime cross-sectional framework, retaining one lifetime observation per AMMF. We calculate variables of interest, as well as control variables, as average values over the AMMF's lifetime. Results under this cross-sectional framework support those presented earlier. High-user AMMFs generate significantly negative annualized performance measures, while significantly underperforming the non-user AMMFs. The low-user AMMFs continue to perform similarly to the non-user AMMFs.

6.4. Matched sample

We repeat our analyses with a one-to-one matched sample. The use of a matched sample removes any concerns that investment objectives or fund size are the underlying driver of our results. We construct a sample of non-ETF-user AMMFs by first matching on AMMF objective. We further require that each potential non-user match has data available over the same time period as our ETF-user AMMFs. From the potential matches, we retain the non-ETF-user with the closest size (TNA) to each ETF-user AMMFs.

Performance results under a matched sample remain qualitatively unchanged. We find that low-user AMMFs generate annualized alphas, style excess, objective excess, and benchmark excess returns that are not statistically different from non-user AMMFs. Among high-user AMMFs, we find significant underperformance. High-user AMMFs generate significantly negative annualized performance and the difference in performance between high-user AMMFs and non-user AMMFs is significant across all measures of performance.

6.5. Monthly returns over 24 month periods

To ensure our results do not result from the use of daily returns, we repeat our analyses using 24 month ranking periods and monthly returns. We transition from 12 month ranking periods to 24 months to ensure that calculations of alpha contain sufficient number of monthly return observations. All performance results under this methodology remain qualitatively unchanged. We find that high-user AMMFs significantly underperform both non-user AMMFs and low-user-AMMFs.

6.6. Time sub periods

To determine if our findings are robust to various sub periods, we divide our sample into two parts, a sample from 2004 through 2009 and from 2010 through 2015. This helps to account for the growth of ETFs in the market place over our observed periods. Performance results over the 2004 through 2009 sample are consistent with our reported results, though of slightly decreased significance and magnitude. However, over the latter sample period of 2010 through 2015, our results become more significant and have increased magnitude of underperformance. This result is as expected due to the growth of ETFs over the period of our study (ICI, 2016).

7. Conclusion

We find that over one third of AMMFs hold an ETF at some point between 2004 and 2015, accounting for approximately one trillion dollars of assets under management. While current AMMF portfolio research focuses on overall portfolio preferences, short positions, or derivatives use, we are the first in-depth analysis to focus on passive ETF holdings.

We find that AMMFs differ substantially in their decision to hold ETF positions, and that the size of an ETF position is a strong indicator of AMMF ability. In particular, we find that large ETF positions are associated with large underperformance, whereas AMMFs with small ETF positions closely resemble non-ETF user AMMFs. These results hold across various measures of performance, across various AMMF styles, and across measures of market timing and cash management. We do observe differences in performance by the type of ETF held. AMMF underperformance is predominantly a result of large traditional index tracking ETF positions. However, this underperformance is not a result of closet indexing, as high-user AMMFs hold index tracking ETF positions outside of their assigned benchmark and significantly underperform with both their ETF and non-ETF portfolios.

Our results provide compelling evidence that large ETF positions are a strong indicator of unskilled AMMFs, measured directly and indirectly. To ensure these results are robust, we utilize tercile rankings, style-based subsample rankings, lifetime cross sectional rankings, a matched sample, monthly returns, and across various sub periods. Under all robustness specifications, results remain qualitatively unchanged.

The results presented throughout this paper provide strong evidence that AMMF portfolios do not suffer from the use of small ETF positions. In contrast, large passive ETF positions among AMMF portfolios can be a "red flag" for investors. Given that AMMFs should provide investors with benefits above those offered by passive management, it comes as no surprise that AMMFs allocating substantial portions of their portfolios to ETFs fail to create value for investors.

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Appendix A1. Exchange traded fund (ETF) positions by user, ETF type, and ETF style

ETF style	Low-user AMMF Percent	High-user AMMF Percent
Traditional index tracking ETFs		
Domestic equity sector ETFs	34.295	33.396
Domestic equity style ETFs	5.584	5.557
Domestic equity cap ETFs	50.944	35.407
Foreign equity ETFs	7.820	15.191
Fixed income ETFs	0.960	8.884
Mixed fixed income and equity ETFs	0.393	1.091
Other ETFs	0.004	0.475
Smart Beta ETFs		
Domestic equity sector ETFs	16.232	10.248
Domestic equity style ETFs	33.296	30.026
Domestic equity cap ETFs	50.017	52.474
Foreign equity ETFs	0.056	6.216
Fixed income ETFs	0.000	0.822
Mixed fixed income and equity ETFs	0.399	0.180
Other ETFs	0.000	0.035
Leveraged ETFs		
Domestic equity sector ETFs	40.364	34.832
Domestic equity style ETFs	57.675	62.122
Domestic equity cap ETFs	1.961	1.934
Foreign equity ETFs	0.000	0.000
Fixed income ETFs	0.000	0.000
Mixed fixed income and equity ETFs	0.000	1.111
Other ETFs	0.000	0.000
Inverse ETFs		
Domestic equity sector ETFs	0.000	1.567
Domestic equity style ETFs	76.106	81.984
Domestic equity cap ETFs	0.000	0.000
Foreign equity ETFs	0.000	0.000
Fixed income ETFs	23.894	16.448
Mixed fixed income and equity ETFs	0.000	0.000
Other ETFs	0.000	0.000

This table reports the distribution of ETF positions by actively managed mutual funds (AMMFs), divided into low-user and high-user AMMFs. We first breakdown ETF holding positions in traditional, smart beta, leveraged, and inverse ETFs, then we further breakdown each type of ETF position into ETF objectives. Each ETF type subgroup weights sum to 100%.

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