Holding Horizon: A New Measure of Active Investment Management

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ABSTRACT

This paper proposes new holding horizon (HH) measures of active management, and examines the relation between horizon and manager skill. Our HH measures identify, in the cross-section, funds with higher future long-term alphas, while reported turnover identifies, in the time-series, when a particular fund is likely to exhibit a higher alpha in the short run. The superior long-term performance of long-horizon funds is due to their selection of stocks with strong long-run firm fundamentals. Moreover, stocks largely held by long-horizon funds outperform stocks largely held by short-horizon funds by $2.7\% - 3.5\%$ per year, adjusted for risk, over the following five-year period.

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1 Introduction

Are patient investment managers, who hold risky stock positions for an extended period of time, rewarded with superior performance? Both theoretical work and anecdotal evidence suggest that long-term investing is potentially valuable and rewarded.

In a dynamic rational-expectations model (Wang, 1993), where information about dividend growth rates are spread unevenly among investors, and where supply shocks in the stock occur due to noise traders, such heterogenously-informed investors have very different trading strategies. Less-informed investors will trade when they observe price changes in a stock, as they will strongly infer the future growth in dividends (i.e., cashflows) from such price changes. This inference can generate short-term trading strategies that include trend-chasing (momentum), where such investors buy more of a stock that has increased in price, and sell some of a stock that has decreased. Better-informed investors will rely less on temporal price changes and more on their private information about dividend growth rates to make trades.[1] The result is a higher level of short-term trading (turnover) among less-informed investors.[2]

Anecdotally, several equity portfolio managers achieved their fame by implementing strategies that involve holding periods of several years.[3]

It is intuitive that that the holding horizon of stocks by a fund matters, and that different managers tend to pursue different horizon strategies. First, it is clear that fund managers possess differential abilities in identifying and processing information that yields superior returns over different investment periods. Forecasting long-term firm value or cash flows

[1] Better-informed investors will trade, however, to counter the estimation error in less-informed traders' inference of the dividend growth rate. Such trading will tend to be contrarian in nature, and will only occur in response to estimation errors (while less-informed traders will trade on total price movements), so positions will tend to be more stable among informed investors than among uninformed. Uninformed investors will trade in the same direction as price movements each period.

[2] Andrei and Cujean (2017) provide a model where information "percolates" among investors, also resulting in heterogenously informed investors (through a different mechanism). In their model, which emphasizes the dynamics of information flow, investors who become better-informed, through the percolation of information, implement longer-term strategies and trade against those who are lesser-informed–who tend to implement short-term momentum strategies.

[3] For example, Warren Buffett, a student and follower of Benjamin Graham–who is considered to be the father of value investing–is widely known to focus on long-term growth, and to invest in quality firms with good fundamentals. He famously stated that his "favorite holding period is forever." Mario Gabelli, who manages the Gabelli Small Cap Growth fund, held stocks, on average, for 5.5 years, and was awarded a five-star rating from Morningstar. See "TIP SHEET: Gabelli Fund Aims for Big Stakes, Long-Term Investments," *Wall Street Journal*, November 21, 2012.

requires fund managers to generate insights about the future prospects of a firm's major projects, the competitive position of the firm's products, and the strength of the firm's balance sheet. This type of long-term information is likely to diffuse gradually into the market over time, as managers possessing superior long-term fundamental analysis skills are in short supply (e.g., Berk and Green, 2004, and Barras et al., 2010). Second, because mutual fund flows tend to chase recent past returns (e.g., Sirri and Tufano, 1998), committing to long-term positions involves short-term labor-market risk for fund managers. Therefore, we would expect that a manager who truly understands the long-term competitive position of a firm will hold a position in that firm for the long-run, while managers without such skills will tend to exploit short-term information. Past research indicates that much of this short-term information has a temporal effect on stock prices, such as time-varying investor sentiment (Baker and Wurgler, 2006) and the momentum anomaly (Grinblatt et al., 1995).

Although a large literature examines the value added to actively-managed portfolios, its empirical evidence mainly focuses on short-term investing strategies and performance.[4] This short-term focus is consistent with the fact that active mutual fund managers have substantial incentives to concentrate on short-run performance to attract fund flows (e.g., Sirri and Tufano, 1998).

Notably, some prior mutual fund studies that examine the relation between fund turnover—a proxy for trading activeness or the inverse of holding horizon—and fund performance provide conflicting evidence. Some papers (e.g., Carhart, 1997) find a negative relation, while others (e.g., Grinblatt and Titman, 1993; and Wermers, 2000) demonstrate a positive relation. More recently, Pástor et al. (2017) find that time-series variation in turnover at a given fund positively forecasts that fund's future performance. Although this fund turnover-performance relation is closely related to the fund horizon-performance relation, we argue that, being a simple summary statistic about trading activity, (the inverse of) turnover is a flawed and downward biased proxy for fund holding horizon.[5]

[4]The literature on the value of active management is vast. Studies include, inter alia, Grinblatt and Titman (1989, 1993), Daniel et al. (1997), Wermers (2000), Chen et al. (2000), Cohen et al. (2005), Kacperczyk and Seru (2007), Kacperczyk et al. (2005, 2008, 2014), Alexander et al. (2007), Jiang et al. (2007), Cremers and Petajisto (2009), and Baker et al. (2010).

[5]The difference between (the inverse of) the turnover ratio and the portfolio-weighted holding period is driven by Jensen's inequality. As we show in our paper, the more dispersion in the holding period of stocks, across stocks within a fund portfolio, the more downward bias in the inverse of the turnover ratio as a proxy of holding horizon. This bias is less likely to affect the time-series dimension of a fund's changes in turnover level, since individual funds tend to exhibit a persistent level of portfolio dispersion in the horizon over which

Accordingly, as an alternative to reported fund turnover, we propose new holdings-based measures of fund investment horizon, which we call fund "holding horizon" (HH) measures, then use these measures to examine the horizon-managerial skill relation of U.S.-domiciled actively managed equity mutual funds. Using our horizon measures, we identify significant cross-sectional differences in fund manager skills, as opposed to the time-series variations within a fund that are identified by Pástor, et al. (2017) using reported fund turnover. Indeed, we find that fund holding horizon and turnover, although negatively correlated, are quite different variables. They are both persistent over time, especially fund holding horizon, but have only marginal explanatory power for each other.

In this paper, we calculate a fund's holding horizon as the value-weighted average of the holding period of stocks held by the fund, where we calculate the holding period of each stock using different approaches. The first measure, termed the "Simple" horizon measure, calculates stock holding periods from the time a position is first initiated to the time it is completely liquidated. Because this measure uses ex-post holdings—it "looks ahead" to determine holding periods—and cannot be used in real time to predict managerial skills, we also consider an ex-ante measure (termed "Ex-Ante Simple"), which is a modified version of the Simple measure that uses only past holdings information. We note that this ex-ante measure may underestimate the stock holding period, especially during the first few periods after a stock purchase, when a fund manager intends to hold a position for the long run. Nevertheless, it has the advantage of being potentially implemented in real time to assess a particular manager's skill.[6]

To compare the holding horizons of different funds, we account for funds' investment objectives. Funds with different investment objectives typically focus on different pools of stocks, which may involve different "optimal" holding periods, even for the same management company.[7] Following Hunter et al. (2014), we assign the best-fit index of Cremers and Petajisto (2009) to each fund as its benchmark. Hence, we classify a fund as long- or short-

they hold individual stocks. However, and important to our study, this bias greatly affects the cross-section of funds, as different funds have very different average levels of dispersion in the horizon over which they hold individual stocks in their portfolios.

[6]We also implement two measures of fund holding horizon that account for partial changes in a stock position by a fund (rather than the horizon between the initiation and complete liquidation). These two measures, which are explained in detail in a separate Internet Appendix, provide results that are qualitatively similar to those for the Simple and Ex-Ante Simple measures that we discuss in this paper.

[7]Specifically, we find that value funds have a longer investment horizon, on average, than growth funds, and that large-cap funds have a longer investment horizon, on average, than small- and mid-cap funds.

horizon using a style-adjusted fund investment horizon, calculated as that fund's investment horizon, in excess of the average investment horizon of all funds with the same investment style as that fund.

Using our holding horizon measures, we find a wide, cross-sectional dispersion of fund holding horizons. For example, short-horizon funds, on average, hold stocks for 2.02 (1.01) years, according to the Simple (ex-ante Simple) measure, whereas long-horizon funds hold stocks for 7.39 (4.47) years. Furthermore, long-horizon funds have much greater within-fund standard deviation (across their portfolio holdings) of holding horizons than short-horizon funds: 1.83 vs. 0.07 years using the Ex-Ante Simple measure. We also find that long-horizon funds take a much longer time, more than 1.5 years, on average, to either build or decrease their positions in a particular stock, compared with short-horizon funds, which take only a few months. This finding suggests that long-horizon funds possess information that disseminates to the market slowly, which allows them to strategically accumulate or reduce a position.[8] We also find an interesting clientele effect: long-horizon funds tend to attract more long-term investors than short-horizon funds, through raising more capital via share classes with front-end loads.

To study the horizon-managerial skill relation, our paper adopts two approaches: one at the fund level, and the other at the stock level. The fund-level approach directly examines the relation between fund holding horizon and future fund performance. The stock-level approach aggregates the consensus opinion of the value of a stock from long- and short-horizon funds separately, and investigates future performance over various holding periods for stocks preferred by one type of fund over the other. If fund managers optimally exploit their differing information advantage, we conjecture that stocks that reflect the aggregate consensus opinion of long-horizon (short-horizon) funds perform well in the long (short) term. Because funds include some stocks for non-performance purposes, such as limiting their deviations from a benchmark to control tracking error, the stock-level approach based on differential information possessed by long- versus short-horizon funds, helps to remove the effect of non-skill related holdings that are common across these two types of funds. Thus, the stock-level approach is more likely to uncover powerful evidence of the horizon-skill relation than the fund-level approach. Nevertheless, the latter provides a better gauge

[8] This slow accumulation or reduction of equity positions helps long-horizon funds to control their benchmark tracking error, as well as the impact of their trades on stock prices.

of the benefits for mutual fund investors of implementing an investment rule based on our horizon measures.

We find that long-horizon funds exhibit higher long-term risk-adjusted performance than short-horizon funds, even when we control for fund characteristics and other dimensions of active management that, according to prior studies, predict fund performance. Short-horizon funds charge relatively high expense ratios, and earn negative Carhart (1997) four-factor net return alphas. This finding suggests that short-horizon funds, on average, do not have sufficient skills to cover their fees and expenses, and are therefore likely to make fund investors worse off, compared with a low-cost index fund.[9]

When we change our perspective to the stock-level, we find that the stock-holdings, in aggregate, of long-horizon funds are informative about the future long-term abnormal returns of a stock. For instance, depending on which fund horizon measure we use, the risk-adjusted returns of stocks that are largely held by long-horizon funds are $15.9\% - 18.7\%$ over a five-year period; risk-adjusted returns of stocks that are largely held by short-horizon funds are -1.8% to 2.8% over the next five years. The difference between these two groups is roughly $13.5\% - 17.7\%$ over a five-year horizon, or about $2.7\% - 3.5\%$ per year, which is both statistically and economically significant. The superior long-term performance of stocks with large long-horizon fund ownership mainly derives from long-term equity positions, as opposed to short-term positions, held by such funds. In contrast, we find no evidence of short-term abnormal performance of stocks predominantly held by aggregate short-horizon funds.

We further explore the economic sources—firm fundamentals—of stock-selection skills. We measure information shocks to firm fundamentals using four different variables: cash-flow news ($CFnews$), consensus analyst earnings forecast revisions (FRV), earnings-announcement-window returns (EAR), and market-adjusted EAR. We find that stocks mostly held by long-horizon funds are associated with positive and higher long-term $CFnews$, FRV, EAR, and adjusted EAR. This finding indicates that long-horizon fund managers are skillful in analyzing long-term firm fundamentals and, through these skills, achieve superior performance in the long run.

[9]This conclusion depends on whether funds should be rewarded for their tendency to use momentum strategies.

Our paper adds a novel dimension—the measurement of fund holding horizon—to the growing literature examining differential skills of active mutual fund managers. Prior research has uncovered various metrics of fund activities that can add value to managed assets, such as peer tracking records (Cohen et al., 2005), industry concentration and Return Gap (Kacperczyk et al., 2005, 2008), network connections (Cohen et al., 2008), Active Share (Cremers and Petajisto, 2009), and R-squared from benchmark regressions (Amihud and Goyenko, 2013). Importantly, our paper indicates that fund holding horizon has independent predictive power for future risk-adjusted returns, relative to Return Gap, Active Share, and R-squared.

Our paper is also related to prior studies that use 13-F holdings data to characterize institutional investors as either short-term or long-term based on a constructed holdings-based turnover ratio (e.g., Bushee, 2001; Cremers and Pareek, 2011; Gaspar et al., 2005; Yan and Zhang, 2009). Yan and Zhang (2009) show that trading of short-term institutions (instead of long-term) predicts future stock returns. Their conclusion is different from ours for two reasons. First, our more direct horizon measures, compared with turnover, better identify long-term fund skills. Second, portfolio holdings in the 13-F data are aggregated at the fund advisor level, whereas mutual fund holdings we use are reported at the fund level. A good deal of heterogeneity in investment horizons of different funds managed by the same advisor, such as hedge funds and mutual funds, is lost in the aggregated 13-F data.

Finally, Cremers and Pareek (2016) find that investment managers, of both mutual funds and aggregate 13-F institutions, with high Active Share (Cremers and Petajisto, 2009) have better performance if their portfolio-averaged stock holding period is longer. Frazzini et al. (2015) argue that Active Share lacks power in identifying the most skilled managers within a given actively managed fund peer group.[10] We simply note that our holding horizon measures work well in this circumstance and subsume the explanatory power of Active Share in many cases. Moreover, we form stock-level measures of holding horizon that even more effectively reveal differential skills between long-horizon and short-horizon fund managers. We also make the important distinction between turnover ratio and HH measure by showing that they reflect different aspects of active management.

[10]For example, for mutual funds that benchmark against the S&P 500 Value index, Active Share negatively predicts fund alpha.

2 Methodology

This section introduces our new holdings-based measures of investment horizon. It then proceeds to discuss the approaches that we use to examine the relation of investment horizon to manager skills.

2.1 Measures of Holding Horizon

Based on mutual fund holdings, we propose both ex-post and ex-ante holding horizon (HH) measures. These HH measures are calculated as value-weighted holding periods of all stocks held in a fund portfolio, but they differ in how to define the holding horizon of each stock.

The first measure, termed the "Simple" horizon measure, calculates the holding horizon of a stock in a given fund portfolio as the time span with nonzero holdings—the length of time from the initiation of a position to the time that the stock is fully liquidated by the fund. Letting $h^{(1)}_{i,j,t}$ denote, in this measure, the holding horizon of stock i held by fund j at time t,

$$h^{(1)}_{i,j,t} = s - k, \text{ for } k \leq t < s, \tag{1}$$

where the stock is purchased at time k and sold at time s.[11] As long as a manager holds a long position of a stock, we consider her outlook for the stock to be positive. Thus, the holding horizon of stock i stays constant throughout the span with non-zero holdings.

To implement investment horizon measures in real time, we further consider a modified, ex-ante version of the Simple measure, termed the "Ex-Ante Simple" measure, that uses only current and past information. Let θ_j be the date that is five years after the initiation date of fund j. Let $h^{(2)}_{i,j,t}$ denote, in this measure, the holding horizon of stock i held by fund j at time t, then

$$h^{(2)}_{i,j,t} = \begin{cases} t - k, & \text{for } k \leq t \text{ and } t > \theta_j \\ 0, & \text{otherwise,} \end{cases} \tag{2}$$

where the stock is purchased at time k.[12]

[11] As a concrete example—keeping in mind that the ex-post measure "looks ahead" to see when a position is liquidated, consider a fund that today purchases 1,000 shares of General Electric (GE) and purchases another 100 shares in year 1. It sells 300 shares in year 2 and liquidates the position in year 3. In this example, the holding period of GE, today and in year 1 and year 2, is 3 years based on the Simple measure.

[12] We also construct an Ex-Ante Simple measure with a two-year or three-year warm-up period, and all these versions have almost the same correlation with the Simple measure.

This ex-ante measure is likely to underestimate the stock holding period, especially in the first few periods after a purchase of a stock, when a fund manager intends to hold the position for a long time. Nevertheless, an investment rule based on our ex-ante measure instead of our ex-post measure has the advantage that it can be implemented in real time.

These two simple measures do not account for position changes of a stock held in a fund portfolio during the holding period, which may partially be executed to meet investor flows. As robustness check, we also consider another ex-ante and another ex-post measures that allow for the possibility that position changes may also be informative about the intended holding horizon. We find that the sophistication of accounting for position changes in construction horizon measures does not have a material impact: the two ex-post (ex-ante) horizon measures have similar characteristics, and using them as a metric of fund holding horizon produces similar results. To save space, we only discuss the Simple and the Ex-Ante Simple measures and the results based on these two measures in the main body of our paper. Details about the other two measures can be found in a separate Internet Appendix.

After the holding horizons of all stocks held by a fund are calculated, the holding horizon of fund j at time t, denoted by $HH_{j,t}$, is then defined as the value-weighted holding periods of all stocks held in the fund. Specifically,

$$HH_{j,t}^{(m)} = \sum_{i=1}^{M_{j,t}} \omega_{i,j,t} h_{i,j,t}^{(m)}, \quad m = 1, 2 \tag{3}$$

where $M_{j,t}$ is the number of stocks held by fund j at time t, and $\omega_{i,j,t}$ is the portfolio weight of stock i in fund j at time t. $\omega_{i,j,t}$ is computed as the number of shares of stock i held in fund j at time t multiplied by the time-t stock price, then divided by the time-t market value of the equity portfolio of fund j.

To compare the HH of different funds, we further account for fund investment objectives and styles. Funds with different investment objectives and styles typically focus on different pools of stocks. Even if the best stocks are selected from different pools, their optimal holding periods are likely to be different because of differential firm fundamentals and discount rates associated with these different style categories. Therefore, we classify funds as long-horizon or short-horizon based on their style-adjusted HH, or a fund's investment horizon in excess of the average HH of all funds with the same investment style as that fund (see Section 3 for the definition of investment styles).

2.2 Risk Models

We mainly rely on a sorted-portfolio method to study the relation between fund investment horizon and manager skills. After sorting at the end of each month, we calculate buy-and-hold portfolio returns and risk-adjusted abnormal returns over the next n periods, ranging from one month to five years. The portfolios are equally or value weighted in the formation month, then updated through the holding period using a buy-and-hold strategy; this monthly portfolio formation strategy with the resultant overlapping windows improves the statistical power of our tests (e.g., Richardson and Smith, 1991). To calculate standard errors, we apply a Newey-West approach with a lag of $n - 1$ to account for autocorrelation and heterogeneity.

To control for risk exposure, we use the Carhart (1997) four-factor model and the holdings-based characteristics model of Daniel, Grinblatt, Titman, and Wermers (1997; DGTW) and Wermers (2003). The four-factor alphas and DGTW-adjusted returns reflect managerial skills after accounting for risk. As robustness checks, we also take account of risk exposure using two different five-factor models: the Pástor and Stambaugh (2003) liquidity factor in addition to the Carhart four factors, and the De Bondt and Thaler (1985) long-term reversal factor in addition to the Carhart four factors. Our results to follow are robust to all these models used to capture risk.

To obtain four-factor alphas, we follow Fama and French (1993) and the description of data construction from Ken French's web site to construct four factors over a holding horizon of interest. For each component portfolio that is used to construct Carhart's four factors, we calculate a buy-and-hold return over a horizon of interest. Analogous to the construction of the monthly four factor returns, we calculate four factors with different holding horizons ranging from one month to five years. For example, similar to Kamara et al. (2016), HML of horizon n is the average of n-period compounded returns of small value portfolios and big value portfolios, minus the average of n-period compounded returns of small growth portfolios and big growth portfolios. The four-factor alpha is obtained by regressing buy-and-hold portfolio returns on the corresponding Carhart four factors with the same holding horizon. Similarly, to obtain DGTW-adjusted returns over n periods for a portfolio, we compound n-period DGTW benchmark returns (reconstituted every quarter)

for the portfolio,[13] then subtract them from n-period compounded returns of the portfolio.

3 Data and Summary Statistics

Our data for U.S. actively managed equity mutual funds come from the intersection of Thomson Reuters mutual fund holdings database and the Center for Research in Securities Prices (CRSP) mutual fund database. These two databases are linked using MFLINKS from Wharton Research Data Services (WRDS). Thomson Reuters provides information on equity mutual fund holdings of common stocks in a quarterly or semiannual frequency. CRSP provides information on mutual fund net returns, total net assets (TNA), and several fund characteristics such as expense ratio and turnover ratio. The information provided by CRSP is at the share class level. We therefore calculate value-weighted fund net returns and fund characteristics across multiple share classes within a fund using the latest TNA as weights, except that fund age is calculated based on the oldest share class and TNA as the sum of net assets across all share classes belonging to the same fund. For the sample selection, we follow the procedure of Kacperczyk et al. (2008). In particular, we exclude funds that do not invest primarily in equity securities, funds that hold fewer than 10 stocks, and those that, in the previous month, manage assets of less than $5 million. Finally, we exclude index funds using both fund names and the sample of index funds identified by Cremers and Petajisto (2009) and available at www.sfsrfs.org/addenda_viewpaper.php?id=379.

The final sample includes $2,969$ equity funds over the sample period ranging from March of 1980 to December of 2010 due to the data availability in the version of MFLINK used in this paper. All the other data cover the sample period of March of 1980 to December of 2012. Stock returns, prices, and shares outstanding are obtained from CRSP. Accounting data, such as earnings, come from COMPUSTAT. Analyst earnings forecasts come from the Institutional Broker's Estimate System (IBES) summary unadjusted file.

[13] Prior to matching with our mutual fund holdings, we reconstitute DGTW benchmark portfolios every quarter instead of every June to better control for both active and passive style effects. Specifically, we sort, at the end of each quarter, all common stocks into 125 ($5 \times 5 \times 5$) benchmark portfolios using a sequential triple-sorting procedure based on size, book-to-market ratio (BM), and momentum. Size is the market cap at the end of the quarter (using NYSE breakpoints when sorting). BM is computed as the book value of equity for the most recently reported fiscal year divided by the quarter-end market cap (adjusted for the industry-average). Momentum is the twelve-month return ending one-month prior to the quarter-end. The DGTW benchmark return for a stock is the value-weighted return of one of 125 DGTW portfolios to which the stock belongs.

Fund investment styles come from Hunter et al. (2014). They consider nine style categories of funds, according to whether they 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 funds (with benchmark Russell 2000 Value, Russell 2000, or Russell 2000 Growth). This classification of fund investment styles not only keeps a reasonably large number of funds in each category, which reduces noise in calculating the average investment horizon for each style, but also avoids the agency issues caused by the use of misleading self-claimed benchmarks (Sensoy, 2009).

3.1 Summary Statistics

Panel A of Table 1 reports summary statistics for our mutual fund sample. On average, equity mutual funds hold stocks with total net assets of 764 million for a period of approximately 3.5 years in terms of the Simple horizon measure. The average holding periods in terms of the Ex-Ante Simple measure are smaller, since this measures uses only past and current information and, thus, underestimates the intended holding period of the average stock by a particular manager. The average CRSP reported turnover ratio is almost 90%. The holdings-based turnover ratio (see Section 6 for details on the calculation) is lower, as expected, because some funds engage in intraquarter trading that cannot be detected by quarterly or semi-annual holdings disclosures (Puckett and Yan, 2011); these funds may also engage in non-equity position trading, which is not included in the Thomson holdings database. The average fund age is 14.3 years. Due to the entry of a large number of small funds in the most recent decade, the median fund age, at 9.5 years, is much smaller than the average age.

To examine investment preferences of funds, we first calculate value-weighted quintile ranks of stocks in a fund portfolio, where ranks are sorted separately on size, book-to-market ratio, momentum, or illiquidity, as measured by Amihud's (2002) measure, with one being the lowest and five being the highest quintile. Then, we average these quintile ranks across funds and time. Consistent with previous studies (e.g., Falkenstein, 1996, and Chan et al., 2002) equity mutual funds, on average, tend to prefer larger companies, past winners, and more liquid stocks.

Panel B of Table 1 shows that fund HH varies considerably across investment styles. Because equity mutual funds with the same investment style typically focus on a similar subcategory of stocks, it is likely that being in a particular style affects the investment horizon of a given fund. The results in Panel B support this conjecture: large-cap funds hold stocks, on average, longer than mid- and small-cap funds, and value funds hold stocks on average longer than growth funds. The mean and median Simple horizon measures for large-cap and value funds are roughly four years, while those for mid- and small-capitalization funds (excluding the value variants of these sectors) are below three years. It is clear that funds in different investment objective categories routinely hold stocks for different lengths of time. These differences motivate us to adjust a fund's horizon measure for that of the average fund within its style category when analyzing the fund horizon-performance relation.

Panel C of Table 1 presents the average values of fund characteristics and stock characteristics in each fund quintile, where funds are sorted on their style-adjusted Ex-Ante Simple, $HH^{(2)}$, measures.[14] Notice that funds in the shortest, middle, and longest HH quintiles, on average, hold stocks for 1.01, 1.96, 4.47 years, respectively, in terms of the Ex-Ante Simple measure, or for 2.02, 3.49, and 7.39 years, respectively, in terms of the Simple measure. Long-term funds are large and long-established funds with a lower expense ratio. Both types of funds, on average, hold stocks with similar book-to-market ratios and liquidity, although long-term funds prefer mildly less past winners and larger companies.

We also find evidence that long-term funds cater to long-term investors. Since the 1990s, many funds, to cater to different types of investors, offer multiple share classes representing ownership interests in the same portfolio, but using different fee structures. Nanda et al. (2009) suggest that "investors with relatively long investment horizons will prefer the A class with its up-front load and lower annual charges, while those with short and uncertain horizons will prefer the B or C class."[15] Panel C of Table 1 shows that long-term funds have a significantly greater proportion of TNA invested in the A share class than short-term funds (60% vs. 50%).[16] This finding is consistent with the clientele of long-horizon fund investors

[14] We note that Panel C summary statistics for fund quintiles sorted on the other horizon measures are qualitatively similar.

[15] The A class is characterized by high front-end loads and low annual 12b-1 fees. The B and C classes typically have no front-end loads but may charge a contingent deferred sales load upon exit and usually charge higher annual 12b-1 fees.

[16] Given the absence of an identifier for A class, motivated by Nanda et al. (2009), we classify a share class as an A class if it charges a front-end load.

being more patient, since more of them have made a significant (front-end) commitment to holding fund shares for a long period of time.

Panel D of Table 1 reports the correlation matrix of our fund horizon measures, the inverse of CRSP reported turnover, and the inverse of holdings-based turnover. Although there is a high correlation of 0.89 between our horizon measures, the correlations between our measures and the inverse of turnover ratios are much smaller, less than 0.4. These results are consistent with the discussion about the difference between our horizon measures and turnover in Section 6 and imply that our horizon measures and turnover reflect different aspects of active management.

If long-term fund managers are able to exploit information that is reflected in stock prices over the long run, we would expect these managers to slowly accumulate or liquidate a position to both reduce the impact of their trades, and to more easily accommodate these changes through investor flows or through trades of other portfolio securities. To capture these dynamics, we calculate the value-weighted average of the time span of consecutive purchases (sales) of all stocks held in a fund portfolio, in the same way as we calculate fund investment horizon specified in (3) by replacing a stock's holding horizon with a stock's time span of consecutive purchases (sales). The time span of consecutive purchases (sales) of a stock by a fund is defined as the longest time interval that starts with a purchase (sale) of the stock by the fund and ends with another purchase (sale) of the same stock, without a sale (purchase) of the stock in between. Table 2 reports summary statistics of the average time span that long-horizon and short-horizon funds use to accumulate or liquidate a stock position.

Note that long-horizon funds take a much longer time to either increase or decrease their positions than short-horizon funds. Take the Simple horizon measure as an example. Long-horizon funds take almost 19 (23) months, on average, to accumulate (reduce) a position compared with approximately 5 (8) months for short-horizon funds. Some long-horizon funds take roughly three to four years to accumulate or liquidate a position, as shown in the "P90" column! The results for the other horizon measures are qualitatively similar—long-horizon funds routinely accumulate or liquidate much more patiently than short-horizon funds.

3.2 Persistence of Fund Horizon Measures

If fund managers are skillful at exploiting private information that is profitable over different horizons, we would expect that managers intentionally choose long-horizon investments or short-horizon investments accordingly. An interesting question is whether funds have persistent holding horizons. To check this persistence, each month, we sort fund portfolios into deciles according to one of our HH measures, the style-adjusted Simple or Ex-Ante Simple measure. D1 consists of funds with the lowest holding periods within their investment styles, while D10 consists of funds with the highest holding periods. Figure 1 depicts the average style-adjusted fund holding horizons of each decile at the formation period and during the subsequent 20 quarters.

Fund investment horizons exhibit long-term stability. The ranking of the decile portfolios remains identical even in the 20th quarter after the formation period. Take the Simple horizon measure as an example. Fund investment periods in excess of their style average are -2.2, -1.2, -0.37, 0.67, and 3.1 years, on average, for the decile portfolios at the formation period, while these average investment periods become -1.1, -0.67, -0.19, 0.54, and 2.8 years after 20 quarters. Moreover, this remarkably persistent pattern is evident for both ex-post and ex-ante horizon measures. For simplicity, we will use style-adjusted measures without explicitly mentioning "style-adjusted" throughout the rest of the paper. If confusion may arise, we will clearly specify which type of measures are used.

4 Empirical Results on Fund Performance

In this section, we examine the fund horizon-performance relation, using both a sorted fund portfolio approach and Fama-MacBeth regressions that control for fund characteristics, as well as other measures of active fund management that, according to prior studies, predict future fund performance.

4.1 Fund Performance using a Sorted Portfolio Approach

In the sorted fund portfolio approach, each month we group funds into deciles based on one of the fund horizon measures that we have discussed in Section 2.1. For each decile, we then calculate buy-and-hold cumulative fund portfolio returns at a look-ahead horizon of the

next month, and up to the next five years.[17] Portfolio weights are equal or value-weighted at the formation month, then updated following a buy-and-hold strategy. Finally, we average these buy-and-hold returns across all formation quarters for each decile and for each look-ahead holding horizon. We also compute four-factor alphas and DGTW abnormal returns, as described in Section 2.2, for each decile and for each look-ahead holding horizon.

Table 3 summarizes the portfolio performance of fund deciles sorted on the Simple horizon measure on the left and the Ex-Ante Simple measure on the right, with D1 (D10) consisting of short-horizon (long-horizon) funds. We present results for equally-weighted portfolios in Panel A and value-weighted portfolios in Panel B. The four-factor alphas for long-term funds are the highest and always positive and often significant, whereas the alphas for short-term funds are the lowest and are negative or insignificant.[18] The spread portfolio D10-D1 earns a one-month alpha of 0.16% per month (equivalent to 1.92% per year) when $HH^{(1)}$ is used and 0.11% per month (equivalent to 1.32% per year) when $HH^{(2)}$ is used. The results are statistically significant for both measures. When we consider the five-year look-ahead period the results are comparable. Indeed, the spread portfolio earns a five-year alpha of 9.10% (1.82% per year) when $HH^{(1)}$ is used and 9.98% (2% per year) when $HH^{(2)}$ is used. The columns marked as "DGTW" of Table 3 report DGTW-adjusted returns, holdings-based returns in excess of DGTW benchmarks that ignore expenses and transaction costs. Again, we see evidence that long-horizon funds outperform short-horizon funds. DGTW-adjusted returns are higher than the 4-factor net return alphas because they are computed from holdings-based returns before subtracting fees and expenses. Comparing the results using equally-weighted portfolios with value-weighted portfolios, the value-weighted results tend to be more significant. This result is expected given that long-term funds tend to be larger than short-term funds.

Note that the above results regarding the fund horizon-performance relation are weaker when the Ex-Ante Simple measure is used as a metric to sort funds, compared with the

[17] We note that the existent mutual fund literature, with a few exceptions, focuses on predicting short-term performance of up to one year; such studies may miss a significant portion of the longer-term outperformance of long-horizon funds.

[18] In an unreported table, we show that short-horizon funds exhibit much larger three-factor alphas (excluding the momentum factor) than four-factor alphas. Moreover, short-horizon funds experience fund flows that are more sensitive to their past-year performance than long-horizon peers. These results suggest that short-horizon funds are attractive to short-term investors and tend to follow mechanical strategies, such as trend-following investing.

results based on the Simple measure. One possible reason is that the ex-ante measure, by construction, assigns a short holding horizon when a stock position is newly initiated, even if this stock is held for a long period. This can weaken the ability of the ex-ante measure to capture actual fund investment horizons. Nevertheless, in the Fama-MacBeth regressions reported next that control for fund characteristics, the Ex-Ante Simple measure exhibits a significant and positive association with future fund performance.

4.2 Fund Performance using Fama-MacBeth Regressions

To control for the effect of different fund characteristics on fund performance, we run Fama-MacBeth (1973) regressions of future fund performance on fund holding horizon as well as other fund characteristics. Specifically, each month, we run cross-sectional regressions of abnormal buy-and-hold fund returns (measured using either four-factor alphas or DGTW-adjusted returns) on the Ex-Ante Simple fund horizon measure, $HH^{(2)}$, controlling for a list of standard fund characteristics that may be related to performance. These fund characteristics include fund age (measured in logs), fund size (measured by log TNA), fund expense ratio, past-year fund flow (as a fraction of lagged fund TNA), the most recently available CRSP turnover ratio, and a dummy for growth funds.[19] Then, we calculate the time-series means of these first-stage coefficient estimates using the inverse of standard error of the first-stage estimates as weights, following the suggestion of Fama (1998).[20] Since our dependent variables overlap on a monthly frequency, standard errors are calculated using the Newey and West (1987) approach with a lag of the number of holding periods minus one. Table A5 reports estimation results, based on four-factor fund net return alphas in Panel A and DGTW-adjusted returns in Panel B.[21]

Clearly, fund holding horizon is a highly significant predictor of abnormal long-term fund returns: The coefficient estimates on the Ex-Ante Simple measure, $HH^{(2)}$, are statistically significant. Controlling for fund characteristics, a two-standard-deviation increase in $HH^{(2)}$ raises the fund four-factor alpha by about 4.81% (Panel A) and the fund DGTW-adjusted

[19] Grinblatt and Titman (1989) find that growth funds earned positive risk-adjusted returns.

[20] Our results are similar when we use the time-series means of equally weighted first-stage coefficient estimates.

[21] If we replace turnover with inverse turnover (a proxy of fund holding horizon, see Section 6), the results in this section and Section 6 stay similar. Because turnover is widely used in the literature, for simplicity, we present results using turnover instead of inverse turnover.

return by about 3.36% (Panel B) over a five-year period, where the standard deviation of $HH^{(2)}$ is 1.38 years.

Next, we test whether fund holding horizon retains its explanatory power for future fund alphas, after controlling for other metrics of active management proposed by prior studies. These prior "activeness" measures include Active Share (Cremers and Petajisto 2009), R^2 (Amihud and Goyenko, 2013), and Return Gap (Kacperczyk et al., 2008).[22] As shown in columns 5-16 of Table A5, while these other proxies for manager skills predict alphas, as documented in their respective papers,[23] the power of our horizon measure changes only slightly with their inclusion in the models. Thus, fund holding horizon, HH, represents a new dimension of manager skills that cannot be explained by previously discovered proxies of active management. We show further evidence about this in our robustness check section.

5 Empirical Results on Stock Performance

As we discussed before, managers are likely to exploit their differing informational advantage with different horizon focuses. A fund manager who possesses information of long-term profitability of a stock is likely to hold the stock for a long period; a fund manager who has information of short-term gains of a stock is likely to hold the stock for a short time. In this section, we aggregate holdings information about each stock from long-horizon funds and short-horizon funds separately, then study the future performance of stocks that are largely held by one type of funds over the other.

5.1 Informativeness of Fund Holdings

In our stock-level analysis, we first construct a stock-level metric that reflects aggregate holdings information from long-horizon funds relative to short-horizon funds. Specifically, we rank all funds each month into terciles based on their style-adjusted fund investment horizon.

[22] Active Share (AS) is downloaded from Petajisto's web site; R^2 is obtained by running regressions of fund excess returns on the Carhart four factors using a 24-month rolling window; Return Gap is defined, following Kacperczyk et al. (2008), as the monthly difference between the reported fund net return, plus 1/12 the most recent fund expense ratio, and the return of a hypothetical portfolio that invests in the most recently disclosed portfolio holdings.

[23] The coefficient estimates on Return Gap has a wrong sign for the regressions of DGTW abnormal returns (Panel B). Kacperczyk et al. (2008) provide results that Return Gap positively predicts future four-factor alphas with controlling for fund characteristics, but no results for DGTW abnormal returns in regressions.

Funds in the top and bottom terciles are classified as long-horizon funds and short-horizon funds, respectively. We then define long-horizon fund holdings (LFH) and short-horizon fund holdings (SFH) for each stock, similar to Yan and Zhang (2009), as the aggregate holdings of the stock by long-horizon funds and short-horizon funds, respectively, divided by that stock's total number of shares outstanding. Mutual funds often hold stocks for reasons unrelated to their perceived future performance, due to legal restrictions, the requirements of investment objectives and styles, fund flows, etc (Del Guercio, 1996; Brown et al., 1996). If skill-unrelated stock selections for the two groups of funds are overlapped, then LFH minus SFH can remove the common non-performance stock-picking and therefore sharpens the differential information contained in the consensus opinions of long-horizon funds versus short-horizon funds. Thus, we study future stock performance with respect to LFH minus SFH. If fund managers optimize their differing stock selection talents with different horizon focuses, we would expect that stocks with a large (small) value of LFH minus SFH have good *long-term* (*short-term*) performance.

To test this intuition, each month stocks are grouped into deciles according to the relative holdings of long-horizon funds versus short-horizon funds (LFH minus SFH). The top decile (D10) contains stocks that are held, in aggregate, the most by long-horizon funds relative to short-horizon funds; the bottom decile (D1) contains stocks held the most by short-horizon funds. Next, we calculate buy-and-hold portfolio returns for each decile portfolio over the next month, and up to the next five years after portfolio formation. Stocks in each decile are weighted equally at the formation month, then weights are updated over time following a buy-and-hold strategy. If a stock drops out during a buy-and-hold period, we adjust the weights of the existing stocks by dividing each by one minus the weight of the disappearing stock(s). These buy-and-hold portfolio returns are then averaged over all (overlapping) event dates. We also calculate the return spread of the D10-D1 portfolio, which is long D10 and short D1, to examine the outperformance of stocks with large long-horizon fund ownership vs. stocks with predominant short-horizon fund ownership. Figure 2 shows the buy-and-hold portfolio performance of the top and bottom deciles, as well as the D10-D1 portfolio over various holding periods, using either the Simple, ($HH^{(1)}$), or the Ex-Ante Simple, ($HH^{(2)}$), measure as the horizon measure.

The results indicate that stocks with large long-horizon fund ownership offer much higher

long-term returns than stocks held predominantly by short-horizon funds, whereas there is no evidence that stocks largely held by short-horizon funds perform better in the short run. The first column of Figure 2 shows that the buy-and-hold returns for stocks in the top decile (D10) are larger than those in the bottom decile (D1) for all holding periods. Although the returns for both deciles increase with the holding period, the increase is much larger for the top decile. This leads to an increasing pattern of the positive spread for the D10-D1 portfolio (the first column, second and fourth graphs) as the holding period goes longer.

Consider the 5-year performance as an example. As shown in Table 5 under the columns of "Ret", regardless of which fund horizon measure is used, the top decile exhibits an average buy-and-hold return of about 90% or higher, whereas the bottom decile exhibits an average buy-and-hold return of about 75% or lower. The difference ranges from 18.40% to 21.33% for five years, or 3.68% to 4.27% per year, which is statistically and economically significant.

Even after risk adjustment using either Carhart four-factor alphas or DGTW adjusted returns, the long-term outperformance of stocks with large long-horizon fund ownership is still pronounced, and there is still no evidence of stock-picking abilities based on short-horizon fund ownership. Indeed, the last two columns of Figure 2 illustrate that both of the two risk-adjusted returns for the top decile increase with the holding horizon, whereas both of them for the bottom decile are close to zero at all horizons. As a result, the abnormal returns for the D10-D1 portfolio are significantly positive at all horizons, and exhibit an increasing pattern with the holding horizon, as shown in the second and fourth rows.

Take the five-year horizon as an example. Table 5 shows that the four-factor alphas (columns "4-F α") for the top decile portfolio are about 16%, and that DGTW-adjusted returns (columns "DGTW") are about $17\% - 19\%$, for each of the HH measures being used. For the bottom decile portfolio, the four-factor alphas are between -1.8% and 2.8%, and DGTW-adjusted returns are between 2.4% and 2.7%. As a result, the abnormal returns on the D10-D1 portfolio range from 13.5% to 17.7% over five years, or about 2.7% to 3.5% per year, both economically and statistically significant.

The preceding results about the differing informativeness of fund holdings along with the low correlation between LFH and SFH (around 0.1) imply that long- and short-horizon funds generally overweight different groups of stocks. One possibility is that long- and short-horizon funds apply different investment strategies that are implementable to different groups

of stocks, which we will explore further in Section 5.3.

Overall, stocks with large long-horizon fund ownership exhibit superior long-term performance. The results are robust if we use the ex-ante or ex-post fund horizon measures to identify short and long-horizon funds. These findings suggest that the informativeness of long-horizon fund holdings about superior long-term stock performance is not driven by the use of future information in the construction of our fund investment horizon measures.

5.2 Refinement of the Informativeness of Fund Holdings

If long-horizon fund managers are skillful in selecting stocks with superior long-term value, we would expect that they hold those stocks for a long time. Furthermore, if these fund managers discriminate in their holdings of stocks for which they have better information, we would expect that stocks held for a long period would be likely to outperform stocks held for a short time in their portfolios. Similarly, if short-horizon fund managers are skillful at selecting stocks with good short-run returns, we would expect that they trade those stocks quickly. Therefore, stocks held for a short time in a short-horizon fund portfolio are likely to perform well in the short-run. This intuition motivates us to refine the informativeness of fund holdings about picking-skills by distinguishing stocks that are, on average, held for a long or short time in a long- versus short-horizon fund portfolio.

We first define the average holding span of a stock belonging to each type of fund, long-horizon or short-horizon. Letting $h_{i,j,t}$ denote the holding period of stock i held in fund j at time t, the average holding period of stock i held by all long-horizon funds at time t, called *long-horizon fund holding span*, is then defined as

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

where $M_{i,t}^{long}$ is the number of long-horizon funds that hold stock i at time 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 at time t. Similarly, we define the *short-horizon fund holding span* of stock i as

$$hs_{i,t}^{short} = \sum_{j=1}^{M_{i,t}^{short}} \eta_{i,j,t} h_{i,j,t}. \tag{5}$$

Accordingly, we consider four stock portfolios that are constructed as follows. First, we assign stocks into deciles each month based on LFH minus SFH, with D1 (D10) consisting of stocks that are largely held by short-horizon (long-horizon) funds, as we have done in section 5.1. Then, we split stocks in D1 (D10) into two groups: a long-term position group if a stock's short-horizon (long-horizon) fund holding span is above the median value among all stocks belonging to short-horizon (long-horizon) funds, and a short-term position group otherwise. Table 6 presents the performance of these four portfolios in the next month, the next quarter, and the next one to five years after the portfolio formation month using the Ex-Ante Simple measure, $HH^{(2)}$, as the metric of fund investment horizon.

Consistent with our intuition, the long-run outperformance of long-horizon funds stems from their long-term stock positions. Stocks that are held for a long period by long-horizon funds exhibit the best future long-term performance among the four stock groups. For example, at a five-year horizon, this group exhibits a buy-and-hold return of almost 90%, a four-factor alpha of 23.58%, and a DGTW-adjusted return of 17.24%, the highest values among the four groups. All these abnormal returns are statistically and economically significant. This group clearly outperforms stocks with large long-horizon fund ownership (D10) before the split into long-term and short-term positions (see Table 5). Note that the long-term abnormal returns of short-term positions in long-horizon funds are, at times, significantly positive, but they are substantially lower than those of the long-term positions in long-horizon funds. This result indicates that long-horizon managers may sell stocks before they have fully realized their abnormal returns, in order to reallocate their portfolios toward even better stocks.[24] Even with the refinement, there is still no statistically significant evidence of positive short-term risk-adjusted performance for stocks that are held for a short time in short-horizon funds.

5.3 Economic Source of Manager Skills

In this section, we delve into a central issue regarding the economic source of manager skills: firm fundamentals reflected in funds' stock selection. If fund managers take use of corporate fundamental information in picking stocks, then we would expect that long-horizon fund managers are skillful at exploiting information related to long-term firm fundamentals.

[24] Chen et al. (2000) also find evidence of skilled managers selling stocks with positive future abnormal returns.

Therefore, we would expect that the patterns of future cash flows and profitability for stock portfolios sorted on relative fund holdings are analogous to the previously discussed return patterns of these portfolios.

To measure information shocks to firm fundamentals, we use four variables: cash-flow news ($CFnews$), analyst forecast revisions (FRV), earnings-announcement-window returns (EAR), and risk-adjusted EAR.[25] $CFnews$ is the cash-flow component of unexpected quarterly returns and is obtained via a Campbell-Shiller (1988) decomposition. FRV is the consensus EPS forecast for the current fiscal year, minus the three-month lagged consensus EPS forecast for the same fiscal year, divided by the stock price three months ago. EAR is the buy-and-hold return during the [-1, +1] trading-day-window around an earnings announcement date.[26] If earnings are announced during a non-trading day, we treat the next immediate trading day as the announcement date. Adjusted EAR is the EAR minus the buy-and-hold return on the NYSE, AMEX, and Nasdaq market index during the same trading-day-window. To reduce the effect of outliers, all these information variables are cross-sectionally winsorized at the top and bottom 1%. These four variables capture fundamental shocks from different perspectives: $CFnews$ captures revisions of expected future cash flows over an infinite horizon that are reflected in stock returns. FRV reflects changes in earnings expectations for the current fiscal year, presumably due to new information arrival during the quarter. EAR and adjusted EAR measure the magnitude of investors' earnings surprises in terms of stock returns and stock abnormal returns, respectively.

Figure 3 displays cumulative fundamental variables over the next 1 to 20 quarters following the stock portfolio formation date. Specifically, we first sort stocks into deciles according to relative fund holdings, as we did in Section 5.1. We then calculate for each decile the cross-sectional mean of each fundamental variable in the nth quarter after the formation quarter, where $1 \leq n \leq 20$, and we proceed to cumulate these quarterly means over one to 20 quarters. Finally, we compute an average across all portfolio formation dates for each of these cumulated measures.

Regardless of using the Simple or the Ex-Ante Simple measure to define LFH minus SFH

[25] Since EAR is available only at a quarterly frequency, we construct all variables of fundamental shocks at a quarterly frequency, for simplicity. Details about the construction of $CFnews$ are provided in the Appendix.

[26] We also use EAR as the buy-and-hold return during the [-2, +2] trading-day-window around an earnings announcement date. Both definitions of the EAR deliver very similar results in our tests to follow.

to sort stocks, the cash-flow and profitability patterns suggest that the long-run outperformance of stocks with predominant long-horizon fund ownership is associated with superior long-term firm fundamentals. Notice that all four cumulative fundamental variables are positive, and increase with holding periods for stocks that are largely held by long-horizon funds (D10). Untabulated results confirm that these positive cumulative results for D10 are statistically significant. In contrast, cumulative fundamental variables can be negative ($CFnews$), positive (FRV), or close to zero (EAR and adjusted EAR) for stocks with large short-horizon fund ownership (D1). All of these four variables for the D10-D1 portfolio are significantly positive at the horizons of six quarters and longer.

In an untabulated analysis, we further check the patterns based on fundamental-related information that is incorporated in buy-and-hold portfolio returns. Specifically, in a buy-and-hold portfolio approach, we replace returns with the fundamental variables, keeping the same portfolio weights as we calculate buy-and-hold portfolio returns. This calculation can be roughly regarded as the cash-flow component of a buy-and-hold portfolio return. The message is very similar to what we have obtained using the cumulative fundamental variables.

In summary, the patterns of portfolio performance in terms of cash flows and profitability are analogous to the patterns of portfolio returns. Our results indicate that stock selection skills are associated with superior ability in exploiting corporate fundamental-related information. Long-horizon fund managers are able to buy and hold stocks with strong long-term firm fundamentals.

6 Comparison of HH with Portfolio Turnover

To compare our HH measures with prior research on fund trading behavior, we also use (the inverse of) turnover as a proxy of fund holding horizon. Generally, a fund that trades frequently tends to have high turnover and low holding horizon. Reported turnover ratio (available from mutual fund databases or SEC filings) is defined as

$$TR = \frac{min(\$buys, \$sells)}{Average\ TNA}$$

during a fund's fiscal year. To calculate a holdings-based analog to reported turnover, we first compute quarterly turnover as the minimum of stock purchases and sales executed by a fund during a quarter (according to the beginning- and end-of-quarter portfolio disclosures),

divided by the fund's average total net assets during the quarter (Yan and Zhang, 2009). Then, we sum this quarterly churn rate over the past year to arrive at a holdings-based turnover.

Although our HH measures and the inverse of turnover are positively correlated in general, the former effectively captures fund holding periods of actively managed funds, while the latter mainly reflects fund trading activeness.[27] These two types of metrics are equal to each other in a special case in which a fund, such as an index fund,[28] holds its securities for the exact same holding period. Actively managed funds in fact hold various positions for different horizons. For such a fund, these two types of metrics differ primarily for two reasons. First, Jensen's inequality results in the inverse of turnover being a downward-biased measure of the true portfolio-weighted holding horizon. The greater amount of heterogeneity in the holding horizons of securities in a fund portfolio, the more severe is this bias. Second, short holding periods of stocks in a fund portfolio are a key determinant of turnover, while long stock holding periods are a dominant factor determining fund horizon measures. Put differently, a change in the left tail of the stock-holding-period distribution can alter (the inverse of) turnover considerably but shifts HH measures to a much smaller extent, while a change in the right tail of the distribution does the opposite.

Take a simple example in which a fund holds 50% of its managed assets in each of two stocks, with holding horizons (measured in years), h_1 and h_2, respectively. Fund holding horizon, HH, is simply the weighted-average stock holding horizon, $(h_1 + h_2)/2$, while a hypothetical turnover ratio, TR, is calculated as $0.5\frac{1}{h_1} + 0.5\frac{1}{h_2}$, which is a convex function of h_1 and h_2. Consider the following cases:

(1) If $h_1 = h_2 = 1$, then $TR = 1$ and $HH = 1 = \frac{1}{TR}$.

(2) If $h_1 = 1$ and $h_2 = 2$, then $TR = 0.75$ and $HH = 1.5 > \frac{1}{TR} = 1.33$.

(3) If $h_1 = 1$ and $h_2 = 7$, then $TR = 0.57$ and $HH = 4 \gg \frac{1}{TR} = 1.75$.[29]

(4) If $h_1 = 0.1$ and $h_2 = 6.1$, then $TR = 5.082$, $HH = 3.1$, and $\frac{1}{TR} = 0.197$.

From cases (1) to (3), as the extent of heterogeneity in the stock holding periods increases,

[27] We note that reported turnover, however, has the advantage of being able to capture intra-quarter trades.

[28] With the exception of index reconstitutions, buys and sells in an index fund are made of the entire index to meet investor subscriptions or redemptions.

[29] This third case roughly corresponds to the mean and variability in stock holding horizon among funds in the top quintile sorted on style-adjusted Ex-Ante Simple measure. The long-horizon funds in the top quintile, on average, have a mean and standard deviation of stock holding horizon, $h^{(2)}_{i,j,t}$, of 4.47 and 2.52 years, respectively.

the downward bias of inverse turnover becomes more severe due to Jensen's inequality. To illustrate the second reason mentioned above, we compare case (2) with cases (3) and (4). Note that the volatility of stock holding periods in the latter two cases is the same, so the differences in these two cases are not caused by Jensen's inequality. We see that, relative to case (2), both HH and $\frac{1}{TR}$ become larger in case (3) due to an increase in the long stock holding period, but the former measure rises much more than the latter because the former is largely affected by long stock holding periods. In contrast, compared with case (2), the long stock holding period goes up and the short one goes down in case (4), which leads to a large increase in HH but a dramatic decline in $\frac{1}{TR}$ because short stock holding periods play a dominant role in determining TR. Notice that HH and $\frac{1}{TR}$ move in opposite directions: the former suggests that the fund in case (4) has a longer holding horizon than the fund in case (2), while the latter indicates the fund in case (4) trades more actively. Indeed, a small number of long-horizon funds in our sample do exhibit a high level of turnover, indicating that they hold some stocks for a long period and, at the same time, churn other stocks quickly.

In our fund sample, the average fund in the top quintile ranked each quarter on fund-level ex-ante holding horizon, $HH^{(2)}$, has a standard deviation of stock-level ex-ante horizon, $h^{(2)}$, of 2.25 years, while the average in the bottom quintile is 0.66 years. Since the standard deviation of stock horizon is substantially larger for long-horizon funds, the gap between the inverse of turnover and HH for long-horizon funds will be much larger than the gap between those of short-horizon funds. Moreover, long-horizon funds, on average, hold more stocks with long holding periods and have larger weights on those stocks than short-horizon funds. Therefore, the mismeasurement of horizon using inverse turnover (which is largely determined by the left tail of the holding-horizon distribution of stocks in a fund portfolio) will be more severe for long-horizon funds.[30]

Despite the above issues, the turnover ratio of a mutual fund has long been deemed an important metric of fund trading activeness by academic researchers, and is virtually the only statistic that it has been used in the literature to proxy for holding horizon. To further compare HH with turnover, we examine whether HH and the reported fund turnover ratio

[30]Another issue is that turnover is measured over a fiscal year for a fund. This rolling-window approach leads to a potential oscillation of the turnover ratio for funds with a long horizon, with the worst case being an indeterminant holding horizon if no stocks are traded during a given year by a long-horizon investor.

predict each other. Because using either CRSP reported turnover or holdings-based turnover delivers a similar message and the former is widely used in the mutual fund literature, for simplicity, we only report the results involving CRSP turnover.

Table 7 presents the estimation results of panel regressions of the next-year Ex-Ante Simple measure, $HH^{(2)}$ (in the left panel), or next-year CRSP turnover (in the right panel), on current-year $HH^{(2)}$ and CRSP turnover, as well as other fund characteristics. These panel regressions differ in the inclusion of no fixed effect, a fund fixed effect, and a time fixed effect. Because CRSP normally reports turnover at an annual frequency, we use yearly data as of December of each year to run panel regressions. Standard errors are calculated based on two-way clusters by fund and year.[31]

The regression results indicate that fund investment horizon and turnover are quite different variables, though related. First, note that both of the variables are persistent, especially $HH^{(2)}$. Their own lag explains the majority of their variation, although they have a marginal explanatory power for each other. For instance, in regressions with no fixed effect, or with a time fixed effect, a one-standard-deviation increase in Ex-Ante Simple measure (1.43 years) leads to roughly a one-year increase in the next-year $HH^{(2)}$, while a one-standard-deviation increase in turnover (1.2) leads to less than a 0.05-year decrease. Although both variables are less persistent when a fund fixed effect is considered in pooled regressions, the message is similar. Moreover, note that expense ratio has a positive and significant impact on turnover, but not on fund investment horizon.[32] This comparison is consistent with some funds having higher fees being more likely to prefer to exhibit a high level of "activeness" through their turnover ratio to justify their fees.

6.1 Turnover vs. HH as a Predictor of Fund Performance

Prior mutual fund research has examined the relation between fund performance and trading behavior, in terms of turnover, and provides mixed evidence. Using gross returns

[31] In the regressions with fund fixed effects, because explanatory variables include the lagged value of dependent variables, a standard regression method for inclusion of fixed effect is likely to produce inconsistent coefficient estimates. Therefore, we follow Wooldridge (2001, Chap. 11) and adopt the first-differencing method to obtain consistent coefficient estimates based on a pooled 2SLS approach, where instruments are the Ex-Ante Simple measure (turnover) over the past two years, along with other explanatory variables, when next-year horizon measure (turnover) is the dependent variable.

[32] The correlation between expense ratio and fund size do not significantly affect this impact, as we have confirmed in unreported regression results.

based on holdings, Grinblatt and Titman (1993), Chen et al. (2000), and Wermers (2000) show that high-turnover mutual funds have better, or marginally better, stock selection skills than low-turnover funds. Recently, Pástor et al. (2017) find a positive *time-series* turnover-performance relation, demonstrating that mutual funds perform better when they trade more. In contrast, using net returns, Carhart (1997) documents a negative *cross-sectional* association between turnover and net fund performance.

As suggested by previous results, long-horizon funds, being attractive to long-term investors who provide "patient capital," tend to exploit investment opportunities that are profitable over a long period of time. In contrast, short-horizon fund managers tend to exploit short-term oriented investment strategies. If they capture such short-term opportunities, they are likely to trade quickly, which is reflected in temporarily high turnover. Such frequent trading is likely to occur when short-run opportunities are ample in the market (Pástor et al., 2017). If short-term opportunities cannot be frequently found, it is hard for short-horizon funds to sustain their performance. Therefore, we would expect that fund investment horizon reflects intrinsic skills, a feature pronounced across funds; turnover reflects detection of time-varying investment opportunities, a feature pronounced within a fund.

To test this conjecture, we run panel regressions of future fund abnormal returns on current fund investment horizon and turnover, while controlling for fund characteristics. These panel regressions differ in their inclusion of no fixed effects, fund fixed effects, and time fixed effects. Heteroskedasticity-robust standard errors are calculated based on two-way clusters by fund and by month. Table 8 presents the results based on four-factor alphas in Panel A, and on DGTW abnormal returns in Panel B. The regression results are consistent with our conjecture. In the regressions with no fixed effects or with time fixed effects, $HH^{(2)}$ positively predicts future fund performance over horizons of one quarter and longer, while fund turnover plays an insignificant role. Once we add a fund fixed effect to panel regressions, turnover becomes a significant indicator of future one-month fund performance, while the predictive ability of $HH^{(2)}$ is insignificant. This result indicates that turnover reflects time-varying individual fund manager skills in the short term, which is better captured with a fund fixed effect, consistent with Pástor et al. (2017).

The last column of Table 8 provides further evidence that $HH^{(2)}$ best captures cross-sectional fund skills. the coefficient estimates on $HH^{(2)}$ are statistically positive almost

over all look-ahead horizons, whereas the coefficient estimates on turnover are not for both four-factor alphas and DGTW abnormal returns.

7 Additional Analyses and Robustness Tests

In this section, we consider additional tests and robustness checks. To save space, we tabulate the results in a separate Internet Appendix.

7.1 Being a New Dimension of Active Fund Management

To further test whether our fund horizon measures are truly a new proxy for manager skills, we run both Fama-MacBeth and panel regressions of our horizon measures on a list of explanatory variables that we used as control variables in Section 4.2. The explanatory power of these variables combined is, at most, about 36%, suggesting that our fund horizon measures are not simply a proxy for simple fund characteristics or metrics of active fund management uncovered in prior research. This result is also consistent with our evidence that the informativeness of fund investment horizon about managerial skills, remains even after we control for this list of explanatory variables.

7.2 Liquidity

To address the possibility that the outperformance of long-term funds could capture a liquidity premium, we use a five-factor model (Carhart's four factors plus the liquidity risk factor of Pástor and Stambaugh, 2003) to control for risk exposure. Both the fund-level and stock-level five-factor alphas are very similar to the four-factor alphas shown in Table 3 and Table 5, respectively. Hence, our results are not driven by the liquidity premium.[33]

Furthermore, the results of the informativeness of long-horizon fund holdings are actually stronger for liquid than illiquid stocks. Specifically, in each stock decile portfolio sorted on relative fund holdings (LFH minus SFH), as described in Section 5.1, we further divide stocks into two groups according to the Amihud illiquidity measure. We then contrast the performance of liquid stocks versus illiquid stocks, where liquid (illiquid) stocks are securities

[33]Following the delisting adjustment recommended by Beaver et al. (2007), we also verify that our conclusions are not affected by incorporating delisting returns.

with Amihud's illiquidity measure below (above) the median. The risk-adjusted performance of the spread portfolio between stocks with large long-horizon fund ownership and stocks with large short-horizon fund ownership is generally higher for the liquid stock group than for the illiquid one. This finding further substantiates that our conclusions are not driven by long-horizon funds' investment in illiquid stocks. It also means that the strategy of buying liquid stocks with predominant long-term fund ownership and selling liquid stocks with predominant short-term fund ownership can be quite profitable, even after accounting for transaction costs.

7.3 Fund Performance Conditional on Benchmarks

Frazzini et al. (2015) claim that the predictive power of Active Share (AS) is driven by the strong correlation between AS and fund benchmark types. As they argue, AS is higher for funds having certain benchmarks, such as a small-capitalization benchmark; for funds following the same benchmark, AS does not exhibit significant forecasting power. Of course, this could be due to more skilled managers locating in similar areas of the U.S. equity universe, rather than AS simply higher for funds located in less efficient sectors.

Regardless, we confirm this finding using our sample. To test whether our horizon measures suffer a similar benchmark-related "bias," we rank funds into terciles according to the Ex-Ante Simple or Simple measure within each fund benchmark group, using the same benchmark group data as Frazzini et al. (2015) use. We find that the forecasting power of our horizon measures is robust to this conditional sorting; the alphas of the Q3-Q1 portfolio (buy long-horizon funds and sell short-horizon funds within each fund benchmark group) are mostly positive and often statistically significant.

7.4 Comparison with Cremers and Pareek (2016)

Cremers and Pareek (2016) find that, among high active share funds, only those with patient investment strategies outperform. Patient strategies are identified with funds that have either a long investment horizon or a low turnover ratio. They do not address the importance to make a distinction between turnover ratio and a measure of investment horizon obtained from the holdings, as we do in this paper. In this section, we test whether our horizon measure remains significant when we control for Active Share interacted with the

measures of patient strategies used by Cremers and Pareek (2016).

We run panel regressions of future buy-and-hold risk-adjusted returns (4-factor alphas and DGTW-risk adjusted returns) on the Ex-Ante Simple measure and controls which include dummies for high and low Active Share, and an interaction between the Active Share dummies and the measures of patient strategies. We include time and benchmark fixed effects similar to Cremers and Pareek (2016). We find that the Ex-Ante Simple measure remains statistically significant when we control for Cremers and Pareek's measure. Concerning the economic significance, a one standard deviation change in the Ex-Ante Simple measure increases the five-year alpha by 1.65% and the five-year DGTW-adjusted return by 0.96%, whereas one standard deviation change in the high Active Share interaction term increases the five-year alpha by only 0.53% and the five-year DGTW-adjusted return by -0.10%. When we use turnover ratio instead of our horizon measure, the high Active Share interaction term is only significant using a five-year horizon. To address Frazzini et al.'s (2015) critique in Panel B we also include style fixed effects. With this additional fixed effect the significance of Cremers and Pareek's measure goes away whereas our horizon measure remains significant using a long look-ahead period (three and five years horizons).

7.5 Comparison with Yan and Zhang (2009)

Based on 13-F institutional holdings data aggregated at the fund advisor level, Yan and Zhang (2009) show that both the level and the change in short-term institutional ownership are significant predictors of future stock returns, while there is no evidence of a similar result for long-term institutional ownership. Following Yan and Zhang, we use quintile portfolios and the holdings-based turnover ratio to classify a fund in our mutual fund sample as long- or short-term. We confirm their result at a horizon of one month, but their result is reversed at a horizon of more than a year.

The conclusions of Yan and Zhang (2009) are different from ours for a few reasons. First, as discussed in Section 6, our more direct measures of fund investment horizon, compared with turnover, facilitate the detection of long-term investing skills. Second, a good deal of heterogeneity in the investment horizon of different funds managed by the same advisor is lost in the 13-F data; in fact, many advisors manage pensions, other types of accounts, and even index funds, all of which are aggregated in 13-F data. Finally, Yan and Zhang treat,

homogeneously, different types of institutional advisors, such as those that advise pension funds, insurance companies, hedge funds, and mutual funds. A fund with a relatively long holding horizon within a mutual fund group is likely to be classified as short-term relative to a typical pension fund.

Even in our mutual fund sample, our horizon measures constructed based on portfolio holdings aggregated at the fund family level is much less informative about long-term fund skills than those constructed at the fund level, even though funds in the same family are likely to rely on similar in-house analysis that can lead to similar investment horizons across funds. To compare the effects of investment horizon at both the fund and the family levels on future fund performance, in an untabulated analysis we include in the Fama-MacBeth regressions the Ex-Ante Simple horizon measure at the both levels, in addition to the fund characteristics that we included in Section 4.2. The horizon measure at the fund family level is constructed using holdings data aggregated at the family level, where fund family information comes from Thomson Reuters mutual fund holdings database. In these regressions, for the five-year horizon the impact of investment horizon at fund level is far larger than that at the fund family level: the coefficient on the family-level investment horizon is very small. Moreover, there is only a slight decrease in the positive coefficients on the fund-level measure after adding the family-level measure.

7.6 Other Tests

We also apply the Jegadeesh and Titman (1993) approach to test portfolio abnormal returns. Specifically, each month we sort stocks on relative fund holdings information into deciles, as we did before, and holds these decile portfolios for n months. Returns of each decile portfolio are equally weighted. This approach holds a series of portfolios that are selected in the current month as well as in the previous $n-1$ months, where n is the holding period. That is, it closes out the old position initiated in month $t-n$, initiates new positions in month t, and carries over the rest from the previous month. We then run regressions of these monthly portfolio returns to get Carhart four-factor alphas. Again, all of these results confirm that stocks mostly held by long-horizon funds outperform stocks mostly held by short-horizon funds.

Survivorship bias is likely to be a concern if it affects long-term funds and short-term

funds differently. We first check the surviving rate of long- and short-horizon funds. For instance, when the Ex-Ante Simple measure is used to group funds into quintiles, on average 77.29% (83.25%) of the short-term funds in Q1 survive after five (three) years, while this rate becomes 85.15% (89.55%) for long-term funds in Q5. One explanation for the relatively low survival rate of short-term funds is that some funds may exist for a short period due to their poor performance. It seems that, survivorship bias may affect short-term funds a bit more than long-term funds. To address this concern, we redo our analysis based on a subset of funds that have been in the sample for at least five years, and results are similar.

8 Conclusions

Using newly proposed direct measures of fund holding horizon, this paper finds a positive fund horizon-managerial skill relation. Our holding horizon measures identify, in the cross-section, funds with better long-term alphas, while reported turnover identifies, in the time-series, when a particular fund is likely to exhibit a higher alpha in the short-term. Key to the efficacy of our HH measures is that skilled managers hold different stocks for very different horizons, while simple portfolio turnover ratio tends to mask this holdings heterogeneity at the fund level. In addition, we show that stock-holdings, in aggregate, of long-horizon funds provide valuable information about the long-term superior abnormal returns of a stock. The superior performance stems from long-horizon fund managers possessing private information about superior long-term firm fundamentals. Our findings lend support to both the work of Wang (1993) and the anecdotal evidence of the success of fund managers with long-term focus.

Our fund investment horizon measures can help investors to better identify long- or short-term funds. The finding of the superior long-term performance of long-horizon mutual funds critically depends on the use of our more direct measures than what was previously used in the institutional investors literature. There is empirical evidence that individual investors have long rebalancing horizons. Ameriks and Zeldes (2004) find that, for a sample of defined contribution retirement plan participants, 47% (21%) made no changes (one change) to their allocation of contributions over a ten-year period. Similar results are found for 401(k) plans by Mitchell et al. (2006). For those individual investors with long rebalancing horizons, our analysis suggests that they are better off selecting long- rather than short-horizon mutual

funds.

Our evidence that some mutual funds implement and succeed in long-term investment strategies by exploiting fundamental-related information contributes to the debate regarding the excessive short-term focus of institutional investors (Porter 1992), as well as the undesirable consequences induced by short-termism, such as stock price fluctuations during turmoil periods (Cella et al., 2013) and distorted corporate decisions (Bushee, 1998; Gaspar et al., 2005). Although such short-termism is a characteristic of a distinct subset of funds, we find that a subset of other funds shows more patience in their investments, and are rewarded for doing so. Moreover, our evidence implies that long-term mutual funds incorporate their private information about fundamentals, though slowly, into stock prices, which reduces concerns that institutions over-rely on short-term information and increase the high-frequency volatility of stock prices (Bushee 2001).

Appendix: Construction of Cash-Flow News ($CFnews$)

This measure considers changing expectations of the sum of discounted cash flows of a firm over all future periods. It is constructed using Institutional Brokers Estimate System (IBES) summary unadjusted file. Specifically, we keep consensus earnings forecasts for the current and subsequent fiscal year ($FE1_t$, $FE2_t$), along with its long-term growth forecast (LTG_t). The earnings forecasts are denominated in dollars per share, and t denotes when a forecast is employed. The long-term growth forecast represents an annualized percentage growth rate and pertains to the next three to five years.

Similar to Frankel and Lee (1998), Pástor et al. (2008), Da and Warachka (2009), Da et al. (2012), and Balduzzi and Lan (2013), we use a three-stage model to construct cash flow news by taking advantage of multiple earnings forecasts for different maturities. Let $X_{t,t+j}$ denote the time-t expectations of future earnings at $t+j$. In the first stage, expected earnings are computed directly using analyst forecasts as follows:

$$X_{t,t+1} = FE1_t, \quad X_{t,t+2} = FE2_t, \tag{A.1}$$

$$X_{t,t+j} = X_{t,t+j-1}(1 + LTG_t), \quad j = 3, 4, 5. \tag{A.2}$$

In the second stage, expected earnings are assumed to converge to an economy wide steady-state growth rate g_t from year six to year 10. Specifically,

$$X_{t,t+j+1} = X_{t,t+j}[1 + LTG_t + \frac{j-4}{5}(g_t - LTG_t)], \text{ for } j = 5, \ldots, 9. \tag{A.3}$$

The steady-state growth rate g_t is the cross-sectional average of LTG_t.

Following Da and Warachka (2009), Da et al.(2012), and Balduzzi and Lan (2013), we assume the cash-flow payout is equal to a fixed portion (Ψ) of the ending-period book value. Under this assumption, the clean surplus accounting identity implies that the evolution of expected book value is $B_{t,t+j+1} = (B_{t,t+j} + X_{t,t+j+1})(1-\Psi)$. The parameter Ψ is set to 5% since this percentage is close to the average payout rate for the firms in our sample.

In the third stage, expected earnings growth converges to g_t, which implies expected accounting returns converge to $\frac{g_t}{1-\Psi}$ beyond year 10. The expected log accounting returns $e_{t,t+j}$ is estimated at time t as:

$$e_{t,t+1+j} = \begin{cases} \log(1 + \frac{X_{t,t+1+j}}{B_{t,t+j}}) & \text{for } 0 \le j \le 9 \\ \log(1 + \frac{g_t}{1-\Psi}) & \text{for } j \ge 10 \end{cases} \tag{A.4}$$

The three-stage growth model implies expected future cash flows:

$$E_t \sum_{j=0}^{\infty} \rho^j e_{t+1+j} = \sum_{j=0}^{9} \rho^j e_{t,t+1+j} + \frac{\rho^{10}}{1-\rho} \log(1 + \frac{g_t}{1-\Psi}), \tag{A.5}$$

where ρ results from the log-linear approximation (Campbell and Shiller, 1988) and equals 0.96 in our sample. Vuolteenaho (2002) shows that the cash-flow news are the difference between cash-flow expectations over consecutive months:

$$CFnews_{t+1} = E_{t+1} \sum_{j=0}^{\infty} \rho^j e_{t+1+j} - E_t \sum_{j=0}^{\infty} \rho^j e_{t+1+j} \tag{A.6}$$

where $CFnews_t$ denotes cash-flow news at month t.

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Table 1: Summary statistics

This table reports summary statistics of fund investment horizon, including the Simple and the Ex-Ante Simple horizon measures, and fund turnover ratios, including CRSP turnover and holdings-based turnover, for U.S. domestic equity mutual funds over the period of March 1980 to December 2010. These fund variables are described in Section 2. Style-adjusted fund investment horizon is calculated as a fund's investment horizon in excess of the average investment horizon of its peers with the same investment style. Investment style data come from Hunter et al. (2014), including Russell 1000 (R1), Russell 1000 Growth (R1G), Russell 1000 Value (R1V), Russell Midcap (RM), Russell Midcap Growth (RMG), Russell Midcap Value (RMV), Russell 2000 (R2), Russell 2000 Growth (R2G), and Russell 2000 Value (R2V). The size, book-to-market, momentum, and Amihud (2002) measure ranks are the average quintile ranks, with 1 being the lowest and 5 being the highest quintile. The stock assignments for size, book-to-market, and momentum quintiles were obtained from Russ Wermers's web site at http://www.smith.umd.edu/faculty/rwermers/ftpsite/Dgtw/coverpage.html. The proportion of TNA in A class is computed only for funds that have an A class, where A Class is identified in the sample as the share class that charges a front-end load. Cash position is the percentage of total net assets held in cash. Panel A reports statistics for the full sample, Panel B presents the mean, median, and standard deviation of the Simple and Ex-Ante Simple horizon measures for each fund investment style, and Panel C summarizes statistics for each quintile portfolio that is sorted on the style-adjusted Ex-Ante Simple horizon measure, with Q1 (Q5) consisting of funds with the shortest (longest) investment horizons. The last column of Panel C presents the difference of statistics between Q5 and Q1, with ** and *** representing significance at the 5% and 1% confidence intervals, respectively. Panel D reports the correlation matrix of style-adjusted fund horizon measures (the Simple and Ex-Ante Simple measures) and the inverse of two fund turnover ratios (CRSP TR and Holdings TR).

Panel A: The full sample

	Mean	Median	SDEV
TNA (millions)	764.50	131.74	2750.01
Expense ratio (%)	1.19	1.14	0.77
Fund age (years)	14.34	9.49	14.12
Simple measure (years)	3.48	2.95	2.18
Style-adjusted Simple measure (years)	-0.00	-0.45	2.07
FIFO measure (years)	2.49	2.08	1.54
Ex-Ante Simple measure (years)	2.31	1.99	1.38
Style-adjusted Ex-Ante Simple measure (years)	0.00	-0.27	1.32
Duration measure (years)	1.16	1.10	0.45
CRSP fund turnover (%)	89.53	65.33	107.46
Holdings-based fund turnover (%)	63.88	53.85	47.47
Size rank	3.97	4.30	0.93
Book-to-market rank	2.69	2.69	0.54
Momentum rank	3.24	3.22	0.57
Amihud measure rank	1.29	1.12	0.40

Panel B: Fund investment horizon conditional on styles

	Simple			Ex-Ante Simple		
Investment styles	Mean	Median	SDEV	Mean	Median	SDEV
R1	4.36	3.88	2.37	2.71	2.40	1.49
R1G	3.64	3.14	2.16	2.34	2.05	1.34
R1V	4.18	3.84	2.21	2.62	2.40	1.37
RM	2.75	2.43	1.35	1.81	1.68	0.79
RMG	2.68	2.31	1.56	1.69	1.46	0.93
RMV	3.52	3.07	2.12	2.31	2.07	1.27
R2	2.71	2.48	1.31	1.73	1.58	0.87
R2G	2.58	2.30	1.39	1.66	1.51	0.80
R2V	3.55	3.14	2.02	2.29	2.05	1.21

Panel C: Sorting based on the style-adjusted Ex-Ante Simple measure

	Q1 (short)	Q2	Q3	Q4	Q5 (long)	Q5-Q1
TNA (millions)	785.26	875.99	1166.22	1468.57	2402.16	1616.91***
Expense ratio (%)	1.32	1.29	1.26	1.18	1.05	-0.27***
Fund age (years)	19.88	19.34	19.37	20.51	24.67	4.79***
Simple measure (years)	2.02	2.71	3.49	4.74	7.39	5.37***
Ex-Ante Simple measure (years)	1.01	1.47	1.96	2.71	4.47	3.46***
Style-adjusted Ex-Ante Simple measure (years)	-1.43	-0.78	-0.27	0.42	2.09	3.52***
CRSP fund turnover (%)	146.76	108.03	79.75	55.34	31.22	-115.54***
Cash allocation (%)	5.58	5.89	5.83	6.52	6.03	0.45
Size rank	4.11	3.99	4.00	4.06	4.22	0.11***
Book-to-market rank	2.74	2.66	2.64	2.67	2.73	-0.01**
Momentum rank	3.35	3.36	3.28	3.15	3.03	-0.31***
Amihud measure rank	1.19	1.24	1.25	1.25	1.23	0.04***
Proportion of TNA in class A	0.50	0.45	0.53	0.58	0.60	0.10***

Panel D: Correlations of fund horizon measures and the inverse of fund turnover

	Simple	Ex-Ante Simple	1/CRSP TR	1/Holdings TR
Simple	1.00	0.89	0.37	0.30
Ex-ante simple	0.89	1.00	0.39	0.33
1/CRSP TR	0.37	0.39	1.00	0.37
1/Holdings TR	0.30	0.33	0.37	1.00

Table 2: Consecutive trade periods

This table reports summary statistics for long- and short-horizon funds separately of the number of months that a fund on average takes to consecutively purchase or consecutively sell a stock position. Specifically, we calculate the value-weighted average of the time span of consecutive purchases (sales) of each stock held in a fund portfolio. The time span of consecutive purchases (sales) of a given stock by a fund is the longest time interval that must start with a purchase (sale) of the stock by the fund and end with another purchase (sale) of the same stock, without a sale (purchase) of the stock in between. The Simple and Ex-Ante Simple measures are the style-adjusted fund horizon measures described in Section 2, and used to sort funds into terciles. Funds in the top and bottom terciles are classified as long-horizon and short-horizon, respectively.

	Mean	SDEV	P10	P90	Mean	SDEV	P10	P90
Simple	Short-horizon funds				Long-horizon funds			
Buy	4.73	4.17	0.73	10.17	18.86	17.84	3.38	38.81
Sell	8.24	5.86	2.24	15.41	22.93	20.24	4.79	47.29
Ex-Ante Simple	Short-horizon funds				Long-horizon funds			
Buy	5.39	5.07	0.95	11.40	19.12	20.21	2.80	42.13
Sell	10.09	7.62	3.01	18.56	25.34	21.98	5.69	52.25

Table 3: Informativeness of fund holdings—Fund portfolio performance

Funds are sorted into deciles each month according to the style-adjusted Simple or Ex-ante Simple fund horizon measures, with D1 consisting of short-horizon funds and D10 consisting of long-horizon funds. This table reports buy-and-hold fund portfolio net returns and abnormal returns over the next month, next quarter, and next one to five years after portfolio formation. The abnormal returns are the Carhart four-factor alpha, which are computed from buy-and-hold net returns, and DGTW-adjusted returns, which are computed from holdings-based returns. In Panel A (B) portfolio weights are equal (value-weighted) at the formation month and then are updated following a buy-and-hold strategy. The table also reports the return spreads between the D10 and D1 portfolios. All returns are expressed in percentage. *, **, and *** represent significance for abnormal returns and return 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 holding period minus one.

Panel A: Using equally-weighted portfolios

	Simple ($HH^{(1)}$)			Ex-Ante Simple ($HH^{(2)}$)		
	Net ret	Net 4-F α	DGTW	Net ret	Net 4-F α	DGTW
1-month						
D1 (short)	0.83***	-0.11**	-0.06	0.81***	-0.11**	0.01
D2	0.80***	-0.13**	-0.03	0.83***	-0.10*	0.01
D3	0.82***	-0.11**	-0.01	0.84***	-0.10*	0.02
D4	0.87***	-0.08	-0.00	0.89***	-0.05	0.03
D5	0.88***	-0.07	-0.01	0.84***	-0.08*	0.02
D6	0.87***	-0.06	0.02	0.88***	-0.04	0.01
D7	0.88***	-0.03	0.03	0.86***	-0.06	-0.03
D8	0.90***	0.00	0.06**	0.84***	-0.04	0.01
D9	0.88***	-0.01	0.07**	0.83***	-0.06	0.03
D10 (long)	0.93***	0.05	0.08***	0.87***	0.00	0.05*
D10-D1	0.10	0.16***	0.14***	0.06	0.11**	0.04
1-quarter						
D1 (short)	2.59***	-0.21	-0.14	2.55***	-0.22*	0.03
D2	2.56***	-0.27*	-0.09	2.56***	-0.25*	0.01
D3	2.52***	-0.29**	-0.01	2.64***	-0.18	0.07
D4	2.70***	-0.13	0.02	2.70***	-0.12	0.13
D5	2.69***	-0.15	-0.06	2.64***	-0.12	0.06
D6	2.67***	-0.09	0.04	2.67***	-0.08	0.05
D7	2.70***	-0.05	0.12	2.61***	-0.11	-0.05
D8	2.73***	0.05	0.18***	2.58***	-0.06	0.07
D9	2.68***	0.04	0.19***	2.59***	-0.06	0.10
D10 (long)	2.84***	0.26**	0.25***	2.65***	0.06	0.15*
D10-D1	0.25	0.46***	0.39***	0.10	0.29***	0.10
1-year						
D1 (short)	11.16***	0.39	-0.14	10.45***	-0.44	0.04
D2	10.92***	0.09	-0.38	10.61***	-0.45	0.01
D3	10.68***	-0.29	0.04	11.02***	-0.02	0.39
D4	10.94***	-0.25	-0.04	11.11***	0.10	0.20
D5	10.63***	-0.44	-0.36	10.98***	-0.08	0.18
D6	10.85***	0.02	0.07	10.63***	-0.22	0.12
D7	10.98***	0.22	0.65	10.49***	-0.22	-0.39
D8	11.08***	0.46	0.60	10.37***	-0.21	0.06
D9	10.89***	0.18	0.70*	10.74***	0.08	0.42
D10 (long)	11.77***	1.29*	1.10**	10.89***	0.37	0.67
D10-D1	0.60	0.90	1.23***	0.44	0.80	0.63
2-year						
D1 (short)	21.93***	0.34	-0.24	20.61***	-0.98	-0.09
D2	22.61***	1.03	-0.42	21.17***	-0.75	-0.04
D3	21.51***	-0.33	-0.07	21.75***	-0.06	0.64
D4	21.73***	-0.54	-0.30	22.50***	0.22	0.54
D5	20.90***	-1.13	-0.92	21.74***	-0.40	0.27
D6	21.72***	-0.19	0.03	21.28***	-0.35	0.15
D7	21.90***	0.55	1.04	20.82***	-0.96	-0.83
D8	21.84***	0.28	0.97	20.77***	-0.25	-0.24
D9	21.79***	0.25	1.29	21.31***	-0.01	0.65
D10 (long)	23.58***	2.61**	2.36**	21.93***	1.04	1.39
D10-D1	1.65	2.27	2.60***	1.32	2.02*	1.51**
3-year						
D1 (short)	33.97***	0.04	-0.65	31.79***	-2.11*	-0.20
D2	35.27***	1.56	-0.55	32.59***	-1.51	-0.45
D3	33.48***	-0.42	-0.38	33.56***	-0.39	0.76
D4	33.35***	-1.27	-0.73	34.57***	0.05	0.57
D5	32.14***	-2.03*	-1.37	33.41***	-0.61	0.11
D6	33.78***	0.04	0.03	32.66***	-0.79	0.02
D7	33.64***	0.51	1.28	32.81***	-0.45	-0.98
D8	33.17***	0.41	0.90	32.16***	0.10	-0.49
D9	33.47***	0.48	1.91	32.60***	-0.28	0.51
D10 (long)	36.22***	3.95**	3.70**	33.99***	1.80	2.55*
D10-D1	2.25	3.91*	4.35***	2.20	3.91***	2.83***
4-year						
D1 (short)	44.80***	-0.50	-1.04	41.41***	-3.53***	-1.02
D2	46.13***	1.95	-0.61	43.23***	-1.61	-0.43
D3	43.61***	-0.02	-0.37	43.65***	-0.92	0.91
D4	44.34***	-1.24	-0.51	46.20***	0.20	1.01
D5	43.11***	-1.24	-1.11	44.39***	-0.42	0.71
D6	44.60***	0.41	0.19	43.87***	-0.30	0.26
D7	44.22***	0.57	1.84	43.51***	-0.06	-0.83
D8	43.86***	1.28	1.34	42.73***	0.43	-0.54
D9	44.27***	1.47	3.03	43.41***	0.11	1.67
D10 (long)	48.27***	5.99**	5.46**	45.30***	3.21*	4.06*
D10-D1	3.47	6.50**	6.51***	3.88	6.74***	5.16***
5-year						
D1 (short)	59.15***	-1.28	-0.27	55.11***	-5.20***	-0.50
D2	59.55***	1.60	-0.37	57.46***	-1.41	0.61
D3	57.03***	0.17	0.43	57.31***	-1.87**	1.99
D4	58.87***	-0.74	0.40	60.46***	-0.19	2.47
D5	57.21***	-0.81	-0.35	59.15***	-0.17	2.10
D6	58.24***	0.31	1.11	57.17***	-0.54	1.06
D7	57.57***	0.76	2.76	57.33***	-0.05	0.11
D8	57.25***	1.79	2.04	55.74***	0.55	0.36
D9	58.80***	2.79	5.25*	57.96***	-0.03	4.18
D10 (long)	63.26***	7.83**	8.03**	60.12***	4.78*	7.06**
D10-D1	4.11	9.10***	8.30***	5.01	9.98***	7.57***

Panel B: Using value-weighted portfolios

	Simple ($HH^{(1)}$)			Ex-Ante Simple ($HH^{(2)}$)		
	Net ret	Net 4-F α	DGTW	Net ret	Net 4-F α	DGTW
1-month						
D1 (short)	0.83***	-0.15***	-0.07	0.82***	-0.15***	-0.03
D2	0.81***	-0.17***	-0.03	0.86***	-0.12**	0.04
D3	0.84***	-0.11**	0.02	0.87***	-0.09	0.01
D4	0.85***	-0.11**	-0.04	0.91***	-0.06	-0.03
D5	0.85***	-0.11*	-0.07	0.87***	-0.07	-0.01
D6	0.88***	-0.06	0.01	0.94***	-0.02	0.02
D7	0.90***	-0.05	0.01	0.77***	-0.15*	-0.05
D8	0.84***	-0.06	0.01	0.89***	-0.03	0.02
D9	0.85***	-0.06*	0.01	0.88***	-0.03	0.00
D10 (long)	0.95***	0.02	0.06**	0.94***	0.03	0.07**
D10-D1	0.12*	0.18***	0.13**	0.11*	0.18***	0.10*
1-quarter						
D1 (short)	2.58***	-0.43***	-0.14	2.48***	-0.38***	-0.07
D2	2.57***	-0.36***	-0.13	2.69***	-0.28**	0.11
D3	2.58***	-0.34**	0.06	2.73***	-0.22	-0.03
D4	2.61***	-0.30**	-0.11	2.70***	-0.23*	-0.04
D5	2.67***	-0.24*	-0.13	2.75***	-0.10	0.03
D6	2.66***	-0.22*	-0.04	2.96***	0.06	0.09
D7	2.73***	-0.21*	0.03	2.48***	-0.35**	-0.18
D8	2.58***	-0.27**	-0.00	2.80***	-0.01	0.10
D9	2.64***	-0.19**	0.01	2.72***	-0.08	0.03
D10 (long)	2.94***	0.11	0.22***	2.85***	0.10	0.20**
D10-D1	0.36**	0.55***	0.36***	0.32**	0.46***	0.26**
1-year						
D1 (short)	11.10***	-1.18	-0.19	10.39***	-1.11*	-0.02
D2	11.12***	-0.84	-0.28	10.84***	-0.56	-0.08
D3	11.30***	-0.89	0.27	11.29***	-0.35	0.14
D4	10.94***	-1.12***	-0.40	10.73***	-0.68*	-0.19
D5	11.20***	-0.80	-0.60*	11.29***	-0.15	0.28
D6	11.42***	-0.64	-0.01	11.20***	-0.02	0.21
D7	11.57***	-0.26	0.22	9.96***	-0.80	-0.60
D8	10.88***	-1.24***	-0.21	11.02***	-0.32	0.03
D9	11.03***	-1.34***	-0.08	11.13***	-0.48	0.24
D10 (long)	12.61***	0.53	1.00**	11.42***	0.19	0.81*
D10-D1	1.51*	1.71***	1.20**	0.99	1.31**	0.83
2-year						
D1 (short)	23.34***	-1.68	-0.06	20.63***	-1.80	-0.37
D2	23.54***	-1.13	0.02	22.14***	-0.15	0.08
D3	23.02***	-1.81	0.42	22.37***	-0.50	0.46
D4	22.99***	-2.27**	-0.52	22.02***	-0.69	-0.16
D5	22.77***	-2.18***	-1.22*	21.90***	-1.18	0.25
D6	23.49***	-1.45**	-0.34	22.70***	0.23	0.50
D7	24.10***	0.06	0.55	20.49***	-1.38	-1.03
D8	22.15***	-2.74***	-0.54	21.98***	-0.65	-0.62
D9	23.57***	-2.51***	-0.10	22.21***	-1.74*	0.40
D10 (long)	26.16***	1.24*	2.13**	23.22***	0.95*	1.81*
D10-D1	2.82**	2.92**	2.19***	2.53**	2.76**	2.21**
3-year						
D1 (short)	36.22***	-1.28	-0.28	31.33***	-2.46*	0.02
D2	35.48***	-1.77	0.13	32.64***	-1.33	-0.22
D3	35.52***	-2.28*	0.24	33.36***	-0.58	0.75
D4	35.03***	-3.44**	-0.28	33.82***	-0.40	0.28
D5	35.20***	-2.17	-1.22	33.09***	-1.66	0.09
D6	36.04***	-1.77	-0.34	33.91***	-0.13	0.35
D7	37.06***	0.48	0.96	31.90***	-0.74	-1.83
D8	33.70***	-3.69***	-1.41	32.77***	-1.47	-1.12
D9	36.62***	-2.73***	0.16	33.63***	-1.60	0.59
D10 (long)	40.18***	2.24*	3.54**	35.34***	2.22*	3.40*
D10-D1	3.96*	3.52*	3.82***	4.07**	4.76***	3.46**
4-year						
D1 (short)	49.53***	-2.58	-0.73	42.55***	-3.25**	-0.13
D2	48.25***	-2.56	0.28	44.66***	-1.23	-0.18
D3	49.25***	-2.75	0.39	46.03***	-1.34	1.21
D4	48.47***	-2.47	0.70	46.28***	0.18	0.07
D5	48.43***	-1.35	-1.67	45.45***	-1.33	0.34
D6	50.18***	-1.10	-0.00	46.74***	0.68	0.58
D7	51.40***	-0.03	1.82	43.99***	-0.63	-2.00
D8	47.27***	-2.49	-1.16	44.54***	-1.75	-1.40
D9	50.84***	-2.83**	0.83	45.56***	-1.23	1.62
D10 (long)	55.78***	3.74**	5.38**	48.89***	3.77*	5.28*
D10-D1	6.26**	6.32**	6.12***	6.37***	7.04***	5.50***
5-year						
D1 (short)	66.52***	-4.00	-0.29	57.21***	-4.55***	0.84
D2	63.74***	-3.75*	0.43	60.04***	-0.23	0.87
D3	65.76***	-3.22	0.98	61.00***	-1.21	1.63
D4	65.12***	-1.56	1.87	61.40***	0.51	1.32
D5	65.31***	-0.41	-1.06	59.20***	-1.63	0.89
D6	67.46***	-0.83	1.19	60.44***	0.80	0.84
D7	68.03***	-0.26	2.25	56.57***	-0.44	-1.87
D8	63.98***	-0.79	-0.73	58.68***	-1.49	-0.87
D9	67.79***	-3.53	2.11	60.78***	-1.37	4.64
D10 (long)	74.13***	4.91**	8.35**	64.53***	5.37*	7.97*
D10-D1	7.60**	8.90**	8.64***	7.26**	9.76**	7.13***

Table 4: Fama-MacBeth regressions of fund performance

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. The dependent variable is the four-factor alpha associated with buy-and-hold fund net returns (Panel A) or buy-and-hold DGTW-adjusted abnormal returns (Panel B). The look-ahead holding periods are 1 month, 1 year, 3 years, and 5 years. The style-adjusted Ex-Ante Simple measure ($HH^{(2)}$) 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, fund size measured as log of total net assets, the CRSP turnover ratio (TR), a dummy for growth funds, the Active Share (AS) of Petajisto and Cremers (2009), the R^2 of Amihud and Goyenko (2013), and the Return Gap of Kacperczyk et al. (2008). Standard errors are calculated using the Newey-West (1987) procedure with a lag equal to the total number of months in the look-ahead holding period minus one.

Panel A: Using four-factor alphas

	1M	1Y	3Y	5Y	1M	1Y	3Y	5Y	1M	1Y	3Y	5Y	1M	1Y	3Y	5Y
Ex-Ante Simple ($HH^{(2)}$)	0.016	0.219	0.898	1.741	0.012	0.187	0.863	1.619	0.013	0.194	0.748	1.403	0.017	0.241	0.952	1.853
	(0.018)	(0.025)	(0.001)	(0.000)	(0.093)	(0.053)	(0.002)	(0.000)	(0.048)	(0.035)	(0.004)	(0.000)	(0.010)	(0.013)	(0.001)	(0.000)
Fund size	-0.001	0.007	0.175	-0.094	-0.004	0.001	0.344	0.389	0.001	0.026	0.276	0.136	-0.000	0.014	0.162	-0.155
	(0.834)	(0.885)	(0.254)	(0.788)	(0.366)	(0.983)	(0.025)	(0.330)	(0.843)	(0.628)	(0.127)	(0.705)	(0.928)	(0.776)	(0.286)	(0.671)
Expense	-0.076	-0.615	-0.907	-1.457	-0.087	-0.832	-2.235	-3.995	-0.084	-0.723	-1.433	-2.414	-0.069	-0.577	-0.939	-1.596
	(0.000)	(0.004)	(0.086)	(0.053)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.007)	(0.081)	(0.035)
Age	-0.001	-0.315	-1.553	-2.686	-0.003	-0.351	-1.599	-2.614	-0.006	-0.367	-1.730	-2.999	0.002	-0.293	-1.505	-2.599
	(0.876)	(0.036)	(0.008)	(0.006)	(0.762)	(0.020)	(0.003)	(0.004)	(0.494)	(0.012)	(0.003)	(0.001)	(0.839)	(0.056)	(0.012)	(0.009)
Fund flow	0.011	0.041	0.084	0.228	0.008	0.020	0.073	0.075	0.010	0.031	0.021	0.097	0.011	0.035	0.072	0.190
	(0.000)	(0.374)	(0.643)	(0.430)	(0.004)	(0.651)	(0.712)	(0.810)	(0.001)	(0.538)	(0.917)	(0.759)	(0.001)	(0.432)	(0.699)	(0.513)
CRSP TR	0.015	0.305	0.822	0.838	0.012	0.375	0.854	0.701	0.011	0.255	0.587	0.295	0.018	0.365	1.070	1.301
	(0.156)	(0.055)	(0.020)	(0.121)	(0.348)	(0.055)	(0.073)	(0.298)	(0.259)	(0.096)	(0.115)	(0.633)	(0.100)	(0.040)	(0.014)	(0.018)
GrowthD	0.038	0.681	1.108	0.672	0.033	0.671	0.912	0.010	0.044	0.723	1.406	1.338	0.038	0.666	1.075	0.556
	(0.287)	(0.128)	(0.388)	(0.730)	(0.354)	(0.156)	(0.529)	(0.996)	(0.213)	(0.094)	(0.238)	(0.452)	(0.296)	(0.134)	(0.403)	(0.776)
Active Share					0.101	2.265	13.789	31.901								
					(0.370)	(0.072)	(0.000)	(0.000)								
R2									-0.288	-3.650	-16.371	-30.762				
									(0.024)	(0.038)	(0.004)	(0.002)				
Return gap													0.526	7.294	13.422	20.050
													(0.419)	(0.009)	(0.060)	(0.001)

Panel B: Using DGTW-adjusted returns

	1M	1Y	3Y	5Y	1M	1Y	3Y	5Y	1M	1Y	3Y	5Y	1M	1Y	3Y	5Y
Ex-Ante Simple ($HH^{(2)}$)	0.010	0.181	0.457	1.218	0.009	0.164	0.409	1.057	0.007	0.147	0.350	1.068	0.011	0.200	0.503	1.248
	(0.134)	(0.036)	(0.042)	(0.030)	(0.188)	(0.069)	(0.088)	(0.072)	(0.284)	(0.050)	(0.101)	(0.067)	(0.103)	(0.023)	(0.033)	(0.029)
Fund size	-0.000	-0.032	-0.135	-0.245	0.001	-0.012	0.063	0.122	0.002	-0.012	-0.062	-0.117	0.001	-0.030	-0.113	-0.196
	(0.956)	(0.439)	(0.336)	(0.343)	(0.787)	(0.778)	(0.683)	(0.663)	(0.623)	(0.736)	(0.592)	(0.570)	(0.890)	(0.538)	(0.464)	(0.458)
Expense	-0.000	-0.086	-0.274	-0.439	-0.016	-0.280	-0.939	-1.533	-0.007	-0.179	-0.583	-0.896	0.001	-0.047	-0.277	-0.391
	(0.994)	(0.601)	(0.565)	(0.622)	(0.347)	(0.165)	(0.068)	(0.106)	(0.685)	(0.292)	(0.192)	(0.259)	(0.936)	(0.760)	(0.544)	(0.645)
Age	-0.001	-0.101	-0.399	-0.617	0.003	-0.079	-0.251	-0.069	-0.004	-0.136	-0.517	-0.853	-0.001	-0.098	-0.370	-0.563
	(0.941)	(0.170)	(0.273)	(0.479)	(0.684)	(0.358)	(0.517)	(0.917)	(0.586)	(0.052)	(0.103)	(0.278)	(0.902)	(0.193)	(0.317)	(0.515)
Fund flow	0.006	-0.026	-0.137	-0.115	0.003	-0.058	-0.136	-0.161	0.005	-0.038	-0.187	-0.190	0.006	-0.032	-0.167	-0.151
	(0.051)	(0.419)	(0.142)	(0.348)	(0.308)	(0.095)	(0.075)	(0.163)	(0.113)	(0.275)	(0.032)	(0.168)	(0.058)	(0.300)	(0.064)	(0.241)
CRSP TR	0.010	-0.005	-0.331	-0.398	0.009	-0.015	-0.257	-0.341	0.008	-0.036	-0.440	-0.601	0.013	0.004	-0.248	-0.345
	(0.339)	(0.971)	(0.224)	(0.526)	(0.470)	(0.929)	(0.484)	(0.584)	(0.480)	(0.796)	(0.157)	(0.403)	(0.250)	(0.978)	(0.411)	(0.587)
GrowthD	0.012	-0.250	-1.018	-1.593	-0.010	-0.365	-1.123	-1.844	0.020	-0.180	-0.770	-1.266	0.013	-0.232	-0.972	-1.552
	(0.738)	(0.599)	(0.521)	(0.561)	(0.787)	(0.443)	(0.478)	(0.500)	(0.582)	(0.684)	(0.605)	(0.627)	(0.729)	(0.627)	(0.544)	(0.575)
Active Share					0.153	1.938	7.015	12.692								
					(0.138)	(0.054)	(0.003)	(0.000)								
R2									-0.264	-3.156	-11.406	-17.151				
									(0.069)	(0.060)	(0.025)	(0.091)				
Return gap													-0.596	-4.073	-8.570	-11.364
													(0.403)	(0.095)	(0.136)	(0.236)

Table 5: Informativeness of fund holdings—Stock portfolio performance

This table reports buy-and-hold returns and abnormal returns of stocks portfolios sorted on the relative fund holdings, long-horizon fund holding (LFH) minus short-horizon fund holding (SFH). A mutual fund is classified as short-term (long-term) if it ranks in the bottom (top) tercile based on one of two style-adjusted fund investment horizon measures—the Simple ($HH^{(1)}$) and the Ex-Ante Simple ($HH^{(2)}$) measures. 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 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. The decile portfolios are equally weighted at formation date and then are updated following a buy-and-hold strategy. The buy-and-hold returns, four-factor alphas, and DGTW-adjusted returns for each decile portfolio are examined over the next month, the next quarter, 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, with p-values in parentheses. p-values are obtained using the Newey-West (1987) procedure with a lag equal to the total number of months in the look-ahead holding period minus one.

	Simple ($HH^{(1)}$)			Ex-Ante Simple ($HH^{(2)}$)		
	Ret	4-F α	DGTW	Ret	4-F α	DGTW
1-month						
D1 (short)	0.94	-0.17	-0.07	0.98	-0.15	-0.05
D2	0.84	-0.17	-0.15	1.06	0.04	0.02
D3	1.03	0.05	0.03	0.94	-0.06	-0.07
D4	0.98	0.03	-0.01	0.94	-0.01	-0.00
D5	1.07	0.08	0.11	1.06	0.09	0.09
D6	1.01	0.02	0.07	1.03	0.07	0.07
D7	1.05	0.07	0.06	1.10	0.10	0.14
D8	1.11	0.14	0.14	0.98	0.00	0.04
D9	1.14	0.15	0.17	1.13	0.15	0.18
D10 (long)	1.14	0.13	0.15	1.13	0.12	0.15
D10-D1	0.20	0.29	0.22	0.15	0.27	0.20
	(0.27)	(0.03)	(0.03)	(0.28)	(0.03)	(0.04)
1-quarter						
D1 (short)	2.82	-0.66	-0.27	3.17	-0.32	0.00
D2	2.59	-0.64	-0.49	3.04	-0.25	-0.14
D3	3.12	0.09	0.02	2.74	-0.36	-0.38
D4	3.03	-0.07	-0.01	2.85	-0.28	-0.07
D5	3.23	0.17	0.27	3.24	0.21	0.22
D6	2.99	-0.05	0.08	3.10	0.14	0.17
D7	3.29	0.24	0.26	3.30	0.27	0.33
D8	3.23	0.22	0.28	3.01	0.01	0.12
D9	3.44	0.44	0.47	3.40	0.43	0.50
D10 (long)	3.43	0.37	0.42	3.37	0.30	0.34
D10-D1	0.60	1.03	0.68	0.20	0.61	0.34
	(0.11)	(0.00)	(0.00)	(0.51)	(0.01)	(0.14)
1-year						
D1 (short)	11.07	-2.74	-0.94	12.50	-1.00	-0.01
D2	10.48	-2.48	-1.82	11.78	-1.48	-0.74
D3	14.06	1.64	1.10	12.27	-0.88	-0.41
D4	13.23	0.14	0.87	13.37	0.49	0.79
D5	13.67	1.10	1.63	13.53	1.23	1.40
D6	12.95	0.39	1.11	12.73	0.42	0.97
D7	13.75	1.45	1.49	13.06	0.89	1.16
D8	13.39	1.27	1.33	13.09	1.12	1.27
D9	14.25	2.15	2.12	14.04	2.17	2.08
D10 (long)	14.17	1.95	1.96	14.28	2.06	1.98
D10-D1	3.10	4.69	2.90	1.77	3.05	1.99
	(0.10)	(0.00)	(0.04)	(0.18)	(0.01)	(0.11)
2-year						
D1 (short)	22.66	-3.15	-1.25	25.57	0.87	0.52
D2	23.12	-2.35	-1.45	24.89	-0.01	-0.11
D3	27.56	3.80	1.66	25.80	0.94	0.19
D4	28.24	2.42	2.91	27.08	2.58	1.69
D5	27.89	3.15	3.34	26.57	1.69	2.21
D6	26.89	2.23	2.57	25.76	1.43	1.95
D7	28.81	4.87	3.91	27.31	3.59	3.29
D8	26.95	3.37	2.52	28.21	5.21	3.82
D9	29.54	5.59	4.89	29.30	5.49	4.86
D10 (long)	28.83	4.53	4.08	28.65	4.08	4.04
D10-D1	6.18	7.69	5.34	3.08	3.21	3.52
	(0.03)	(0.00)	(0.03)	(0.24)	(0.08)	(0.10)
3-year						
D1 (short)	37.24	-2.30	-0.95	40.41	1.93	1.17
D2	37.87	-2.32	-0.62	39.43	0.14	-0.08
D3	43.56	5.71	3.26	40.14	0.90	0.39
D4	43.59	3.94	3.94	43.04	4.45	3.14
D5	43.48	4.38	4.97	41.97	3.55	3.55
D6	43.21	4.59	4.63	41.35	3.52	3.46
D7	44.84	7.69	5.66	43.52	6.45	5.46
D8	42.78	6.08	4.00	44.64	8.75	5.79
D9	46.38	9.05	7.46	47.42	10.00	8.25
D10 (long)	44.90	6.49	5.91	45.71	6.68	6.47
D10-D1	7.67	8.79	6.86	5.30	4.75	5.29
	(0.03)	(0.00)	(0.03)	(0.08)	(0.00)	(0.05)
4-year						
D1 (short)	51.44	-0.98	1.16	53.81	3.05	2.34
D2	49.24	-4.01	-0.88	53.86	-0.43	1.07
D3	57.61	6.00	4.16	53.75	0.48	1.34
D4	57.56	7.39	4.61	55.81	6.04	3.01
D5	57.09	5.63	5.87	57.93	8.42	5.93
D6	57.86	7.99	6.24	55.74	7.14	5.20
D7	58.84	11.34	6.68	58.36	11.33	7.63
D8	58.34	12.07	6.24	59.07	13.99	7.47
D9	62.61	14.02	10.26	64.76	15.50	11.37
D10 (long)	64.09	12.07	10.60	65.11	13.09	11.66
D10-D1	12.65	13.04	9.44	11.30	10.04	9.31
	(0.01)	(0.00)	(0.05)	(0.00)	(0.00)	(0.01)
5-year						
D1 (short)	68.56	-1.83	2.66	71.63	2.83	2.43
D2	66.82	-4.24	1.73	72.85	1.63	3.16
D3	75.59	5.65	4.96	72.28	1.47	3.29
D4	75.63	11.94	5.63	76.59	9.00	6.30
D5	75.30	8.79	6.83	77.06	13.20	7.93
D6	78.39	14.76	9.26	74.29	12.36	7.19
D7	78.63	16.02	9.66	75.87	16.23	8.99
D8	78.96	18.71	10.14	80.85	21.01	12.85
D9	85.46	20.41	15.73	86.61	20.14	17.48
D10 (long)	89.89	15.90	17.27	90.03	16.34	18.74
D10-D1	21.33	17.73	14.62	18.40	13.51	16.31
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)

Table 6: Refinement of informativeness of fund holdings

Stocks are sorted each month into deciles based on relative fund holdings, long-horizon fund holdings (LFH) minus short-horizon fund holdings (SFH), with D10 (D1) consisting of stocks largely held by long-horizon (short-horizon) funds. In D10 (D1), 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. This table presents buy-and-hold returns, 4-factor alphas, and DGTW adjusted returns for these four stock portfolios, two portfolios for each of D1 and D10, over the next month, the next quarter, and the next one to five years after portfolio formation. The style-adjusted Ex-Ante Simple 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 holding period minus one.

	Return	Pvalue	4-F α	Pvalue	DGTW	Pvalue
1-month						
Short-term positions in short-horizon funds	1.03	0.01	-0.11	0.34	-0.03	0.70
Long-term positions in short-horizon funds	1.15	0.00	0.11	0.25	0.12	0.09
Short-term positions in long-horizon funds	0.91	0.02	-0.06	0.67	0.03	0.80
Long-term positions in long-horizon funds	1.17	0.00	0.14	0.11	0.17	0.00
1-quarter						
Short-term positions in short-horizon funds	3.12	0.00	-0.59	0.00	-0.19	0.30
Long-term positions in short-horizon funds	3.60	0.00	0.28	0.15	0.38	0.01
Short-term positions in long-horizon funds	3.08	0.00	-0.23	0.46	0.23	0.37
Long-term positions in long-horizon funds	3.55	0.00	0.43	0.03	0.40	0.00
1-year						
Short-term positions in short-horizon funds	11.19	0.00	-2.60	0.00	-1.29	0.01
Long-term positions in short-horizon funds	14.38	0.00	0.88	0.34	1.65	0.00
Short-term positions in long-horizon funds	12.89	0.00	-0.22	0.89	1.58	0.22
Long-term positions in long-horizon funds	14.68	0.00	2.47	0.02	1.87	0.03
2-year						
Short-term positions in short-horizon funds	23.82	0.00	-1.29	0.65	-0.77	0.63
Long-term positions in short-horizon funds	28.29	0.00	3.00	0.20	1.91	0.13
Short-term positions in long-horizon funds	26.48	0.00	0.24	0.93	3.65	0.06
Long-term positions in long-horizon funds	31.08	0.00	6.59	0.01	4.76	0.01
3-year						
Short-term positions in short-horizon funds	35.51	0.00	-2.69	0.54	-1.65	0.41
Long-term positions in short-horizon funds	43.25	0.00	5.91	0.22	2.93	0.12
Short-term positions in long-horizon funds	41.36	0.00	1.72	0.57	5.53	0.02
Long-term positions in long-horizon funds	47.75	0.00	11.14	0.01	7.36	0.00
4-year						
Short-term positions in short-horizon funds	49.91	0.00	-4.91	0.35	-0.18	0.96
Long-term positions in short-horizon funds	58.58	0.00	8.03	0.25	4.59	0.13
Short-term positions in long-horizon funds	56.12	0.00	3.80	0.15	6.70	0.06
Long-term positions in long-horizon funds	67.53	0.00	17.56	0.01	12.00	0.00
5-year						
Short-term positions in short-horizon funds	66.32	0.00	-6.47	0.28	-1.37	0.74
Long-term positions in short-horizon funds	77.97	0.00	11.94	0.18	7.17	0.11
Short-term positions in long-horizon funds	81.90	0.00	8.64	0.03	12.10	0.04
Long-term positions in long-horizon funds	89.68	0.00	23.58	0.01	17.24	0.00

Table 7: Comparison of fund holding horizon with CRSP turnover

This table reports the estimation results of panel regressions of next-year fund holding horizon (in the left columns) or next-year CRSP turnover (in the right columns) on current fund holding horizon, current CRSP turnover, and other fund characteristics. These regressions are panel regressions with no fixed effects, fund fixed effects, and time fixed effects. The style-adjusted Ex-Ante Simple measure ($HH^{(2)}$) is used as the metric of fund investment horizon. The other fund characteristics include fund size, the expense ratio, fund age, past-year flow volatility, past-year fund flow, past-year fund return volatility. p-values are reported in parentheses based on heteroskedasticity-robust standard errors clustered by fund and year.

Dependent var.	Next-year Ex-Ante Simple			Next-year CRSP turnover		
	No fixed effects	Fund fixed effects	Time fixed effects	No fixed effects	Fund fixed effects	Time fixed effects
Ex-Ante simple ($HH^{(2)}$)	0.910	0.674	0.910	-0.025	0.007	-0.025
	(0.00)	(0.00)	(0.00)	(0.12)	(0.77)	(0.12)
CRSP turnover	-0.038	-0.024	-0.037	0.865	0.740	0.865
	(0.03)	(0.10)	(0.03)	(0.00)	(0.00)	(0.00)
Fund size	0.013	0.059	0.013	-0.011	-0.031	-0.013
	(0.00)	(0.00)	(0.00)	(0.01)	(0.05)	(0.03)
Expense ratio	-0.271	0.691	-0.134	1.875	1.574	1.709
	(0.71)	(0.32)	(0.85)	(0.14)	(0.31)	(0.16)
Fund age	-0.000	-0.002	-0.000	0.001	0.005	0.001
	(0.40)	(0.26)	(0.21)	(0.05)	(0.23)	(0.05)
Flow volatility	0.343	-0.187	0.336	0.130	0.126	0.102
	(0.00)	(0.24)	(0.00)	(0.32)	(0.43)	(0.41)
Fund flow	0.000	-0.001	0.000	-0.000	0.000	-0.000
	(0.79)	(0.00)	(0.78)	(0.23)	(0.50)	(0.71)
Return volatility	-0.239	0.642	-0.545	-0.312	-0.695	0.177
	(0.42)	(0.01)	(0.13)	(0.71)	(0.30)	(0.88)

Table 8: Fund holding horizon versus CRSP turnover: Predicting future fund performance

This table reports the coefficient estimates and p-values (in parentheses) of three panel regressions, one between-estimator regression, and one Fama-MacBeth regression of future fund performance on fund holding horizon and CRSP turnover while controlling for other fund characteristics. The first three regressions are panel regressions with no fixed effects, fund fixed effects, and time fixed effects. In the between-estimator regression, we first average the variables for each fund over time and then run a cross-sectional regression. The dependent variable is the four-factor alpha associated with buy-and-hold net returns (Panel A) or buy-and-hold DGTW-adjusted abnormal returns (Panel B) in percentage. Five look-ahead holding periods we report are 1 month, 1 quarter, 1 year, 3 years, and 5 years. The style-adjusted Ex-Ante Simple measure ($HH^{(2)}$) is used as the metric of fund investment horizon. The other fund characteristics (not reported in the table to save space) include fund size, the expense ratio, fund age, past-year flow volatility, past-year fund flow, and past-year fund return volatility. Heteroskedasticity-robust standard errors are calculated for panel regressions based on two-way clusters by fund and by month. Standard errors for Fama-MacBeth regressions are calculated using the Newey-West (1987) procedure with a lag equal to the total number of months in the look-ahead holding period minus one.

Panel A: Dependent variable—four-factor alphas				
	No fixed effects	Fund fixed effects	Time fixed effects	Fama-MacBeth
1 month				
Ex ante simple	0.013	-0.019	0.013	0.011
	(0.16)	(0.20)	(0.16)	(0.09)
CRSP turnover	-0.005	0.035	-0.000	0.000
	(0.75)	(0.08)	(0.99)	(0.98)
1 quarter				
Ex ante simple	0.038	-0.053	0.040	0.042
	(0.06)	(0.13)	(0.05)	(0.03)
CRSP turnover	0.001	0.072	0.016	0.004
	(0.98)	(0.17)	(0.63)	(0.88)
1 year				
Ex ante simple	0.150	-0.116	0.172	0.204
	(0.03)	(0.28)	(0.01)	(0.05)
CRSP turnover	0.180	0.190	0.211	0.149
	(0.14)	(0.21)	(0.08)	(0.32)
3 years				
Ex ante simple	0.776	-0.118	0.839	0.881
	(0.00)	(0.66)	(0.00)	(0.00)
CRSP turnover	0.333	0.262	0.435	0.503
	(0.27)	(0.46)	(0.15)	(0.20)
5 years				
Ex ante simple	1.602	-0.075	1.725	1.604
	(0.00)	(0.86)	(0.00)	(0.00)
CRSP turnover	0.106	-0.210	0.270	0.075
	(0.87)	(0.77)	(0.68)	(0.91)

Panel B: Dependent variable—DGTW adjusted abnormal returns				
	No fixed effects	Fund fixed effects	Time fixed effects	Fama-MacBeth
1 month				
Ex ante simple	0.012	-0.004	0.013	0.009
	(0.21)	(0.85)	(0.17)	(0.21)
CRSP turnover	-0.003	0.039	0.014	0.012
	(0.84)	(0.27)	(0.36)	(0.36)
1 quarter				
Ex ante simple	0.039	-0.014	0.043	0.040
	(0.07)	(0.77)	(0.04)	(0.02)
CRSP turnover	0.005	0.140	0.059	0.046
	(0.90)	(0.08)	(0.15)	(0.22)
1 year				
Ex ante simple	0.168	0.001	0.197	0.196
	(0.02)	(0.99)	(0.01)	(0.01)
CRSP turnover	0.011	0.485	0.213	0.164
	(0.93)	(0.10)	(0.13)	(0.31)
3 years				
Ex ante simple	0.382	-0.596	0.553	0.544
	(0.11)	(0.23)	(0.03)	(0.01)
CRSP turnover	-0.230	0.166	0.376	0.073
	(0.65)	(0.77)	(0.47)	(0.88)
5 years				
Ex ante simple	0.707	-0.988	1.201	1.274
	(0.14)	(0.23)	(0.01)	(0.00)
CRSP turnover	-1.073	-0.696	-0.139	-0.016
	(0.18)	(0.46)	(0.87)	(0.97)

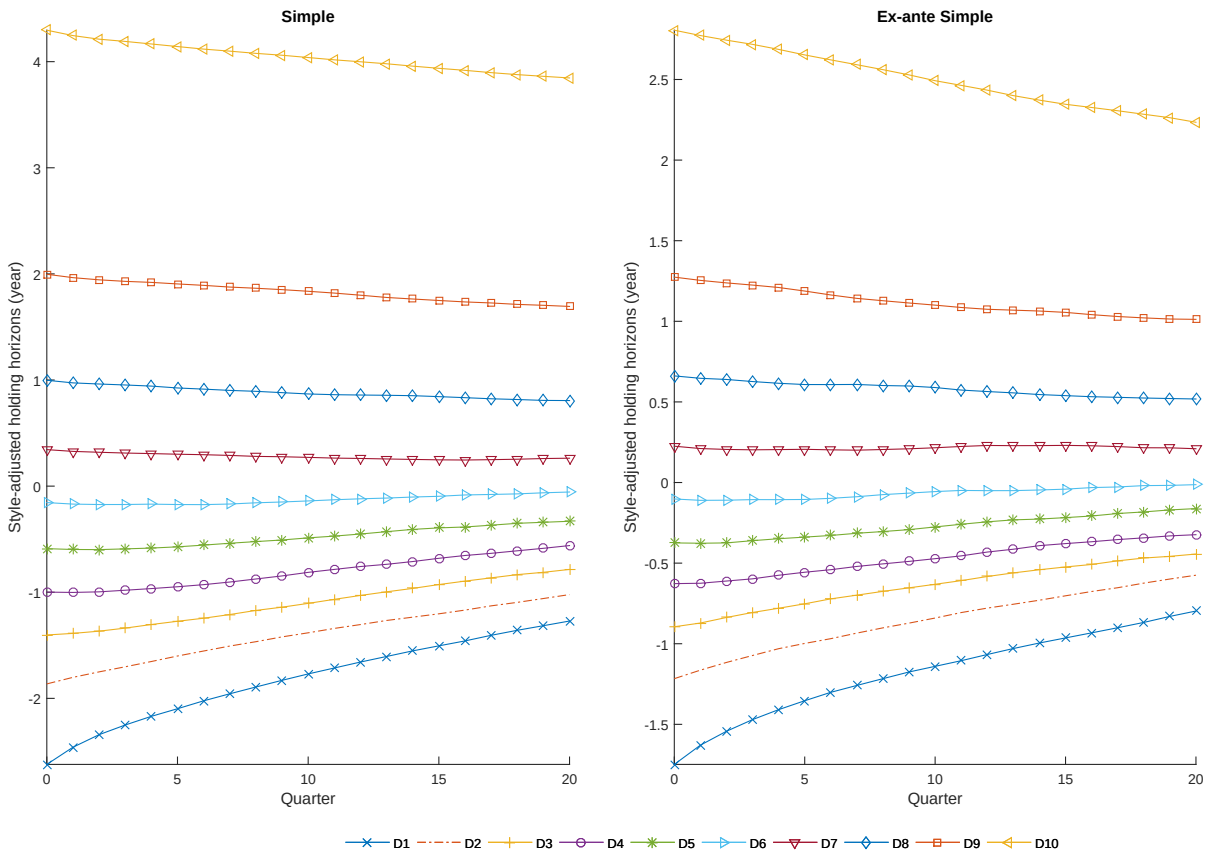

Figure 1: This figure plots the average style-adjusted fund holding periods for each fund decile at the formation period, and the first to the 20th quarter into the future after the formation period. Each month funds are sorted into deciles according to either style-adjusted Simple or style-adjusted Ex-Ante Simple fund horizon measure, with D1 consisting of funds with short holding periods and D10 consisting of funds with long holding periods.

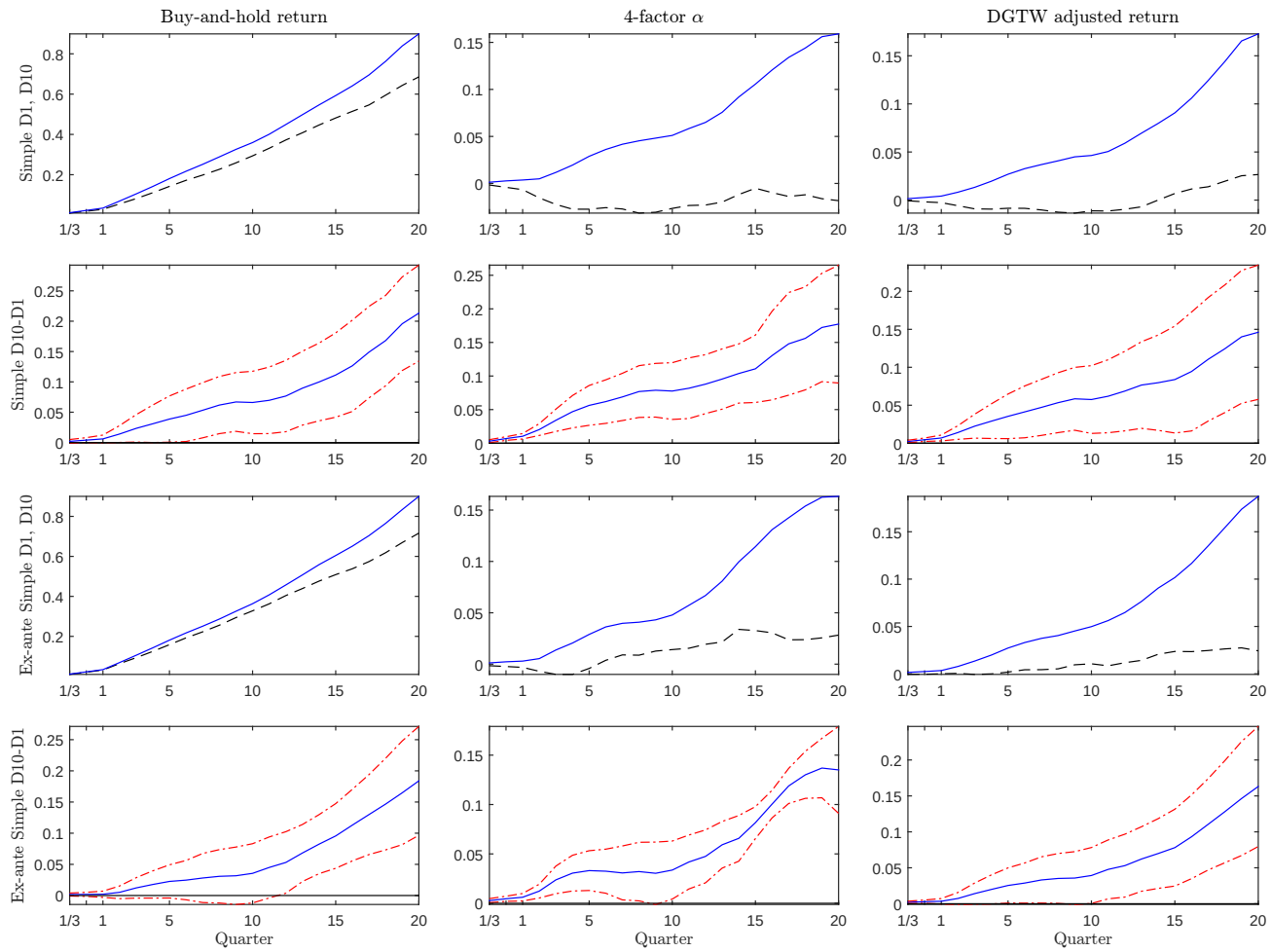

Figure 2: This figure plots buy-and-hold returns, four-factor alphas, and DGTW-adjusted returns for the D1 (dashed line) and D10 (solid line) portfolios in the first and third rows, and for the D10-D1 position that is long the D10 and short the D1 portfolio in the second and fourth rows. For the D10-D1 portfolios, the plots also include the 90% confidence intervals computed based on the Newey-West approach. These portfolios are deciles sorted on LFH minus SFH, where LFH (SFH) is the percentage of the shares of a stock held by long- (short-) horizon funds. D10 (D1) is the portfolio with large ownership by long-horizon (short-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 style-adjusted Simple measure in the first two rows or the style-adjusted Ex-Ante Simple measure in the last two rows.

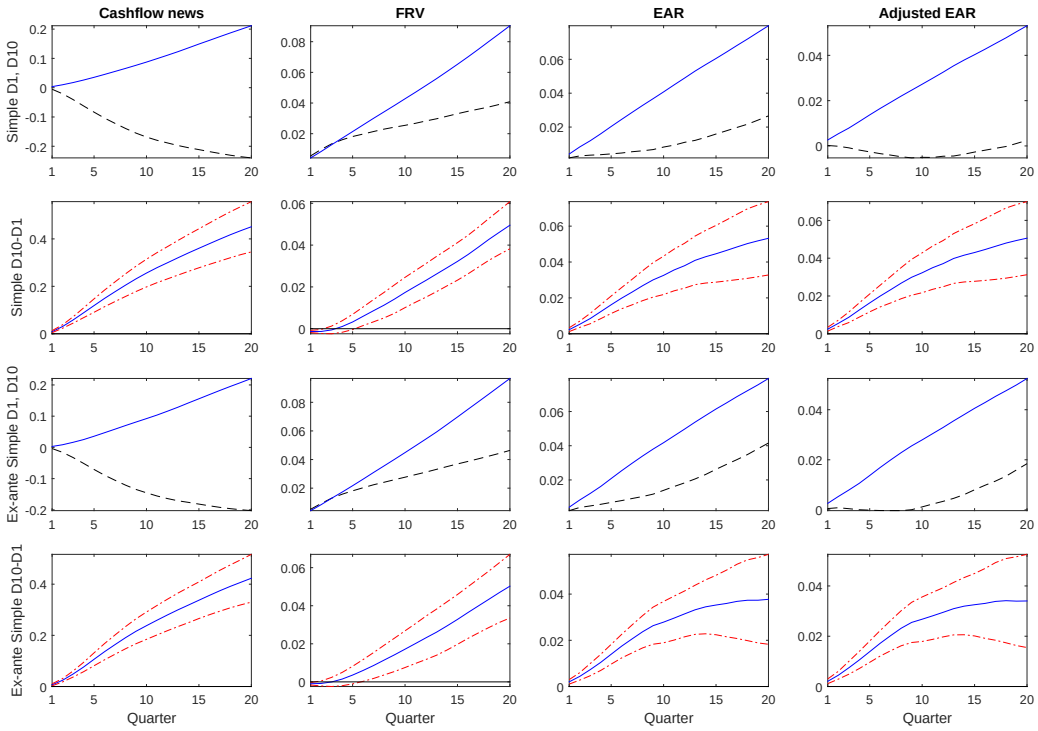

Figure 3: This figure plots cumulative fundamental variables, including cash-flow news, analyst forecast revision (FRV), earnings-announcement-window returns (EAR), and market adjusted EAR, over the next 1-20 quarters after stock portfolio formation. Specifically, the average quarterly fundamental information is calculated first for each stock portfolio in the nth quarter after the formation period, where $1 \leq n \leq 20$, and then the quarterly fundamental information is accumulated over 1-20 quarters. The odd rows plot future firm fundamentals for stock portfolio decile D1 (dashed line) consisting of stocks held most by short-horizon funds and for stock portfolio decile D10 (solid line) consisting of stocks held most by long-horizon funds. The even rows exhibit future fundamental information for D10 in excess of that for D1, with the 90% confidence interval calculated using the Newey-West approach. The first two rows use the style-adjusted Simple measure as a metric of fund investment horizon, and the last two rows use the style-adjusted Ex-Ante Simple measure.

Holding Horizon: A New Measure of Active Investment Management

Separate Internet Appendix

A1 Other measures of fund holding horizon

In this section, we describe two additional measures of fund holding horizon. First, we consider an ex-post measure, termed the "FIFO" horizon measure, that allows for the possibility that position changes may also be informative about the intended holding horizon. It assumes that shares purchased first are sold first (first-in-first-out). Let $h^{(3)}_{i,j,t}$ denote, in this measure, the holding horizon of stock i held by fund j at time t. Then

$$h^{(3)}_{i,j,t} = \begin{cases} \dfrac{\sum\limits_{\substack{k,s \\ k \le t < s}} N_{i,j,k,s} * (s-k)}{N_{i,j,t}}, & \text{if } N_{i,j,t} > 0 \\ 0 & \text{if } N_{i,j,t} = 0 \end{cases} \tag{A.7}$$

where $N_{i,j,k,s}$ is the number of shares of stock i purchased by fund j at time k and sold at time s, $k \le t < s$, and $N_{i,j,t}$ is the number of shares of stock i held by fund j at time t with $N_{i,j,t} = \sum\limits_{\substack{k,s \\ k \le t < s}} N_{i,j,k,s}$.[1]

We also consider an ex-ante measure, termed the "Duration" measure, that is similar to the measure proposed by Cremers and Pareek (2011). It accounts for changes in stock positions and can be considered as a modified, ex-ante version of the FIFO measure. Let $h^{(4)}_{i,j,t}$ denote, in this measure, the holding horizon of stock i held by fund j at time t. Let W be a specified window ending at time t. $B_{i,j}$ is the percentage of total shares outstanding of stock i bought by fund j between time $t-W$ and time t, while $H_{i,j}$ is the percentage of total shares outstanding of stock i held by fund j at time $t-W$. Then

$$h^{(4)}_{i,j,t} = \sum_{s=t-W+1}^{t} \frac{(t-s)\alpha_{i,j,s}}{H_{i,j} + B_{i,j}} + \frac{W * H_{i,j}}{H_{i,j} + B_{i,j}}, \tag{A.8}$$

where $\alpha_{i,j,s}$ is the percentage of total shares outstanding of stock i bought or sold by fund j during period s, while $\alpha_{i,j,s} > 0$ for buys and $\alpha_{i,j,s} < 0$ for sells.[2,3]

After the holding horizons of all stocks held by a fund are calculated, the holding horizon of fund j at time t, denoted by $HH_{j,t}$, is then defined as the value-weighted holding periods of all stocks held in the fund. Specifically,

$$HH^{(m)}_{j,t} = \sum_{i=1}^{M_{j,t}} \omega_{i,j,t} h^{(m)}_{i,j,t}, \quad m = 3, 4 \tag{A.9}$$

where $M_{j,t}$ is the number of stocks held by fund j at time t, and $\omega_{i,j,t}$ is the portfolio weight of stock i in fund j at time t. $\omega_{i,j,t}$ is computed as the number of shares of stock i held in fund j at time t multiplied by the time-t stock price, then divided by the time-t market value of the equity portfolio of fund j.

Because our two ex-post measures have similar characteristics and produce similar results, so do the two ex-ante measures. For simplicity, we only report the stock-level results based on all four measures in Table **??**. (Results based on the Simple and Ex-Ante Simple measures are already reported in Table 8 of our paper, which are included here for comparison.)

A2 Tables for additional tests and robustness checks

Tables A1-A11 report the results discussed in section 7 of our paper.

[1] As a concrete example, consider a fund that today purchases 1,000 shares of General Electric (GE) and purchases another 100 shares in year 1. It sells 300 shares in year 2 and liquidates the position in year 3. In this example, the holding period of GE based on the FIFO measure is (700*3+300*2)/1000 = 2.7 years today; and is (700*3+300*2+100*2)/1100 = 2.6 years in year 1 and (700*3+100*2)/800 = 2.9 years in year 2.

[2] Cremers and Pareek (2011) study all institutional investors using 13-F data. They consider the past five years to calculate the Duration measure. Since mutual funds tend to invest for a shorter term than other institutional investors, we consider the specified window W to be three years of past data. We also tried two or four years of past data, and obtained similar results.

[3] For example, consider a fund that owns 1% of GE: assume 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.

Table A1: Determinants of the Ex-Ante Simple measure

This table reports results of regressions of the Ex-Ante Simple horizon measure on different 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 years, past-year fund flow, the Active Share (AS) from Petajisto and Cremers (2009), the R2 of Amihud and Goyenko (2013), and the Return Gap of Kacperczyk et al. (2008). Panel A reports the results of Fama-MacBeth regressions with p-values obtained based on the Newey-West (1987) procedure with a lag equal to four. Panel B reports the results of a panel regression with p-values calculated based on standard errors clustered by funds.

Panel A: Using Fama-MacBeth regressions

	Coeff	P-value
Intercept	6.96	0.00
Fund size	-0.01	0.46
Expense	-0.11	0.00
Age	0.13	0.00
Fund flow	-0.02	0.16
CRSP TR	-0.83	0.00
Active Share	-0.20	0.00
R2	-0.16	0.00
Return Gap	-0.01	0.37

Panel B: Using panel regression

	Coeff	P-value
Intercept	6.43	0.00
Fund size	0.02	0.74
Expense	-0.09	0.04
Age	0.15	0.00
Fund flow	-0.03	0.10
CRSP TR	-0.81	0.00
Active Share	-0.25	0.00
R2	-0.16	0.00
Return Gap	0.00	0.79
Coeff. of determination	0.36	

Table A2: Informativeness of fund holdings—Fund portfolio performance: Robustness check using 5-factor model

Funds are sorted into deciles each month according to the style-adjusted Simple or Ex-ante Simple fund horizon measures, 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, next quarter, and next one to five years after portfolio formation. The abnormal returns are the five-factor alpha. In addition to the Carhart four factors, the 5-factor model includes as a fifth factor the Pástor-Stambaugh liquidity factor. In Panel A (B) portfolio weights are equal (value-weighted) at the formation month and then are updated following a buy-and-hold strategy. The table also reports the return spreads between the D10 and D1 portfolios. All returns are expressed in percentage. *, **, and *** represent significance for abnormal returns and return 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 holding period minus one.

Panel A: Using equally-weighted portfolios

	Simple ($HH^{(1)}$)	Ex-Ante Simple ($HH^{(2)}$)
1-month		
D1 (short)	-0.12**	-0.12**
D10 (long)	0.03	-0.02
D10-D1	0.15***	0.10**
1-quarter		
D1 (short)	-0.24*	-0.24*
D10 (long)	0.21*	0.01
D10-D1	0.45***	0.25***
1-year		
D1 (short)	0.68	-0.43
D10 (long)	0.81	-0.06
D10-D1	0.13	0.37
2-year		
D1 (short)	-0.25	-0.75
D10 (long)	2.51	1.24
D10-D1	2.76*	1.99
3-year		
D1 (short)	1.04	-0.79
D10 (long)	3.33*	1.24
D10-D1	2.29	2.03
4-year		
D1 (short)	-0.22	-2.79**
D10 (long)	5.26**	2.78
D10-D1	5.48**	5.58**
5-year		
D1 (short)	-1.27	-4.98***
D10 (long)	6.38***	3.38*
D10-D1	7.65***	8.35***

Panel B: Using value-weighted portfolios

	Simple ($HH^{(1)}$)	Ex-Ante Simple ($HH^{(2)}$)
1-month		
D1 (short)	-0.16***	-0.15***
D10 (long)	0.01	0.02
D10-D1	0.17***	0.17***
1-quarter		
D1 (short)	-0.46***	-0.40***
D10 (long)	0.08	0.06
D10-D1	0.53***	0.43***
1-year		
D1 (short)	-0.95	-0.95
D10 (long)	0.33	-0.21
D10-D1	1.28**	0.74
2-year		
D1 (short)	-1.76	-1.33
D10 (long)	1.17	0.57
D10-D1	2.92**	1.86*
3-year		
D1 (short)	-0.03	-1.27
D10 (long)	1.89	1.78
D10-D1	1.92	3.13*
4-year		
D1 (short)	-1.99	-2.27*
D10 (long)	3.43**	3.59
D10-D1	5.42*	5.81**
5-year		
D1 (short)	-3.14	-3.51***
D10 (long)	4.84**	4.57
D10-D1	7.98**	7.89***

Table A3: Informativeness of fund holdings—Fund portfolio performance: Robustness check using 5-factor model

This table reports five-factor alphas of stocks portfolios sorted on the relative fund holdings, long-horizon fund holding (LFH) minus short-horizon fund holding (SFH). A mutual fund is classified as short-term (long-term) if it ranks in the bottom (top) tercile based on one of two style-adjusted fund investment horizon measures—the Simple ($HH^{(1)}$) and the Ex-Ante Simple ($HH^{(2)}$) measures. 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 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. The decile portfolios are equally weighted at formation date and then are updated following a buy-and-hold strategy. In addition to the Carhart four factors, the 5-factor model includes as a fifth factor the Pástor-Stambaugh liquidity factor. The buy-and-hold five-factor alphas are examined over the next month, the next quarter, and the next one to five years after portfolio formation. These alphas are expressed in percentage. The table also reports the performance difference between D10 and D1 portfolios, with p-values in parentheses. p-values are obtained using the Newey-West (1987) procedure with a lag equal to the total number of months in the look-ahead holding period minus one.

	Simple ($HH^{(1)}$)	Ex-Ante Simple ($HH^{(2)}$)
1-month		
D1 (short)	-0.18	-0.18
D10 (long)	0.10	0.10
D10-D1	0.28	0.28
	(0.04)	(0.02)
1-quarter		
D1 (short)	-0.65	-0.34
D10 (long)	0.33	0.29
D10-D1	0.98	0.63
	(0.00)	(0.01)
1-year		
D1 (short)	-2.70	-1.86
D10 (long)	1.71	2.09
D10-D1	4.42	3.95
	(0.00)	(0.00)
2-year		
D1 (short)	-4.17	-1.19
D10 (long)	5.61	5.96
D10-D1	9.78	7.16
	(0.00)	(0.00)
3-year		
D1 (short)	-2.47	0.95
D10 (long)	6.68	6.70
D10-D1	9.15	5.75
	(0.00)	(0.01)
4-year		
D1 (short)	-3.90	1.39
D10 (long)	12.87	13.28
D10-D1	16.76	11.89
	(0.00)	(0.00)
5-year		
D1 (short)	-4.45	-1.81
D10 (long)	12.14	14.01
D10-D1	16.59	15.82
	(0.00)	(0.00)

Table A4: Stock portfolios sorted on relative fund holdings and liquidity

This table reports buy-and-hold abnormal returns of stocks portfolios sorted on the relative fund holdings, long-horizon fund holding (LFH) minus short-horizon fund holding (SFH). A mutual fund is classified as a short-term (long-term) investor if it ranks in the bottom (top) tercile based on either the style-adjusted Simple or Ex-Ante Simple measures. 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, 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 the stocks into two groups according to their liquidity. The stock liquidity is measured using the Amihud's measure. Liquid (illiquid) stocks are stocks with below (above) median Amihud's illiquidity measure. The decile portfolios are equally weighted at formation date and then are updated following a buy-and-hold strategy. The four-factor alphas and DGTW-adjusted returns for each decile 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 holding period minus one.

	Simple Illiquid		EA Simple Illiquid		Simple Liquid		EA Simple Liquid	
	4-F α	DGTW	4-F α	DGTW	4-F α	DGTW	4-F α	DGTW
1-month								
D1 (short)	-0.19	-0.01	-0.02	0.07	-0.19	-0.13	-0.07	-0.02
	(0.10)	(0.92)	(0.88)	(0.51)	(0.09)	(0.19)	(0.53)	(0.82)
D10 (long)	-0.13	0.04	-0.09	-0.00	0.09	0.18	0.17	0.20
	(0.30)	(0.62)	(0.47)	(0.99)	(0.37)	(0.01)	(0.10)	(0.01)
D10-D1	0.06	0.05	-0.07	-0.07	0.28	0.32	0.24	0.22
	(0.63)	(0.68)	(0.65)	(0.60)	(0.05)	(0.00)	(0.08)	(0.04)
1-year								
D1 (short)	-3.06	0.40	-0.99	1.11	-2.86	-1.53	-0.86	-0.15
	(0.06)	(0.61)	(0.56)	(0.14)	(0.00)	(0.02)	(0.22)	(0.80)
D10 (long)	-0.73	1.23	0.29	1.61	1.20	1.88	1.94	1.80
	(0.72)	(0.26)	(0.88)	(0.16)	(0.28)	(0.04)	(0.09)	(0.10)
D10-D1	2.33	0.83	1.28	0.50	4.06	3.41	2.80	1.95
	(0.13)	(0.44)	(0.33)	(0.64)	(0.00)	(0.01)	(0.02)	(0.16)
2-year								
D1 (short)	-3.48	0.63	0.74	2.48	-2.61	-0.72	0.01	0.23
	(0.27)	(0.62)	(0.86)	(0.09)	(0.10)	(0.59)	(0.99)	(0.90)
D10 (long)	2.52	2.83	2.76	3.63	2.58	4.60	2.67	4.22
	(0.61)	(0.17)	(0.54)	(0.06)	(0.17)	(0.01)	(0.09)	(0.02)
D10-D1	6.00	2.19	2.02	1.15	5.19	5.32	2.66	3.98
	(0.01)	(0.28)	(0.25)	(0.54)	(0.02)	(0.02)	(0.19)	(0.14)
3-year								
D1 (short)	-0.95	2.61	2.16	4.83	-1.78	0.76	-0.30	-0.43
	(0.87)	(0.25)	(0.78)	(0.05)	(0.46)	(0.77)	(0.92)	(0.88)
D10 (long)	4.58	4.20	4.63	5.91	4.22	7.75	4.87	7.16
	(0.58)	(0.13)	(0.53)	(0.03)	(0.14)	(0.00)	(0.01)	(0.01)
D10-D1	5.53	1.60	2.46	1.07	6.01	6.99	5.17	7.59
	(0.05)	(0.52)	(0.06)	(0.62)	(0.08)	(0.05)	(0.01)	(0.04)
4-year								
D1 (short)	5.41	6.53	5.74	6.14	-2.65	0.30	-1.19	-0.37
	(0.59)	(0.09)	(0.61)	(0.04)	(0.24)	(0.95)	(0.71)	(0.93)
D10 (long)	8.83	9.02	10.80	12.51	10.99	14.93	11.83	12.31
	(0.47)	(0.07)	(0.37)	(0.02)	(0.01)	(0.00)	(0.00)	(0.00)
D10-D1	3.43	2.50	5.05	6.37	13.64	14.63	13.03	12.68
	(0.31)	(0.50)	(0.01)	(0.11)	(0.00)	(0.00)	(0.00)	(0.01)
5-year								
D1 (short)	11.29	10.98	5.13	4.58	-5.41	-2.55	0.46	0.07
	(0.36)	(0.07)	(0.69)	(0.27)	(0.06)	(0.68)	(0.90)	(0.99)
D10 (long)	16.59	15.86	14.82	19.62	15.36	24.08	18.17	19.06
	(0.34)	(0.03)	(0.37)	(0.02)	(0.01)	(0.00)	(0.00)	(0.00)
D10-D1	5.30	4.87	9.69	15.04	20.77	26.63	17.71	18.98
	(0.45)	(0.29)	(0.07)	(0.05)	(0.00)	(0.00)	(0.00)	(0.00)

Table A5: Comparison with Cremers and Pareek (2016): Panel regressions of fund performance

This table reports the coefficient estimates and p-values (in parentheses) of panel regressions regressions of future fund performance on fund holding horizon 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 holding periods are 1 month, 1 year, 3 years, and 5 years. The style-adjusted Ex-Ante Simple measure ($HH^{(2)}$) is used as the metric of fund investment horizon. The other explanatory variables include past-year fund flow, the expense ratio, fund age, flow volatility, fund size measured as log of total net assets, the CRSP turnover ratio (TR), dummies for high and low Active Share quintiles, interaction between Active Share dummies and the Ex-Ante Simple measure, and interaction between Active Share dummies and the CRSP turnover ratio. The regressions include benchmark and time fixed effects in Panel A and also style fixed effects in Panel B. The benchmarks are obtained from Martijn Crmers's website and the investment style data come from Hunter et al. (2014). Standard errors are clustered by benchmark and time (benchmark, style, and time in Panel B).

Panel A: Without style fixed effects

	4-Factor α								DGTW-risk adjusted returns							
	1M	1Y	3Y	5Y	1M	1Y	3Y	5Y	1M	1Y	3Y	5Y	1M	1Y	3Y	5Y
Ex-Ante Simple ($HH^{(2)}$)	0.013	0.117	0.608	1.272	0.013	0.148	0.706	1.388	0.011	0.128	0.389	1.084	0.012	0.125	0.283	0.811
	(0.085)	(0.029)	(0.001)	(0.000)	(0.084)	(0.008)	(0.000)	(0.000)	(0.212)	(0.057)	(0.031)	(0.000)	(0.121)	(0.017)	(0.056)	(0.000)
Fund size	-0.004	0.036	0.167	-0.283	-0.004	0.037	0.168	-0.287	-0.007	-0.134	-0.322	-0.635	-0.007	-0.135	-0.325	-0.634
	(0.671)	(0.696)	(0.378)	(0.182)	(0.670)	(0.689)	(0.375)	(0.183)	(0.305)	(0.008)	(0.002)	(0.006)	(0.310)	(0.008)	(0.002)	(0.006)
Expense	-0.051	-0.426	-1.362	-3.096	-0.051	-0.423	-1.360	-3.121	0.012	0.105	0.137	0.058	0.012	0.105	0.124	0.031
	(0.066)	(0.050)	(0.049)	(0.104)	(0.064)	(0.050)	(0.049)	(0.099)	(0.581)	(0.636)	(0.852)	(0.971)	(0.578)	(0.634)	(0.864)	(0.984)
Age	-0.002	-0.346	-1.375	-2.101	-0.002	-0.344	-1.373	-2.105	0.010	0.086	0.069	0.011	0.010	0.089	0.077	0.015
	(0.902)	(0.156)	(0.015)	(0.021)	(0.923)	(0.158)	(0.015)	(0.021)	(0.224)	(0.389)	(0.763)	(0.979)	(0.212)	(0.363)	(0.734)	(0.971)
Fund flow	0.000	-0.002	0.048	0.056	0.000	-0.002	0.047	0.051	-0.000	-0.016	-0.058	-0.082	-0.000	-0.016	-0.060	-0.083
	(0.730)	(0.219)	(0.026)	(0.268)	(0.752)	(0.206)	(0.039)	(0.279)	(0.969)	(0.000)	(0.039)	(0.159)	(0.964)	(0.000)	(0.032)	(0.136)
CRSP TR	0.010	0.321	0.615	0.529	0.016	0.358	0.648	0.743	0.010	0.020	-0.375	-0.856	0.012	0.063	-0.258	-0.973
	(0.409)	(0.010)	(0.099)	(0.341)	(0.219)	(0.009)	(0.128)	(0.277)	(0.402)	(0.866)	(0.375)	(0.103)	(0.322)	(0.577)	(0.548)	(0.033)
Low AS	-0.037	-0.772	-3.228	-6.682	-0.021	-0.571	-3.406	-7.508	-0.034	-0.482	-1.721	-3.094	-0.025	-0.405	-1.628	-3.529
	(0.201)	(0.000)	(0.000)	(0.000)	(0.464)	(0.000)	(0.000)	(0.000)	(0.204)	(0.002)	(0.000)	(0.000)	(0.363)	(0.012)	(0.000)	(0.000)
High AS	0.026	0.415	2.448	5.100	0.057	0.522	2.927	7.298	0.055	0.720	1.276	2.384	0.058	0.982	2.099	2.142
	(0.462)	(0.087)	(0.000)	(0.000)	(0.100)	(0.206)	(0.006)	(0.000)	(0.034)	(0.001)	(0.071)	(0.069)	(0.099)	(0.001)	(0.001)	(0.048)
Low AS*Ex-Ante Simple	-0.001	0.003	0.003	-0.009					-0.000	-0.005	-0.034	-0.106				
	(0.106)	(0.491)	(0.762)	(0.693)					(0.912)	(0.397)	(0.038)	(0.009)				
High AS*Ex-Ante Simple	0.002	0.020	0.064	0.102					0.001	0.010	-0.007	-0.019				
	(0.119)	(0.066)	(0.054)	(0.056)					(0.506)	(0.438)	(0.872)	(0.834)				
Low AS*TR					-0.022	-0.266	0.216	1.135					-0.012	-0.107	-0.156	0.382
					(0.188)	(0.022)	(0.517)	(0.239)					(0.309)	(0.443)	(0.806)	(0.702)
High AS*TR					-0.037	-0.146	-0.633	-2.711					-0.005	-0.314	-0.944	0.306
					(0.229)	(0.566)	(0.430)	(0.047)					(0.838)	(0.295)	(0.233)	(0.870)

Panel B: With style fixed effect

	4-Factor α								DGTW-risk adjusted returns							
	1M	1Y	3Y	5Y	1M	1Y	3Y	5Y	1M	1Y	3Y	5Y	1M	1Y	3Y	5Y
Ex-Ante Simple ($HH^{(2)}$)	0.010	0.054	0.426	0.850	0.010	0.090	0.564	1.057	0.011	0.124	0.411	1.101	0.012	0.127	0.334	0.869
	(0.270)	(0.323)	(0.033)	(0.044)	(0.254)	(0.199)	(0.013)	(0.004)	(0.286)	(0.204)	(0.109)	(0.059)	(0.211)	(0.131)	(0.086)	(0.051)
Fund size	-0.005	0.014	0.170	-0.254	-0.005	0.015	0.171	-0.259	-0.007	-0.126	-0.258	-0.519	-0.007	-0.126	-0.260	-0.518
	(0.536)	(0.860)	(0.380)	(0.278)	(0.574)	(0.857)	(0.367)	(0.270)	(0.251)	(0.020)	(0.069)	(0.141)	(0.307)	(0.070)	(0.043)	(0.134)
Expense	-0.055	-0.495	-1.555	-3.678	-0.055	-0.492	-1.549	-3.692	0.010	0.072	0.093	-0.069	0.010	0.071	0.080	-0.102
	(0.072)	(0.033)	(0.041)	(0.048)	(0.076)	(0.032)	(0.039)	(0.045)	(0.660)	(0.756)	(0.893)	(0.967)	(0.659)	(0.753)	(0.907)	(0.952)
Age	-0.002	-0.330	-1.269	-1.803	-0.002	-0.328	-1.268	-1.808	0.008	0.072	-0.014	-0.132	0.008	0.075	-0.006	-0.124
	(0.898)	(0.229)	(0.078)	(0.108)	(0.920)	(0.230)	(0.077)	(0.107)	(0.390)	(0.560)	(0.968)	(0.788)	(0.506)	(0.619)	(0.989)	(0.848)
Fund flow	0.000	-0.002	0.045	0.051	0.000	-0.002	0.043	0.047	-0.000	-0.017	-0.059	-0.080	-0.000	-0.017	-0.061	-0.082
	(0.846)	(0.610)	(0.090)	(0.323)	(0.854)	(0.572)	(0.195)	(0.295)	(0.976)	(0.002)	(0.292)	(0.286)	(0.967)	(0.013)	(0.227)	(0.397)
CRSP TR	0.008	0.252	0.483	0.246	0.013	0.290	0.510	0.440	0.010	0.032	-0.279	-0.734	0.012	0.077	-0.152	-0.845
	(0.575)	(0.146)	(0.237)	(0.647)	(0.356)	(0.138)	(0.287)	(0.554)	(0.436)	(0.823)	(0.479)	(0.115)	(0.388)	(0.582)	(0.698)	(0.058)
Low AS	-0.015	-0.440	-2.323	-4.509	0.005	-0.221	-2.451	-5.188	-0.028	-0.375	-1.617	-2.899	-0.017	-0.273	-1.408	-3.146
	(0.527)	(0.061)	(0.000)	(0.000)	(0.815)	(0.293)	(0.006)	(0.035)	(0.086)	(0.006)	(0.005)	(0.000)	(0.382)	(0.037)	(0.004)	(0.000)
High AS	0.032	0.285	1.322	2.093	0.062	0.378	1.698	4.034	0.063	0.728	1.240	1.977	0.066	0.980	2.016	1.586
	(0.206)	(0.203)	(0.003)	(0.004)	(0.000)	(0.200)	(0.002)	(0.001)	(0.001)	(0.000)	(0.005)	(0.082)	(0.008)	(0.002)	(0.002)	(0.267)
Low AS*Ex-Ante Simple	-0.000	0.008	0.012	0.009						-0.004	-0.032	-0.104				
	(0.643)	(0.180)	(0.574)	(0.858)						(0.543)	(0.251)	(0.135)				
High AS*Ex-Ante Simple	0.002	0.016	0.075	0.135						0.012	0.010	0.008				
	(0.202)	(0.235)	(0.123)	(0.107)						(0.449)	(0.877)	(0.935)				
Low AS*TR					-0.026	-0.281	0.144	0.893	0.000				-0.014	-0.141	-0.315	0.158
					(0.076)	(0.004)	(0.753)	(0.610)	(0.945)				(0.285)	(0.229)	(0.565)	(0.883)
High AS*TR					-0.036	-0.123	-0.513	-2.404	0.001				-0.005	-0.300	-0.895	0.429
					(0.097)	(0.654)	(0.560)	(0.120)	(0.605)				(0.711)	(0.207)	(0.154)	(0.790)

Table A6: 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 short 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 classiffied 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 percent 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 period minus one.

	LFH-SFH			LFH			SFH		
	HB ret	**4-F α**	**DGTW**	**HB ret**	**4-F α**	**DGTW**	**HB 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
		(0.00)	(0.00)		(0.49)	(0.13)		(0.01)	(0.00)
Q5	0.95	-0.14	-0.03	1.01	-0.09	0.04	1.44	0.36	0.40
		(0.10)	(0.55)		(0.29)	(0.47)		(0.00)	(0.00)
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
		(0.44)	(0.19)		(0.97)	(0.23)		(0.38)	(0.47)
Q5	14.18	-0.57	0.96	14.13	-0.64	1.05	14.05	0.75	1.12
		(0.57)	(0.10)		(0.55)	(0.09)		(0.49)	(0.16)
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
		(0.91)	(0.21)		(0.77)	(0.15)		(0.56)	(0.15)
Q5	30.92	2.61	3.32	30.53	2.25	3.50	27.30	0.46	1.89
		(0.29)	(0.00)		(0.33)	(0.01)		(0.82)	(0.20)
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
		(0.93)	(0.12)		(0.62)	(0.26)		(0.40)	(0.03)
Q5	48.04	6.20	5.49	48.19	5.73	6.63	41.12	0.15	3.24
		(0.12)	(0.00)		(0.11)	(0.00)		(0.94)	(0.15)
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
		(1.00)	(0.18)		(0.72)	(0.41)		(0.25)	(0.01)
Q5	67.86	12.76	8.86	68.62	11.30	11.00	56.81	2.16	5.25
		(0.02)	(0.00)		(0.02)	(0.00)		(0.22)	(0.20)
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
		(0.12)	(0.16)		(0.62)	(0.53)		(0.18)	(0.01)
Q5	92.48	18.89	13.10	94.12	16.26	16.68	78.88	5.91	9.75
		(0.02)	(0.00)		(0.02)	(0.00)		(0.00)	(0.17)
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 A7: Informativeness of fund holdings: Jegadeesh and Titman's approach

This table reports 4-factor alphas of stocks portfolios sorted on the relative fund holdings, long-horizon fund holding (LFH) minus short-horizon fund holding (SFH). A mutual fund is classified as a short-term (long-term) investor if it ranks in the bottom (top) tercile based on the style-adjusted Ex-Ante Simple or Simple horizon 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, 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 adopt Jegadeesh and Titman's (1993) overlapping portfolio approach for holing period returns. These returns are monthly returns expressed in percentage. The table also reports the performance difference between D10 and D1 portfolios, with p-values summarized in parentheses.

	Simple ($HH^{(1)}$)	Ex-Ante Simple ($HH^{(2)}$)
1-month		
D1 (short)	-0.20	-0.16
	(0.03)	(0.09)
D10 (long)	0.03	0.06
	(0.77)	(0.50)
D10-D1	0.22	0.22
	(0.04)	(0.04)
1-year		
D1 (short)	-0.21	-0.07
	(0.02)	(0.42)
D10 (long)	0.04	0.07
	(0.63)	(0.41)
D10-D1	0.25	0.14
	(0.01)	(0.10)
2-year		
D1 (short)	-0.16	-0.03
	(0.04)	(0.69)
D10 (long)	0.03	0.09
	(0.69)	(0.21)
D10-D1	0.19	0.13
	(0.01)	(0.06)
3-year		
D1 (short)	-0.09	-0.00
	(0.20)	(0.99)
D10 (long)	0.04	0.09
	(0.65)	(0.24)
D10-D1	0.13	0.09
	(0.05)	(0.13)
4-year		
D1 (short)	-0.06	0.01
	(0.38)	(0.91)
D10 (long)	0.08	0.13
	(0.32)	(0.08)
D10-D1	0.14	0.12
	(0.03)	(0.05)
5-year		
D1 (short)	-0.05	0.02
	(0.50)	(0.76)
D10 (long)	0.12	0.16
	(0.12)	(0.04)
D10-D1	0.17	0.13
	(0.01)	(0.02)