Mutual Fund Investment Horizon and Performance

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ABSTRACT

This paper proposes several new holdings-based measures of fund investment horizon, and examines the relation between manager skills and fund holding horizon. We find that both aggregate holdings and trades of long-horizon funds are informative about superior future long-term stock returns, whereas aggregate trades, but not holdings, of short-horizon funds are associated with future short-term stock returns. Specifically, stocks that are largely held by long-term funds outperform stocks that are largely held by short-term funds by roughly 3% per year over the following five-year period. This superior performance of fund managers with long investment horizons stems from their ability to identify superior long-term firm fundamentals. In contrast, short-term funds predict short-term earnings or use simple mechanical strategies, such as momentum strategies, to select stocks.

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1 Introduction

U.S.-domiciled actively managed equity mutual funds exhibit significant cross-sectional variation in investment horizons, although they are traditionally considered as being shorter-term investors than other institutional investors, such as pension funds. One explanation for this variation may stem from the differential abilities of fund managers to identify and process information that may yield superior returns over different investment periods. That is, some fund managers may possess skills in forecasting long-run stock returns, while others may possess skills in forecasting over the short-run.

These fund managers, in essence, claim to possess superior information about the future cash flows of firms, which are related to firm-specific fundamentals. Forecasting cash flows involves detailed firm-level analysis. This fundamental analysis, especially that of forecasting long-term cash flows, requires fund managers to generate insights about the future prospects of the firm's major projects, as well as the competitive position of the firm's products and the strength of the firm's balance sheet. Accordingly, we can expect that a manager who truly understands the long-term competitive position of a company to extract abnormal stock returns from its holdings of that firm over the long-run, regardless of short-term patterns in the returns (such as that due to momentum).[1]

Berkshire Hathaway, managed by one of the most successful investors of the 20th century—Warren Buffett—is a vivid illustration of achieving superior profits from long-term investments. Indeed, Warren Buffett famously stated that his "favorite holding period is forever." Buffett, a student and follower of Benjamin Graham, the father of value investing, is known to focus on long-term growth, and to invest in quality firms with strong fundamentals. An example from the mutual fund industry is Mario Gabelli, who manages the Gabelli Small Cap Growth fund. He holds stocks, on average, for five and half years,

[1] In equilibrium, we would expect that managers possessing superior long-term fundamental analysis skills will be in short supply, and, thus, will be rewarded over the long term before their information is fully realized by the market. Indeed, this is a key assumption of the Berk and Green (2004) model and an equilibrium outcome from the costly information model of Grossman and Stiglitz (1980).

and was recently awarded a five-star rating from Morningstar.[2]

On the other hand, short-term information, such as that about next-quarter earnings or time-varying investor sentiment, has a temporal effect on stock prices. Algorithmic trading, in particular, has been widely used in recent years to explore profitable temporary mispricing opportunities that can arise, for instance, due to time-varying investor sentiment that quickly reverts. Moreover, fund managers may exploit short-term earnings surprises, and collect short-run information from analysts. Fund managers who utilize these types of information are rather short-termist, and if skillful, are expected to be able to identify stocks with short-term profits, such as investors who trade to exploit the momentum anomaly (Grinblatt et al., 1995).

In this paper, we propose some novel, holdings-based measures of a fund's investment horizon. All of our measures are the value-weighted average of the holding period of stocks in a fund's portfolio; these measures differ, however, in their measure of the holding period of stocks. The first measure, termed the "Simple Horizon Measure," (SHM) calculates stock holding periods from the time a position is first initiated to the time it is completely liquidated. In this measure, the stock holding horizon does not account for the adjustment of positions of a stock, which may partially be executed to meet investor flows. The second measure, termed the "FIFO Horizon Measure" (FHM), allows for the possibility that position changes may also be informative about the intended holding horizon, and tracks inventory layers of each stock held by each fund. It assumes that the stocks purchased first by a fund are sold first (FIFO).

While these two measures capture true holding periods of stocks, they are ex-post measures that cannot be used in real-time to predict manager skills. Accordingly, we also consider two ex-ante measures of fund holding period. One is a modified version of the SHM, while the other is a modified version of the duration measure proposed by Cremers and Pareek (2011). The difference is that the second,

[2]See "TIP SHEET: Gabelli Fund Aims for Big Stakes, Long-Term Investments," *Wall Street Journal*, November 21, 2012.

similar to the FHM, adjusts as positions are changed by a fund, while the first does not. These two ex-ante measures use only past holdings information. Thus, both of them estimate, in real-time, a fund's investment horizon, but they may also underestimate the stock holding period when a fund manager purchases a stock and intends to hold the position for a long horizon. That is, our ex-post and ex-ante measures provide useful information about fund investment horizons from different perspectives.

Using these four measures, we find a wide, cross-sectional dispersion of fund investment horizons. For example, using the SHM to divide funds into quintiles, we find average holding periods are 1.18, 2.96, and 7.01 years, for the shortest, middle, and longest horizon quintiles, respectively. Moreover, long-horizon funds take a much longer time to either build or decrease their positions in a particular stock than short-horizon funds. Long-horizon and short-horizon funds take, on average, about 18 and 4 months to accumulate a position, respectively, while they take about 23 and 8 months to reduce a position, respectively. This finding suggests that long-horizon funds possess information that allows them to strategically accumulate or curtail a position. Relative to funds with short-term investment horizons, funds with long-term investment horizons tilt toward large stocks, stocks with high B/M ratios, and less liquid stocks. By contrast, short-term funds prefer past winners. Thus, short-horizon funds appear to employ more mechanical, trend-like strategies, while long-horizon funds appear to use more fundamentals-based strategies.

To study the relation between fund investment horizon and manager skills, our paper adopts two approaches, one at the stock level and the other at the fund level. The stock-level approach aggregates consensus opinions of the value of the stock from long- and short-horizon funds separately, and investigates future stock performance over various holding horizons. Our conjecture is that stocks that reflect the aggregate consensus opinion of long-horizon funds perform well in the long term, while stocks that reflect the aggregate opinion of short-horizon funds perform well in the short term, if fund managers optimally exploit their differing information advantage. The fund-level approach directly examines the

relation between fund holding horizons and future fund performance.

Each approach has its own strength. The stock-level approach is powerful in detecting fund managerial skills, because it studies the performance of stocks that can well-reflect the aggregate information across all fund managers. The fund-level approach is useful to analyze the performance of actual mutual funds, as it examines the performance of fund portfolios that can include stocks for non-performance purposes, such as controlling for deviation from a benchmark, as well as complying to legal restrictions and investment-objective requirements. The performance of fund portfolios can provide a realistic gauge of the benefits for mutual fund investors of our metrics of holding horizon, while the performance of stock portfolios can provide more precise information about how fund manager skills vary with holding horizon (and may also represent a quantitative stock investment signal).

Consistent with our conjecture, the stock-level approach reveals that the stock-holdings, in aggregate, of long-horizon funds are informative about the future long-term abnormal returns of a stock. For instance, risk-adjusted returns of stocks that are largely held by long-horizon funds increase almost linearly with holding horizons, and are as high as 6-14% over a five-year horizon; risk-adjusted returns of stocks that are largely held by short-horizon funds are either close to zero, or as low as -12% over the next five years, depending on the method that is used to control for risk exposure. The difference in the five-year risk-adjusted performance is 13%–18%, or roughly 3% per year, which is not only statistically but also economically significant. At this aggregate holdings level, we find little evidence of short-horizon risk-adjusted performance of stocks that are predominantly held by short-horizon funds. This may reflect that many stocks are held over longer periods by short-horizon funds for non-performance reasons, thus, these stocks repeatedly appear, over time, in our aggregation of holdings across short-horizon funds.

Interestingly, fund trades, in aggregate, of *both* long-horizon funds and short-horizon funds are informative about stock selection skills. Stocks that are largely purchased by long-horizon funds perform

well over the long run, while stocks that are largely purchased (sold) by short-horizon funds perform well (poorly) over the short term. Moreover, stocks that are largely purchased by short-horizon funds often outperform stocks that are largely purchased by long-horizon funds in the short term, although not in the long term. The long-run performance of stocks that are largely purchased by long-horizon funds is also quite good, although slightly lower than the performance of stocks largely held in long-horizon fund portfolios using our prior analysis of fund holdings rather than trades.[3]

We further delve into the economic sources of managers' stock selection skills, that is, the fundamental cashflow information that is reflected in the above-noted measures of funds' stock holdings or trades. We measure information shocks to firm fundamentals using four different variables: cashflow news ($CFnews$), consensus analyst forecast revision (FRV), earnings-announcement-window return (EAR), and market-adjusted EAR. Interestingly, we find the pattern of portfolio performance in terms of cash flows for different stock portfolios sorted on fund holdings or trading information is analogous to the pattern of portfolio performance in terms of returns. This finding indicates that long-horizon fund managers are skillful in analyzing long-term firm fundamentals, and achieve superior long-run performance, while short-horizon fund managers make use of short-term cashflow information to make small profits, consistent with our initial conjecture about manager skills.

In our analysis of fund-level performance, we use both a sorting fund portfolio analysis and Fama-MacBeth regressions that control for fund characteristics to examine the relation between future fund returns and fund investment horizon. In the sorting portfolio analysis, we find superior performance in terms of buy-and-hold (pre-expense) gross abnormal returns of long-horizon funds, but this superior

[3]These results reflect the trade-off of the informativeness of fund holdings vs. trades about managerial skills. Trades represent a more immediate signal of fund manager information, while fund holdings include both past and recent signals because holdings are the aggregate of all past trades. At the same time, trades represent a much smaller sample than holdings, because long-horizon funds may hold stocks for a long period and are able, as described earlier, to strategically and slowly accumulate or curtail their positions. Accordingly, long-horizon funds' superior information can spread into several fund trades over time and can be well captured by fund holdings. Thus, fund holdings are more informative than fund trades for long-horizon funds; while fund trades are more informative for short-horizon funds because short-term profitable opportunities quickly disappear if short-horizon funds do not take them. This result has implications for comparisons of studies of fund performance that use trades vs. holdings.

performance is not present for buy-and-hold net abnormal returns. Therefore, fund management captures long-horizon fund skill-based returns, while fund investors benefit little (consistent with Berk and Green, 2004 and Grossman and Stiglitz, 1980). Interestingly, long-horizon funds significantly outperform short-horizon funds over the long run for fund net abnormal returns, but not for fund gross abnormal returns. The reason is that short-horizon funds charge higher expense ratios, therefore, adding back these charges improves the performance of short-horizon funds more than that of long-horizon funds. We find stronger results when we control, in a multivariate Fama-MacBeth setting, for fund characteristics. Specifically, we find a significant positive relation between fund investment horizon and fund performance, regardless of whether we use gross or net fund abnormal returns to measure performance.[4]

Finally, we compare our horizon measures with the traditional turnover level that has been used in prior studies of fund performance. Turnover is a measure of the churn rate, which describes how frequently an institution rotates its positions in all its securities.[5] This measure has been used both in the studies of mutual funds and of institutional investors using 13-F data. In the 13-F literature a similar measure was suggested by Gaspar et al. (2005). Although (the inverse of) reported turnover of a mutual fund is a summary statistic that is positively correlated with our measures of fund investment period, it does not describe the rich information that is contained in the heterogeneity of stock holding periods.[6] Indeed, the turnover ratio tends to ignore positions that have been held for a long period. Therefore, the turnover ratio cannot adequately reflect the right tail distribution of holding periods of stocks held in a fund portfolio.

[4]The reason is that fund performance decreases with fund age, which, in turn, is positively correlated with fund investment horizon. Fund portfolios sorted solely on fund horizon therefore entangle two offsetting effects: fund performance decreases with fund age and fund performance increases with fund horizon. This is an interesting result: it indicates that younger fund managers trade frequently to learn about (or exhibit more quickly) their skill-levels, while older managers either become entrenched or (if skilled) become secure in their employment and are able to take longer bets that are, ultimately, more profitable.

[5]For mutual funds, the turnover ratio is an annual measure available in standard databases or in SEC filings. It is formally defined as the minimum of the annual dollar value of buys and sells divided by total net assets.

[6]For example, a fund with a particular turnover level may hold some stocks over long horizons, while trading others repeatedly over short horizons. Another fund with a similar turnover level may trade stocks over much more homogeneous investment horizons. Thus, turnover is an incomplete summary measure of a manager's typical holding period. Moreover, turnover can also be interpreted as a noisy proxy for other interesting manager behaviors. For instance, Cremers and Petajisto (2009) suggest that the turnover rate is a poor proxy of active management, and offer their Active Share measure as an alternative. They document that the correlation between active share and turnover ratio is only 18%.

Consistent with some prior studies, we find some evidence that managers of funds with higher levels of trading activity (high turnover) possess better skills in selecting stocks over the short run than managers of funds with low turnover, when CRSP reported turnover is used. We further run a horse race between our horizon measures and (the inverse of) turnover. At the fund-level in a multivariate regression, we find that the coefficient estimates on our horizon measures remain about the same magnitude, after the inverse of turnover is added as a regressor. In contrast, once our horizon measures are included, the coefficient estimate on the inverse of turnover becomes insignificant, or even turns negative. At the stock level, aggregate long-horizon fund holdings associated with our horizon measures again win out, in general, at the long and short terms.

This paper is related to a growing literature that uses holdings information to better understand the trading behavior and managerial skills possessed by fund managers.[7] However, when this literature has investigated the relation between investment horizon and fund performance, it has done so in an indirect way by using the reported turnover ratio of funds, rather than–as we do–through a detailed analysis of trades implied by periodic portfolio holdings data. The results from this literature are mixed: Using net returns, Carhart (1997) finds a negative relation between the turnover ratio and performance, whereas, using gross returns based on holdings, Grinblatt and Titman (1993) and Wermers (2000) provide evidence of a positive relation. Chen et al. (2000) also provide evidence that funds that trade more frequently have marginally better stock selection skills than funds that trade less often, prior to expenses. Our paper shows that the relation between holding-period and performance is much better understood through our new portfolio-holdings based measures of holding horizon.

Our paper is also related to the literature that studies, using 13-F data, whether institutional investors are informed by looking at the relation between institutional ownership or institutional trading

[7]This literature is too vast to review thoroughly in this paper. 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).

and future stock returns. While Cai and Zheng (2004) document a negative relation between institutional trading and the next quarter's stock returns, other papers (see Gompers and Metrick, 2001, Nofsinger and Sias, 1999) document the opposite relation. Interestingly, Yan and Zhang (2007) show that it is important to separate short-term institutional investors from long-term institutional investors.[8] They document that short-term institutions are better informed than long-term institutions: short-term institutional trading forecasts future stock returns, while long-term institutional trading does not.[9] Cremers and Pareek (2011) present evidence suggesting that the presence of short-term institutional investors can help explain some stock pricing anomalies such as the momentum, reversal, and share issuance anomalies.

Importantly, we show that, when we analyze the portfolio holdings of mutual funds, the above-mentioned findings of Yan and Zhang (2007) are reversed: long-horizon funds are better informed than short-horizon funds.[10] Indeed, long-term funds invest in stocks that deliver higher long-run cash flow news and earnings than stocks held by short-term funds. In contrast, short-term funds tend to merely exploit short-term strategies, such as engaging in momentum strategies.

Our paper proceeds as follows. Sections 2 and 3 discuss our empirical methodology and the data sets that we use. Section 4 presents our main empirical findings, where we focus on the performance of stocks held for differing horizons by mutual funds. Section 5 shifts to the fund level, for which we present estimates of performance based on holding periods, while Section 6 shows further evidence on the uniqueness of our holdings horizon measures. Section 7 concludes.

[8]Several other studies, focused on institutional investors, also characterize investors as either short-term or long-term. For example, the distinction between short- and long-term institutions appears to matter when investigating the effect of shareholder composition on corporate decisions (e.g., Bushee, 2001 and Gaspar et al., 2005). Almost all these studies use a measure of turnover ratio proposed by Gaspar et al. (2005) to classify investors, which is very similar to the reported mutual fund turnover ratio. Our results suggest an improved approach to classify institutions as short- or long-term investors in a given stock.

[9]Yan and Zhang (2009) do not distinguish between different types of institutions, such as pension funds, insurance companies, and mutual funds.

[10]We focus on mutual funds instead of all institutional investors. Mutual funds are included as part of aggregate portfolio lists in the 13-F data, but only at the fund advisor level. There is a good deal of heterogeneity in the investment horizon of different funds managed by the same advisor that is lost in the 13-F data; in addition, many advisors manage pension and other types of accounts, all of which are aggregated in 13-F data.

2 Methodology

2.1 Measures of fund investment horizon

The goal of our study is to investigate the relation between the investment horizon of a fund and the stock selection skills of its managers; as such, it is critical to properly measure a fund's investment horizon. We propose four alternative fund horizon measures: two ex-post, and two ex-ante measures. These four measures differ in how they define the holding horizon of a stock held in a fund's portfolio.

For the first measure, termed the "Simple Horizon Measure," the holding horizon of a stock is calculated as the time span with nonzero holdings–that is, the length of time from the initation of a position to the time that the stock is fully liquidated by a fund. Letting $h^{(1)}_{i,j,t}$ denote, in this measure, the holding horizon of stock i held by fund j at time t,

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

where the stock is purchased at time k and sold at time s. This measure does not account for changes in the number of shares of stock i held by fund j during the holding period.

Our second measure, termed the "FIFO Horizon Measure," addresses this issue by assuming that the first purchased shares are sold first (first-in-first-out). Let $h^{(2)}_{i,j,t}$ denote, in this measure, the holding horizon of stock i held by fund j at time t. Then

$$h^{(2)}_{i,j,t} = \begin{cases} \frac{\sum_{s,k} N_{s,k} * (s-k)}{N_{i,j,t}}, & \text{if } N_{i,j,t} > 0 \\ 0 & \text{if } N_{i,j,t} = 0 \end{cases} \tag{2}$$

where $N_{i,j,t}$ is the number of shares of stock i held by fund j at time t, $N_{s,k}$ is the number of shares purchased at time k and sold at time s, and $k \leq t < s$.[11] Construction of both simple and FIFO measures uses future information, so they are ex-post measures.

[11] As a concrete example–keeping in mind that the measure "looks ahead" to see when a position is liquidated–consider a fund that today purchases 1000 shares of General Electric (GE) and purchases 100 shares more in one year. In two years it sells 300 shares and in three years it liquidates the position. The simple measure is always equal to 3 years. The FIFO measure of GE today is (700*3+300*2)/1000 = 2.7 years. The FIFO of GE in one year is (700*3+300*2+100*2)/1100 = 2.6 years. The FIFO of GE in two years is (700*3+100*2)/800 = 2.9 years.

Although these ex-post measures are useful in measuring fund holding horizons, they cannot be implemented by the econometrician in real time. We, therefore, consider two ex-ante measures that only use information available at time t. Our third measure, termed the "Ex-Ante Simple Measure," modifies the simple measure by only using information available at t. Let θ_j be the date that is two years after the initiation date of fund j. Let $h^{(3)}_{i,j,t}$ denote, in this measure, the holding horizon of stock i held by fund j at time t, then

$$h^{(3)}_{i,j,t} = \begin{cases} t-k, & \text{for } k \leq t \text{ and } t > \theta_j \\ 0, & \text{otherwise,} \end{cases} \tag{3}$$

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

The fourth measure, termed the "Duration Measure," is a modified version of the measure that was proposed by Cremers and Pareek (2011). This measure is constructed based on past and current information, and accounts for changes in stock positions. It can be considered an ex-ante version of the FIFO measure, with the main difference being that it uses information on the percentage of total shares outstanding traded or held by a fund. 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 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

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

where $\alpha_{i,j,s}$ is the percentage of total shares outstanding of stock i bought or sold by fund j at time s, while $\alpha_{i,j,s} > 0$ for buys and $\alpha_{i,j,s} < 0$ for sells.[13,14]

[12] We also construct an ex-ante simple measure without the two-year warm-up period, and the two versions of modified simple measures have a correlation of 99%. The results to follow in later sections are very similar using either of these two modified versions.

[13] Cremers and Pareek (2011) study all institutional investors using 13f 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 four years of past data, and obtained similar results.

[14] 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.

The holding horizon of fund j at time t, denoted by $hf_{j,t}$, is then defined as the value-weighted holding periods of all stocks held in fund j. Specifically,

$$hf_{j,t} = \sum_{i=1}^{N_{j,t}} \omega_{i,j,t} h_{i,j,t}^{(m)}, \quad m = 1, 2, 3, 4 \tag{5}$$

where $N_{j,t}$ 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 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 our results with prior studies in the literature, we also use the inverse of turnover as a fund horizon measure. The turnover ratio is either obtained directly from the Center for Research in Securities Prices (CRSP) mutual fund database, or calculated based on a mutual fund's equity holdings. To calculate the holdings-based turnover, we first compute quarterly turnover as the minimum of purchases and sales executed by a fund during a quarter, divided by the fund's average total net assets during the quarter. Then, we average this quarterly turnover over the past year (or, alternatively, past three years).

2.2 Measures of short- and long-horizon fund holdings and trades

Past research indicates that consensus opinions of mutual funds about a stock may represent superior (e.g., Wermers, Yao, and Zhao, 2012) or inferior (e.g., Wei, Wermers, and Yao, 2014) information about the value of that stock, depending on the setting. It is also important to note that 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 inflows, competitive pressures, etc.[15] Examining the performance of stocks that reflect consensus opinions of one type of funds over another can be a simple and powerful method to test whether the two groups possess differential skills (if their skill-unrelated stock selections are similar).[16] We, therefore, aggregate holdings and trade information from

[15] See, for example, Del Guercio (1996) and Brown, Harlow, and Starks (1996).

[16] As noted by Wermers, et al. (2012), a stock-level analysis serves as a "magnifying glass" on the collective stock-picking wisdom of fund managers; they develop a stock return predictive measure based on an efficient aggregation of the portfolio

long-horizon funds and short-horizon funds separately, then study the performance of stocks that are largely held or traded by one type of fund vs. the other.

To define long-horizon fund holdings (LFH) and short-horizon fund holdings (SFH), we first rank all funds in each month into terciles, based on the different measures of fund investment horizon that we have discussed in the preceding section. Funds in the top tercile are classified as long-horizon funds, and those in the bottom tercile are classified as short-horizon funds. Similar to Yan and Zhang (2009), we calculate LFH (SFH) as the aggregate holdings of a given stock by long- (short-) horizon funds divided by that stock's total number of shares outstanding.

If long-horizon fund managers possess skills different from short-horizon fund managers in picking stocks, LFH and SFH are likely to vary considerably across stocks. If long-horizon fund managers have stock selection skills, we would expect that stocks with a large LFH have good long-term performance. If short-horizon fund managers have stock selection talents, we would expect that stocks with large SFH have good short-term performance.

To capture fresh information about the consensus opinion of the value of a stock, we define a long-horizon fund trade ($LFTrade$) as the 3-month change in long-horizon fund holdings, and a short-horizon fund trade ($SFTrade$) as the 3-month change in short-horizon fund holdings. Specifically, LFTrade and SFTrade in month t are defined as $LFTrade_t = LFH_t - LFH_{t-3}$ and $SFTrade_t = SFH_t - SFH_{t-3}$, respectively. Since most funds report their holdings at a quarterly frequency, this 3-month change measure captures trades for most funds.[17] In addition, a 3-month change in fund holdings works well even if funds report their quarterly holdings in the first or the middle month of a calendar quarter, because LFH and SFH are defined at a monthly frequency.

If long-horizon fund managers are talented in selecting stocks that perform well in the long-run, we

holdings of all actively managed U.S. domestic equity mutual funds. Jiang et al. (2014) is another recent application of a stock level analysis using mutual fund over- and under-weighting stock decisions.

[17]We also study the definition of fund trades as a 6-month change in fund holdings, the results are very similar.

would expect that those managers take time to strategically accumulate their stock positions. Moreover, these well-performing long-term stocks are held for a long time, and are not traded frequently by long-horizon funds, so it is likely that $LFTrade$ is less informative than LFH in reflecting long-run stock performance. This may not be the case for short-horizon funds. If short-term opportunities are not taken, then they may quickly disappear. Therefore, $SFTrade$ is likely to be more informative than SFH in reflecting short-run stock performance.

2.3 Evaluating stock and fund performance

We use two methods to examine fund managers' stock-selection skills across funds with different holding horizons. The first method, the stock-level analysis, aggregates holdings and trade information from long-horizon and short-horizon funds separately, then studies the relation between stock performance over different horizons in the future and the aggregate holdings or trading information from either long- or short-horizon funds. The second method, the fund-level analysis, directly investigates the relation between future fund performance and fund holding horizons.

We rely mainly on a sorted-portfolio approach to evaluate long-term and short-term portfolio performance. Each month, we sort stocks into different portfolios based either on aggregate fund holdings or trades (separately for long-horizon and short-horizon funds), or we sort funds into quintiles based on the fund holding horizon measures. We then calculate buy-and-hold stock or fund portfolio returns over the next month, and up to the next five years. The portfolios are equally weighted in the formation month, then updated using a buy-and-hold strategy.

To evaluate portfolio performance, we use both buy-and-hold portfolio returns and risk-adjusted abnormal returns. We select the Carhart (1997) four-factor model and the holdings-based characteristics model of Daniel, Grinblatt, Titman, and Wermers (1997; DGTW) and Wermers (2003) to control for risk exposure. The four-factor alphas and DGTW-adjusted returns reflect managerial skills after accounting for risk. Specifically, to construct the former, we download monthly returns on component portfolios

that are used to construct Carhart's four factors from Ken French's web site,[18] then compound these monthly returns on each component portfolio into a holding horizon of interest. Analogous to the construction of monthly four factors, we calculate four factors with different holding horizons from one month to five years. For example, HML of horizon n is the average of n-period returns of small value portfolios and big value portfolios, minus the average of n-period returns of small growth portfolios and big growth portfolios. The four-factor alpha is obtained by regressing buy-and-hold returns on the corresponding Carhart four factors with the same holding horizon. In implementing this horizon regressions, we use overlapping buy-and-hold returns, reconstituted at a monthly frequency, to improve statistical power. We apply the Newey-West approach in calculating standard errors to account for autocorrelation and heterogeneity. For example, in the test of three-year portfolio performance, we use a lag of 35 in the Newey-West formula to compute standard errors.

To obtain DGTW-adjusted returns for a portfolio over a horizon of interest, we compound monthly DGTW benchmark returns for the portfolio over the holding horizon of interest, then subtract it from the similarly compounded returns of the portfolio (overlapping, monthly reconstituted portfolios are employed here, too, with a Newey-West correction).[19] DGTW benchmark portfolios are reconstituted 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 using the book value of equity for the most recently reported fiscal year and 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 monthly DGTW benchmark return for a stock is the value-weighted return of one of 125 DGTW portfolios to which the stock belongs.

[18] See $http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html$.

[19] We obtain the benchmark returns for the DGTW performance measures from Russ Wermers's web site at http://www.smith.umd.edu/faculty/rwermers/ftpsite/Dgtw/coverpage.htm.

3 Data

We study U.S. active equity mutual funds from the intersection of Thomson Reuters mutual fund holdings database and the Center for Research in Securities Prices (CRSP) mutual fund database. Those two databases are linked using MFLINKS, available 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 TNA as weights, except that fund age is the oldest share class and TNA is the sum of net assets across all share classes belonging to a given fund. For the sample selection, we follow the same 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 five 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.[20]

The final sample includes 2,969 equity funds over a sample period that starts at the end of March of 1980. The sample period of fund holdings ends in 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, and analyst earnings forecasts come from the Institutional Broker's Estimate System (IBES) summary unadjusted file.

[20] As a robustness check, we also add another filter requiring two years of holdings data. This filter eliminates 148 funds to avoid the possibility that a fund has a short investment horizon simply because there is a short history. The results of this paper stay the same when we include these 148 funds.

3.1 Summary statistics

Table 1 reports some summary statistics for our mutual fund sample. On average, mutual funds hold around 90 stocks with total assets of $790 million for a period about three and half years in terms of the simple horizon measure or two and half years in terms of the FIFO measure. Both the number of stocks and total net assets managed by mutual funds are skewed. The average holding periods in terms of the ex-ante simple and duration measures are smaller because the holding period of each stock is cut at the current time. CRSP reported turnover ratio is almost 90%. As expected, turnover calculated using fund holdings averaged over the past four quarters is lower and about 64% because some funds engage in intraquarter trading that cannot be captured by holdings (Puckett and Yan, 2011) and also engage in non-equity position trading. The average fund age is almost 15 years. Due to mushrooming of small funds in the recent decade, the median fund age is much smaller and about 10 years.

The portfolio characteristics considered are the cross-sectional average quintile ranks of stocks sorted according to size, book-to-market ratio, momentum, and liquidity with one being the lowest and five being the highest quintile.[21] Consistent with previous studies (e.g., Falxenstein, 1996, and Chan et al., 2002) equity mutual funds, on average, tend to prefer larger companies, past winners, and more liquid stocks.

To better understand fund characteristics and stock holdings' characteristics of short-term institutions vs. long-term institutions, we sort all the mutual funds into quintiles according to our horizon measures, then calculate the average fund and stock characteristics in each quintile. Panel B of Table 1 presents the results using the simple horizon measure.[22] Notice that total net assets and fund age increase with fund holding horizons and that expense ratio decreases with fund holding horizons. Put differently, long-term funds are large and long-established funds with a relatively small expense ratio.[23]

[21] Stock liquidity is captured by the stock level turnover defined as the prior quarter average of the daily turnover ratio. The daily turnover ratio is defined as the daily trading volume divided by the number of shares outstanding.

[22] Results with the other horizon measures are very similar.

[23] Despite the lower expense ratio, the revenue fees of long-term funds is not necessarily lower than short-term funds given the difference in size.

There are also clear patterns in the characteristics of stock holdings of funds with different holding horizons. Long-term funds tend to prefer larger companies, more value firms (high book-to-market), less past winners, and less liquid stocks than short-term funds. Moreover, there is a wide dispersion in the fund investment horizons. For example, the average simple measure in each fund quintile suggests that short-, medium-, and long-term funds hold stocks for about one, three, and seven years, respectively.

To better characterize how long a fund takes to accumulate or lower a position in a row, we calculate the time span of consecutive purchases (sales) by a fund as the value-weighted average of time span of purchases (sales) of all stocks in the fund portfolio. The time span of a purchase must start with the purchase of a stock and end with a purchase, with no sales in between. Similarly, the time span of a sale must start with the sale of a stock and end with a sale, with no purchases in between. Table 2 reports the summary statistics of time span, in terms of the number of months, that long-horizon and short-horizon funds use to purchase or sell a stock in a row.

Long-horizon funds take much longer time to either continuously increase or continuously decrease their positions than short-horizon funds. Long-horizon and short-horizon funds take on average about 18 and four months to accumulate a position, respectively. Long-horizon and short-horizon funds take on average about 23 and eight months to reduce a position, respectively. Interestingly and surprisingly, long-horizon funds can take about three to four years to keep increasing or decreasing a position. This finding suggests that long-horizon funds are able to take time to strategically accumulate or curtail a position.

Table 3 reports the correlation matrix of our investment horizon measures, CRSP reported turnover, and holdings-based turnover. While there is a high correlation among our measures of investment horizons with values ranging from 0.77 to 0.89, the correlations between our horizon measures and turnovers, especially CRSP reported turnover, are smaller in magnitude, around 0.5 in absolute value. The correlations among long-horizon fund holdings that are constructed using different fund horizon

measures are quite high, roughly 0.7—0.9. The correlations among short-horizon fund holdings have a similar magnitude. However, the correlation of LFH and SFH is quite low. This means that long- and short-horizon funds are interested in different stock groups in general.

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 horizon skills tend to persist. To check this persistence, each month, we sort fund portfolios into quintiles according to one of our horizon measures, the Simple, FIFO, Ex-Ante Simple, or Duration Measure. Q1 consists of funds with the lowest holding periods and Q5 consists of funds with the highest holding periods. Figure 1 depicts the average fund holding horizons of each quintile at the formation period and subsequent first to 20th quarter.

Fund investment horizons exhibit long-term stability. The ranking of the quintile portfolios in the 20th quarter after the formation period remains identical to that in the formation period. Take the Simple Horizon Measure as an example. The average investment periods are 1.2, 2.2, 3.1, 4.3, and 6.9 years for the five quintiles at the formation period, while the average investment periods become 2.2, 2.7, 3.5, 4.3, and 6.6 years in the 20th quarter after the formation period. Moreover, this remarkably persistent pattern is evident for both ex-post and ex-ante horizon measures. Thus, funds appear to self-select into a particular type of holding horizon–long or short.

4 Empirical results on stock performance

In this section, we examine whether the consensus opinion of long-horizon funds contains information about long-term stock performance, and whether the consensus opinion of short-horizon funds contains information about short-term stock performance. Since the correlation between LFH and SFH is low, long- and short-horizon fund managers are generally interested in different groups of stocks. Moreover,

stocks are often selected by both long- and short-horizon funds due to legal restrictions, style and investment objective requirements, etc., rather than due to manager skills in locating mispriced stocks. Therefore, we use holdings information of LFH and SFH together to classify stocks that favored by one fund group vs. the other. This simple method can help to capture stock picks due to managerial skills as opposed to other reasons for holding stocks. Similarly, we use the trade information embedded in $LFTrade$ and $SFTrade$ together to single out stock groups that are likely to reflect skills of either long- or short-horizon fund managers. Then, we compare future stock performance over different holding periods of stock portfolios that are preferred by long-horizon versus short-horizon mutual funds.

4.1 Informativeness of fund holdings

We first examine whether fund holdings can provide valuable information about future stock performance. Each month, stocks are grouped into quintiles based on the difference between LFH and SFH. The top quintile (Q5) contains stocks that are held more by long- and less by short-horizon funds, whereas the bottom quintile (Q1) consists of stocks that are held more by short- and less by long-horizon funds. We then calculate buy-and-hold portfolio returns for each quintile portfolio over the next month and up to five years after portfolio formation. Stocks in each quintile are weighted equally at formation date, then weights are updated following a buy-and-hold strategy. If a stock drops out due to, e.g., a delisting, we adjust the weights of the existing stocks. These buy-and-hold portfolio returns are then averaged over time. Figure 2 shows the buy-and-hold portfolio performance of the top and bottom quintiles over various holding periods, using either the Simple or FIFO Measure as the horizon measure. It also displays the return spread of the long-short position, which is long the top quintile and short the bottom quintile, along with 10% confidence intervals.

The results show a clear long-term outperformance of stocks in the top quintile, Q5, and no short-term outperformance of stocks in the bottom quintile, Q1. The first column of Figure 2 shows that the buy-and-hold returns for both top and bottom quintiles increase with holding periods. The increase is

much larger for the top quintile than for the bottom quintile. This leads to a rise in the positive spread on the long-short position over holding horizons, and the positive spread is statistically significant after two quarters. Consider the 5-year (20-quarter) performance as an example. The top quintile exhibits an average buy-and-hold return of 92% using the Simple Measure and 95% using the FIFO Measure, whereas the bottom quintile exhibits an average buy-and-hold return of about 70% using both horizon measures. The difference in the buy-and-hold returns of the two quintiles is more than 22% for five years, or 4.4% per year, which is statistically and economically significant.

The long-term outperformance of the top quintile is pronounced even after adjusting for risk exposure using Carhart (1997) four-factor alphas and DGTW (1997) adjusted returns. Figure 2 shows that both of the two risk-adjusted return approaches for the top quintile increase over holding horizons, whereas for the bottom quintile, the four-factor alpha is negative and decreasing with horizon, and DGTW-adjusted returns are close to zero at all horizons. As a result, the abnormal returns for the long-short portfolio are statistically positive at all horizons, and exhibit a monotonically increasing pattern as holding horizons increases.

Take the five-year horizon as an example. The four-factor alphas and DGTW adjusted returns for the top quintile portfolio are about 6% and 14%, respectively, for both the Simple and FIFO Measures. And the four-factor alpha and DGTW adjusted returns for the bottom quintile portfolio are about -12% and zero, respectively. The abnormal returns on the long-short portfolio are about 18% and 13%, respectively, over five years, or about 3% per year, both economically and statistically significant. On the other hand, both of the two abnormal returns for the bottom quintiles are negative and close to zero at the short run. This result indicates that there is little evidence of skillful stock selection based on short-horizon fund holdings.[24]

Using the ex-ante horizon measures, the Ex-Ante Simple and Duration Measures, Figure 3 displays

[24] As a robustness check, we also use a five-factor model that includes the Carhart four factors plus Pástor and Stambaugh's (2003) liquidity factor. All results in this paper remain quite similar using the 5-factor alpha instead of the 4-factor alpha to measure abnormal returns.

the buy-and-hold portfolio performance of top and bottom quintiles and their spread at horizons ranging from one month to five years. All the results and patterns we have seen in Figure 2, which uses ex-post horizon measures, remain, albeit with a slightly weaker magnitude of some results. This comparison indicates that the informativeness of long-horizon fund holdings about superior long-term stock performance is also pronounced using ex-ante horizon measures, and is not driven by the use of future information in the construction of fund holding horizon measures.[25]

We further examine how future stock performance varies with aggregate long-horizon fund holdings and short-horizon fund holdings together. Each month we double-sort stocks into terciles according to LFH and SFH independently, and then we examine future buy-and-hold returns of the intersected nine portfolios over the next month, and up to five years. Table 4 reports the buy-and-hold portfolio performance over the next month, next quarter, and next one to five years. Note that the best long-term holding returns come from two stock portfolios with medium or high LFH and low SFH, followed by two groups with medium or high LFH and medium SFH. While the portfolio of stocks with low LFH and high SFH have poor future buy-and-hold returns. Take the five-year holding horizon using the Simple Measure as an example. Panel A shows that the five-year buy-and-hold return is 97% for the stock portfolio with high LFH and low SFH, and that the five-year holding returns for stocks with low LFH and high SFH is only 75%, which is about 22%, or 4.4% per year, lower than the returns on the stocks with high LFH and low SFH. This difference is both economically and statistically significant.

Abnormal returns after accounting for risk exposure tell us a similar message: stocks with medium or high LFHs, combined with medium or low SFHs perform well in the long term. Consider the Carhart four-factor alpha at the five-year horizon as an example. The four-factor alphas are roughly 12% for stocks with a high LFH and low SFH, and almost 9% for stocks with a medium LFH and low SFH. While the four-factor alpha for the stocks with low LFH and high SFH is almost -11%, roughly

[25]For instance, with ex-post measures of holding horizon, long-horizon investors may simply be those investors who were the beneficiaries of more good luck, which motivated them to continue holding positions for a longer period.

4% per year lower than the previously mentioned good performers. These differences are economically and statistically significant, as seen in Panel B of Table 4. Overall, these double-sorting results further confirm that long-horizon funds have abilities in selecting stocks with superior long-term performance, and that stocks with large ownership by short-horizon funds perform poorly in the long run. One possible reason is that short-horizon funds are not concerned about the long-term performance of these stocks, and hold them for other reasons, such as to track a benchmark.

To present a more complete picture of how well stocks with different levels of LFH and SFH perform at various holding horizons, Figure 4 exhibits buy-and-hold returns for stocks with medium LFH and low SFH (denoted as Q2), stocks with high LFH and low SFH (denoted as Q3), and stocks with low LFH and high SFH (denoted as Q7) for holding horizons ranging from one month to five years using the Simple Horizon Measure. It also plots the return spreads for the long-short portfolio that buys Q3 and sells Q7 and the position that buys Q2 and sells Q7 in the last two rows along with the 10% confidence intervals. The long-short portfolio that buys Q3 and sells Q7 has positive and significant holding returns over a horizon of two years or longer. The abnormal returns for these long-short portfolios are also positive and significant at all horizons for the four-factor alphas and up to four years with DGTW-adjusted returns. Overall, these double-sorting results suggest that, consistent with the previous univariate-sorting results, the stocks with medium or large ownership by long-horizon funds and at the same time with small ownership by short-horizon funds perform quite well in the future.

All the preceding results using fund holdings information along with the low correlation between LFH and SFH imply that long- and short-horizon funds are generally interested in different groups of stocks. One possibility is that stocks with superior long-term performance are different from stocks with good short-term performance. Long-horizon fund managers are able to select stocks with good long-term returns. Another possibility is that a talented long-term fund manager strategically avoids

picking a stock that is popular among short-horizon funds. Because short-term funds are likely to move money in and out of a stock frequently, this behavior can generate a temporarily adverse price impact. By not selecting such a stock, long-term funds avoid the consequences of a temporary adverse price impact, such as experiencing fund outflows that follow underperformance in the short-run.

4.2 Informativeness of fund trades

If fund managers have talents in stock selection, fund holdings will incorporate current as well as historical superior information about the value of stocks, whereas fund trades will only reflect managers' current superior information. Therefore, we would expect that fund holdings are more informative about long-horizon funds' stock selection skills than trades for three reasons. First, if long-horizon funds apply techniques to pick stocks with good expected long-term performance and intend to hold those stocks for a long period, those funds are likely to slowly accumulate their positions to avoid market impact and purchase positions at low prices. Second, long-horizon funds are likely to hold their best stock picks for a long time, so those best picks appear in trades only at the time of purchase but appear in fund holdings for a long period. Third, since long-horizon funds hold but do not frequently trade their best selected stocks, they are likely to trade other stocks in their portfolio that are less attractive; in addition, they may trade these less attractive stocks for other reasons, such as to incorporate fund flows or to stay close to their benchmark. In contrast, if short-horizon funds use techniques to select stocks with temporarily good returns, then they have to trade quickly, otherwise, short-term profits can disappear. Therefore, fund trades can be more useful than fund holdings to capture skills of short-term funds that are more likely to take advantage of short-term information (see Chen et al., 2000). Accordingly, this section uses fund trades to analyze stock selection skills.

Our first test investigates whether fund purchases reflect stock selection skills. We sort stocks into quintiles based on long-horizon fund purchases relative to short-horizon fund purchases. Specifically,

stocks are assigned to five groups based on positive $LFTrade$ minus positive $SFTrade$.[26] The top quintile includes stocks that are purchased more by long-horizon funds than by short-horizon funds, and the bottom quintile consists of stocks that are purchased more by short-horizon funds than by long-horizon funds. Since stock purchases from both long- and short-horizon funds can be driven for reasons others than selection skills, such as style or investment objective requirements, our sorting based on the relative purchase can help to remove non-skill related purchases, and, thus, isolate purchases related to short-term or long-term selection skills.

Figure 5 presents the buy-and-hold returns and abnormal returns for the top (Q5) and bottom (Q1) quintiles over next month and up to five years using the Simple and FIFO Horizon Measures. A few points are noteworthy. First, different from the pattern based on fund holdings in Figure 2, short-term performance of the bottom quintile can be better than that of the top quintile. The short-term returns are negative for the long-short portfolio that buys the top quintile and shorts the bottom quintile, although these negative short-term returns are small and insignificant. Second, we see some evidence that purchases made largely by short-horizon funds are informative about future short-term stock performance. For example, the DGTW adjusted return at the two-month horizon is 25 basis points, and statistically significant, when the FIFO measure is used. Third, abnormal returns of the top quintile are positive over the long term. Finally, the long-short portfolio has positive alphas and positive DGTW adjusted returns at a horizon of roughly two years or longer, with most of these abnormal returns being statistically significant.

Comparing the patterns in Figure 2, which uses fund holdings information, with the patterns in Figure 5, which uses fund purchase information, we notice some interesting differences. First, as expected, holdings are more informative than purchases about managerial skills of long-term funds. Long-term abnormal returns on stocks that are largely held by long-horizon funds are larger in magnitude and

[26] One might also look at instances where $LFTrade$ and $SFTrade$ are negative, but it is more difficult to interpret such cases, as both types consider the stock unattractive, but perhaps to a different degree.

more statistically significant compared with long-term abnormal returns on stocks that are predominantly purchased by long-term funds. Since long-horizon funds take time to accumulate the positions of favorite stocks to smooth out potentially adverse price impacts, purchases can provide only partial information about long-horizon funds' good ideas compared with holdings. Moreover, purchases may be driven by non-skill related reasons, such as fund inflows and minimizing tracking errors. In this case, purchases may not reflect stock selection skills.

Second, the long-term performance of stocks that are largely held by short-horizon funds are worse than the long-term performance of stocks that are largely purchased by short-horizon funds. The above two differences make the long-term return spread of the long-short portfolio more positive when stocks are sorted based on fund holdings rather than fund purchases. Finally, fund purchases are more informative about short-term fund managerial skills. We find some (weak) evidence of stock selection ability of short-term funds using fund purchases, but little using fund holdings.

Next, we investigate the informativeness of fund sales. Stocks are sorted into quintiles based on the relative sales by long-horizon funds versus sales by short-horizon funds, or the absolute value of negative values of $LFTrade$ minus the absolute value of negative values of $SFTrade$. The top quintile includes stocks that are sold largely by long-horizon funds relative to short-horizon funds, while the bottom quintile consists of stocks that are sold predominately by short-horizon funds. Figure 6 presents stock portfolio performance over the next month and up to five years for the top and bottom quintiles, as well as for the long-short portfolio that buys the top quintile and sells the bottom quintile using the Simple and FIFO Horizon Measures.

Notice that the top quintile generally outperforms the bottom quintile at a horizon of a quarter or longer. The four-factor alpha for the long-short portfolio is significantly positive at the horizons of roughly 15 to 18 quarters, while the DGTW adjusted returns are positive but insignificant at all horizons. This result implies that stocks that are sold largely by long-horizon funds are likely to exhibit

good long-term performance, compared with stocks that are sold largely by short-horizon funds. One possible explanation is that long-horizon funds are able to pick stocks with good long-run returns. Even though they sell some of their holdings due to outflows or to exploit new investment opportunities, these stocks continue to outperform after they sell. Another possible explanation is that long-horizon funds sell stocks early because they want to realize some profits and not continue to take the risk of holding the position. In addition, we notice that short-term fund sales indicate short-term poor performance. For example, the four-factor alpha at the two- and three-quarter horizons is significantly negative.

4.3 Long holding-period stocks versus short holding-period stocks

If long-horizon fund managers are skillful in selecting stocks with good long-run performance, we would expect that stocks that are actually held by long-horizon funds for a long period perform better than stocks that these same funds hold for a short period. Similarly, if short-horizon fund managers are skillful at selecting stocks with good short-run performance, we would expect that stocks that are actually held by short-horizon funds for a short period perform well in the short term. This section refines the informativeness of fund holdings and fund trades about selection skills by distinguishing stocks that are on average held for a long or short period in the portfolios of long-horizon or short-horizon funds.

We use ex-ante measures to define stock holding periods. Specifically, let $h_{i,j,t}$ denote the holding horizon of stock i held in fund j at time t, then the average holding horizon of stock i owned by long-horizon funds, long-horizon fund holding period, is defined as

$$hs_{i,t}^{long} = \sum_{j=1}^{M_{i,t}^{long}} \eta_{i,j,t} h_{i,j,t}, \tag{6}$$

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 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. $h_{i,j,t}$ can be either the Ex-Ante Simple Measure or the Duration Measure.

Similarly, we define the average short-horizon fund holding period of stock i as

$$hs_{i,t}^{short} = \sum_{j=1}^{M_{i,t}^{short}} \eta_{i,j,t} h_{i,j,t}. \tag{7}$$

In an untabulated analysis, we show that, like fund holding period measures, the stock holding period measure is also very persistent. Therefore, a stock that has been held for a long period based on current and past information tends to also exhibit a long holding period in the future. This feature is important for us to identify stocks that are likely to have a long or short ex-post holding period using ex-ante information. This feature also enables us to avoid the reverse causality that stocks continue to be held because their current performance is good.

If the long-horizon fund holding period of a stock is larger (smaller) than the median holding period among all stocks that belong to long-horizon funds, then we say this stock has a long (short) holding period by long-horizon funds. Analogously, if the short-horizon fund holding period of a stock is larger (smaller) than the median holding period among all stocks that belong to short-horizon funds, then we say this stock has a long (short) holding period by short-horizon funds.

Figure 7 presents the stock portfolio performance along with the 10% confidence intervals of buy-and-hold returns and risk-adjusted abnormal returns. This figure considers four stock portfolios that are constructed as follows. We first classify stocks into quintiles based on LFH minus SFH, with Q5 consisting of stocks that are largely held by long-horizon funds, and Q1 consisting of stocks that are largely held by short-horizon funds, as we have done in section 4.1. In each of Q1 and Q5, we further divide stocks into two groups based on whether the short-horizon fund holding period of a stock is above the median in Q1, and whether the long-horizon fund holding period of a stock is above the median in Q5.

Stocks that are held for a long period by long-horizon funds have the best long-term future performance among the four stock groups. Buy-and-hold returns, four-factor alphas, and DGTW adjusted abnormal returns for this stock group all increase with holding horizons. For example, the buy-and-

hold return, the four-factor alpha, and the DGTW adjusted abnormal return at a five-year horizon for this stock group are 94%, 7%, and 14%, respectively, all statistically and economically significant. In contrast, stocks that are also held by long-horizon funds, but for a short period, have a five-year buy-and-hold return of 87%, a negative four-factor alpha and a positive DGTW-adjusted abnormal returns. This result confirms that the long-run outperformance of long-horizon funds stems from their long-term stock positions.

Similarly, we combine fund purchase information and stock holding periods to form four stock portfolios. Specifically, stocks are grouped into quintiles based on $LFTrade$ minus $SFTrade$, where $LFTrade > 0$ and $SFTrade > 0$, with Q1 being stocks that are purchased largely by short-horizon funds, and Q5 being stocks that are purchased largely by long-horizon funds, as we have done in section 4.2. Then in Q1 (Q5), we group stocks into two portfolios depending on whether the stock holding period by short-horizon (long-horizon) funds is above the median stock holding period. Using the Duration Measure as the fund horizon measure, Figure 8 displays the performance of these four stock portfolios during the one month, and up to five years after the portfolio formation month.

Again, stocks that are largely purchased by long-horizon funds and are held for a long period have the best long-term performance. DGTW-adjusted returns increase with holding horizons, and they are both economically and statistically significant at horizons of longer than one month. Four-factor alphas are economically and statistically significant at horizons of roughly four years or more. Meanwhile stocks that are largely purchased by long-horizon funds and are held for a short period perform worse. Stocks that are largely purchased by short-horizon funds and are held for both a short and long period perform well in the short run. For example, DGTW adjusted returns at the quarterly horizon are 45 and 58 basis points, which are statistically significant, for stocks with a short and long holding period among short-horizon funds, respectively. These results further confirm that trades contain information regarding the skills of both long-horizon and short-horizon funds.

Analogously, we combine fund sell information and stock holding periods to form four stock portfolios, then examine future performance. Figure 9 shows the results. Stocks that are largely sold by long-horizon funds and are held for a long period still have the best long-term performance. While stocks that are largely sold by short-horizon funds and are held for a short period have significantly negative four-factor alphas and DGTW adjusted returns. This result suggests that short-horizon funds have skills in identifying and selling stocks with poor short-run performance.

Finally, we examine the stocks for which long-horizon and short-horizon funds have different consensus opinions, with one group buying and the other selling. Specifically, we collect, in one portfolio, stocks that are purchased by long-horizon funds ($LFTrade > 0$), but sold by short-horizon funds ($SFTrade < 0$); and, we collect, in another portfolio, stocks that are purchased by short-horizon funds ($SFTrade > 0$), but sold by long-horizon funds ($LFTrade < 0$). Then in the former (latter) portfolio, we classify stocks into two groups depending on whether the stock holding period by long-horizon (short-horizon) funds is above the median long-horizon (short-horizon) holding period.

Figure 10 displays the buy-and-hold portfolio performance for these four portfolios. The best long-term performers are stocks that have above the median long-horizon fund holding periods and are purchased by long-horizon funds but sold by short-horizon funds. Both 4-factor alphas and DGTW adjusted returns are significantly positive at horizons of two years or longer. Stocks that are bought by short-horizon funds, but sold by long-horizon funds, have positive 4-factor alphas and DGTW-adjusted returns in the short term, with DGTW-adjusted returns statistically significant from zero. This result further confirms that both long-horizon and short-horizon fund trades are informative about stock selection skills. Stocks that are held for a short period by long-horizon funds can have poor long-term performance and, therefore, their presence works against finding evidence of overall outperformance of long-horizon funds. Thus, it is important to look at the horizons of individual stockholdings and trades of funds, rather than a fund-level average horizon measure, in order to determine the relation between

holding period and manager skills.

4.4 Cashflow information

In this section, we delve into a central issue regarding the economic source of managerial skills: the fundamental cashflow information reflected in funds' stock selection. If long-horizon fund managers are skillful at exploiting information related to long-term firm fundamentals, while short-horizon fund managers are good at evaluating short-horizon information, then we would expect the pattern of future cashflow information for different stock portfolios to be analogous to the pattern of stock portfolio returns that have been discussed in previous sections.

Accordingly, we measure information shocks to firm fundamentals using four variables: cashflow news ($CFnews$), analyst forecast revisions (FRV), earnings-announcement-window returns (EAR), and risk-adjusted EAR.[27] $CFnews$ is the cashflow component of unexpected quarterly returns that is obtained via a Campbell-Shiller decomposition; it reflects revisions in expected future cashflow information for all future periods. (The Appendix describes the details of the construction of this variable.) 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.[28] 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 of 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 cashflows over an infinite horizon that are reflected in stock returns. FRV reflects changes in earnings

[27] Since EAR is available only at the quarterly frequency, we construct all variables of information shocks at the quarterly frequency for simplicity.

[28] We also use EAR as 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.

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 11 displays cumulative results over the 1 to 20 quarters following the stock portfolio formation date. Specifically, we first calculate the cross-sectional mean of each information variable in the n^{th} quarter after the portfolio formation quarter, where $1 \leq n \leq 20$, then 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. Figure 11 shows the results for the stock portfolios that are largely held, purchased, and sold by long-horizon funds (Q5); and for the stock portfolios that are largely held, purchased, and sold by short-horizon funds (Q1), respectively. The second, fourth, and sixth rows show the result for long-short portfolios that buy Q5 and sell Q1, along with 10% confidence intervals.

Let us first focus on the cashflow results using the level of fund holdings to identify the different stock portfolios. Notice that all four cumulative fundamental variables are positive, and increase with holding horizons for stocks that are largely held by long-horizon funds (Q5). Untabulated results confirm that these positive cumulative cashflow results for Q5 are statistically significant. This result suggests that the long-run outperformance of stocks held in long-horizon fund portfolios is associated with superior long-term firm fundamentals. In contrast, cumulative cashflow variables can be negative ($CFnews$), positive (FRV), or close to zero (EAR and adjusted EAR) for stocks that are largely held by short-horizon funds (Q1). All of these four cashflow variables for the long-short portfolio that buys Q5 and sells Q1 are significantly positive at the horizons of six quarters and longer.

Interestingly, when fund purchase information is used to group stocks, stocks that are largely purchased by short-horizon funds (Q1) have better short-term cashflow information than stocks that are largely purchased by long-horizon funds (Q5). All four variables for the long-short position that buys Q5 and sells Q1 are negative, and two of them, $CFnews$ and FRV, are statistically significant. On

the other hand, stocks that are largely purchased by long-horizon funds (Q5) have better long-term cashflow information than stocks that are largely purchased by short-horizon funds (Q1)–in the long run, all four fundamental variables for the long-short portfolio are positive. $CFnews$ is statistically significant at horizons of one year and longer, and the other three variables are marginally significant at horizons of more than four years. When fund sale information is used to group stocks, only $CFnews$ on the long-short portfolio is statistically significant at all horizons; this result for $CFnews$ again indicates that stocks sold by Q5 remain more attractive than stocks sold by Q1.

We further use a buy-and-hold portfolio approach to investigate the cashflow content in the stock portfolio performance that we have discussed in previous sections. Specifically, we replace returns with returns on fundamental variables, keeping the same portfolio weights that we used to calculate buy-and-hold portfolio returns. This calculation can be roughly regarded as the cashflow component of a buy-and-hold portfolio return. Figure 12 presents the results using $CFnews$ and EAR as cashflow variables and using the Simple Measure as the horizon measure. Again, we see that stocks that are largely purchased by short-horizon funds have good short-term cash flow fundamentals, and stocks that are largely purchased by long-horizon funds have good long-term fundamentals.

In summary, the patterns in our cashflow results are analogous to the pattern in our prior stock portfolio return results of previous sections. First, long-horizon fund holdings are quite informative about stock selection skills. This result means that good long-run performance of stocks that are largely held in long-horizon fund portfolios is associated with strong long-term firm cash flows. Second, short-horizon fund trades suggest short-horizon fund skills, and long-horizon fund trades, though less informative than fund holdings, suggest long-horizon fund skills. Among the four cashflow variables, $CFnews$ provides the strongest evidence. One possible reason is that $CFnews$ represents quarterly revisions of expected future cash flows at all future horizons and, therefore, captures long-run changes in expected future cash flows that can affect stock prices; whereas other cashflow variables are related

to short-run earnings that reflect a short-term part of firm cash flows.

5 Empirical results on fund performance

In this section, we examine the relation between investment horizon and performance at the mutual fund level, using both a sorted fund portfolio approach and Fama-MacBeth regressions that control for fund characteristics.

5.1 Fund performance at different investment horizons

First, using a sorting fund portfolio approach, we group funds into quintiles each month based on the different fund horizon measures that we have discussed in Section 2.1. The average performance of each quintile is calculated as the buy-and-hold cumulative fund portfolio return at a horizon of one month, and up to five years. Portfolio weights are equal at the formation month, then updated following a buy-and-hold strategy. We use both CRSP reported fund net returns after expenses, and fund gross returns that are fund net returns plus $\frac{1}{12}$ times the most-recent fund expense ratio. Fund net returns are compensation that fund investors can actually obtain, whereas fund gross returns can be taken as the sum of compensation to both fund investors and fund managers, net of portfolio trading costs. Table 5 summarizes the results of portfolio performance in fund quintiles that are sorted on the Simple Horizon Measure at a horizon of one month, one quarter, and one to five years. It also reports the returns of the long-short portfolios that are long the fifth quintile and short either the first or the third quintile, where the first, third, and fifth quintile includes funds with the shortest, medium, and longest holding horizons, respectively.

Let us focus on the results using fund net returns in the first three columns of Table 5. First, there is a clear U-shaped fund performance in terms of buy-and-hold net returns with respect to fund holding horizons. Long-horizon funds perform the best in general, medium-horizon funds perform the worst, and short-horizon funds perform in between. Moreover, a U-shaped fund performance also exists in

terms of FF 3-factor alphas. But the best performers are short-horizon funds, while long-horizon funds rank second. Take the three-year horizon as an example. The buy-and-hold net return is 37.8% for short-term funds in the first quintile, decreasing to 36% in the second quintile, and then increasing to the best performance of 38.5% for long-horizon funds in the fifth quintile. The 3-factor alpha decreases from 1.5% in the first quintile to almost zero in the third quintile and then increases to 0.8% in the fifth quintile. Interestingly, once we control for momentum with the 4-factor model, the U-shaped pattern almost disappears, and the best performers are long-horizon funds. Moreover, the 4-factor alphas for short-horizon funds are much lower than the 3-factor alphas. For example, the three-year 4-factor alphas are -2.3%, -0.3%, 1.4% for the short-, medium-, long-horizon funds, respectively. The 4-factor alpha for short-horizon funds is 3.8% lower than the 3-factor alpha. Importantly, these results suggest that short-horizon funds generate alphas largely from momentum strategies. Once the momentum factor is controlled for, the performance of short-horizon funds becomes poor. These results are also consistent with the summary statistics shown in Table 1, that short-horizon funds prefer past winners.

Second, long-horizon funds outperform short- and medium-horizon funds in the long term, whereas short-horizon funds perform no better than long-horizon funds in the short term, according to the 4-factor alphas. Take the three-year holding horizon as an example. The long-short portfolio that buys the top quintile with long-horizon funds and sells the bottom quintile with short-horizon funds gains, on average, roughly 72 basis point in terms of buy-and-hold net returns. Since short-horizon funds are more exposed to momentum risk, compared to long-horizon funds, the 4-factor alpha of the long-short portfolio is a much larger 3.6%, or 1.2%, annualized–both statistically and economically significant. Buying the fifth quintile and selling the third quintile earns a three-year 4-factor alpha of 1.7%, which is also statistically different from zero. On the other hand, there is no evidence that short-horizon funds significantly outperform long-horizon funds in the short term, regardless of whether performance is measured using buy-and-hold net returns or abnormal returns.

Table 5 also reports fund performance in terms of gross returns, which add back expense ratios to net returns. Here, a couple of differences exist, compared with the results based on net returns. First, there is also a U-shaped relation between buy-and-hold gross returns and fund holding horizons, but short-horizon funds tend to generate the highest raw fund returns. Moreover, the long-short portfolio that buys the fifth quintile and sells either the first or third quintile earns lower alphas, using gross returns compared with net returns. The reason is that expense ratios decrease with fund holding horizons, as shown in Table 1, so short-horizon fund performance increases more than long-horizon fund performance after expense ratios are added back to gross fund returns. Second, long-horizon funds earn a significantly positive 4-factor alpha using gross returns, where they earn insignificant and a much small 4-factor alpha using net returns. This result means that long-horizon fund managers have stock picking-skills, but fund managers and fund expenses consume almost all of the value of active management. In contrast, short-horizon funds earn an insignificantly positive 4-factor alpha in the short run using gross returns, whereas they earn a negative or even significantly negative 4-factor alpha using net returns. This finding suggests that short-horizon funds, on average, do not have enough skill to cover their fees and expenses, and, therefore, might make fund investors worse off, compared to a low-cost index fund.

To view a complete picture of the relation between fund performance and fund holding horizons, Figures 13 and 14 display the fund performance over horizons ranging from one month to five years for the first, third, and fifth fund quintiles sorted on the Simple and FIFO Measures, respectively. They also present the return differences between the fifth and first quintiles and between the fifth and third quintiles, along with 10% confidence intervals. The four-factor alpha associated with buy-and-hold net returns for Q5 is small at a horizon of one year or less, but increases dramatically up to a horizon of roughly four years; in contrast, four-factor alphas for the first and third quintiles are negative at all horizons. The difference in the four-factor alphas between the fifth and first quintiles is more than 3% and statistically significant at a horizon of more than two years using the FIFO Measure, slightly

stronger than the result using the Simple Measure. The four-factor alpha for the long-short portfolio that buys the fifth quintile and sells the third quintile increases with holding horizons and statistically positive at all horizons using both the Simple and FIFO Measures. When we examine fund gross returns, four-factor alphas for these long-short positions are smaller because expense ratios decrease with fund holding horizons. Even so, they are positive with statistical significance at some horizons.

We also investigate the relation between fund investment horizons and fund performance using the Ex-Ante Simple and Duration Measures. The results using these two ex-ante horizon measures are similar to, but weaker than the results using the two ex-post measures. One possible reason is that the ex-ante measures, by construction, assign 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 measures to capture fund investment horizons.

Overall, comparing our prior results of the stock portfolio approach with these results that use a fund portfolio approach, we see that the former are more supportive than the latter of the notion that long-horizon funds are capable of picking stocks with good long-run performance and short-horizon funds are skillful in identifying stocks with good short-run performance. The reason is that our constructed stock portfolios reflect aggregate consensus opinions of either long-horizon funds or short-horizon funds, whereas portfolios that are weighted by fund holdings include stocks that are held for a variety of non-performance reasons (such as benchmark tracking). Therefore, the stock portfolio approach is more effective in revealing stock selection skills.[29]

Prior studies have documented that fund characteristics play an important role in determining fund performance and portfolio choice. Therefore, in further tests, we control for fund characteristics in the examination of the relation between fund performance and fund holding horizon. Specifically, in each month we run cross-sectional regressions of abnormal buy-and-hold fund returns on one of our horizon

[29]For example, when we use the inverse of CRSP turnover to classify funds into long- or short-horizon funds, as we will discuss in Section 6, we see evidence of stock selection abilities of long-horizon funds using our stock portfolio approach, but little evidence using the fund portfolio approach.

measures, controlling for a list of fund characteristics including fund age, log fund TNA, fund expense ratio, growth fund dummy, past year fund flow, as well as flow volatility and fund return volatility over the past year. We calculate means of the time series of coefficient estimates, following the Fama-MacBeth (1973) approach. Since our dependent variables overlap on a monthly frequency, standard errors are calculated using the Newey and West (1987) approach to account for autocorrelation and heteroskedasticity. We use as dependent variable the 4-factor alphas obtained using either fund net returns or fund gross returns.

Figure 15 reports coefficient estimates over horizons ranging from one month to five years using the Ex-Ante Simple Measure, with the first two rows containing results using fund net returns, and the last two rows using fund gross returns. We see that fund abnormal returns increase almost linearly with fund holding horizons over horizons of more than one year, and that this positive relation is statistically significant over horizons of more than two and half years. Take the five-year coefficient as an example. A one standard deviation increase in fund holding horizon increases fund abnormal performance by about 2.8% over a five-year horizon.[30] Interestingly, fund age significantly and negatively affects fund performance. This is also consistent with Pastor et al. (2014), who find that performance deteriorates over a typical fund's lifetime.[31] Because fund age increases with fund holding horizons, as shown in Panel B of Table 1, our fund sorting portfolio approach cannot disentangle these two offsetting effects, leading to a weak relation between fund performance and fund investment horizons. Moreover, fund expense ratios significantly decrease fund net returns. Consistent with the literature, growth funds have superior performance in the short run; however, their long-run advantage is lower.

[30]The result is stronger if ex-post horizon measures are used.

[31]Pastor et al. (2014) find evidence of industry-level, instead of fund-level, decreasing returns to scale, which could explain the above pattern. Consistent with their finding, our tests indicate no evidence of a fund-level economy of scale, as indicated by the insignificant coefficient on size (log TNA).

6 Using the inverse of turnover as a fund horizon measure

The mutual fund literature provides mixed evidence on the relation between the level of trading activity and fund performance. Wermers (2000) and Yan and Zhang (2007) show that a higher level of funds' trading activity is associated with better stock selection skills, whereas Carhart (1997) documents the opposite. These prior studies use turnover, which is usually either obtained from CRSP or calculated based on past one-year's fund equity holdings, to measure trading activity. If we assume that funds with a high level of trading activity generally hold stocks for a short period, whereas funds with a low level of trading activity generally hold stocks for a long time, then the inverse of turnover can be a proxy for fund holding horizon. Indeed, a turnover ratio computed from 13-F holdings data has been used in the institutional investor literature to classify investors as short or long-term.

Because CRSP turnover is widely used, our discussion mainly focuses on the results using the inverse of CRSP turnover. Figure 16 shows that funds with high turnover (Q1) outperform their low-turnover peers (Q5). When fund gross returns are used to measure fund performance, the four-factor alpha associated with buy-and-hold fund portfolios is significantly positive for funds with high levels of trading activity (Q1). Moreover, the four-factor alpha for funds with low turnover (Q5) is significantly lower than the four-factor alpha for funds with high turnover (Q1) at horizons of one year or less. The difference is about 1% a year. When fund net returns are used, the four-factor alpha is not statistically distinguishable from zero. The spread of the four-factor alpha for Q5-Q1 is negative, but insignificant for a short period. Furthermore, we see only weak evidence that funds with low turnover (Q5) outperform funds with high turnover (Q1) in the long term. These results suggest that managers of funds with higher levels of trading activities have skills to pick stocks with good short-term performance. But the value of skillful stock-picking is either retained by fund managers or consumed by fund expenses, and fund investors do not benefit.

We further run Fama-MacBeth regressions of fund abnormal returns on the inverse of CRSP turnover

along with other fund characteristics, as we have discussed in section 5.1. Figure 17 presents the estimation results. The inverse of CRSP turnover does not play a significant role in forecasting future fund performance regardless of the use of fund net returns or fund gross returns. This result suggests that our horizon measure is essential to capture stock-picking skills of managers with long investment horizon.

Why does CRSP turnover better capture stock-picking skills of short-term fund managers, while our holdings-based horizon measures better reveal skills of long-horizon fund managers? First, CRSP reported turnover reflects intraquarter trading, while ours does not. Puckett and Yan (2011) show that intraquarter trading earns positive abnormal returns, so the measures constructed using low-frequency fund holdings have a downward bias in capturing short-term selection skills because of their inability to account for interim trades. Therefore, when the inverse of CRSP turnover is used to sort funds, short-horizon (high-turnover) funds have significantly positive 4-factor alphas at a short period and significantly outperform their low-turnover peers. This result becomes much weaker when our horizon measures are used as the sorting variable. Similarly, based on the stock-portfolio approach, as we have discussed in section 4, the evidence that stocks largely purchased by short-horizon funds perform well in the short run is strongest when the inverse of CRSP turnover is used to divide funds into long- or short-horizon funds.

Second, turnover better captures average fund trading activities, whereas our measures more richly capture fund holding horizons, especially long horizons. Turnover tends to miss out positions that have been held for a long period. Put differently, turnover cannot adequately reflect the right tail distribution of holding periods of stocks held in a fund portfolio. Although levels of trading activities and fund holding horizons are negatively correlated, the correlations are far from perfect. Table 3 shows that the correlations between the CRSP turnover ratio and our horizon measures is as low as -0.43.

We also run a horse race between our horizon measures and the inverse of turnover to test which

one better reflect informativeness of fund holdings and fund trades. Specifically, we run regressions of abnormal buy-and-hold stock returns over one month and up to five years on aggregate long-horizon fund holdings in excess of aggregate short-horizon fund holdings (LFH minus SFH), where long- and short-horizon funds are computed both from one of our horizon measure and the inverse of turnover. Four-factor alphas and DGTW-adjusted returns are used to represent abnormal stock returns. We report the means, along with the 10% confidence intervals, of time series of coefficient estimates following the Fama-MacBeth (1973) approach. Standard errors are calculated using Newey-West approach to account for autocorrelation and heteroskedasticity. The first two rows of Figure 18 present the results. The estimated coefficients on LFH minus SFH are significantly positive, with a large magnitude when the Ex-Ante Simple Measure is used to define long- or short-horizon funds. In contrast, when the inverse of turnover, either CRSP reported turnover or holdings-based turnover, is used to define long- or short-horizon funds, the estimated coefficients on LFH minus SFH are small and insignificant. Therefore, our horizon measures are better than turnover in capturing informativeness of fund holdings and predicting stock performance. Similarly, we run these regressions for aggregate fund purchases instead of ownership level. The middle two rows of Figure 18 present results for the comparison between the Ex-Ante Simple Measure and the inverse of turnover, while the last two rows of the figure present results for the comparison between the Simple Measure and the inverse of turnover. In most cases, CRSP reported turnover performs worse than the horizon measures at identifying the difference between long-horizon and short-horizon fund skills.

Finally, we run a horse race between our horizon measures and the inverse of turnover in reflecting future fund performance at the fund level. We run the Fama-MacBeth regressions of abnormal buy-and-hold fund performance on the Ex-Ante Simple Measure and the inverse of turnover, controlling for the list of fund characteristics used previously. Figure 19 reports coefficient estimates on the horizon measure and the inverse of turnover. No matter whether alphas from fund net returns or fund gross returns are

used as a proxy of fund performance, the Ex-Ante Simple Measure wins out and significantly forecasts superior long-run fund performance, whereas the coefficient estimates on the inverse of turnover, both CRSP reported turnover or holdings-based turnover, are negative although insignificant.

7 Conclusions

Using newly proposed direct measures of fund investment horizon, this paper examines the relation between fund investment horizons and manager skills and further explores the economic sources of stock selection skills for managers with different investment horizons. We use two approaches, one at the stock-level and the other at the fund-level, to examine the relation. The stock-level approach aggregates consensus opinions of the value of a stock from long- and short-horizon funds separately and investigates stock performance over various holding horizons. The fund-level approach directly examines the relation between fund performance and fund holding horizons.

We find that the stock-holdings, in aggregate, of long-horizon funds provide valuable information about the long-term superior abnormal returns of a stock, whereas aggregate short-horizon fund holdings provide little information about the short-term abnormal returns of a stock. Interestingly, aggregate fund trades are informative about the stock selection skills of *both* long-horizon funds and short-horizon funds, and aggregate long-horizon fund trades are less informative than holdings. This result reflects the trade-off in examining fund holdings vs. trades. Trades represent a much smaller sample than holdings, since long-horizon funds may hold stocks for a long period and are able to strategically and slowly accumulate or curtail their positions. Accordingly, long-horizon funds' superior information can spread into several fund trades over time and can be well captured in fund holdings. In contrast, short-term profitable opportunities disappear soon if short-horizon funds do not take them, so fund trades are more informative for short-horizon funds.

We also delve into the economic sources of stock selection skills of fund managers with different

investment horizons, that is, the fundamental cashflow information that is reflected in funds' stock-holdings or trades. We find that the pattern of portfolio performance in terms of cash flows for different stock portfolios sorted on fund holdings or trading information is analogous to the pattern of portfolio performance in terms of returns. This finding indicates that long-horizon fund managers are skillful in analyzing long-term firm fundamentals, and achieve good long-run performance, and that short-horizon fund managers make use of short-term cashflow information to make small profits. Our paper is the first that shows superior long-run performance of stocks largely held or purchased by long-horizon funds. This provides support to the anecdotal evidence of the success of some long-term fund managers.

We further study the relation between fund investment horizon and fund performance to provide fund-level evidence. In this fund-level analysis, we use both a ranked fund portfolio approach and Fama-MacBeth regressions that control for fund characteristics. Using the ranked fund portfolio approach, we find superior buy-and-hold (pre-expense) gross return performance of long-horizon funds, but this superior performance is not present for buy-and-hold net returns. Thus, fund management captures long-horizon fund skill-based returns, while fund investors benefit little, consistent with Berk and Green (2004) and Grossman and Stiglitz (1980). Based on Fama and MacBeth regressions, we find a significantly positive relation between fund performance and fund holding horizon in the long run regardless of whether we use fund gross or net returns to measure performance. The reason is that fund performance decreases with fund age, which, in turn, is positively correlated with fund investment horizon. Fund portfolios sorted solely on fund horizon therefore entangle two offsetting effects: fund performance decreases with fund age and fund performance increases with fund horizon.

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). Our fund-level analysis suggests that

individual investors with long rebalancing horizons are better off investing in long-horizon funds rather than choosing short-horizon funds.

Appendix

A.1 Construction of cashflow news ($CFnews$)

This measure accounts for changing expectations of the sum of discounted firms' future cash flows over all future periods. It is constructed using Institutional Brokers Estimate System (IBES) summary unadjusted file. Monthly analyst earnings forecasts allow us to measure cashflow news at the monthly frequency. 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 the t subscript 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), Pastor, Sinha, and Swaminathan (2008), Da and Warachka (2009), Da, Liu, and Schaumburg (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:

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

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

$$X_{t,t+3} = FE2_t(1 + LTG_t), \tag{A.3}$$

$$X_{t,t+4} = X_{t,t+3}(1 + LTG_t), \tag{A.4}$$

$$X_{t,t+5} = X_{t,t+4}(1 + LTG_t). \tag{A.5}$$

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,

$$X_{t,t+j+1} = X_{t,t+j}[1 + LTG_t + \frac{j-4}{5}(g_t - LTG_t)], \text{ for } j = 5, \ldots, 9. \tag{A.6}$$

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

Following Da and Warachka (2009), Da, Liu, and Schaumburg (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:

$$e_{t,t+1+j} = \begin{cases} \log(1+\frac{X_{t,t+1+j}}{B_{t,t+j}}) & \text{for } 0 \le j \le 9 \\ \log(1+\frac{g_t}{1-\Psi}) & \text{for } j \ge 10 \end{cases} \tag{A.7}$$

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

$$E_t \sum_{j=0}^{\infty} \rho^j e_{t+1+j} = \sum_{j=0}^{9} \rho^j e_{t,t+1+j} + \frac{\rho^{10}}{1-\rho} \log(1+\frac{g_t}{1-\Psi}), \tag{A.8}$$

where ρ results from the log-linear approximation (Campbell and Shiller, 1988) and equals 0.96 in our sample. After ten years, the annualized discount factor $\rho = 0.96$ means that the remaining cash flows exert little influence on the cashflow news. Vuolteenaho (2002) shows that the cash flow news are the difference between cash flow expectations over consecutive months:

$$CFnews_{t+1} = E_{t+1} \sum_{j=0}^{\infty} \rho^j e_{t+1+j} - E_t \sum_{j=0}^{\infty} \rho^j e_{t+1+j} \tag{A.9}$$

where $CFnews_t$ denotes cashflow news at time t.

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Table 1: Summary statistics

This table reports the summary statistics of the sample of actively managed equity mutual funds. Panel A presents the statistics of fund characteristics, fund horizon measures, and portfolio characteristics of stock ranks for the full sample of mutual funds. Panel B summarizes these statistics for each fund quintile that is sorted according to the simple horizon measure that is defined in section 2. Stocks are ranked into quintiles according to various measures of stock characteristics such as size, book-to-market, momentum, and stock-level turnover, with 1 being the lowest and 5 being the highest. These stock ranks, with the exception of stock-level turnover, are available from Russ Wermers's Web site at http://www.smith.umd.edu/faculty/rwermers/ftpsite/Dgtw/coverpage.html. The stock-level turnover is defined as the average of the daily turnover ratio at the end of prior calendar quarters. The daily turnover ratio is defined as the daily trading volume divided by the number of shares outstanding. The sample covers the period of March 1980 through December 2010.

Panel A: The full sample

	Mean	**Median**	**SDEV**
TNA (in millions)	790.35	148.13	2823.05
Expense ratio (in %)	1.18	1.14	0.50
Number of stocks in the portfolio	88.60	62.06	104.97
Fund age	15.05	10.36	14.20
Simple horizon measure	3.46	2.93	2.19
FIFO horizon measure	2.47	2.07	1.53
Ex-ante simple horizon measure	2.04	1.77	1.19
Duration measure	1.16	1.10	0.44
Holdings fund turnover ratio (in %)	64.15	54.09	47.77
CRSP fund turnover ratio (in %)	89.89	65.40	105.33
Size rank	3.95	4.28	0.93
Book-to-market rank	2.68	2.69	0.54
Momentum rank	3.25	3.22	0.57
Stock level turnover	3.67	3.64	0.49

Panel B: Sorting based on the simple measure

	Mean	Median	SDEV
TNA (in millions) quintile 1	233.08	71.19	539.71
TNA (in millions) quintile 2	417.29	125.95	962.58
TNA (in millions) quintile 3	618.48	160.75	1769.36
TNA (in millions) quintile 4	907.97	231.00	2456.12
TNA (in millions) quintile 5	1875.27	308.69	5304.53
Expense ratio (in %) quintile 1	1.32	1.29	0.56
Expense ratio (in %) quintile 2	1.25	1.21	0.51
Expense ratio (in %) quintile 3	1.21	1.16	0.48
Expense ratio (in %) quintile 4	1.14	1.09	0.45
Expense ratio (in %) quintile 5	1.01	0.98	0.42
Number of stocks in the portfolio quintile 1	76.00	59.80	67.66
Number of stocks in the portfolio quintile 2	86.12	63.49	89.44
Number of stocks in the portfolio quintile 3	90.04	62.76	108.52
Number of stocks in the portfolio quintile 4	97.81	62.39	122.92
Number of stocks in the portfolio quintile 5	93.15	62.20	103.44
Fund age quintile 1	10.55	6.99	10.89
Fund age quintile 2	12.33	8.81	11.84
Fund age quintile 3	13.86	9.66	13.52
Fund age quintile 4	17.16	11.99	15.18
Fund age quintile 5	21.18	16.14	16.68
Size rank quintile 1	3.64	3.82	0.94
Size rank quintile 2	3.83	4.09	0.93
Size rank quintile 3	3.95	4.29	0.93
Size rank quintile 4	4.09	4.45	0.88
Size rank quintile 5	4.27	4.59	0.81
Book-to-market rank quintile 1	2.60	2.58	0.55
Book-to-market rank quintile 2	2.63	2.62	0.55
Book-to-market rank quintile 3	2.69	2.69	0.54
Book-to-market rank quintile 4	2.71	2.72	0.54
Book-to-market rank quintile 5	2.79	2.82	0.50
Momentum rank quintile 1	3.53	3.58	0.63
Momentum rank quintile 2	3.36	3.39	0.57
Momentum rank quintile 3	3.20	3.21	0.53
Momentum rank quintile 4	3.12	3.12	0.48
Momentum rank quintile 5	3.02	3.00	0.47
Stock level turnover quintile 1	3.95	3.97	0.48
Stock level turnover quintile 2	3.79	3.80	0.45
Stock level turnover quintile 3	3.64	3.62	0.44
Stock level turnover quintile 4	3.54	3.51	0.43
Stock level turnover quintile 5	3.40	3.35	0.44
Simple horizon measure quintile 1	1.18	1.24	0.33
Simple horizon measure quintile 2	2.07	2.06	0.24
Simple horizon measure quintile 3	2.96	2.95	0.29
Simple horizon measure quintile 4	4.16	4.12	0.44
Simple horizon measure quintile 5	7.01	6.53	1.73

Table 2: Consecutive trade periods

This table reports the summary statistics of the number of months that a fund portfolio takes to purchase or sell a stock in a row, or the time span for consecutive buys or consecutive sells in a fund portfolio for both long- and short-horizon funds.

	mean	sd	p10	p90	mean	sd	p10	p90
Simple	Short-horizon funds				Long-horizon funds			
Buy	4.21	3.41	0.71	8.71	18.80	17.91	3.22	38.88
Sell	7.83	5.21	2.26	14.31	23.11	20.27	4.83	47.55
FIFO	Short-horizon funds				Long-horizon funds			
Buy	4.15	3.29	0.72	8.48	19.56	17.78	3.53	39.07
Sell	7.30	4.71	2.14	13.08	24.37	20.01	5.76	48.05
Ex ante simple	Short-horizon funds				Long-horizon funds			
Buy	5.18	4.71	0.92	10.88	18.30	18.85	2.74	39.87
Sell	8.82	6.28	2.74	16.11	23.94	20.66	5.43	49.08
Duration	Short-horizon funds				Long-horizon funds			
Buy	5.41	5.29	1.01	11.09	20.32	18.70	3.28	42.29
Sell	8.60	6.03	2.72	15.66	26.17	21.39	6.37	52.78

Table 3: Correlations of fund horizon measures and long- and short-horizon fund holdings

Panel A reports the correlation matrix of six fund horizon measures. As described in section 2, the first four measures (simple, FIFO, ex-ante simple, and duration measures) are based on different definitions of the holding horizons of the stocks in a fund's portfolio. The other two measures are based on the fund turnover ratio. While one measure (holdings TR) is computed using only equity holdings, the other measure is the ratio available from the CRSP and is computed using the minimum of the annual dollar value of buys and sales of all the holdings divided by total net assets. Panels B and C present correlation matrices of long-horizon fund holdings (LFH) and short-horizon fund holdings (SFH), respectively. LFH (SFH) is defined as the aggregated shares held by long-horizon (short-horizon) funds divided by the number of shares outstanding, where long-horizon and short-horizon funds are classified using each of six fund horizon measures. Panel D reports the correlations of LFH and SFH, with each pair defined using one of six fund horizon measures. The correlation matrices are calculated as time-series averages of cross-sectional correlation matrices.

Panel A: Correlations of fund horizon measures

	Simple	**FIFO**	**Ex-ante simple**	**Duration**	**Holdings TR**	**CRSP TR**
Simple	1	0.89	0.88	0.77	-0.59	-0.43
FIFO	0.89	1	0.82	0.84	-0.62	-0.48
Ex-ante simple	0.88	0.82	1	0.83	-0.61	-0.46
Duration	0.77	0.84	0.83	1	-0.74	-0.58
Holdings TR	-0.59	-0.62	-0.61	-0.74	1	0.57
CRSP TR	-0.43	-0.48	-0.46	-0.58	0.57	1

Panel B: Correlations among long-horizon fund holdings (LFH)

	Simple	**FIFO**	**Ex-ante simple**	**Duration**	**Holdings TR**	**CRSP TR**
Simple	1	0.91	0.89	0.76	0.82	0.83
FIFO	0.91	1	0.87	0.80	0.86	0.87
Ex-ante simple	0.89	0.87	1	0.79	0.80	0.80
Duration	0.76	0.80	0.79	1	0.76	0.78
Holdings TR	0.82	0.86	0.80	0.76	1	0.87
CRSP TR	0.83	0.87	0.80	0.78	0.87	1

Panel C: Correlations among short-horizon fund holdings (SFH)

	Simple	**FIFO**	**Ex-ante simple**	**Duration**	**Holdings TR**	**CRSP TR**
Simple	1	0.89	0.85	0.67	0.77	0.75
FIFO	0.89	1	0.83	0.73	0.80	0.81
Ex-ante simple	0.85	0.83	1	0.76	0.79	0.77
Duration	0.67	0.73	0.76	1	0.74	0.70
Holdings TR	0.77	0.80	0.79	0.74	1	0.82
CRSP TR	0.75	0.81	0.77	0.70	0.82	1

Panel D: Correlations of long-horizon fund holdings (LFH) and short-horizon fund holdings (SFH)

LFH/SFH	**Simple**	**FIFO**	**Ex-ante simple**	**Duration**	**Holdings TR**	**CRSP TR**
LFH	0.12	0.10	0.13	0.11	0.10	0.08

Table 4: Long- and short-term stock performance based on double sort on long- and short-horizon fund holdings

This table reports buy-and-hold stock portfolio performance over the next one month, one quarter, and one to five years for each stock group that is double sorted according to long-horizon fund holdings (LFH) and short-horizon fund holdings (SFH). Specifically, each month stocks are independently sorted into terciles according to LFH and SFH. We then calculate buy-and-hold stock portfolio returns for the nine groups resulting from the double sorting. LFH (SFH) is defined as the aggregated shares held by long-horizon (short-horizon) funds divided by the number of shares outstanding, where long- and short-horizon funds are classified using the simple horizon measure. Panel A reports buy-and-hold stock portfolio returns and two abnormal returns, Carhart (1997) four-factor alpha (4-Factor α) and Daniel, Grinblatt, Titman, and Wermers (DGTW) (1997) adjusted returns. Panel B presents the performance of the long-short position that buys the portfolio with high LFH and low SFH, and sells the portfolio with low LFH and high SFH as well as the long-short position that buys the portfolio with medium LFH and low SFH, and sells the portfolio with low LFH and high SFH. The returns are expressed in percentage and the p-values are included in parentheses.

Panel A: Buy-and-hold stock portfolio performance

	Returns			4-Factor α			DGTW		
LFH\SFH	Low	Med	High	Low	Med	High	Low	Med	High
1 Month									
Low	1.00	0.98	0.88	-0.02	-0.08	-0.22	-0.04	-0.01	-0.11
Med	1.14	1.12	1.03	0.10	0.06	-0.07	0.12	0.10	0.03
High	1.11	1.19	1.07	0.06	0.10	-0.03	0.12	0.19	0.08
1 Quarter									
Low	3.04	3.07	2.63	-0.39	-0.34	-0.78	-0.21	-0.03	-0.43
Med	3.59	3.51	3.11	0.06	0.17	-0.22	0.35	0.32	-0.03
High	3.48	3.55	3.24	-0.02	0.20	-0.11	0.37	0.44	0.14
1 Year									
Low	14.29	12.80	11.83	-1.80	-1.39	-2.72	0.25	-0.16	-0.77
Med	16.10	14.94	12.83	-0.36	0.39	-1.20	2.14	1.74	0.03
High	15.58	15.07	13.51	0.17	0.21	-0.98	1.98	1.90	0.50
2 Years									
Low	29.86	28.19	24.76	-3.21	-2.59	-5.50	0.49	0.63	-1.02
Med	33.89	31.72	26.52	0.40	2.90	-0.94	4.79	3.93	0.60
High	32.65	30.98	28.35	3.15	2.18	0.26	3.91	3.48	1.79
3 Years									
Low	45.45	42.66	37.89	-6.80	-5.78	-6.56	0.46	0.77	-0.47
Med	51.49	49.02	40.62	2.01	5.94	1.71	7.08	6.35	0.93
High	49.40	47.42	43.28	4.67	4.60	1.29	5.17	5.26	2.67
4 Years									
Low	63.31	56.66	54.23	-8.72	-7.01	-11.29	1.05	-0.06	2.45
Med	69.76	66.88	54.46	4.78	11.55	2.66	8.45	7.77	0.21
High	70.24	66.72	60.92	8.46	7.77	1.55	8.74	8.07	4.54
5 Years									
Low	86.01	74.61	74.83	-6.06	-6.53	-10.84	3.20	-0.20	5.70
Med	92.43	89.09	73.54	8.86	15.57	2.01	10.12	9.72	1.48
High	97.17	90.75	84.50	12.41	9.95	-0.79	14.57	12.29	7.95

Panel B: Return spreads on long-short positions

	LFH=H & SFH=L - LFH=L & SFH=H			LFH=M & SFH=L - LFH=L & SFH=H		
	Returns	4-Factor α	DGTW	Returns	4-Factor α	DGTW
1 Month	0.23	0.28	0.23	0.27	0.32	0.22
	(0.29)	(0.05)	(0.04)	(0.20)	(0.02)	(0.05)
1 Quarter	0.84	0.76	0.79	0.95	0.84	0.78
	(0.08)	(0.01)	(0.00)	(0.05)	(0.00)	(0.00)
1 Year	3.74	2.89	2.75	4.26	2.36	2.91
	(0.12)	(0.01)	(0.03)	(0.03)	(0.01)	(0.00)
2 Years	7.89	8.66	4.94	9.13	5.91	5.81
	(0.06)	(0.01)	(0.01)	(0.01)	(0.04)	(0.00)
3 Years	11.50	11.22	5.65	13.60	8.57	7.56
	(0.04)	(0.01)	(0.02)	(0.01)	(0.04)	(0.00)
4 Years	16.01	19.75	6.29	15.53	16.07	6.00
	(0.09)	(0.00)	(0.21)	(0.06)	(0.00)	(0.22)
5 Years	22.34	23.25	8.87	17.60	19.70	4.42
	(0.07)	(0.00)	(0.26)	(0.15)	(0.00)	(0.64)

Table 5: Fund performance with fund holding horizons

This table reports buy-and-hold fund portfolio returns and abnormal returns over next month and up to five years. Each month funds are sorted into quintiles according to the simple fund horizon measure, with Q1 consisting of short-horizon funds and Q5 consisting of long-horizon funds. Both CRSP reported net returns and total returns (the sum of net returns and $\frac{1}{12}$ expense ratio) are used to measure monthly fund performance. Buy-and-hold net returns or buy-and-hold total returns are calculated over next one month and up to five years. Portfolio weights are equal at the formation month and then are updated following a buy-and-hold strategy. The abnormal returns include the Fame-French 3-factor alpha and the Carhart four-factor alpha associated with both buy-and-hold net returns and buy-and-hold total returns. The table also reports the performance spreads between the Q5 and Q1 portfolios and between the Q5 and Q3 portfolios. The returns are expressed in percentage. *, **, and *** represent significance at the 10%, 5%, and 1% confidence intervals, respectively.

	Net ret	Net 3-Fac α	Net 4-Fac α	Total ret	Total 3-Fac α	Total 4-Fac α
1 Month						
Q1 (short)	0.92***	−0.02	−0.10*	1.03***	0.09	0.01
Q2	0.90***	−0.08*	−0.10**	1.00***	0.03	0.01
Q3	0.89***	−0.10***	−0.08**	0.99***	0.01	0.02
Q4	0.92***	−0.06*	−0.04	1.01***	0.03	0.06*
Q5 (long)	0.94***	−0.04	−0.00	1.03***	0.05*	0.08***
Q5-Q1	0.02	−0.01	0.10*	−0.00	−0.04	0.08
Q5-Q3	0.06	0.06***	0.08***	0.04	0.04**	0.06***
1 Quarter						
Q1 (short)	2.87***	−0.01	−0.18	3.20***	0.32**	0.15
Q2	2.80***	−0.21**	−0.21**	3.12***	0.11	0.11
Q3	2.75***	−0.29***	−0.21**	3.06***	0.02	0.10
Q4	2.84***	−0.19**	−0.08	3.13***	0.10	0.21**
Q5 (long)	2.91***	−0.12	0.02	3.17***	0.14*	0.28***
Q5-Q1	0.04	−0.11	0.21	−0.03	−0.19	0.13
Q5-Q3	0.16	0.17***	0.23***	0.11	0.12**	0.18***
1 Year						
Q1 (short)	12.37***	0.73	−0.32	13.89***	2.18*	1.12
Q2	11.69***	−0.72	−1.08**	13.10***	0.64	0.27
Q3	11.72***	−0.82*	−0.78*	13.10***	0.49	0.53
Q4	11.97***	−0.59	−0.43	13.25***	0.62	0.78*
Q5 (long)	12.24***	−0.31	−0.01	13.38***	0.77**	1.07***
Q5-Q1	−0.13	−1.04	0.31	−0.50	−1.42	−0.05
Q5-Q3	0.53	0.51**	0.77***	0.29	0.28	0.54**
2 Year						
Q1 (short)	25.17***	1.04	−1.74	28.60***	4.20	1.30
Q2	23.80***	−0.91	−1.96*	26.96***	1.97	0.84
Q3	24.18***	−0.77	−0.81	27.27***	2.01*	1.93*
Q4	24.51***	−0.73	−0.73	27.38***	1.81**	1.78**
Q5 (long)	25.29***	0.07	0.43	27.84***	2.35***	2.71***
Q5-Q1	0.13	−0.98	2.17	−0.76	−1.84	1.41
Q5-Q3	1.11	0.83	1.24*	0.56	0.34	0.78
3 Year						
Q1 (short)	37.82***	1.49	−2.26	43.54***	6.52*	2.39
Q2	36.04***	−0.64	−1.72	41.29***	3.90*	2.62
Q3	36.67***	0.01	−0.33	41.81***	4.39***	3.89***
Q4	36.81***	−0.57	−0.36	41.56***	3.45***	3.52***
Q5 (long)	38.53***	0.77	1.38	42.74***	4.36***	4.88***
Q5-Q1	0.72	−0.72	3.64*	−0.80	−2.16	2.49
Q5-Q3	1.86	0.75	1.71**	0.94	−0.02	0.99
4 Year						
Q1 (short)	50.80***	1.75	−1.61	59.15***	8.69*	4.79
Q2	49.64***	−0.57	−1.99	57.36***	5.77**	4.00*
Q3	50.45***	−0.06	−0.61	57.99***	5.96***	5.17***
Q4	50.24***	−0.47	−0.46	57.20***	5.11***	4.88***
Q5 (long)	52.85***	1.28	1.87	59.00***	6.28***	6.69***
Q5-Q1	2.04	−0.47	3.48	−0.14	−2.41	1.90
Q5-Q3	2.40	1.34	2.48**	1.01	0.32	1.53
5 Year						
Q1 (short)	67.42***	2.14	−1.35	78.99***	11.21*	6.95
Q2	66.22***	−0.84	−2.59	76.96***	7.46*	5.26**
Q3	67.12***	−0.55	−1.56	77.63***	7.26***	5.94***
Q4	66.50***	−0.71	−0.94	76.17***	6.55***	5.93***
Q5 (long)	69.98***	1.57	1.31	78.50***	8.18***	7.57***
Q5-Q1	2.56	−0.56	2.65	−0.48	−3.03	0.62
Q5-Q3	2.86	2.12	2.87**	0.87	0.92	1.63

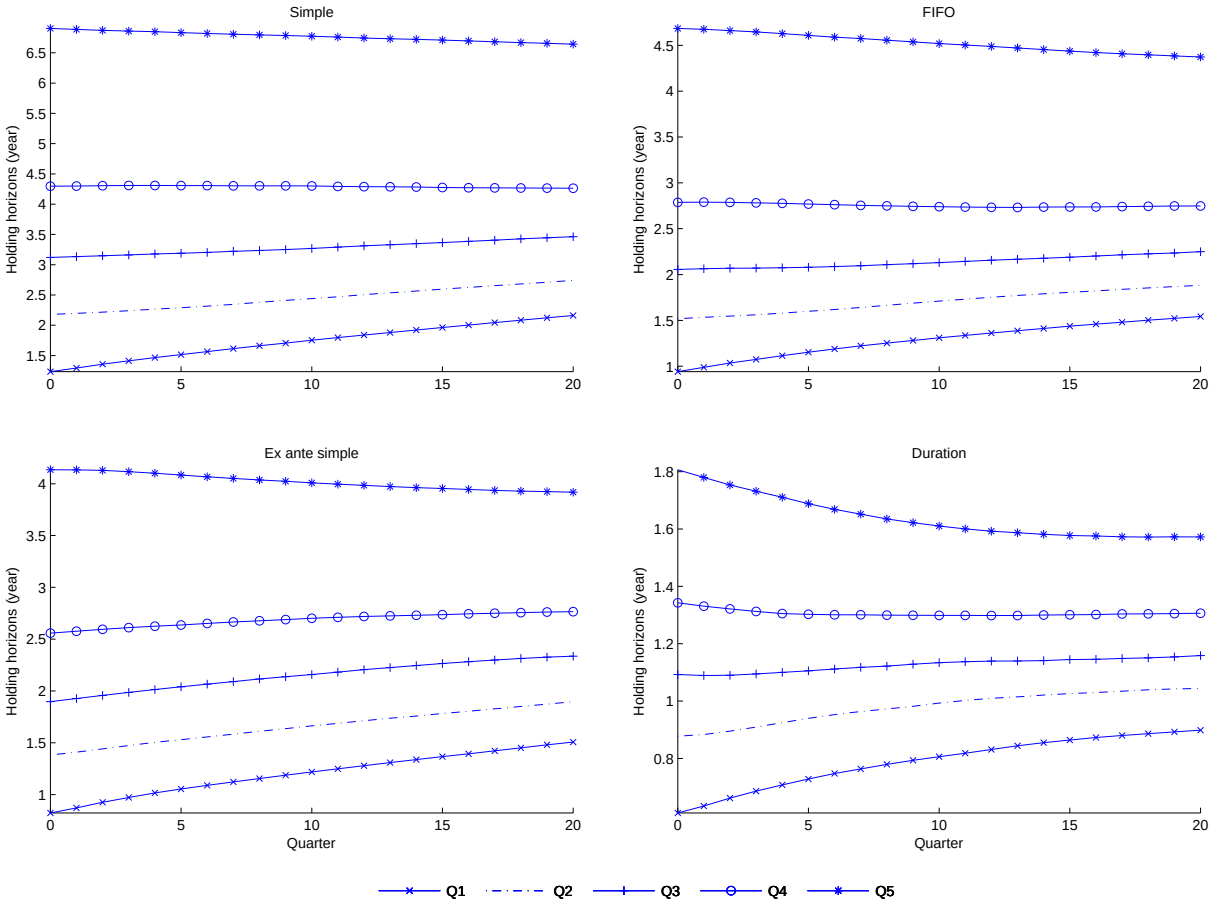

Figure 1: This figure plots average fund holding periods of each fund portfolio quintile at the formation period, as well as first to 20th quarter into the future after the formation period. Each month fund portfolios are sorted into quintiles according to one of the fund investment horizon measures, the simple, FIFO, ex-ante simple, or duration measures, with Q1 consisting of funds with the lowest holding periods and Q5 consisting of funds with the highest holding periods.

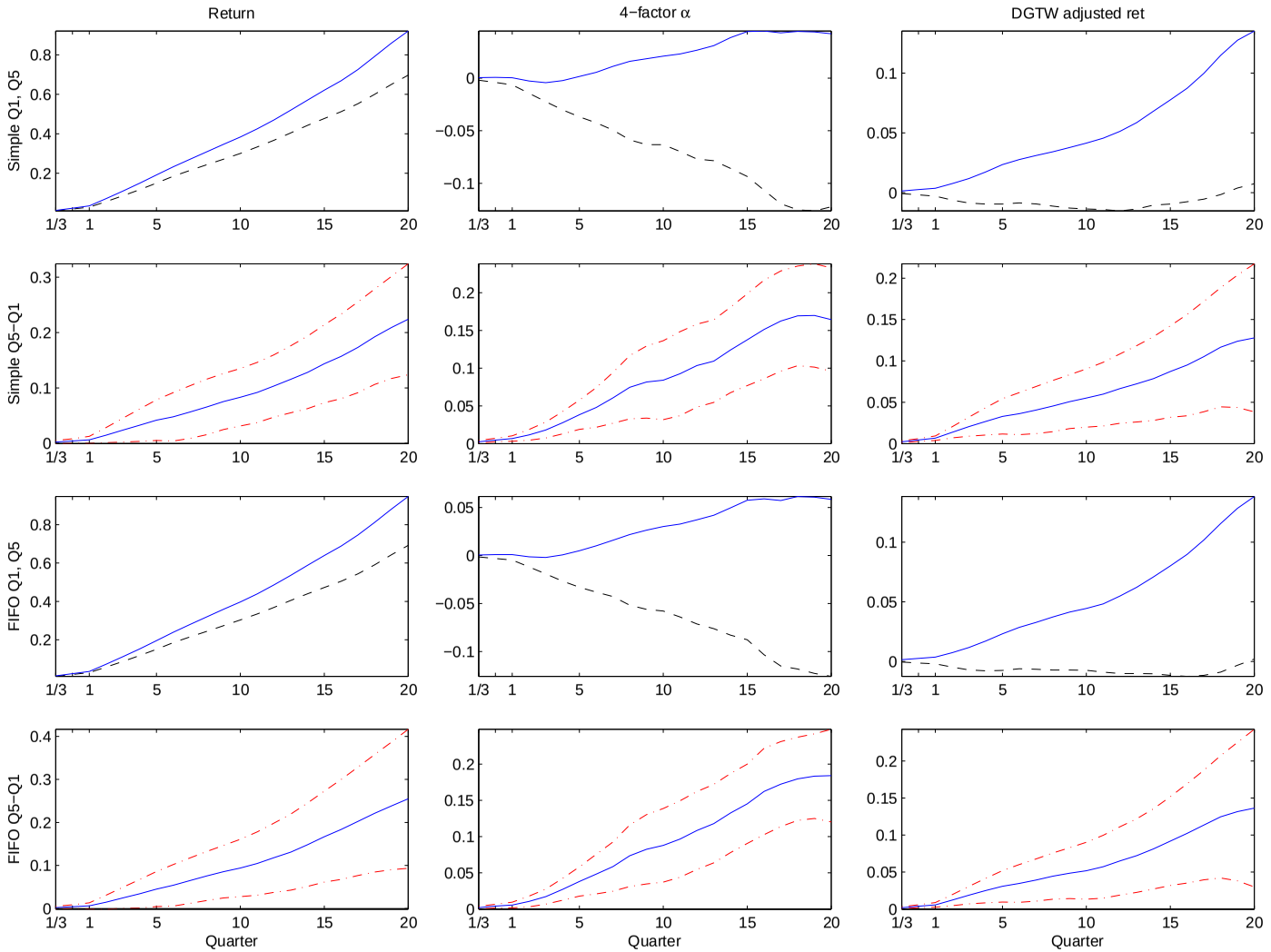

Figure 2: This figure plots buy-and-hold returns, 4-factor alphas, and DGTW adjusted returns for the Q1 (dashed line) and Q5 (solid line) portfolios in the first and third rows and the long-short position that buys the Q5 and short the Q1 portfolio in the second and fourth rows, respectively. For the spread portfolios the plots also include the 10% confidence intervals. These portfolios are quintiles sorted according to LFH minus SFH, where LFH (SFH) is the percentage of the shares of a stock held by long- (short-) horizon funds. Q5 (Q1) 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 simple measure in the first two rows and the FIFO measure in the last two rows. These horizon measures are described in section 2 and their definition is based on the holding horizons of the stocks in a fund's portfolio.

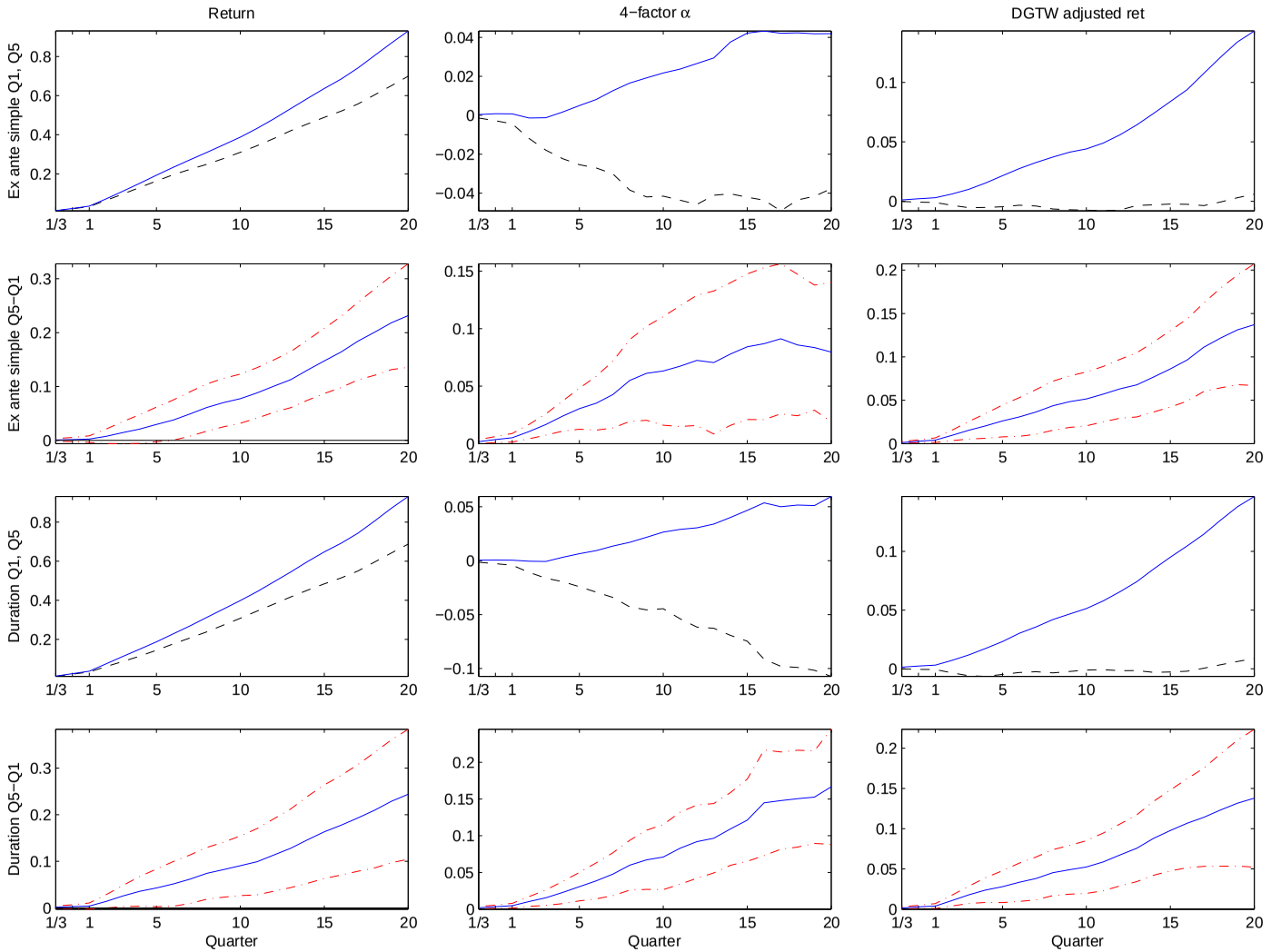

Figure 3: This figure plots buy-and-hold returns, 4-factor alphas, and DGTW adjusted returns for the Q1 (dashed line) and Q5 (solid line) portfolios in the first and third rows and the long-short position that buys the Q5 and short the Q1 portfolio in the second and fourth rows, respectively. For the spread portfolios the plots also include the 10% confidence intervals. These portfolios are quintiles sorted on LFH minus SFH, where LFH (SFH) is the percentage of the shares of a stock held by long- (short-) horizon funds. Q5 (Q1) is the portfolio with large long-horizon (short-horizon) fund holdings. A mutual fund is classified as a short-horizon (long-horizon) fund if it ranks in the bottom (top) tercile based on the ex-ante simple measure in the first two rows and the duration measure in the last two rows. These horizon measures are described in section 2 and their definition is based on the holding horizons of the stocks in a fund's portfolio.

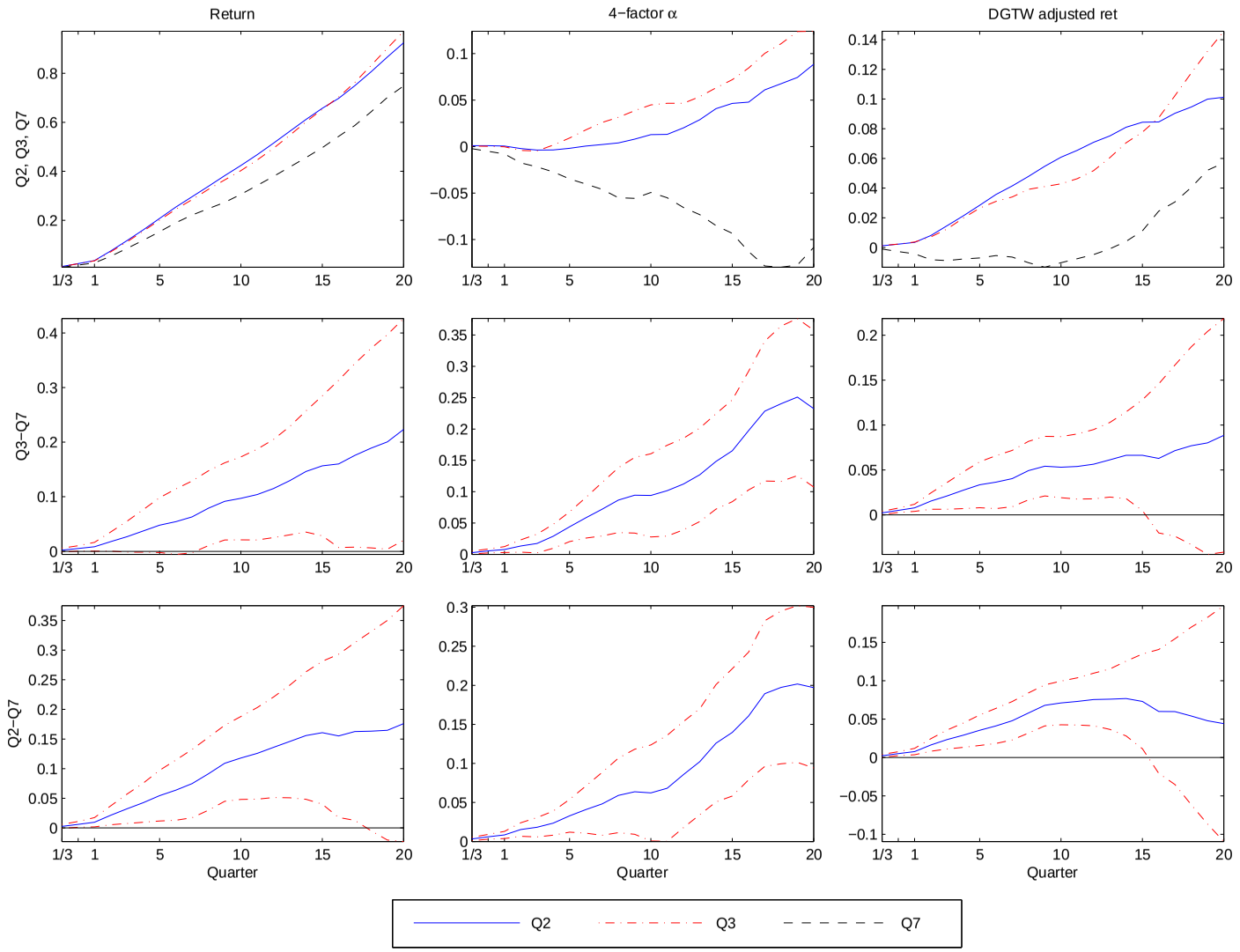

Figure 4: This figure plots buy-and-hold returns, 4-factor alphas, and DGTW adjusted returns for the Q2, Q3, and Q7 portfolios in the first row and the spread portfolios along with the 10% confidence intervals for the long-short positions that buy the Q2 or Q3 portfolio and short the Q7 portfolio in the last two rows. These portfolios are formed based on independent double-sort on LFH and SFH. Q2 is defined when LFH is in the middle tercile and SFH is in the low tercile, Q3 is defined when LFH is in the high tercile and SFH is in the low tercile, and Q7 is defined when LFH is in the low tercile and SFH is in the high tercile. LFH (SFH) is the percentage of the shares ourstanding held by long- (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 simple measure. This measure is described in section 2 and its definition is based on the holding horizons of the stocks in a fund portfolio.

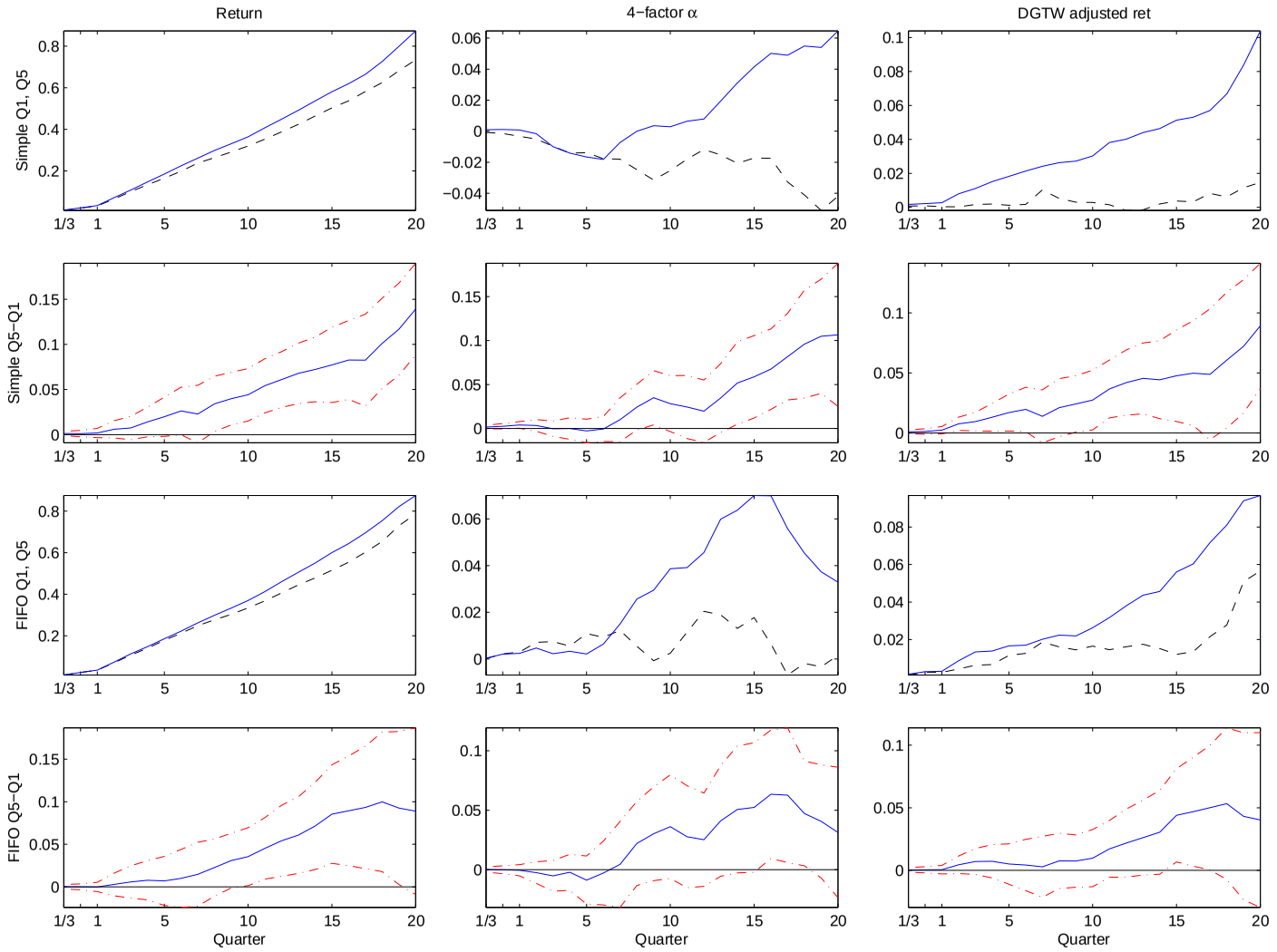

Figure 5: This figure plots buy-and-hold returns, 4-factor alphas, and DGTW adjusted returns for the Q1 (dashed line) and Q5 (solid line) portfolios in the first and third rows and the long-short position that buys the Q5 and short the Q1 portfolio in the second and fourth rows, respectively. For the spread portfolios the plots also include the 10% confidence intervals. These portfolios are quintiles sorted on buys from long-horizon funds ($LFTrade > 0$) minus buys from short-horizon funds ($LFTrade > 0$), where LFTrade (SFTrade) is the trade from long- (short-) horizon funds. Q5 (Q1) is the portfolio that is largely purchased 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 simple measure in the first two rows and the FIFO measure in the last two rows. These measures are described in section 2 and their definition is based on the holding horizons of the stocks in a fund portfolio.

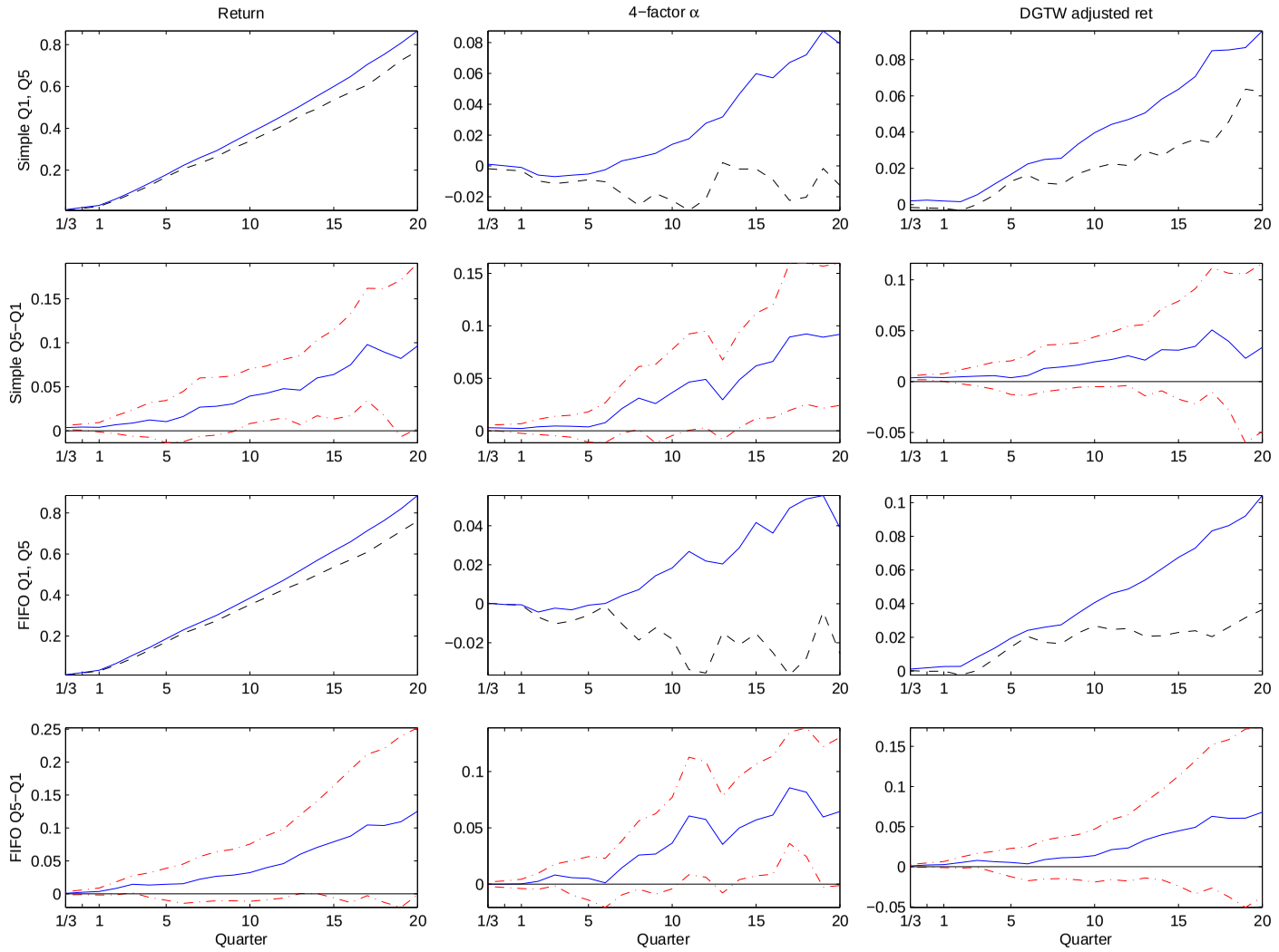

Figure 6: This figure plots buy-and-hold returns, 4-factor alphas, and DGTW adjusted return for the Q1 (dashed line) and Q5 (solid line) portfolios in the first and third rows and the long-short position that buys the Q5 and shorts the Q1 portfolio in the second and fourth rows, respectively. For the spread portfolios the plots also include the 10% confidence intervals. These portfolios are quintiles sorted on sales from long-horizon funds (the absolute value of $LFTrade < 0$) minus sales from short-horizon funds (the absolute value of $LFTrade < 0$), where LFTrade (SFTrade) is the trade from long- (short-) horizon funds. Q5 (Q1) is the portfolio that is largely sold 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 simple measure in the first two rows and the FIFO measure in the last two rows. These measures are described in section 2 and their definition is based on the holding horizons of the stocks in a fund portfolio.

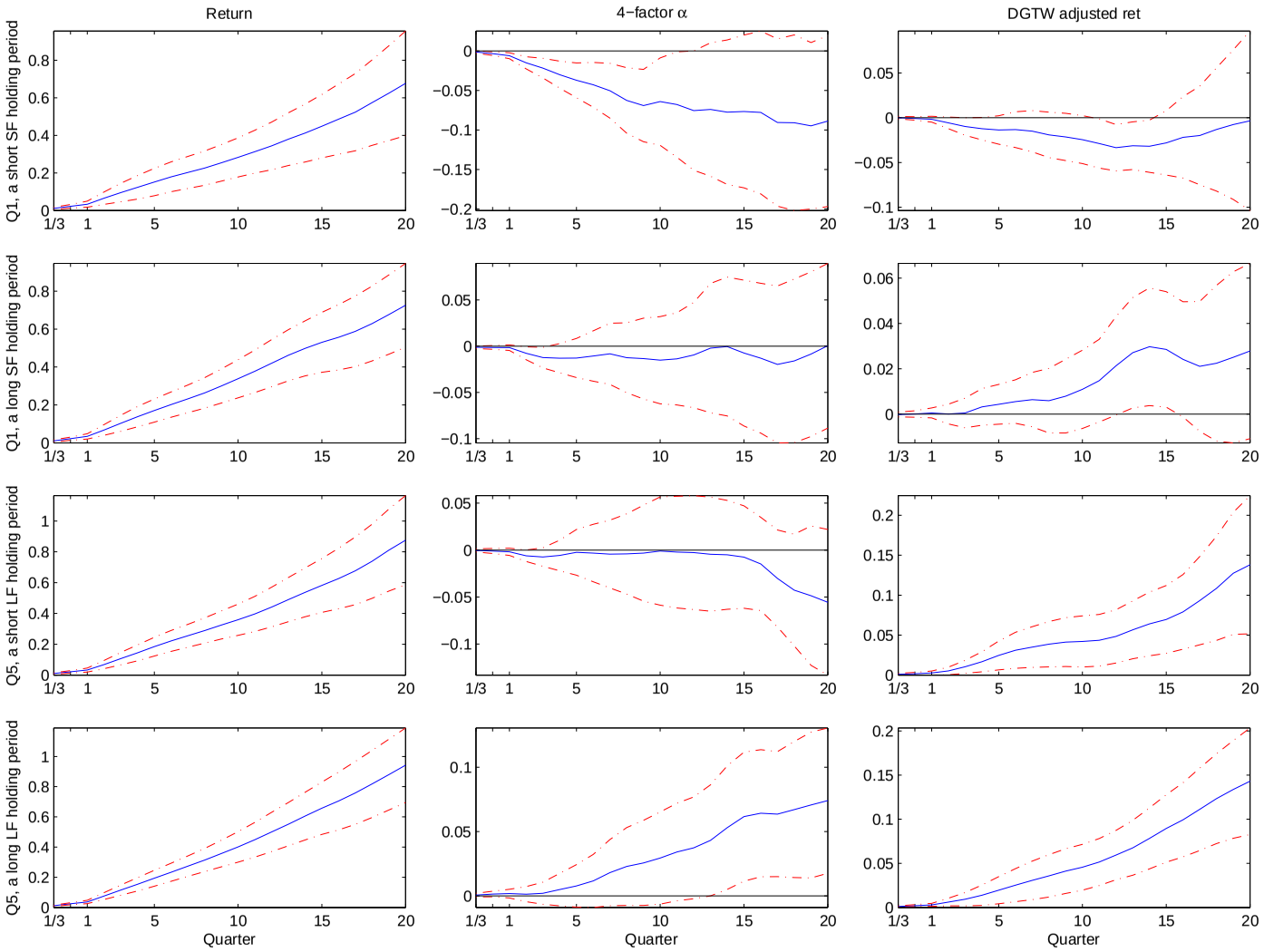

Figure 7: Stocks are sorted into quintiles based on holdings from long-horizon funds (LFH) minus holdings from short-horizon funds (SFH). Q5 (Q1) consists of stocks that are largely held by long-horizon (short-horizon) funds. In Q5 (Q1), stocks are further divided into two groups: stocks are held for a long period by long-horizon (short-horizon) funds if stocks' average holding periods are above the median holding period, for a short period otherwise. This figure plots buy-and-hold returns, 4-factor alphas, and DGTW adjusted returns for four stock portfolios consisting of the two groups of stocks in Q1 and Q5. The plots also include the 10% confidence intervals in dashed lines. The ex-ante simple measure is used to classify funds into long- and short-horizon funds and to define stocks' average holding period across all long- and short-horizon funds.

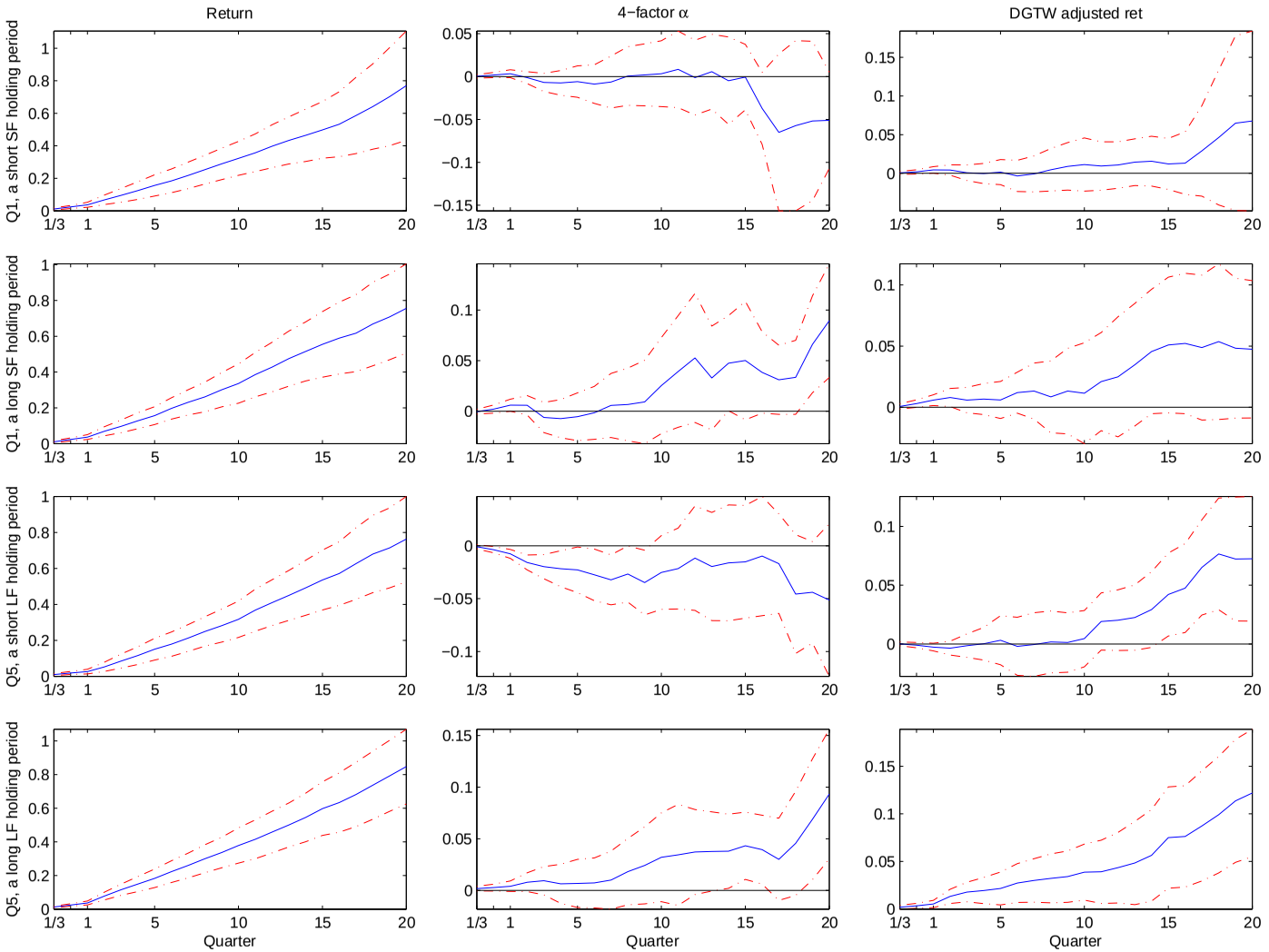

Figure 8: Stocks are sorted into quintiles based on buys from long-horizon funds ($LFTrade > 0$) minus buys from short-horizon funds ($SFTrade > 0$), where $LFTrade$ ($SFTrade$) is the 3-month trade from long- (short-) horizon funds. Q5 (Q1) consists of stocks that are largely purchased by long-horizon (short-horizon) funds. In Q5 (Q1), stocks are further divided into two groups: stocks are held for a long period by long-horizon (short-horizon) funds if stocks' average holding periods are above the median holding period, for a short period otherwise. This figure plots buy-and-hold returns, 4-factor alphas, and DGTW adjusted returns for four stock portfolios consisting of the two groups of stocks in Q1 and Q5. The plots also include the 10% confidence intervals in dashed lines. The duration measure is used to classify funds into long- and short-horizon funds and to define stocks' average holding period across all long- and short-horizon funds.

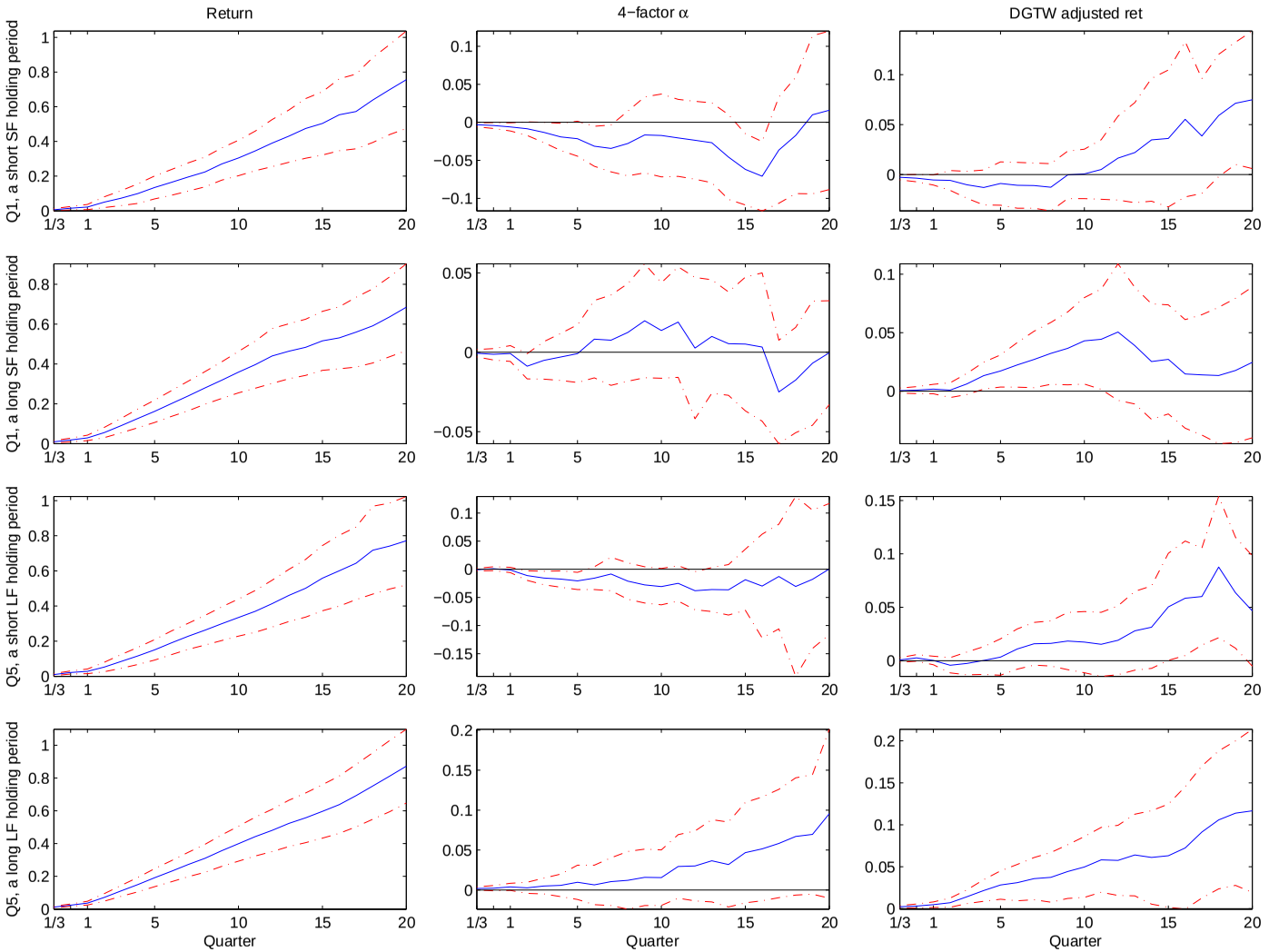

Figure 9: Stocks are sorted into quintiles based on sells from long-horizon funds (the absolute value of $LFTrade < 0$) minus sells from short-horizon funds (the absolute value of $SFTrade < 0$), where $LFTrade$ ($SFTrade$) is the 3-month trade from long- (short-) horizon funds. Q5 (Q1) consists of stocks that are largely sold by long-horizon (short-horizon) funds. In Q5 (Q1), stocks are further divided into two groups: stocks are held for a long period by long-horizon (short-horizon) funds if stocks' average holding periods are above the median holding period, for a short period otherwise. This figure plots buy-and-hold returns, 4-factor alphas, and DGTW adjusted returns for four stock portfolios consisting of the two groups of stocks in Q1 and Q5. The plots also include the 10% confidence intervals in dashed lines. The duration measure is used to classify funds into long- and short-horizon funds and to define stocks' average holding period across all long- and short-horizon funds.

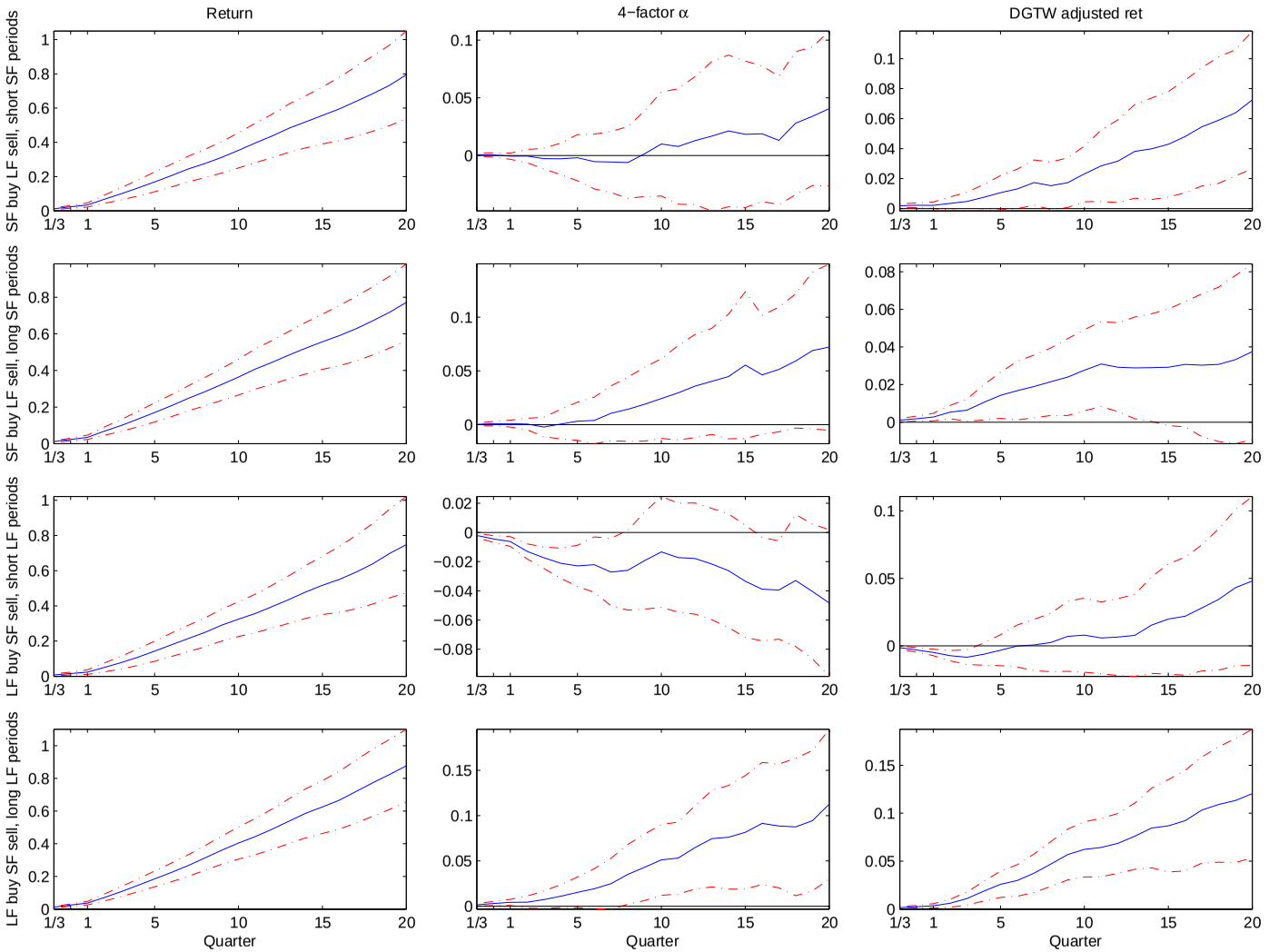

Figure 10: This figure plots buy-and-hold returns, 4-factor alphas, and DGTW adjusted returns, along with the 10% confidence intervals in dashed lines, for four stock portfolios. Stocks that long-horizon funds buy ($LFTrade > 0$) and short-horizon funds sell ($SFTrade < 0$) are collected into one portfolio, and stocks that short-horizon funds buy ($SFTrade > 0$) and long-horizon funds sell ($LFTrade < 0$) are collected into another portfolio, where $LFTrade$ ($SFTrade$) is the 3-month trade from long- (short-) horizon funds. In the former (latter) portfolio, stocks are further classified into two groups depending on whether long-horizon (short-horizon) fund holding period of a stock is above the median long-horizon (short-horizon) fund holding period. The duration measure is used to classify funds into long- and short-horizon funds and to define stocks' average holding period across all long- and short-horizon funds.

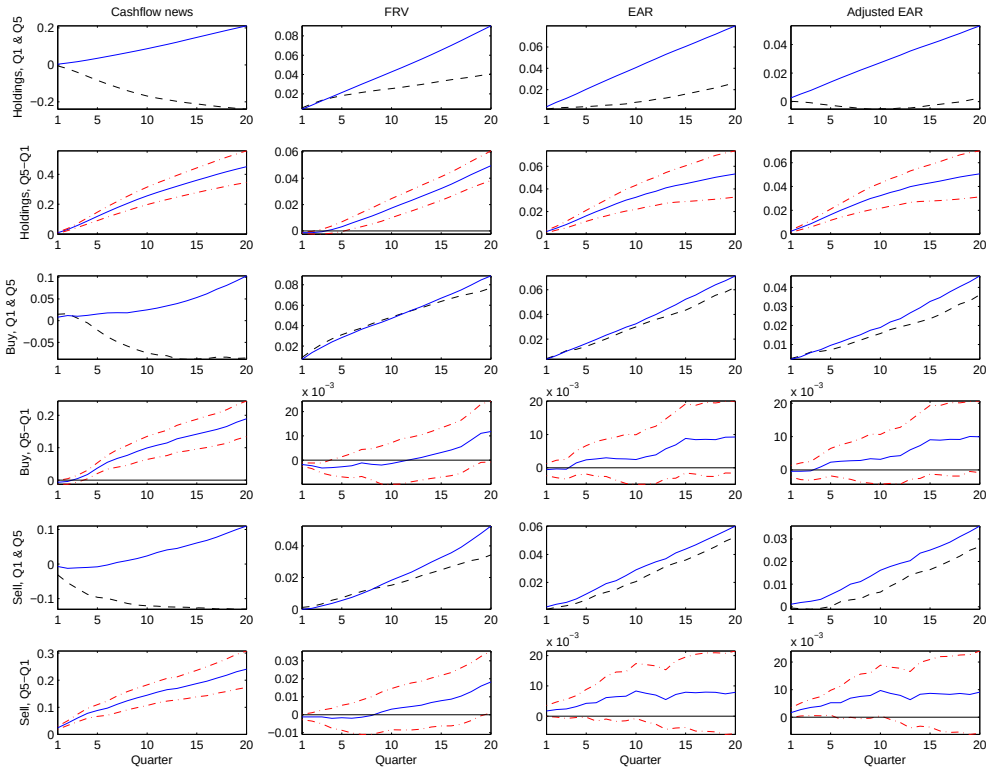

Figure 11: This figure plots cumulative future cash flow information, including cashflow news, analyst forecast revision (FRV), earnings-announcement-window returns (EAR), and market adjusted EAR, over next 1-20 quarters after stock portfolio formation. Specifically, the average quarterly cashflow information is calculated first for each stock portfolio, and then quarterly cashflow information is accumlated over next 1-20 quarters. The odd rows plot cumulative future cash flow information for stock portfolio quintiles Q1 and Q5. The even rows exhibit cumulative future cash flow information for Q5 in excess of that for Q1, with the 10% confidence interval. The first two rows describe the case in which stock portfolios are classified into quintiles according to holdings (LFH minus SFH), with Q5 (Q1) for stocks held largely by long-horizon (short-horizon) funds. The third and fourth rows describe the case in which stock portfolios are classified into quintiles according to buys ($LFTrade$ minus $SFTrade$, $LFTrade > 0$ & $SFTrade > 0$), with Q5 (Q1) for stocks purchased largely by long-horizon (short-horizon) funds. The last two rows describe stock portfolio quintiles that are classified according to sells ($(-1)LFTrade$ plus $SFTrade$, $LFTrade < 0$ & $SFTrade < 0$), with Q5 (Q1) for stocks sold largely by long-horizon (short-horizon) funds. The simple measure is used to classify funds into long- or short-horizon funds.

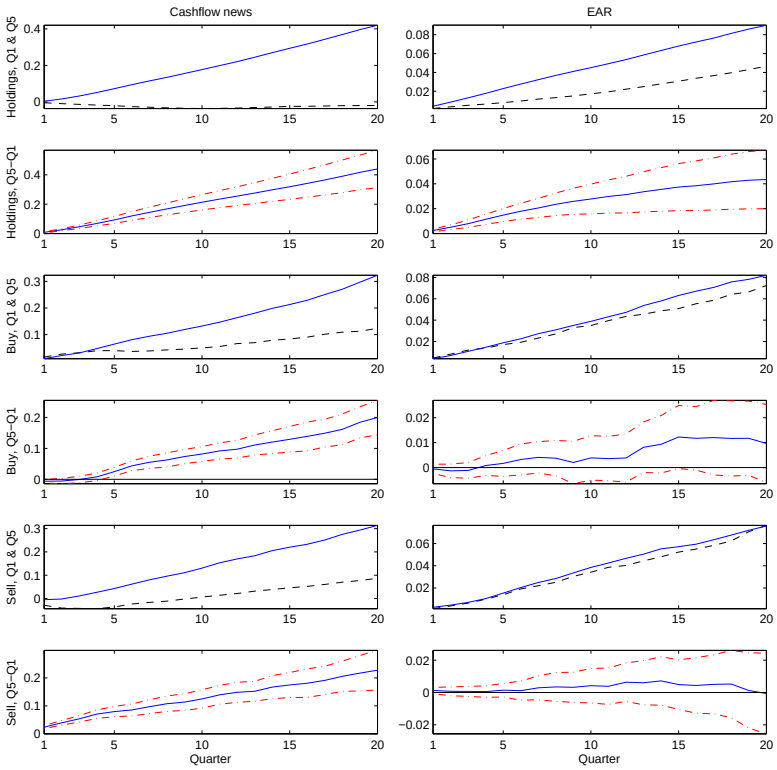

Figure 12: This figure plots buy-and-hold cashflow returns, using either cashflow news or earnings-announcement-window returns (EAR), over next 1-20 quarters after stock portfolio formation. The odd rows plot buy-and-hold cashflow returns for stock portfolio quintiles Q1 and Q5. The even rows exhibit buy-and-hold cashflow returns for Q5 in excess of those for Q1, with the 10% confidence intervals. The first two rows describe the case in which stock portfolios are classified into quintiles according to holdings (LFH minus SFH), with Q5 (Q1) for stocks held largely by long-horizon (short-horizon) funds. The third and fourth rows describe the case in which stock portfolios are classified into quintiles according to buys ($LFTrade$ minus $SFTrade$, $LFTrade > 0$ & $SFTrade > 0$), with Q5 (Q1) for stocks purchased largely by long-horizon (short-horizon) funds. The last two rows describe stock portfolio quintiles that are classified according to sells ($(-1)LFTrade$ plus $SFTrade$, $LFTrade < 0$ & $SFTrade < 0$), with Q5 (Q1) for stocks sold largely by long-horizon (short-horizon) funds. The simple measure is used to classify funds into long- or short-horizon funds.

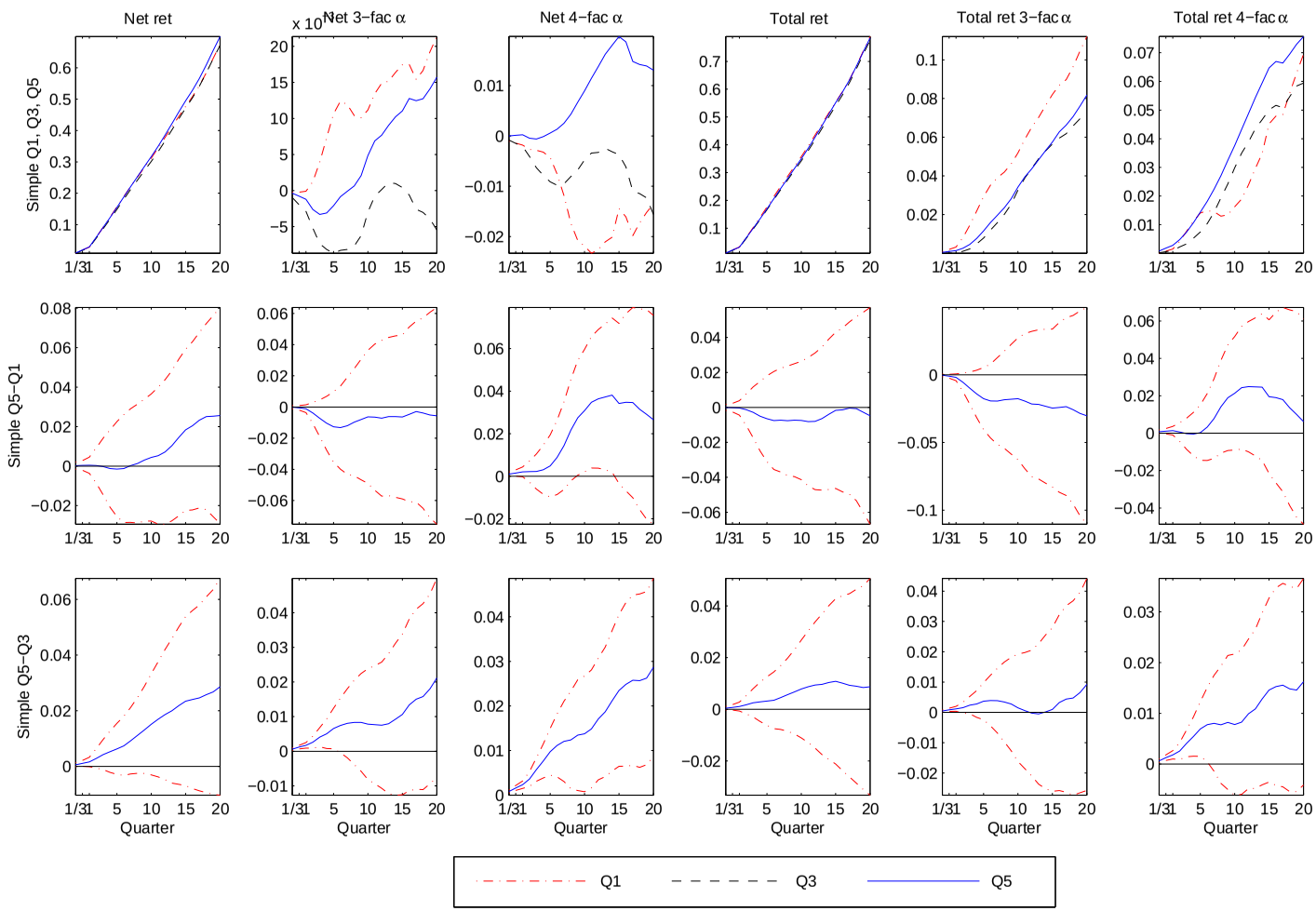

Figure 13: This figure plots buy-and-hold fund portfolio returns and abnormal returns over next month and up to five years. Each month funds are sorted into quintiles according to the simple horizon measure, with Q1 consisting of short-horizon funds and Q5 consisting of long-horizon funds. Both CRSP reported net returns and total returns (the sum of net returns and $\frac{1}{12}$ expense ratio) are used to measure monthly fund performance. Buy-and-hold net returns or buy-and-hold total returns are calculated over next one month and up to five years, with equal portfolio weights at the portfolio formation month. The abnormal returns include the Fame-French 3-factor alpha and the Carhart four-factor alpha associated with both buy-and-hold net returns and buy-and-hold total returns. The first row presents the results for long-horizon (Q5, solid line), medium-horizon (Q3, dashed line), and short-horizon (Q1, dash-dot line) fund quintiles. The second and third rows show the return spreads between Q5 and Q1 portfolios, and between Q5 and Q3 portfolios, respectively, along with the 10% confidence intervals.

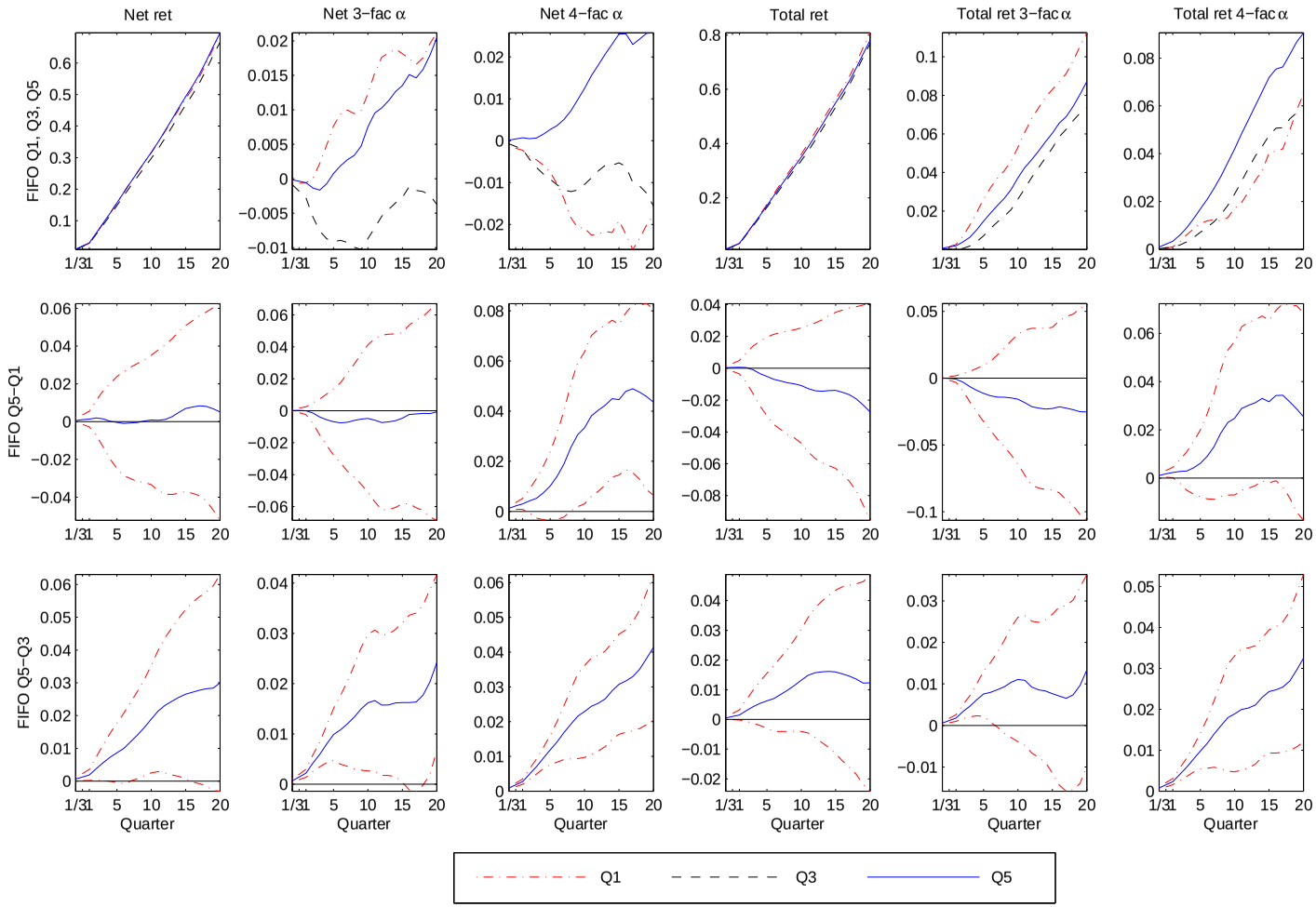

Figure 14: This figure plots buy-and-hold fund portfolio returns and abnormal returns over next month and up to five years. Each month funds are sorted into quintiles according to the FIFO horizon measure, with Q1 consisting of short-horizon funds and Q5 consisting of long-horizon funds. Both CRSP reported net returns and total returns (the sum of net returns and $\frac{1}{12}$ expense ratio) are used to measure monthly fund performance. Buy-and-hold net returns or buy-and-hold total returns are calculated over next one month and up to five years, with equal portfolio weights at the portfolio formation month. The abnormal returns include the Fame-French 3-factor alpha and the Carhart four-factor alpha associated with both buy-and-hold net returns and buy-and-hold total returns. The first row presents the results for long-horizon (Q5, solid line), medium-horizon (Q3, dashed line), and short-horizon (Q1, dash-dot line) fund quintiles. The second and third rows show the return spreads between Q5 and Q1 portfolios, and between Q5 and Q3 portfolios, respectively, along with the 10% confidence intervals.

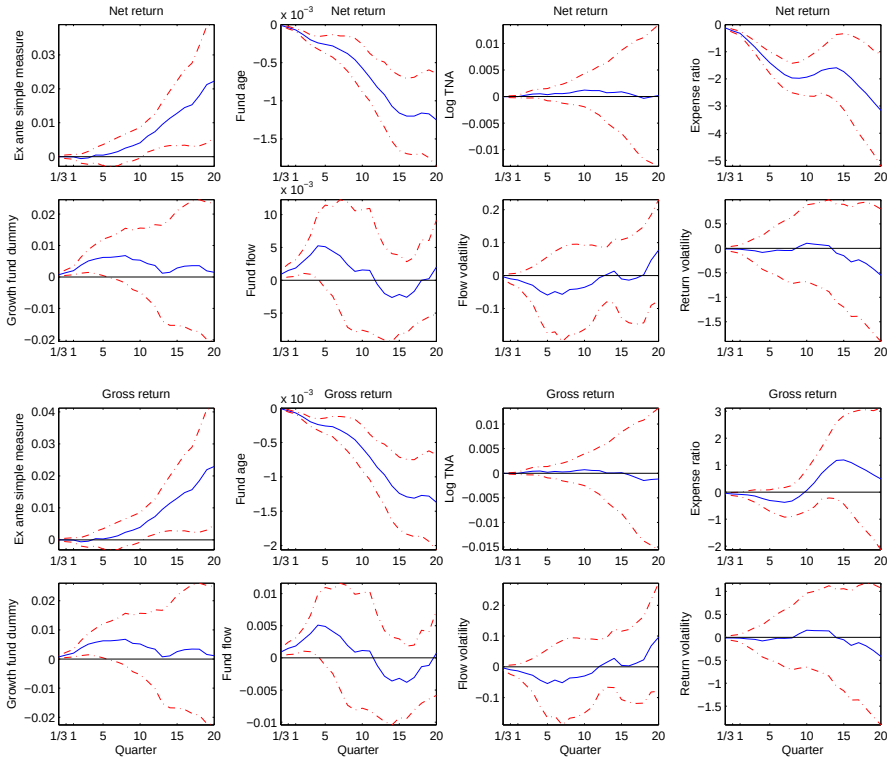

Figure 15: This figure shows the means, along with 10% confidence intervals, of time series of coefficient estimates in Fama-MacBeth regressions of abnormal buy-and-hold fund returns over one month and up to five years. The independent variables in the regression include the ex-ante simple horizon measure and fund characteristics including fund age, log fund TNA, fund expense ratio, growth fund dummy, past year fund flow, as well as flow volatility and fund return volatility over past year. Buy-and-hold fund returns are calculated using fund net returns excluding expenses and fees as fund monthly returns in the first two rows or using fund gross returns including expenses and fees as fund monthly returns in the last two rows. Abnormal buy-and-hold fund returns are risk adjusted buy-and-hold fund returns using the Carhart 4-factor model to capture risk exposure. Standard errors are calculated using the Newey-West approach to account for autocorrelation and heteroskedasticity.

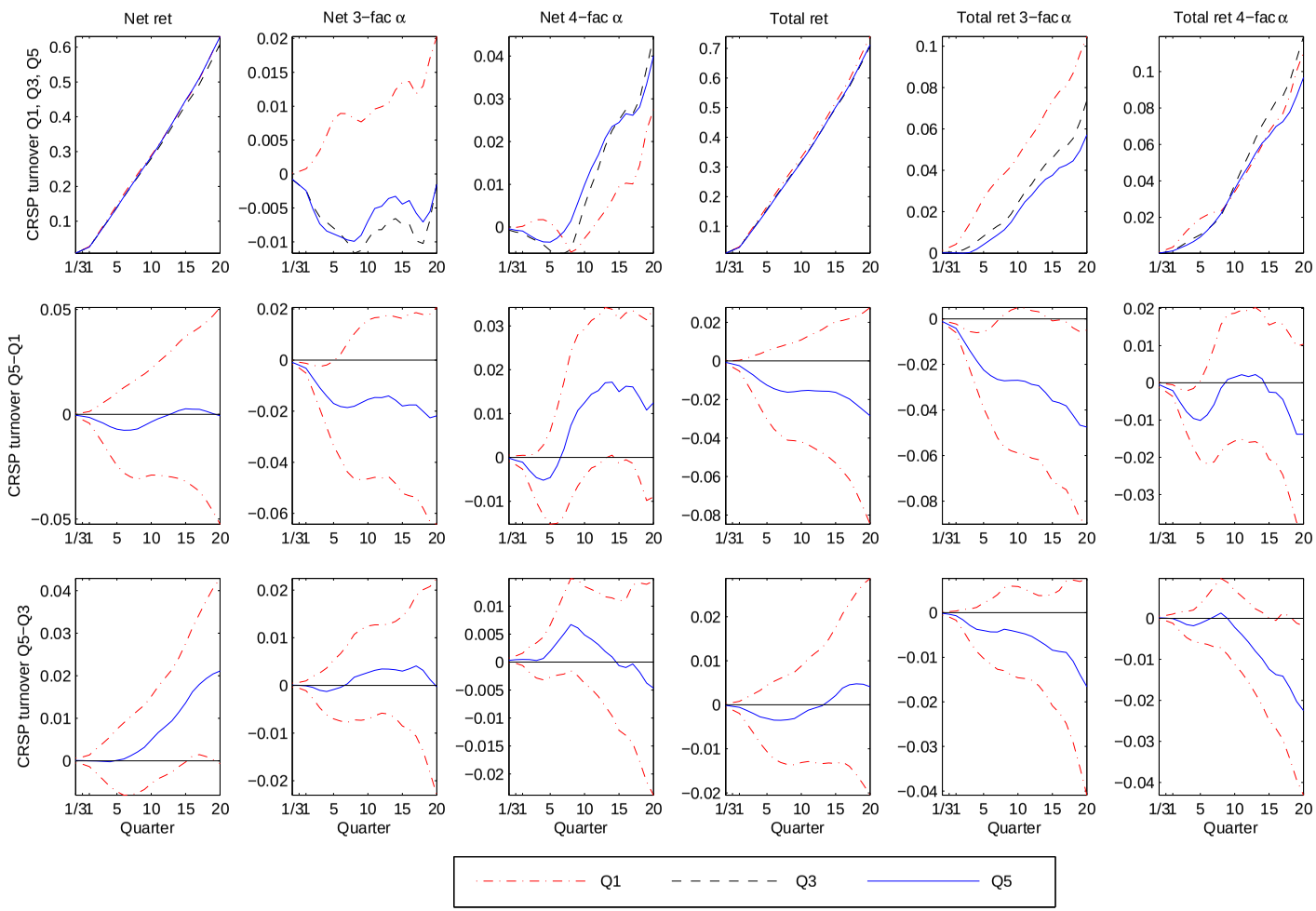

Figure 16: This figure plots buy-and-hold fund portfolio returns and abnormal returns over next month and up to five years. Each month funds are sorted into quintiles according to (the inverse of) CRSP reported turnover, with Q1 consisting of short-horizon funds and Q5 consisting of long-horizon funds. Both CRSP reported net returns and total returns (the sum of net returns and $\frac{1}{12}$ expense ratio) are used to measure monthly fund performance. Buy-and-hold net returns or buy-and-hold total returns are calculated over next one month and up to five years, with equal portfolio weights at the portfolio formation month. The abnormal returns include the Fame-French 3-factor alpha and the Carhart four-factor alpha associated with both buy-and-hold net returns and buy-and-hold total returns. The first row presents the results for long-horizon (Q5, solid line), medium-horizon (Q3, dashed line), and short-horizon (Q1, dash-dot line) fund quintiles. The second and third rows show the return spreads between Q5 and Q1 portfolios, and between Q5 and Q3 portfolios, respectively, along with the 10% confidence intervals.

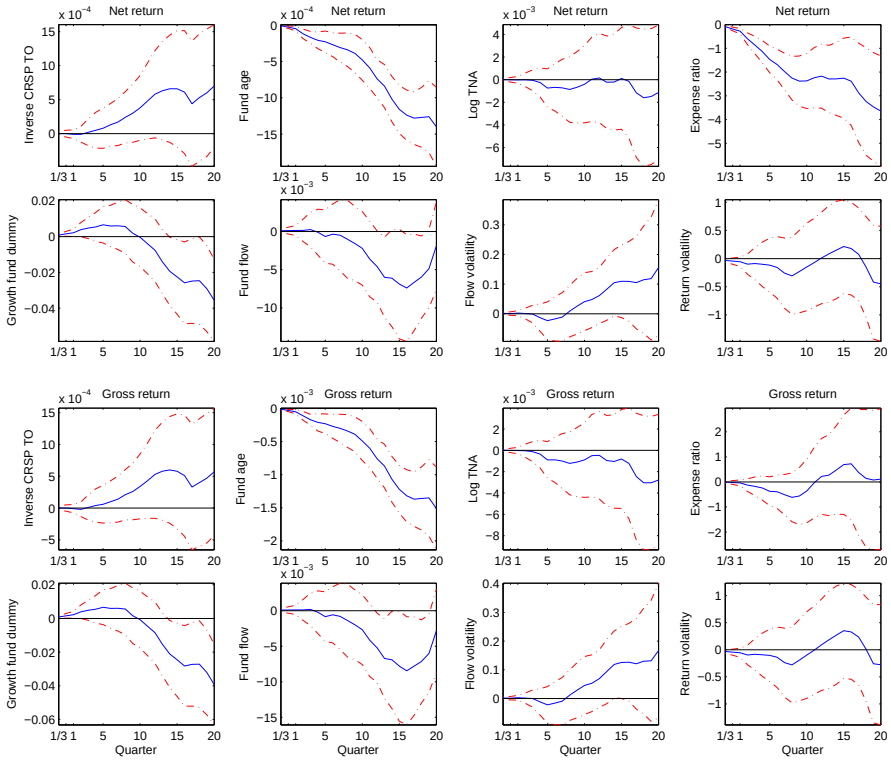

Figure 17: This figure shows the means, along with 10% confidence intervals, of time series of coefficient estimates in Fama-MacBeth regressions of abnormal buy-and-hold fund returns over one month and up to five years. The independent variables in the regression include the inverse of CRSP turnover and fund characteristics including fund age, log fund TNA, fund expense ratio, growth fund dummy, past year fund flow, as well as flow volatility and fund return volatility over past year. Buy-and-hold fund returns are calculated using fund net returns excluding expenses and fees as fund monthly returns in the first two rows or using fund gross returns including expenses and fees as fund monthly returns in the last two rows. Abnormal buy-and-hold fund returns are risk adjusted buy-and-hold fund returns using the Carhart 4-factor model to capture risk exposure. Standard errors are calculated using the Newey-West approach to account for autocorrelation and heteroskedasticity.

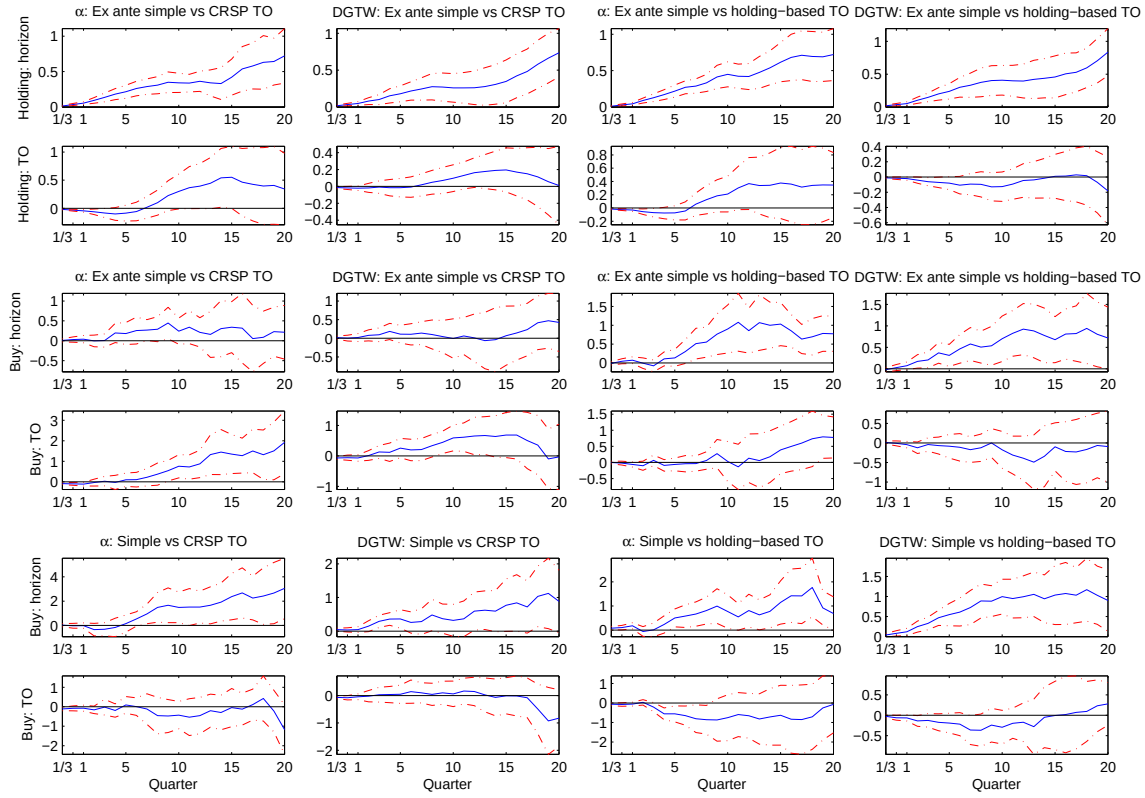

Figure 18: This figure shows the means, along with 10% confidence intervals, of time series of coefficient estimates in Fama-MacBeth regressions of abnormal buy-and-hold stock returns, in terms of FF-Carhart 4-factor alpha and DGTW adjusted returns, over one month and up to five years. The first two rows report the coefficient estimates for the case in which predictive variables are long-horizon fund holdings in excess of short-horizon fund holdings (LFH minus SFH), where long- and short-horizon funds are defined according to the ex-ante simple measure in the first row and the inverse of turnover in the second row. Turnover is either CRSP reported turnover or holdings-based turnover. The middle two rows report the coefficient estimates for the case in which predictive variables are long-horizon fund buys in excess of short-horizon fund buys ($LFTrade$ minus $SFTrade$), where long- and short-horizon funds are defined according to the ex-ante simple measure in the third row and the inverse of turnover in the fourth row. The last two rows report the coefficient estimates for the case in which predictive variables are long-horizon fund buys in excess of short-horizon fund buys ($LFTrade$ minus $SFTrade$), where long- and short-horizon funds are defined according to the simple measure in the fifth row and the inverse of turnover in the last row. Standard errors are calculated using Newey-West approach to account for autocorrelation and heteroskedasticity.

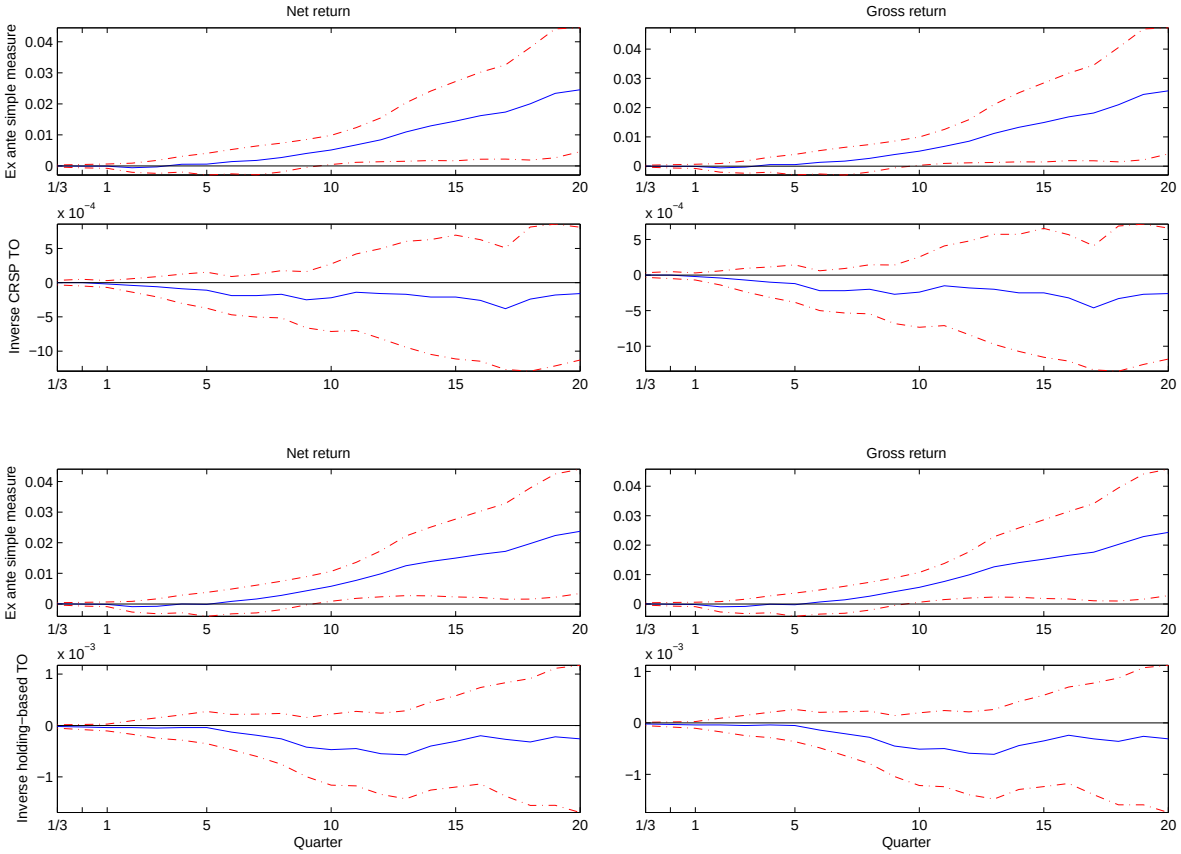

Figure 19: This figure shows the means, along with 10% confidence intervals, of time series of coefficient estimates in Fama-MacBeth regressions of abnormal buy-and-hold fund returns over one month and up to five years. Buy-and-hold fund returns are calculated using fund net returns excluding expenses and fees as fund monthly returns (left column) or using fund gross returns including expenses and fees as fund monthly returns (right column). Abnormal buy-and-hold fund returns are risk adjusted buy-and-hold fund returns using the Carhart 4-factor model to capture risk exposure. The first two rows describe coefficient estimates on the ex-ante simple measure and the inverse of CRSP turnover in the regression that controls for other fund characteristics. The last two rows describe coefficient estimates on the ex-ante simple measure and the inverse of holdings-based turnover in the regression that controls for other fund characteristics. The other fund characteristics include fund age, log fund TNA, fund expense ratio, growth fund dummy, past year fund flow, as well as flow volatility and fund return volatility over past year. Standard errors are calculated using Newey-West approach to account for autocorrelation and heteroskedasticity.