Holding Horizon: A New Measure of Active Investment Management

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SEPERATE INTERNET APPENDIX

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A1 Fund style classification

To avoid the issue caused by the use of misleading self-claimed benchmarks (Sensoy, 2009), we assign objective passive benchmarks to each actively managed equity mutual fund, each quarter, using the best-fit benchmark assigned by Cremers and Petajisto (2009) in their process of computing the Active Share measure. The Active Share of a fund quantifies how active a portfolio is managed, where active management is defined as the portfolio's degree of deviation from a passive index portfolio. It is directly measured by aggregating the absolute differences between the weight of a portfolio's actual holdings and the weight of its closest matching index,

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

where $w_{f,i}$ and $w_{index,i}$ are the portfolio weights of asset i in fund f and in the index, respectively, summed over the universe of all N assets. A fund's best-fit benchmark is the index with the lowest Active Share of the fund. We obtain the best-fit benchmarks for US domestic equity mutual funds over periods of January 1980 to December 2010 from Martijn Cremers and Antti Petajisto, and over periods from January 2011 to December 2015 from Tim Riley's website (https://sites.google.com/view/timbriley/home; Cremers, Fulkerson, and Riley, 2022).

Motivated by the industry practice that US equity mutual funds define their benchmarks on size and value-vs-growth dimensions, as Sensoy (2009) shows and Morningstar claims, we map the above-noted best-fit benchmarks, according to Table A2 in the Appendix of Hunter et al. (2014), to nine different major benchmarks defined in these two dimensions. Our final set of nine benchmark styles are large-capitalization (with benchmark Russell 1000 Value, Russell 1000, or Russell 1000 Growth), mid-capitalization (with benchmark Russell Midcap Value, Russell Midcap, or Russell Midcap Growth), or small-capitalization (with benchmark Russell 2000 Value, Russell 2000, or Russell 2000 Growth). This classification of fund investment styles keeps a reasonably large number of funds in each category, which reduces noise in calculating the average investment horizon for each style.

A2 Fund duration measure

In this section, we describe the fund duration measure proposed by Cremers and Pareek (2016; CP). A fund's holding duration is the value-weighted stock-level duration for all stocks held by a fund using the market value of stock holdings in the fund as weights. The duration of each stock held by a fund is calculated as the weighted buys and sells by the fund (of all buys and sells of that stock) over the past five years.[1] Specifically, let $h^{(D)}_{i,j,t}$ denote, in this measure, the duration of stock i held by fund j in period t. Let W be a specified window ending at period t. $B_{i,j}$ is the percentage of total shares outstanding of stock i bought by fund j between $t-W$ and t, while $H_{i,j}$ is the percentage of total shares outstanding of stock i held by fund j at $t-W$. Then,

$$h^{(D)}_{i,j,t} = \sum_{s=t-W+1}^{t} \frac{(t-s)\alpha_{i,j,s}}{H_{i,j}+B_{i,j}} + \frac{W * H_{i,j}}{H_{i,j}+B_{i,j}}, \tag{2}$$

where $\alpha_{i,j,s}$ is the percentage of total shares outstanding of stock i bought or sold by fund j in period s, while $\alpha_{i,j,s} > 0$ for buys and $\alpha_{i,j,s} < 0$ for sells.[2]

As we have discussed in the main text of the paper, this duration measure treats each buy of a fund (of the same stock) over time as having a different intended holding period, while our H-H measure treats all trades of the stock (until it is completely liquidated) as being part of a unified strategy. The differing treatment of trades of the same stock leads to a key difference between these two measures—when a manager increases a stock's position because her signal updates positively, ceteris paribus, a fund's H-H measure, as expected, becomes longer, but its CP duration becomes shorter.

A simple example helps illustrate this argument. Say, in quarter 1, a fund manager buys 1,000 shares of stock Z. Assume that there are three possible cases: in case 1 (base case) there is no change in the stock position; in cases 2 and 3, she buys another 50 and 500 shares of stock Z in quarter 12, respectively, which approximates the 25th and 75th percentiles

[1] Cremers and Pareek (2016) consider the past five years to calculate the duration measure. We obtain data on the fund duration measure from Cremers's website.

[2] For example, consider a fund that owns 1% of GE: Assume that it bought 5% of GE two years ago, and sold 4% of GE one year ago. The duration measure, today, is (5/5)*2-(4/5)*1= 1.2 years. This stock-level duration measure is introduced by Cremers and Pareek (2015).

of quarterly (percentage) changes in stock positions in our sample. In quarter 20 (the CP duration uses a look-back window of 5 years), the stock-level duration is 19, 18.5, and 15.3 quarters for cases 1–3, respectively. That is, going from no update of the manager's signal, to modestly positive update, and to strongly positive update, the stock-level duration becomes shorter!

Why is it the case? For a given stock, a newly added position has a shorter holding duration relative to the existing position, so the stock-level duration (cases 2 and 3) becomes shorter than that in the base case of no change in the stock position. The rising stock position increases the given stock's portfolio weight, ceteris paribus, and further reinforces a shorter fund-level duration measure. On the other hand, our stock-level H-H is the same across the three cases, as it is the best estimate from the current information set (quarter 20's in the above example) of a fund's intended holding period of the stock. A positive signal induces an increase in the stock position and its portfolio weight, and, ceteris paribus, leads to a longer fund-level H-H measure. Simply put, the CP duration mechanically captures realized holding duration (of various trades over time), whereas our H-H metric measures intended holding period through viewing all trades of a stock as part of a unified strategy.

Including both the H-H and CP duration measures as explanatory variables, we rerun Fama-MacBeth regressions of future risk-adjusted fund returns, as in Table 4, while controlling for other fund characteristics. Table A1 shows that the CP duration measure loses its forecasting power, while the predictability of H-H remains strong.

A3 Fund sample selection

We follow the procedure of Kacperczyk et al. (2008) for our fund sample selection. We start with a sample of all mutual funds available in the CRSP mutual fund database for the period 1980 to 2020. Because our analysis focuses on domestic equity mutual funds (whose holdings data are available at Thomson Reuters mutual fund holdings database), we eliminate balanced, bond, money market, sector, and international funds, as well as funds not invested primarily in equity securities. Specifically, we filter funds based on the objective

codes and on the disclosed asset compositions. We first select funds with the following Lipper classifications: EIEI, G, LCCE, LCGE, LCVE, MCCE, MCGE, MCVE, MLCE, MLGE, MLVE, SCCE, SCGE, or SCVE. If a fund does not have a valid Lipper classification, we select funds with the following Strategic Insight objectives: AGG, GMC, GRI, GRO, ING, or SCG. If a fund has neither a Lipper classification nor a Strategic Insight objective, then we rely on the Wiesenberger Objective Code and pick funds with the following objectives: G, G-I, AGG, GCI, GRI, GRO, LTG, MCG, or SCG. If none of these objectives but a CS policy (Common Stocks are the securities mainly held by the fund) is available for a fund, then the fund is included. If funds have neither the above objective codes nor CS policy available, then we use the CRSP mapping objective code (CRSP mapping of Strategic Insights, Wiesenberger, and Lipper objective codes into a continuous series); we select funds with, on average, at least 80% of AUM invested in stocks and with the following CRSP mapping objective codes: EDCI, EDCL, EDCM, EDCS, EDYB, EDYG, or EDYI. Since the reported objectives do not always indicate whether a fund portfolio is balanced or not, we also exclude funds that, on average, hold less than 80% or more than 105% in stocks. Finally, we remove index funds using fund names, index fund flag, and the sample of index funds identified by Cremers and Petajisto (2009) and available at www.sfsrfs.org/addenda_viewpaper.php?id=379.

Fund holdings data come from the Thomson Reuters mutual fund holdings database (s12), which is linked to the CRSP mutual fund database through WRDS MFLINKS. We exclude funds that have the following Investment Objective Codes in the Thomson Reuters database: International, Municipal, Balanced, Bond, and Metals. We also exclude funds that hold fewer than 10 stocks.

To address Evans' (2004) incubation bias, we exclude (1) the observations where the year for the observation is prior to the reported fund-starting year or (2) observations where the names of the funds are missing in the CRSP database until their first appearance. Fund data may be reported prior to the year of fund organization if a fund is incubated before it is publicly available, and these funds might not report their names or some other fund attributes, as shown by Evans (2004). Incubated funds also tend to be smaller, which

motivates us to exclude funds that had in the previous month less than $20 million USD in assets under management.

Mutual fund families introduced different share classes in the 1990s. Since different share classes have the same holdings composition, we aggregate all observations across different share classes pertaining to the same fund into one observation. For the qualitative attributes of funds (e.g., name, objectives, year of origination), we retain the observation of the oldest share class of the same fund. For the TNA under management, we sum the TNAs across the different share classes for a given fund. Finally, for the other quantitative attributes of funds (e.g., returns, expenses, loads), we take the weighted average of the attributes across share classes, where the weights are the lagged TNAs of the individual share classes.

To compute the H-H measure we require 60 months of holdings data as the warm-up period. That is, funds with less than 5-year holdings data are excluded in the final sample. Our final sample consists of 2,918 unique funds.

A4 Bootstrap simulations

We also draw statistical inference for four-factor net alphas reported in Table 2 of the paper based on bootstrap simulations that account for a potential bias of small sample sizes (Boudoukh, Israel, Richardson, 2019) using two methods. The first simulates monthly returns for each H-H decile portfolio by imposing a zero one-month four-factor net alpha. Specifically, for each H-H decile-portfolio, we run a Carhart four-factor regression using monthly excess net returns, as we do for the one-month results reported in Table 2 of the paper. We then bootstrap regression residuals with replacement, and add the estimated betas times the respective (historical-sample) factor returns. We simulate 5,000 samples, each matching the actual sample size. Next, for each decile-portfolio in each simulated sample, we compound simulated monthly net returns over n periods, in excess of compounded n-period one-month T-bill rates, and run regressions of the compounded excess returns on buy-and-hold four-factor returns over the same horizon. Note that this simulation method

naturally incorporates the econometric issues of using monthly observations of overlapping n-period returns to run regressions, as in our historical sample.

The second method simulates n-period returns directly through block bootstraps by imposing a zero n-period four-factor net alpha. This method considers long-term alphas different from short-term alphas due to their potential nonlinearity relation (Levhari and Levy, 1977; Bessembinder, Cooper, and Zhang, 2022), and assumes that a zero n-period alpha represents no risk-adjusted gain for n-period buy-and-hold fund investors. Specifically, for each H-H decile-portfolio and for a given n period, we run a Carhart four-factor regression using n-period compounded returns, as we do for the n-period results reported in Table 2 of the paper. Then, we draw, via block bootstrap with the block size of $n-1$, from the n-period regression residuals with replacement, as these residuals are obtained from returns being overlapped over $n-1$ periods. We then add the bootstrapped residuals to the saved n-period beta estimates times the respective factor returns. We simulate 5,000 samples, each matching the actual sample size. Then, for each decile-portfolio in each simulated sample, we run regressions of simulated n-period returns on buy-and-hold n-period four-factor returns.

Tables A2 and A3 report empirical p-values using the first and second simulation methods, respectively, of t-statistics associated with the n-period alphas estimated from the historical sample, based on empirical distributions of the respective simulation-based t-statistics, which account for potential alpha estimation biases. Here we rely on t-statistics, instead of multiperiod alphas, per se, to draw statistical inference from empirical distributions, because t-statistic, as a pivotal quantity, produces a better size of tests (Hall, 1992 and Hall and LePage, 1996). Note that, for both simulation methods and both equal- and value-weighted decile-portfolios, funds in the longest H-H decile (D10) have statistically significant four-factor net alphas at horizons longer than a month, which are statistically significantly higher than the respective alphas for funds in the shortest H-H decile (D1).

A5 Refinement of the informativeness of fund holdings

As we have shown in the paper, long-horizon fund managers are skillful in selecting stocks with superior long-term performance. Here we further show that such superior long-term performance come from long-term equity positions rather than short-term positions, primarily because long-horizon fund managers have a superior ability in exploiting long-term information and discriminate in their holdings of stocks for which they have better information.

In doing so, we first define the average holding span of a stock belonging to each type of fund, long-horizon or short-horizon. Let $h_{i,j,t}$ denote the holding period of stock i held by fund j in period t. The average holding period $h_{i,j,t}$ across all long-horizon funds that hold stock i in period t is called *long-horizon fund holding span* of stock i:

$$hs_{i,t}^{long} = \sum_{j=1}^{M_{i,t}^{long}} \eta_{i,j,t} h_{i,j,t}, \tag{3}$$

where $M_{i,t}^{long}$ is the number of long-horizon funds that hold stock i in period t, and $\eta_{i,j,t}$ is the ratio of the number of shares of stock i held by fund j divided by the total number of shares of stock i held by all long-horizon funds in period t. Similarly, we define the *short-horizon fund holding span* of stock i as

$$hs_{i,t}^{short} = \sum_{j=1}^{M_{i,t}^{short}} \eta_{i,j,t} h_{i,j,t}. \tag{4}$$

Next, we consider four stock portfolios that are constructed as follows. First, we assign stocks into quintiles each month based on LFH minus SFH, with Q5 (Q1) consisting of stocks that are largely held by long-horizon (short-horizon) funds, as we have done in section V.A. Then, we define a long-term position group in Q5 (Q1) if a stock's long-horizon (short-horizon) fund holding span is in the top 1/4 among all stocks belonging to long-horizon (short-horizon) funds, and a short-term position group if it is in the bottom 1/4. Table A6 presents the performance of these four portfolios at a horizon of the next month up to the next five years after the portfolio formation.

Clearly, the long-term outperformance of long-horizon funds stems from their long-term stock positions rather than their short-term positions. Stocks that long-horizon funds hold for a long period exhibit the best future long-term performance among the four stock groups. For example, at a five-year horizon, this group exhibits a four-factor alpha of 23.9% and a DGTW-adjusted return of 18.5%, the highest values among the four groups; both are statistically and economically significant.

A6 A recursive out-of-sample test

Following the spirit of the empirical approaches of Pesaran and Timmermann (1995) and Cooper, Gutierrez, and Marcum (2005), we employ a recursive out-of-sample approach to evaluate the ex-ante predictability of our H-H measure. A key feature of this approach is to allow for alternative, competing predictors in the assessment of out-of-sample performance of these variables' predictability in real time. This feature motivates us to select the "best" predictors (to compete with H-H)—those that exhibit strong predictability in-sample, out-of-sample, and during post-publication periods—as shown in Table 1 of Jones and Mo (2021), in addition to several other widely used fund return predictors. Our final list of competing predictors includes H-H, CRSP turnover, past 12-month fund flow, return gap, R^2, Active Share, past 12-month return, past 12-month Carhart alpha, and past 5-year Carhart alpha.

This out-of-sample approach assumes that the real-time investor has no prior belief in the efficacy of any of these predictive variables, and assesses whether she would discover H-H and/or any other variables useful for fund selection using historical data up to a particular point-in-time through backtests. Following Cooper, Gutierrez, Marcum (2005), the rule universe available for the real-time investor consists of all possible one-way decile-sorts using each of the above-noted nine fund predictors. That is, there are a total of 90 deciles formed each month based on the nine predictors.

The recursive out-of-sample procedure using a five-year training window works as follows.[3] The first training (in-sample) window, in terms of the sorting month, covers the period

[3]Using a three-year training window in the recursive out-of-sample approach produces qualitatively similar

December 1984 to November 1989. At the end of each month, t, of the training window funds are sorted into deciles based on each of the nine predictors. Then, for each of these 90 decile-portfolios (rules) we calculate equally weighted four-factor net alphas across funds in each decile over months $t+1$ to $t+60$. Analogously, the 60 sorting months in the first in-sample training window leads to 60 four-factor net alphas for each of 90 decile-portfolios (rules).

Next, for each of the 90 predictor deciles, the investor calculates the average of these 60 net alphas associated with the first in-sample training window. The real-time investor uses this average net alpha to select the highest (lowest) 10% of the total rules—9 rules for the best (worst) performers—as her chosen LONG (SHORT) out-of-sample fund portfolio. This process repeats by rolling forward the in-sample training window one month at a time until five years before the end of our data sample. (Note that the last five-year data are reserved for the last five out-of-sample years.)

As shown in Table A10, over 98% of the total out-of-sample decision-making periods, the real-time investor uses H-H for LONG fund portfolio selection—the highest proportion among the nine predictors.

Over the out-of-sample periods five-year four-factor net alphas are calculated for the LONG and SHORT fund portfolios. Specifically, for each month and each of the top (bottom) 9 rules, we first calculate value-weighted or equal-weighted buy-and-hold five-year net returns in the same way as we do for our baseline tests in Table 2 of the paper. For each month, we then calculate the average five-year buy-and-hold net return across the 9 rules for the LONG (SHORT) fund portfolios, in excess of a corresponding return in T-bills compounded over the five years. To get an out-of-sample four-factor net alpha, we regress this time-series on the monthly observations of five-year compounded FF/Carhart four factors over the same period.

Under the column labelled "With H-H" below "5-year forecasts" in Panel A of Table A11, we see that LONG ("Top 10%") fund portfolios exhibit a significantly positive out-of-sample four-factor net alpha of 3.84% over the next five out-of-sample years, which is 3.71%

results. For simplicity, we only discuss the five-year results.

higher than the alpha for SHORT fund portfolios. We also repeat the iterative out-of-sample procedure using the eight other predictors (excluding H-H) and report the results under the column labelled "Without H-H", as well as the spreads of out-of-sample alphas between the two above-noted scenarios under the column labelled "Diff." We see that LONG ("Top 10%") fund portfolios using the total nine predictors including H-H significantly outperform the respective ones using the eight other predictors excluding H-H. All these results suggest the ex-ante predictability of H-H for mutual fund performance.

A7 Tables for additional tests and robustness checks

Tables below report the results discussed in our paper when we refer to results in the Internet Appendix.

Table A1: Fama-MacBeth regressions of fund performance: Horse race between the H-H and duration measures

This table reports the coefficient estimates and p-values (in parentheses) of Fama-MacBeth (1973) regressions of future fund performance on the style-adjusted H-H measure, the duration measure of Cremers and Pareek (2016), and other explanatory variables. The dependent variable is the four-factor alpha associated with buy-and-hold fund net returns or buy-and-hold DGTW-adjusted abnormal returns. The look-ahead return measurement horizons are 1 month, 1 year, 3 years, and 5 years. The other explanatory variables include fund size measured as log of total net assets, the expense ratio, fund age in logs, past-year fund flow volatility, past-year fund flow, the CRSP turnover ratio (TR), factor-related return (FRR), and dummies (unreported in the table) for the investment styles used by Cremers and Petajisto (2009) obtained from $http://www.petajisto.net/data.html$. We use weighted least square in the first-stage cross-sectional regressions with fund size as weights. Standard errors are calculated using the Newey-West (1987) procedure with a lag equal to the total number of months in the look-ahead return measurement horizon minus one.

	4-F α				DGTW			
	1M	1Y	3Y	5Y	1M	1Y	3Y	5Y
H-H measure	0.02	0.24	0.85	1.17	0.02	0.18	0.39	0.67
	(0.02)	(0.00)	(0.00)	(0.00)	(0.09)	(0.03)	(0.03)	(0.00)
Duration	-0.00	-0.02	0.01	0.26	0.00	0.03	0.12	0.22
	(0.77)	(0.49)	(0.91)	(0.17)	(0.89)	(0.53)	(0.19)	(0.24)
Fund size	0.00	0.05	0.34	0.09	0.00	0.02	-0.06	-0.25
	(0.79)	(0.37)	(0.12)	(0.71)	(0.46)	(0.77)	(0.70)	(0.23)
Expense ratio	-0.07	-0.65	-1.62	-2.55	0.01	0.10	-0.07	-0.04
	(0.00)	(0.00)	(0.02)	(0.00)	(0.55)	(0.60)	(0.84)	(0.96)
Age	0.01	-0.23	-1.56	-2.23	-0.00	0.00	0.05	0.04
	(0.38)	(0.10)	(0.01)	(0.01)	(0.76)	(1.00)	(0.87)	(0.93)
Flow vol	-0.05	-0.82	-6.25	-3.46	-0.11	1.32	4.22	4.24
	(0.73)	(0.69)	(0.22)	(0.60)	(0.56)	(0.55)	(0.26)	(0.62)
Fund flow	0.03	0.09	0.57	0.83	0.01	-0.17	-0.39	-0.43
	(0.00)	(0.51)	(0.29)	(0.41)	(0.22)	(0.22)	(0.13)	(0.35)
CRSP TR	0.01	0.30	0.71	0.65	0.02	0.19	0.35	0.10
	(0.62)	(0.16)	(0.22)	(0.30)	(0.13)	(0.17)	(0.37)	(0.85)
FRR	-0.01	-0.17	-0.35	-0.39	0.00	-0.02	-0.20	-0.44
	(0.32)	(0.00)	(0.05)	(0.18)	(0.58)	(0.77)	(0.13)	(0.06)

Table A2: Fund portfolio performance: Bootstrapped p-values

We simulate monthly fund excess net returns (net of 1-month T-bill rate) of each H-H decile-portfolio by imposing a zero monthly alpha under the Carhart (1997) four-factor model; that is, we bootstrap residuals from the regression of monthly fund excess net returns of a given decile-portfolio in the historical sample using the Carhart (1997) four-factor model, then add the respective estimated betas times (historical) factor returns. H-H decile-portfolios (value-weighted in Panel A and equal-weighted in Panel B) are formed as in Table 2 of the paper. We obtain 5000 simulated samples, each matching the size of the historical sample. Next, for each simulated sample, we construct buy-and-hold returns at horizon n and regress them on the historical-sample n-period four factor returns to obtain t-statistics for the alphas. This table reports empirical p-values (two-sided) that are obtained by comparing the historical-sample t-statistics with simulation-based ones (empirical distribution).

Panel A: Using value-weighted returns

	1M	1Q	1Y	2Y	3Y	4Y	5Y
D1	0.02	0.11	0.36	0.56	0.57	0.54	0.47
D2	0.21	0.40	0.66	0.69	0.56	0.60	0.56
D3	0.41	0.57	0.43	0.52	0.58	0.50	0.52
D4	0.59	0.79	0.67	0.60	0.66	0.72	0.79
D5	0.70	0.96	0.92	0.86	0.69	0.59	0.70
D6	0.69	0.57	0.45	0.34	0.35	0.23	0.27
D7	0.38	0.81	0.90	0.77	0.75	0.65	0.85
D8	0.86	0.73	0.78	0.61	0.43	0.38	0.40
D9	0.87	0.48	0.99	0.89	0.98	0.99	0.69
D10	0.09	0.04	0.06	0.04	0.01	0.01	0.01
D10-D1	0.00	0.00	0.02	0.07	0.03	0.03	0.01

Panel B: Using equal-weighted returns

	1M	1Q	1Y	2Y	3Y	4Y	5Y
D1	0.14	0.35	0.66	0.99	0.90	0.79	0.95
D2	0.51	0.90	0.80	0.62	0.61	0.38	0.44
D3	0.63	0.96	0.97	0.83	0.75	0.69	0.70
D4	0.93	0.69	0.49	0.44	0.43	0.41	0.42
D5	0.66	0.96	0.90	0.93	0.93	0.76	0.59
D6	0.60	0.37	0.38	0.22	0.15	0.08	0.09
D7	0.63	0.85	0.53	0.47	0.30	0.14	0.10
D8	0.91	0.81	0.82	0.74	0.39	0.21	0.12
D9	0.77	0.34	0.46	0.39	0.22	0.13	0.07
D10	0.16	0.05	0.07	0.07	0.01	0.01	0.01
D10-D1	0.00	0.00	0.04	0.15	0.08	0.07	0.03

Table A3: Fund portfolio performance: Bootstrapped p-values with an alternative method

For a given horizon n, we simulate n-period compounded fund excess net returns (net of n-period compounded 1-month T-bill rate) of each H-H decile-portfolio by imposing a zero n-period alpha under the Carhart (1997) four-factor model; that is, we use block bootstrap technique with a size of $n-1$ to draw with replacement residuals from the regression of n-period compounded fund excess net returns of a given decile-portfolio in the historical sample using the Carhart (1997) four-factor model, then add the respective estimated n-period betas times (historical) factor returns. H-H decile-portfolios (value-weighted in Panel A and equal-weighted in Panel B) are formed as in Table 2 of the paper. We obtain 5000 simulated samples, each matching the size of the historical sample. Next, for each simulated sample, we regress simulated n-period compounded fund excess net returns on the historical-sample n-period four factor returns to obtain t-statistics for n-period alphas. This table reports empirical p-values (two-sided) that are obtained by comparing the historical-sample t-statistics with simulation-based ones (empirical distribution).

Panel A: Using value-weighted returns

	1Q	1Y	2Y	3Y	4Y	5Y
D1	0.02	0.12	0.38	0.51	0.52	0.36
D2	0.42	0.68	0.87	0.87	0.86	0.85
D3	0.66	0.82	0.84	0.64	0.66	0.63
D4	0.76	0.49	0.77	0.49	0.27	0.37
D5	0.99	0.92	0.96	0.81	0.60	0.74
D6	0.08	0.45	0.33	0.26	0.11	0.10
D7	0.17	0.94	0.94	0.42	0.35	0.71
D8	0.27	0.62	0.29	0.33	0.44	0.52
D9	0.50	0.79	0.94	0.59	0.41	0.18
D10	0.01	0.05	0.03	0.03	0.01	0.01
D10-D1	0.00	0.00	0.00	0.00	0.00	0.00

Panel B: Using equal-weighted returns

	1Q	1Y	2Y	3Y	4Y	5Y
D1	0.30	0.65	0.95	0.95	0.84	0.47
D2	0.74	0.87	0.68	0.73	0.48	0.53
D3	0.89	0.54	0.46	0.38	0.34	0.35
D4	0.78	0.67	0.45	0.37	0.17	0.20
D5	0.65	0.63	0.43	0.38	0.28	0.31
D6	0.30	0.54	0.34	0.32	0.13	0.22
D7	0.94	0.76	0.80	0.26	0.08	0.18
D8	0.63	0.80	0.36	0.14	0.09	0.06
D9	0.18	0.16	0.16	0.17	0.10	0.07
D10	0.02	0.07	0.05	0.02	0.01	0.00
D10-D1	0.00	0.03	0.05	0.04	0.01	0.00

Table A4: Fund portfolio performance: Robustness check using Jegadeesh and Titman's approach

Funds are sorted into deciles each month according to the style-adjusted H-H measure, with D1 consisting of short-horizon funds and D10 consisting of long-horizon funds. This table reports n-period 4-factor alphas using Jegadeesh and Titman's (1993) overlapping portfolio approach. In particular, we first calculate the average of monthly decile-portfolio returns for a given H-H decile that is formed in each of the previous n months. We then run a regression of the average monthly returns using the Carhart (1997) four-factor model. This table reports 4-factor alphas over the next one to five years, the alpha spreads between the D10 and D1 portfolios, and their associated p-values in parentheses. All alphas are expressed in percentage. Standard errors are obtained using the Newey-West (1987) procedure with a lag equal to the total number of months in the look-ahead return measurement horizon minus one.

	1Y	2Y	3Y	4Y	5Y
D1	-0.08	-0.08	-0.07	-0.07	-0.08
	(0.13)	(0.16)	(0.18)	(0.16)	(0.12)
D2	-0.05	-0.03	-0.04	-0.03	-0.03
	(0.45)	(0.55)	(0.41)	(0.52)	(0.53)
D3	-0.03	-0.03	-0.03	-0.02	-0.03
	(0.67)	(0.62)	(0.64)	(0.65)	(0.61)
D4	-0.05	-0.02	-0.02	-0.02	-0.02
	(0.45)	(0.76)	(0.74)	(0.77)	(0.67)
D5	0.01	-0.00	-0.01	-0.00	-0.02
	(0.84)	(0.95)	(0.90)	(0.95)	(0.74)
D6	0.01	0.02	0.02	0.02	0.00
	(0.82)	(0.66)	(0.73)	(0.70)	(0.97)
D7	-0.00	0.01	0.01	0.01	-0.01
	(0.93)	(0.82)	(0.77)	(0.87)	(0.90)
D8	0.01	0.03	0.01	-0.00	0.00
	(0.77)	(0.58)	(0.89)	(0.93)	(0.96)
D9	0.02	0.02	0.03	0.04	0.05
	(0.65)	(0.58)	(0.48)	(0.38)	(0.24)
D10	0.05	0.07	0.07	0.07	0.07
	(0.18)	(0.07)	(0.07)	(0.07)	(0.06)
D10-D1	0.14	0.15	0.14	0.14	0.15
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Table A5: Informativeness of fund holdings—Fund portfolio performance: Robustness check using net returns adjusted for front loads

We consider the full sample of funds, a subsample of high-load funds, and a subsample of low-load funds, where high-load funds and low-load funds are defined in Table 3 of the paper. In each sample, funds are sorted into deciles each month according to the style-adjusted H-H measure, with D1 consisting of short-horizon funds and D10 consisting of long-horizon funds. This table reports four-factor alphas associated with net returns of D1 and D10 decile-portfolios over the next month and next one to five years after portfolio formation, where the first month return after portfolio formation is adjusted by front-end load, which is either TNA-weighted minimum or maximum front-end charged by all share classes pertaining to the same fund. Decile portfolios are equally weighted at the formation month, then follow a buy-and-hold strategy. If funds drop out of a decile portfolio during a return measurement horizon, we distribute the value of the disappearing funds to the remaining funds in the decile in proportion to the portfolio values of the remaining funds. The table also reports the alpha spreads between the D10 and D1 portfolios. All alphas are expressed in percentage, and the p-values are summarized in parentheses. Standard errors are obtained using the Newey-West (1987) procedure with a lag equal to the total number of months in the look-ahead return measurement horizon minus one.

	Full sample		High loads		Low loads	
	Min front load	Max front load	Min front load	Max front load	Min front load	Max front load
1-month						
D1 (short)	-0.98	-2.26	-1.80	-4.04	-0.08	-1.01
	(0.00)	(0.00)	(0.00)	(0.00)	(0.16)	(0.00)
D10 (long)	-0.82	-1.97	-1.67	-3.65	0.00	-1.12
	(0.00)	(0.00)	(0.00)	(0.00)	(0.99)	(0.00)
D10-D1	0.15	0.29	0.13	0.39	0.08	-0.11
	(0.00)	(0.00)	(0.00)	(0.00)	(0.04)	(0.04)
1-year						
D1 (short)	-1.12	-2.44	-2.14	-4.50	-0.21	-1.29
	(0.02)	(0.00)	(0.00)	(0.00)	(0.72)	(0.05)
D10 (long)	-0.01	-1.19	-0.43	-2.56	0.47	-0.76
	(0.99)	(0.01)	(0.50)	(0.00)	(0.40)	(0.22)
D10-D1	1.12	1.26	1.71	1.94	0.69	0.53
	(0.02)	(0.01)	(0.00)	(0.00)	(0.12)	(0.20)
2-year						
D1 (short)	-1.17	-2.47	-2.80	-5.10	0.46	-0.56
	(0.12)	(0.00)	(0.01)	(0.00)	(0.70)	(0.68)
D10 (long)	1.24	0.03	0.99	-1.20	0.97	-0.17
	(0.10)	(0.97)	(0.32)	(0.13)	(0.42)	(0.90)
D10-D1	2.41	2.50	3.79	3.89	0.51	0.39
	(0.02)	(0.01)	(0.00)	(0.00)	(0.60)	(0.67)
3-year						
D1 (short)	-1.47	-2.73	-3.42	-5.59	0.42	-0.61
	(0.12)	(0.01)	(0.01)	(0.00)	(0.82)	(0.77)
D10 (long)	2.82	1.62	2.38	0.21	2.32	1.23
	(0.02)	(0.17)	(0.19)	(0.88)	(0.12)	(0.47)
D10-D1	4.28	4.35	5.80	5.80	1.90	1.84
	(0.00)	(0.00)	(0.00)	(0.00)	(0.07)	(0.05)
4-year						
D1 (short)	-1.90	-3.25	-4.31	-6.58	0.31	-0.80
	(0.12)	(0.02)	(0.00)	(0.00)	(0.91)	(0.79)
D10 (long)	4.67	3.38	3.90	1.55	4.59	3.44
	(0.00)	(0.01)	(0.12)	(0.40)	(0.02)	(0.12)
D10-D1	6.57	6.62	8.22	8.12	4.29	4.23
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)
5-year						
D1 (short)	-3.49	-4.84	-6.11	-8.34	-1.03	-2.27
	(0.09)	(0.03)	(0.00)	(0.00)	(0.76)	(0.51)
D10 (long)	6.82	5.52	5.55	3.17	6.70	5.43
	(0.00)	(0.00)	(0.07)	(0.17)	(0.02)	(0.07)
D10-D1	10.31	10.36	11.66	11.51	7.73	7.70
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Table A6: Refinement of informativeness of fund holdings

Stocks are sorted each month into quintiles based on relative fund holdings, long-horizon fund holdings (LFH) minus short-horizon fund holdings (SFH), with Q5 (Q1) consisting of stocks held more by long-horizon (short-horizon) funds and less by short-horizon (long-horizon) funds. In Q5 (Q1), stocks are further divided into two groups: long-term positions consisting of stocks held for a long period by long-horizon (short-horizon) funds, and short-term positions consisting of stocks held for a short period by long-horizon (short-horizon) funds. This table presents buy-and-hold returns, four-factor alphas, and DGTW adjusted returns for these four stock portfolios, two portfolios for each of Q1 and Q5, over the next month, the next quarter, and the next one to five years after portfolio formation. The style-adjusted H-H measure is used to classify funds as long- or short-horizon. p-values are calculated using the Newey-West (1987) procedure with a lag equal to the total number of months in the look-ahead return measurement horizon minus one.

	Return	4-F α	p-value	DGTW	p-value
1-month					
Short-term positions in short-horizon funds	0.97	-0.12	0.40	-0.07	0.56
Long-term positions in short-horizon funds	1.16	0.14	0.18	0.14	0.07
Short-term positions in long-horizon funds	0.95	-0.01	0.97	0.00	0.98
Long-term positions in long-horizon funds	1.15	0.12	0.20	0.11	0.07
1-quarter					
Short-term positions in short-horizon funds	2.90	-0.73	0.01	-0.42	0.07
Long-term positions in short-horizon funds	3.66	0.43	0.04	0.49	0.00
Short-term positions in long-horizon funds	3.18	-0.19	0.67	0.15	0.67
Long-term positions in long-horizon funds	3.51	0.38	0.07	0.24	0.12
1-year					
Short-term positions in short-horizon funds	9.66	-4.03	0.00	-2.71	0.00
Long-term positions in short-horizon funds	14.87	1.38	0.17	2.27	0.00
Short-term positions in long-horizon funds	12.99	-1.05	0.60	1.76	0.25
Long-term positions in long-horizon funds	15.12	2.87	0.00	1.77	0.04
2-year					
Short-term positions in short-horizon funds	20.77	-4.68	0.07	-3.04	0.08
Long-term positions in short-horizon funds	29.47	3.61	0.18	2.70	0.04
Short-term positions in long-horizon funds	25.91	-1.39	0.70	3.30	0.15
Long-term positions in long-horizon funds	31.88	7.43	0.00	4.67	0.01
3-year					
Short-term positions in short-horizon funds	33.58	-6.75	0.07	-3.39	0.11
Long-term positions in short-horizon funds	44.67	6.48	0.21	3.35	0.07
Short-term positions in long-horizon funds	40.42	-0.94	0.84	4.00	0.23
Long-term positions in long-horizon funds	49.16	11.33	0.01	7.20	0.00
4-year					
Short-term positions in short-horizon funds	50.90	-10.21	0.01	-1.84	0.66
Long-term positions in short-horizon funds	62.47	10.98	0.19	4.64	0.20
Short-term positions in long-horizon funds	58.01	-0.34	0.94	5.31	0.22
Long-term positions in long-horizon funds	71.86	17.47	0.01	12.31	0.00
5-year					
Short-term positions in short-horizon funds	69.57	-11.47	0.01	-2.57	0.64
Long-term positions in short-horizon funds	82.84	13.97	0.14	7.87	0.15
Short-term positions in long-horizon funds	85.35	-0.08	0.99	11.91	0.04
Long-term positions in long-horizon funds	95.70	23.92	0.00	18.52	0.00

Table A7: Determinants of the H-H measure

This table reports results of a panel regression of the H-H measure on various fund characteristics. All the variables are measured at the end of each quarter. The fund characteristics include fund size measured as log of total net assets, the expense ratio, fund age in logs, past-year flow volatility, past-year fund flow, the CRSP turnover ratio (TR), the Active Share from Cremers and Petajisto (2009), the R^2 of Amihud and Goyenko (2013), and the return gap of Kacperczyk et al. (2008). The p-values are calculated based on standard errors clustered by funds.

	Coeff	p-value
Intercept	6.54	0.00
Fund size	0.01	0.90
Expense ratio	-0.09	0.04
Age	0.14	0.00
Flow volatility	-0.06	0.01
Fund flow	-0.02	0.11
CRSP TR	-0.80	0.00
Active Share	-0.26	0.00
R^2	-0.16	0.001
Return Gap	0.00	0.75
Coeff. of determination	0.36	

Table A8: Informativeness of fund holdings—Fund portfolio performance: Using a 5-factor model

Funds are sorted into deciles each month according to the style-adjusted H-H measure, with D1 consisting of short-horizon funds and D10 consisting of long-horizon funds. This table reports buy-and-hold fund portfolio abnormal returns over the next month and next one to five years after portfolio formation. The abnormal returns are five-factor alphas under a factor model including the Carhart four factors and the Pástor-Stambaugh liquidity factor. Portfolio weights are value- or equal-weighted at the formation month and are then updated following a buy-and-hold strategy. The table also reports the alpha spreads between the D10 and D1 portfolios. All alphas are expressed in percentage. *, **, and *** represent significance for abnormal returns and alpha spreads at the 10%, 5%, and 1% confidence intervals, respectively. Standard errors are obtained using the Newey-West (1987) procedure with a lag equal to the total number of months in the look-ahead return measurement horizon minus one.

	Value weighted	Equally weighted
1-month		
D1 (short)	-0.11*	-0.08
D10 (long)	0.04	0.03
D10-D1	0.15***	0.11***
1-year		
D1 (short)	-0.66	-0.16
D10 (long)	0.26	0.57
D10-D1	0.92*	0.73
2-year		
D1 (short)	-0.67	0.13
D10 (long)	1.31	2.33*
D10-D1	1.98*	2.20*
3-year		
D1 (short)	-0.54	0.74
D10 (long)	2.93*	3.35**
D10-D1	3.47**	2.61*
4-year		
D1 (short)	-1.83	-0.68
D10 (long)	5.16**	5.59***
D10-D1	6.99***	6.26**
5-year		
D1 (short)	-3.01*	-1.84
D10 (long)	6.49***	6.76***
D10-D1	9.50***	8.59***

Table A9: Stock portfolios sorted on relative fund holdings and illiquidity

A mutual fund is classified as a short-term (long-term) fund if it ranks in the bottom (top) tercile based on the style-adjusted H-H measure. LFH (SFH) is defined as the aggregate holdings of a stock by long-horizon (short-horizon) funds divided by the stock's total number of shares outstanding. Each month we group stocks into deciles according to their relative fund holdings (LFH-SFH), with stocks in D10 held more by long- and less by short-horizon funds and stocks in D1 held more by short- and less by long-horizon funds. We further divide each decile of stocks into two groups according to their illiquidity. The stock illiquidity is measured using the Amihud's (2002) measure. Liquid (illiquid) stocks are stocks with below (above) median Amihud's illiquidity measure. The stock portfolios are equally weighted at formation date and are then updated following a buy-and-hold strategy. The four-factor alphas and DGTW-adjusted returns for each stock portfolio are examined over the next month and the next one to five years after portfolio formation. These returns are expressed in percentage. The table also reports the performance difference between D10 and D1 portfolios. p-values in parentheses are obtained using the Newey-West (1987) procedure with a lag equal to the total number of months in the look-ahead return measurement horizon minus one.

	Illiquid stocks		Liquid stocks	
	4-F α	DGTW	4-F α	DGTW
1-month				
D1 (short)	-0.02	0.07	-0.07	-0.02
	(0.88)	(0.51)	(0.53)	(0.82)
D10 (long)	-0.09	-0.00	0.17	0.20
	(0.47)	(0.99)	(0.10)	(0.01)
D10-D1	-0.07	-0.07	0.24	0.22
	(0.65)	(0.60)	(0.08)	(0.04)
1-year				
D1 (short)	-0.99	1.11	-0.86	-0.15
	(0.56)	(0.14)	(0.22)	(0.80)
D10 (long)	0.29	1.61	1.94	1.80
	(0.88)	(0.16)	(0.09)	(0.10)
D10-D1	1.28	0.50	2.80	1.95
	(0.33)	(0.64)	(0.02)	(0.16)
2-year				
D1 (short)	0.74	2.48	0.01	0.23
	(0.86)	(0.09)	(0.99)	(0.90)
D10 (long)	2.76	3.63	2.67	4.22
	(0.54)	(0.06)	(0.09)	(0.02)
D10-D1	2.02	1.15	2.66	3.98
	(0.25)	(0.54)	(0.19)	(0.14)
3-year				
D1 (short)	2.16	4.83	-0.30	-0.43
	(0.78)	(0.05)	(0.92)	(0.88)
D10 (long)	4.63	5.91	4.87	7.16
	(0.53)	(0.03)	(0.01)	(0.01)
D10-D1	2.46	1.07	5.17	7.59
	(0.06)	(0.62)	(0.01)	(0.04)
4-year				
D1 (short)	5.74	6.14	-1.19	-0.37
	(0.61)	(0.04)	(0.71)	(0.93)
D10 (long)	10.80	12.51	11.83	12.31
	(0.37)	(0.02)	(0.00)	(0.00)
D10-D1	5.05	6.37	13.03	12.68
	(0.01)	(0.11)	(0.00)	(0.01)
5-year				
D1 (short)	5.13	4.58	0.46	0.07
	(0.69)	(0.27)	(0.90)	(0.99)
D10 (long)	14.82	19.62	18.17	19.06
	(0.37)	(0.02)	(0.00)	(0.00)
D10-D1	9.69	15.04	17.71	18.98
	(0.07)	(0.05)	(0.00)	(0.00)

Table A10: Model selection

Every month a real-time investor selects top 10% rules (decile-portfolios) among 90 decile-portfolios—from one-way decile-sorting using each of the nine predictors listed in the table—based upon in-sample four-factor net alphas of the 90 portfolios. The in-sample average four-factor net alpha is calculated, in a 5-year (3-year) training window, for each of 90 decile-portfolios using the recent 5 (3) years of past data. See Section A6 for detail. This table reports the proportion out of the total out-of-sample fund-selection decision-making periods when a particular variable is used for fund selection of top 10% rules, i.e., when the top decile (bottom decile for R^2) of each predictor is selected as one of top 10% rules.

	3-year	5-year
H-H measure	0.86	0.98
CRSP TR	0.01	0.00
Fund flow	0.00	0.00
Return Gap	0.00	0.02
R^2	0.43	0.51
Active Share	0.43	0.45
Past 12-month return	0.29	0.16
Past 12-month alpha	0.61	0.52
Past 5-year alpha	0.54	0.57

Table A11: Out-of-sample performance

Every month a real-time investor selects top and bottom 10% rules (decile-portfolios) among 90 decile-portfolios—from one-way decile-sorting using each of nine predictors—based upon in-sample four-factor net alphas of the 90 portfolios. The in-sample average four-factor net alpha is calculated, in a 5-year (3-year) training window, for each of 90 decile-portfolios using the recent 5 (3) years of past data. See Section A6 for detail. The nine predictors are listed in Table A10. This table reports out-of-sample 5-year (3-year) buy-and-hold four-factor net alphas of top and bottom 10% rules, as well as the alpha spreads between these two groups of rules, with p-values reported in parentheses. Each rule (decile-portfolio) is value-weighted (Panel A) or equal-weighted (Panel B) at the formation month; we then take the average across top 10% rules and, separately, across bottom 10% rules. The column labelled "With H-H" reports the results using all the nine predictors, the column labelled "Without H-H" reports the results using eight predictors (excluding H-H), and the column labelled "Diff" reports the difference between the preceding two columns. The alphas are expressed in percentage. Standard errors are obtained using the Newey-West (1987) procedure with a lag equal to the total number of months in the look-ahead return measurement horizon minus one.

Panel A: Value weighted

	3-year forecast			5-year forecast		
	With H-H	Without H-H	Diff.	With H-H	Without H-H	Diff.
Bottom 10%	0.057	0.515	-0.458	0.135	0.425	-0.290
	(0.969)	(0.749)	(0.058)	(0.918)	(0.756)	(0.026)
Top 10%	1.974	1.574	0.400	3.843	3.112	0.731
	(0.128)	(0.251)	(0.006)	(0.008)	(0.053)	(0.010)
Top-Bottom	1.917	1.060	0.858	3.708	2.687	1.021
	(0.002)	(0.068)	(0.001)	(0.011)	(0.077)	(0.001)

Panel B: Equally weighted

	3-year forecast			5-year forecast		
	With H-H	Without H-H	Diff.	With H-H	Without H-H	Diff.
Bottom 10%	-0.034	0.325	-0.359	-0.294	-0.116	-0.178
	(0.978)	(0.813)	(0.053)	(0.827)	(0.938)	(0.378)
Top 10%	2.126	1.710	0.415	4.280	4.032	0.248
	(0.064)	(0.155)	(0.015)	(0.007)	(0.015)	(0.048)
Top-Bottom	2.160	1.386	0.774	4.574	4.148	0.426
	(0.000)	(0.006)	(0.002)	(0.006)	(0.028)	(0.090)

Table A12: Comparison with Cremers and Pareek (2016): Panel regressions for each benchmark (with duration interacted with AS)

This table reports the coefficient estimates and p-values (in parentheses) of panel regressions of future fund performance on fund holding horizon and other explanatory variables. The dependent variable is the 1-year (Panel A), 3-year (Panel B), 5-year (Panel C) four-factor alpha associated with buy-and-hold fund net returns. The style-adjusted H-H measure is used as the metric of fund investment horizon. The other explanatory variables include past-year fund flow, the expense ratio, fund age (in logs), flow volatility, fund size measured as log of total net assets, the CRSP turnover ratio (TR), dummies for high and low Active Share terciles, and interaction between Active Share dummies and the duration measure of Cremers and Pareek (2016). Each column represents a different regression for each benchmark. The fund benchmarks are obtained from $http://www.petajisto.net/data.html$. The benchmarks are the following: Russell 1000 Growth (R1G), Russell 1000 Value (R1V), Russell 2000 (R2), Russell 2000 Growth (R2G), Russell 2000 Value (R2V), Russell Mid Growth (RMG), Russell Mid Value (RMV), S&P 400 (S4), S&P 500 (S5), S&P 500 Growth (S5G). The Russell 1000, Russell 3000, Russell 3000 Growth, Russell 3000 Value, S&P 500 Value, S&P 600, Wilshire 4500, and Wilshire 5000 are excluded due to the low average number of funds in each tercile. The regressions include time fixed effects.

Panel A: Using 1-year four-factor alpha

	RIG	RIV	R2	R2G	R2V	RMG	RMV	S4	S5	S5G
H-H measure	0.04	0.16	0.68	0.54	-0.20	0.35	-0.20	1.30	0.15	0.44
	(0.58)	(0.01)	(0.00)	(0.02)	(0.11)	(0.04)	(0.08)	(0.00)	(0.00)	(0.00)
Fund size	0.17	0.00	0.13	0.04	0.12	0.31	0.19	-0.13	-0.01	0.32
	(0.00)	(0.98)	(0.01)	(0.59)	(0.16)	(0.00)	(0.01)	(0.06)	(0.73)	(0.00)
Expense ratio	-0.79	-1.11	-0.52	-0.28	-0.04	-1.13	-0.92	-0.89	-0.59	0.10
	(0.00)	(0.00)	(0.01)	(0.12)	(0.86)	(0.00)	(0.00)	(0.02)	(0.00)	(0.64)
Age	-0.67	0.15	-0.05	0.84	0.15	-1.69	-0.43	-0.96	-0.26	-1.43
	(0.00)	(0.09)	(0.71)	(0.00)	(0.52)	(0.00)	(0.12)	(0.00)	(0.00)	(0.00)
Flow volatility	-0.28	0.53	2.50	8.30	0.27	7.98	12.53	-7.71	-0.20	-1.71
	(0.85)	(0.59)	(0.11)	(0.00)	(0.91)	(0.00)	(0.00)	(0.01)	(0.84)	(0.31)
Fund flow	0.00	-0.16	0.03	0.03	-0.02	0.22	-0.41	-0.37	0.04	-0.13
	(0.81)	(0.05)	(0.26)	(0.86)	(0.73)	(0.42)	(0.00)	(0.13)	(0.11)	(0.40)
CRSP TR	0.40	-0.03	-0.01	0.74	0.55	0.59	0.12	0.08	0.55	-0.32
	(0.00)	(0.71)	(0.91)	(0.00)	(0.03)	(0.00)	(0.33)	(0.39)	(0.00)	(0.10)
High AS	1.65	-0.02	2.57	-0.18	-2.73	0.44	1.35	-0.03	0.88	0.30
	(0.00)	(0.95)	(0.00)	(0.61)	(0.00)	(0.28)	(0.00)	(0.95)	(0.00)	(0.42)
Low AS	-0.72	0.44	-0.07	-0.35	-2.06	-0.03	-1.28	0.19	-0.16	0.87
	(0.00)	(0.00)	(0.75)	(0.23)	(0.00)	(0.92)	(0.00)	(0.60)	(0.22)	(0.01)
High AS*duration	-0.12	0.11	-0.27	0.09	0.34	-0.04	-0.19	-0.05	0.02	-0.13
	(0.00)	(0.00)	(0.00)	(0.21)	(0.00)	(0.59)	(0.01)	(0.58)	(0.37)	(0.01)
Low AS*duration	0.08	-0.08	-0.04	-0.19	0.14	-0.01	0.07	-0.34	0.02	-0.05
	(0.02)	(0.00)	(0.24)	(0.01)	(0.00)	(0.87)	(0.41)	(0.00)	(0.18)	(0.13)

Panel B: Using 3-year four-factor alpha

	RIG	RIV	R2	R2G	R2V	RMG	RMV	S4	S5	S5G
H-H measure	0.94	0.65	2.20	-0.72	-0.49	1.12	0.69	3.17	0.43	1.34
	(0.00)	(0.00)	(0.00)	(0.03)	(0.06)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)
Fund size	0.80	-0.07	0.76	0.81	1.22	0.19	0.94	0.62	0.19	1.07
	(0.00)	(0.31)	(0.00)	(0.00)	(0.00)	(0.28)	(0.00)	(0.00)	(0.00)	(0.00)
Expense ratio	0.09	-1.32	-0.98	-1.34	0.89	-3.77	-3.09	-2.54	-2.53	-3.38
	(0.78)	(0.00)	(0.02)	(0.00)	(0.04)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Age	-2.98	0.60	0.32	0.57	-0.06	-5.58	-0.44	-5.76	-1.42	-4.41
	(0.00)	(0.00)	(0.24)	(0.33)	(0.94)	(0.00)	(0.37)	(0.00)	(0.00)	(0.00)
Flow volatility	-11.12	-6.33	9.36	18.34	4.96	6.59	-1.27	-5.02	-2.47	-10.48
	(0.00)	(0.04)	(0.00)	(0.00)	(0.31)	(0.12)	(0.77)	(0.57)	(0.26)	(0.02)
Fund flow	0.02	0.43	-0.24	-0.56	0.18	1.61	0.19	-2.15	0.09	-0.66
	(0.60)	(0.03)	(0.00)	(0.13)	(0.04)	(0.00)	(0.48)	(0.00)	(0.12)	(0.06)
CRSP TR	1.45	-0.26	-0.20	1.39	1.10	1.29	1.95	1.25	1.25	-0.07
	(0.00)	(0.26)	(0.43)	(0.00)	(0.07)	(0.00)	(0.00)	(0.00)	(0.00)	(0.85)
High AS	3.89	1.02	4.61	2.58	-9.09	-4.01	2.89	-0.93	1.58	2.47
	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.34)	(0.00)	(0.01)
Low AS	-1.50	-1.08	-2.60	-3.48	-7.29	1.90	-4.38	-0.22	-2.31	0.35
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.74)	(0.00)	(0.54)
High AS*duration	-0.26	0.00	-0.59	-0.12	1.09	0.72	-0.61	0.16	0.37	-0.12
	(0.00)	(0.99)	(0.00)	(0.55)	(0.00)	(0.00)	(0.00)	(0.35)	(0.00)	(0.22)
Low AS*duration	0.02	0.01	-0.06	0.44	0.64	-0.12	0.14	-0.48	0.16	-0.11
	(0.76)	(0.90)	(0.46)	(0.02)	(0.00)	(0.24)	(0.35)	(0.00)	(0.00)	(0.17)

Panel C: Using 5-year four-factor alpha

	RIG	RIV	R2	R2G	R2V	RMG	RMV	S4	S5	S5G
H-H measure	1.52	1.63	3.48	-0.52	-0.40	3.61	1.38	6.30	0.80	1.80
	(0.00)	(0.00)	(0.00)	(0.18)	(0.36)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Fund size	0.51	-0.54	0.87	0.59	1.83	-1.20	1.45	0.69	0.04	1.23
	(0.00)	(0.00)	(0.00)	(0.03)	(0.00)	(0.00)	(0.00)	(0.00)	(0.64)	(0.00)
Expense ratio	-0.58	-2.67	-2.92	-6.91	1.78	-6.61	-3.16	-3.29	-5.28	-6.24
	(0.21)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)
Age	-3.61	1.94	2.57	-0.37	0.75	-4.40	0.50	-9.15	-2.60	-6.26
	(0.00)	(0.00)	(0.00)	(0.60)	(0.42)	(0.00)	(0.58)	(0.00)	(0.00)	(0.00)
Flow volatility	-13.98	-7.65	49.21	16.44	23.98	24.92	-21.92	40.76	0.61	-40.31
	(0.00)	(0.05)	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.87)	(0.00)
Fund flow	0.08	0.93	-1.40	0.60	-0.03	1.12	0.67	-2.73	0.31	0.58
	(0.07)	(0.11)	(0.00)	(0.31)	(0.92)	(0.01)	(0.10)	(0.00)	(0.06)	(0.19)
CRSP TR	2.60	0.71	-1.07	4.51	-1.61	0.16	3.62	2.54	1.25	-0.14
	(0.00)	(0.07)	(0.10)	(0.00)	(0.18)	(0.47)	(0.00)	(0.00)	(0.00)	(0.89)
High AS	5.78	4.29	10.03	-0.34	-12.54	-8.09	0.24	-7.87	3.77	5.55
	(0.00)	(0.00)	(0.00)	(0.74)	(0.00)	(0.00)	(0.88)	(0.00)	(0.00)	(0.00)
Low AS	-3.90	0.12	-4.24	-7.03	-4.45	3.41	-8.95	3.54	-4.85	0.16
	(0.00)	(0.83)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.89)
High AS*duration	-0.21	-0.29	-1.25	1.66	1.48	1.04	-0.30	1.15	0.68	0.10
	(0.18)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.28)	(0.00)	(0.00)	(0.57)
Low AS*duration	0.27	-0.16	0.09	1.22	0.39	-1.04	-0.11	-1.41	0.34	-0.27
	(0.01)	(0.01)	(0.37)	(0.00)	(0.01)	(0.00)	(0.67)	(0.00)	(0.00)	(0.08)

Table A13: Comparison with Cremers and Pareek (2016): Panel regressions for each benchmark (with turnover ratio interacted with AS)

This table reports the coefficient estimates and p-values (in parentheses) of panel regressions of future fund performance on fund holding horizon and other explanatory variables. The dependent variable is the 1-year (Panel A), 3-year (Panel B), 5-year (Panel C) four-factor alpha associated with buy-and-hold fund net returns. The style-adjusted H-H measure is used as the metric of fund investment horizon. The other explanatory variables include past-year fund flow, the expense ratio, fund age (in logs), flow volatility, fund size measured as log of total net assets, the CRSP turnover ratio (TR), dummies for high and low Active Share terciles, and interaction between Active Share dummies and the CRSP turnover ratio. Each column represents a different regression for each benchmark. The fund benchmarks are obtained from $http://www.petajisto.net/data.html$. The benchmarks are the following: Russell 1000 Growth (R1G), Russell 1000 Value (R1V), Russell 2000 (R2), Russell 2000 Growth (R2G), Russell 2000 Value (R2V), Russell Mid Growth (RMG), Russell Mid Value (RMV), S&P 400 (S4), S&P 500 (S5), S&P 500 Growth (S5G). The Russell 1000, Russell 3000, Russell 3000 Growth, Russell 3000 Value, S&P 500 Value, S&P 600, Wilshire 4500, and Wilshire 5000 are excluded due to the low average number of funds in each tercile. The regressions include time fixed effects.

Panel A: Using 1-year four-factor alpha

	RIG	RIV	R2	R2G	R2V	RMG	RMV	S4	S5	S5G
H-H measure	-0.03	0.15	0.55	0.52	0.38	0.28	-0.34	0.86	0.18	0.43
	(0.57)	(0.01)	(0.00)	(0.01)	(0.00)	(0.02)	(0.00)	(0.00)	(0.00)	(0.00)
Fund size	0.19	-0.05	0.10	0.04	0.03	0.27	0.22	-0.11	-0.01	0.33
	(0.00)	(0.23)	(0.03)	(0.60)	(0.71)	(0.00)	(0.00)	(0.08)	(0.76)	(0.00)
Expense ratio	-0.79	-1.16	-0.55	-0.28	-0.33	-1.31	-0.68	-0.76	-0.52	0.04
	(0.00)	(0.00)	(0.01)	(0.17)	(0.20)	(0.00)	(0.03)	(0.04)	(0.00)	(0.81)
Age	-0.69	0.27	-0.12	0.73	0.03	-1.68	-0.50	-1.04	-0.25	-1.39
	(0.00)	(0.00)	(0.38)	(0.00)	(0.91)	(0.00)	(0.05)	(0.00)	(0.00)	(0.00)
Flow volatility	1.12	0.73	5.74	7.34	-1.70	7.50	13.74	-12.46	0.39	0.48
	(0.41)	(0.47)	(0.00)	(0.00)	(0.41)	(0.00)	(0.00)	(0.00)	(0.68)	(0.78)
Fund flow	0.04	0.07	0.09	0.02	0.06	0.24	-0.34	-0.01	0.03	0.01
	(0.07)	(0.00)	(0.00)	(0.00)	(0.19)	(0.41)	(0.01)	(0.03)	(0.14)	(0.05)
CRSP TR	0.20	-0.38	0.33	0.97	-0.70	0.36	0.15	0.31	0.72	1.31
	(0.08)	(0.02)	(0.16)	(0.00)	(0.00)	(0.03)	(0.41)	(0.09)	(0.00)	(0.00)
High AS	0.50	0.38	0.72	0.49	-3.41	-0.19	0.08	1.12	1.25	0.80
	(0.01)	(0.02)	(0.00)	(0.26)	(0.00)	(0.58)	(0.77)	(0.00)	(0.00)	(0.02)
Low AS	-0.25	-0.65	0.09	-0.75	-1.79	-0.47	-0.50	-1.15	0.11	1.66
	(0.13)	(0.00)	(0.69)	(0.03)	(0.00)	(0.08)	(0.02)	(0.00)	(0.27)	(0.00)
High AS*TR	0.64	0.21	0.54	-0.28	4.13	0.37	0.47	-1.41	-0.34	-1.87
	(0.00)	(0.24)	(0.03)	(0.37)	(0.00)	(0.05)	(0.17)	(0.00)	(0.00)	(0.00)
Low AS*TR	-0.10	0.91	-0.54	-0.14	0.77	0.31	-0.47	-0.04	-0.15	-1.65
	(0.40)	(0.00)	(0.02)	(0.54)	(0.01)	(0.09)	(0.02)	(0.86)	(0.06)	(0.00)

Panel B: Using 3-year four-factor alpha

	RIG	RIV	R2	R2G	R2V	RMG	RMV	S4	S5	S5G
H-H measure	0.68	0.62	1.96	-0.47	1.04	1.22	-0.19	2.78	0.75	1.46
	(0.00)	(0.00)	(0.00)	(0.10)	(0.00)	(0.00)	(0.36)	(0.00)	(0.00)	(0.00)
Fund size	0.85	-0.04	0.67	0.62	0.95	0.23	1.05	0.50	0.19	1.09
	(0.00)	(0.52)	(0.00)	(0.00)	(0.00)	(0.17)	(0.00)	(0.00)	(0.00)	(0.00)
Expense ratio	0.06	-1.29	-0.94	-1.56	0.24	-3.74	-1.62	-2.69	-2.29	-3.18
	(0.85)	(0.00)	(0.03)	(0.00)	(0.58)	(0.00)	(0.03)	(0.00)	(0.00)	(0.00)
Age	-2.99	0.63	-0.18	0.96	0.08	-5.53	-0.16	-5.39	-1.24	-4.34
	(0.00)	(0.00)	(0.49)	(0.12)	(0.90)	(0.00)	(0.75)	(0.00)	(0.00)	(0.00)
Flow volatility	-5.43	-2.56	11.51	13.49	-0.28	4.98	2.58	-26.30	-2.61	-4.62
	(0.05)	(0.38)	(0.00)	(0.00)	(0.95)	(0.27)	(0.58)	(0.00)	(0.21)	(0.31)
Fund flow	0.09	0.14	-0.24	-0.02	0.16	1.26	0.44	-0.06	-0.00	-0.14
	(0.11)	(0.00)	(0.00)	(0.09)	(0.04)	(0.00)	(0.10)	(0.00)	(1.00)	(0.00)
CRSP TR	0.57	-1.45	-0.21	0.33	-1.29	-0.04	1.39	1.67	2.23	1.52
	(0.01)	(0.00)	(0.63)	(0.47)	(0.09)	(0.86)	(0.00)	(0.00)	(0.00)	(0.03)
High AS	0.83	0.06	-0.51	-0.50	-6.64	-1.75	-0.52	1.85	5.10	3.51
	(0.04)	(0.85)	(0.19)	(0.55)	(0.00)	(0.00)	(0.33)	(0.01)	(0.00)	(0.00)
Low AS	-2.04	-2.44	-2.51	-3.40	-5.72	-2.05	-3.67	-2.03	-0.49	0.13
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.83)
High AS*TR	1.97	1.46	3.29	2.11	5.21	0.02	0.71	-1.92	-2.29	-2.33
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.95)	(0.21)	(0.00)	(0.00)	(0.01)
Low AS*TR	0.64	2.13	-0.49	0.84	2.42	2.47	0.20	-0.03	-0.82	-0.29
	(0.02)	(0.00)	(0.21)	(0.10)	(0.03)	(0.00)	(0.67)	(0.95)	(0.00)	(0.73)

Panel C: Using 5-year four-factor alpha

	RIG	RIV	R2	R2G	R2V	RMG	RMV	S4	S5	S5G
H-H measure	1.42	1.39	2.72	1.05	1.14	2.96	0.59	5.93	1.41	1.87
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.12)	(0.00)	(0.00)	(0.00)
Fund size	0.58	-0.50	0.83	0.53	1.23	-0.78	1.58	0.54	0.07	1.43
	(0.00)	(0.00)	(0.00)	(0.04)	(0.00)	(0.00)	(0.00)	(0.01)	(0.34)	(0.00)
Expense ratio	-0.55	-2.81	-2.67	-6.69	0.73	-6.16	-1.54	-3.78	-5.39	-5.56
	(0.22)	(0.00)	(0.00)	(0.00)	(0.24)	(0.00)	(0.20)	(0.00)	(0.00)	(0.00)
Age	-3.47	1.89	1.85	0.09	0.96	-4.60	0.67	-7.90	-2.34	-5.79
	(0.00)	(0.00)	(0.00)	(0.90)	(0.28)	(0.00)	(0.45)	(0.00)	(0.00)	(0.00)
Flow volatility	-7.69	1.09	45.72	11.78	18.08	21.86	-22.42	-7.61	2.16	-37.52
	(0.08)	(0.76)	(0.00)	(0.06)	(0.02)	(0.00)	(0.00)	(0.41)	(0.55)	(0.00)
Fund flow	0.16	0.06	-1.20	0.03	-0.07	0.30	1.04	-0.12	0.01	-0.11
	(0.03)	(0.00)	(0.00)	(0.01)	(0.69)	(0.46)	(0.01)	(0.00)	(0.94)	(0.00)
CRSP TR	0.60	-1.64	-4.93	3.67	-10.22	-0.17	4.01	0.14	2.90	4.10
	(0.10)	(0.00)	(0.00)	(0.00)	(0.00)	(0.62)	(0.00)	(0.82)	(0.00)	(0.01)
High AS	1.06	0.37	-2.74	6.87	-11.48	-1.63	-0.41	-0.81	9.85	11.96
	(0.08)	(0.54)	(0.00)	(0.00)	(0.00)	(0.05)	(0.66)	(0.60)	(0.00)	(0.00)
Low AS	-4.08	-3.54	-7.43	-5.93	-11.82	-2.73	-7.51	-6.58	-1.65	0.29
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.81)
High AS*TR	3.80	3.54	9.31	-1.47	10.91	-2.29	-1.09	-1.10	-3.66	-9.31
	(0.00)	(0.00)	(0.00)	(0.08)	(0.00)	(0.00)	(0.26)	(0.30)	(0.00)	(0.00)
Low AS*TR	1.43	4.11	4.43	1.67	14.08	1.64	-1.25	4.10	-1.48	-2.71
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.04)	(0.00)	(0.00)	(0.10)

Table A14: Comparison with Yan and Zhang (2009): Stock portfolios sorted on relative fund holdings (turnover-based)

This table reports buy-and-hold returns, 4-factor alphas, and DGTW adjusted returns for the Q1 and Q5 portfolios and the long-short position that buys the Q5 and shorts the Q1 portfolio. These portfolios are quintiles sorted according to LFH minus SFH, LFH, or SFH, where LFH (SFH) is the percentage of the shares of a stock held by long- (short-) horizon funds.When considering LFH-SFH and LFH, Q5 (Q1) is the portfolio of stocks with relative larger ownership by long-horizon (short-horizon) funds. When considering SFH, Q5 (Q1) is the portfolio of stocks with relative larger ownership by short-horizon (long-horizon) funds. A mutual fund is classified as a short-horizon (long-horizon) fund if it ranks in the bottom (top) tercile based on the inverse of the holdings-based turnover ratio measure. The returns are expressed in percentage and the p-values are summarized in parentheses. The p-values are obtained using the Newey-West (1987) procedure with a lag equal to the total number of months in the look-ahead return measurement horizon minus one.

	LFH-SFH			LFH			SFH		
	Ret	4-F α	DGTW	Ret	4-F α	DGTW	Ret	4-F α	DGTW
1-month									
Q1	1.40	0.32	0.36	1.06	0.05	0.06	0.81	-0.23	-0.17
Q5	0.95	-0.14	-0.03	1.01	-0.09	0.04	1.44	0.36	0.40
Q5-Q1	-0.45	-0.46	-0.38	-0.04	-0.14	-0.03	0.63	0.59	0.57
	(0.02)	(0.00)	(0.00)	(0.73)	(0.21)	(0.68)	(0.00)	(0.00)	(0.00)
1-year									
Q1	14.06	0.85	1.08	13.91	-0.03	0.63	13.57	-0.89	0.48
Q5	14.18	-0.57	0.96	14.13	-0.64	1.05	14.05	0.75	1.12
Q5-Q1	0.13	-1.43	-0.12	0.22	-0.60	0.43	0.47	1.63	0.64
	(0.95)	(0.33)	(0.91)	(0.87)	(0.68)	(0.63)	(0.83)	(0.22)	(0.55)
2-year									
Q1	27.79	0.22	2.20	29.30	0.76	1.86	29.58	1.85	1.74
Q5	30.92	2.61	3.32	30.53	2.25	3.50	27.30	0.46	1.89
Q5-Q1	3.13	2.38	1.12	1.24	1.50	1.64	-2.28	-1.39	0.15
	(0.37)	(0.45)	(0.55)	(0.61)	(0.51)	(0.31)	(0.54)	(0.66)	(0.92)
3-year									
Q1	41.54	-0.18	3.38	44.68	2.52	2.33	46.41	4.67	3.21
Q5	48.04	6.20	5.49	48.19	5.73	6.63	41.12	0.15	3.24
Q5-Q1	6.50	6.39	2.11	3.50	3.22	4.30	-5.29	-4.52	0.04
	(0.14)	(0.14)	(0.34)	(0.27)	(0.38)	(0.06)	(0.33)	(0.44)	(0.99)
4-year									
Q1	56.59	0.01	4.68	60.61	2.22	1.71	64.39	8.33	4.47
Q5	67.86	12.76	8.86	68.62	11.30	11.00	56.81	2.16	5.25
Q5-Q1	11.27	12.75	4.18	8.01	9.07	9.29	-7.57	-6.16	0.78
	(0.09)	(0.03)	(0.21)	(0.03)	(0.00)	(0.00)	(0.37)	(0.40)	(0.83)
5-year									
Q1	77.78	2.84	8.34	81.56	3.65	2.01	87.30	12.80	6.57
Q5	92.48	18.89	13.10	94.12	16.26	16.68	78.88	5.91	9.75
Q5-Q1	14.70	16.05	4.76	12.56	12.61	14.66	-8.42	-6.89	3.18
	(0.14)	(0.03)	(0.40)	(0.00)	(0.00)	(0.00)	(0.48)	(0.43)	(0.61)

Table A15: Informativeness of fund holdings—Fund portfolio performance using H-H measure without style adjustment

Funds are sorted into deciles each month according to a proxy of the H-H measure that is constructed without style adjustment, with D1 consisting of short-horizon funds and D10 consisting of long-horizon funds. This table reports abnormal returns over the next month and next one to five years after portfolio formation. The abnormal returns are the Carhart four-factor alphas, which are computed from buy-and-hold net returns. Portfolio weights are either value- or equal-weighted at the formation month and are then updated following a buy-and-hold strategy. If funds drop out of a decile portfolio during a return measurement horizon, we distribute the value of the disappearing funds to the remaining funds in the decile in proportion to the portfolio values of the remaining funds. The table also reports the alpha spreads between the D10 and D1 portfolios. All alphas are expressed in percentage, and p-values are reported in parentheses. Standard errors are obtained using the Newey-West (1987) procedure with a lag equal to the total number of months in the look-ahead return measurement horizon minus one.

	Value weighted	Equally weighted
1-month		
D1 (short)	-0.11	-0.08
	(0.14)	(0.32)
D10 (long)	0.05	0.03
	(0.25)	(0.44)
D10-D1	0.16	0.11
	(0.01)	(0.06)
1-year		
D1 (short)	-0.86	-0.25
	(0.24)	(0.73)
D10 (long)	0.57	0.72
	(0.14)	(0.15)
D10-D1	1.43	0.97
	(0.03)	(0.12)
2-year		
D1 (short)	-0.89	0.28
	(0.59)	(0.84)
D10 (long)	1.63	1.95
	(0.03)	(0.05)
D10-D1	2.51	1.67
	(0.09)	(0.25)
3-year		
D1 (short)	-0.90	0.18
	(0.68)	(0.93)
D10 (long)	3.41	3.51
	(0.02)	(0.02)
D10-D1	4.31	3.33
	(0.04)	(0.12)
4-year		
D1 (short)	-0.69	0.10
	(0.78)	(0.97)
D10 (long)	5.20	5.04
	(0.01)	(0.00)
D10-D1	5.89	4.94
	(0.03)	(0.11)
5-year		
D1 (short)	-0.51	-0.60
	(0.84)	(0.87)
D10 (long)	6.86	6.87
	(0.01)	(0.00)
D10-D1	7.37	7.46
	(0.02)	(0.08)

Table A16: Informativeness of fund holdings—Fund portfolio performance: Robustness check splitting the sample

Funds are sorted into deciles each month according to the style-adjusted H-H measure, with D1 consisting of short-horizon funds and D10 consisting of long-horizon funds. This table reports buy-and-hold fund portfolio abnormal returns over the next month and next one to five years after portfolio formation. The abnormal returns are the Carhart four-factor alpha computed from net returns. We consider two sample subperiods, the first half of the sample with sorting dates until the end of 2000 and the second half of the sample with sorting dates from January 2001 to December 2015. Portfolio weights are value- or equal-weighted at the formation month and are then updated following a buy-and-hold strategy. If funds drop out of a decile portfolio during a return measurement horizon, we distribute the value of the disappearing funds to the remaining funds in the decile in proportion to the portfolio values of the remaining funds. The table also reports the alpha spreads between the D10 and D1 portfolios. All alphas are expressed in percentage and p-values are summarized in parentheses. Standard errors are obtained using the Newey-West (1987) procedure with a lag equal to the total number of months in the look-ahead return measurement horizon minus one.

	First half of the sample		Second half of the sample	
	Value weighted	Equally weighted	Value weighted	Equally weighted
1-month				
D1 (short)	0.02	0.08	-0.19	-0.17
	(0.81)	(0.43)	(0.00)	(0.00)
D10 (long)	0.11	0.14	0.03	-0.00
	(0.09)	(0.05)	(0.47)	(0.99)
D10-D1	0.09	0.05	0.21	0.17
	(0.24)	(0.40)	(0.00)	(0.00)
1-year				
D1 (short)	0.78	1.66	-1.85	-1.58
	(0.31)	(0.02)	(0.01)	(0.02)
D10 (long)	1.25	1.69	0.35	0.10
	(0.04)	(0.01)	(0.28)	(0.76)
D10-D1	0.47	0.03	2.20	1.69
	(0.49)	(0.96)	(0.00)	(0.00)
2-year				
D1 (short)	2.43	3.64	-2.35	-2.38
	(0.15)	(0.01)	(0.03)	(0.02)
D10 (long)	4.09	4.96	0.88	0.70
	(0.00)	(0.00)	(0.03)	(0.13)
D10-D1	1.65	1.32	3.23	3.08
	(0.19)	(0.29)	(0.00)	(0.00)
3-year				
D1 (short)	2.17	4.01	-2.76	-3.04
	(0.33)	(0.05)	(0.03)	(0.00)
D10 (long)	7.84	7.59	1.89	1.45
	(0.00)	(0.00)	(0.00)	(0.04)
D10-D1	5.67	3.58	4.66	4.48
	(0.00)	(0.06)	(0.00)	(0.00)
4-year				
D1 (short)	1.80	3.29	-2.17	-2.93
	(0.58)	(0.37)	(0.08)	(0.01)
D10 (long)	10.90	9.04	3.10	2.55
	(0.00)	(0.00)	(0.00)	(0.00)
D10-D1	9.10	5.76	5.27	5.47
	(0.00)	(0.06)	(0.00)	(0.00)
5-year				
D1 (short)	-1.26	1.06	-3.00	-3.74
	(0.75)	(0.84)	(0.24)	(0.07)
D10 (long)	14.40	12.77	3.47	2.95
	(0.00)	(0.00)	(0.01)	(0.01)
D10-D1	15.67	11.71	6.47	6.69
	(0.00)	(0.01)	(0.00)	(0.00)

Table A17: Informativeness of fund holdings—Fund portfolio performance: Robustness check using a 6-factor model and Vanguard index funds

Funds are sorted into deciles each month according to the style-adjusted H-H measure, with D1 consisting of short-horizon funds and D10 consisting of long-horizon funds. This table reports buy-and-hold fund portfolio abnormal returns over the next month and next one to five years after portfolio formation. The abnormal returns reported in the first column are alphas using a factor model including the Fama-French (2015) five factors and momentum factor. We also follow Berk and van Binsbergen (2015) and construct a benchmark for each decile-portfolio using the 8 domestic Vanguard index funds (from their Table 1). We follow the procedure described in the Appendix of Berk and van Binsbergen (2015) to construct the benchmarks. The second column reports the average benchmark-adjusted returns over all sorting periods. Portfolio weights are value-weighted at the formation month and are then updated following a buy-and-hold strategy. If funds drop out of a decile portfolio during a return measurement horizon, we distribute the value of the disappearing funds to the remaining funds in the decile in proportion to the portfolio values of the remaining funds. The table also reports the abnormal return spreads between the D10 and D1 portfolios. All returns are expressed in percentage and p-values are summarized in parentheses. Standard errors are obtained using the Newey-West (1987) procedure with a lag equal to the total number of months in the look-ahead return measurement horizon minus one.

	Fama-French 5F+Mom	Vanguard funds
1-month		
D1 (short)	-0.05	-0.09
	(0.43)	(0.02)
D10 (long)	0.03	0.03
	(0.53)	(0.22)
D10-D1	0.08	0.12
	(0.03)	(0.00)
1-year		
D1 (short)	-0.25	-0.65
	(0.69)	(0.14)
D10 (long)	0.14	0.46
	(0.68)	(0.06)
D10-D1	0.38	1.11
	(0.42)	(0.01)
2-year		
D1 (short)	-0.21	0.40
	(0.81)	(0.56)
D10 (long)	1.53	1.96
	(0.01)	(0.00)
D10-D1	1.74	1.56
	(0.05)	(0.03)
3-year		
D1 (short)	0.52	0.02
	(0.68)	(0.99)
D10 (long)	4.15	3.77
	(0.02)	(0.00)
D10-D1	3.64	3.76
	(0.03)	(0.00)
4-year		
D1 (short)	-0.95	-2.09
	(0.52)	(0.24)
D10 (long)	5.68	3.89
	(0.01)	(0.01)
D10-D1	6.63	5.98
	(0.00)	(0.00)
5-year		
D1 (short)	-3.98	-2.04
	(0.02)	(0.35)
D10 (long)	6.96	6.22
	(0.01)	(0.00)
D10-D1	10.94	8.26
	(0.00)	(0.00)

Table A18: Fama-MacBeth regressions of fund performance: Closet indexer sample

This table reports the coefficient estimates and p-values (in parentheses) of Fama-MacBeth (1973) regressions of future fund performance on fund holding horizon and other explanatory variables where we restrict the sample to mutual funds that are closet indexers. A mutual fund is defined as a closet indexer if it is in both the lowest Active Share decile and the lowest tracking error decile; these are the least active funds with the lowest Active Share and tracking error. The dependent variable is the four-factor alpha associated with buy-and-hold fund net returns or buy-and-hold DGTW-adjusted abnormal returns. The look-ahead return measurement horizons are 1 month, 1 year, 3 years, and 5 years. The style-adjusted H-H measure is used as the metric of fund holding horizon. The other explanatory variables include fund size measured as log of total net assets, the expense ratio, fund age in logs, fund flow volatility, past-year fund flow, the CRSP turnover ratio (TR), factor-related return (FRR), and the Active Share of Cremers and Petajisto (2009). We use weighted least square in the first-stage cross-sectional regressions using fund size as weights. Standard errors are calculated using the Newey-West (1987) procedure with a lag equal to the total number of months in the look-ahead return measurement horizon minus one.

	4-F α				DGTW			
	1M	1Y	3Y	5Y	1M	1Y	3Y	5Y
H-H measure	0.00	0.13	-0.20	0.60	0.01	0.42	0.76	0.30
	(0.87)	(0.31)	(0.85)	(0.35)	(0.39)	(0.11)	(0.13)	(0.60)
Fund size	-0.01	-0.04	-0.39	0.47	0.02	0.12	0.28	0.10
	(0.34)	(0.67)	(0.55)	(0.43)	(0.06)	(0.16)	(0.17)	(0.74)
Expense ratio	-0.06	-0.69	2.28	-6.45	0.04	-0.26	-0.95	-1.77
	(0.12)	(0.02)	(0.57)	(0.00)	(0.35)	(0.63)	(0.48)	(0.24)
Age	-0.01	-0.15	1.26	-1.16	0.02	-0.20	-0.51	-0.12
	(0.73)	(0.60)	(0.61)	(0.53)	(0.51)	(0.56)	(0.47)	(0.88)
Flow vol	-0.63	-7.23	-19.82	-25.85	0.06	5.40	14.18	15.57
	(0.15)	(0.23)	(0.23)	(0.18)	(0.92)	(0.21)	(0.13)	(0.26)
Fund flow	0.07	0.92	2.73	2.65	-0.00	-0.55	-1.57	-1.19
	(0.04)	(0.01)	(0.20)	(0.13)	(0.95)	(0.24)	(0.00)	(0.35)
CRSP TR	0.00	0.91	-1.46	0.01	-0.01	0.24	-0.73	-2.67
	(0.87)	(0.06)	(0.45)	(0.99)	(0.79)	(0.46)	(0.14)	(0.01)
FRR	-0.01	-0.24	-0.79	-0.45	-0.01	-0.11	-0.46	-0.44
	(0.37)	(0.02)	(0.01)	(0.20)	(0.21)	(0.34)	(0.10)	(0.42)
Active Share	0.06	2.60	12.35	0.70	0.19	3.07	9.68	16.37
	(0.52)	(0.20)	(0.15)	(0.90)	(0.19)	(0.09)	(0.09)	(0.01)

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