Dash for Cash: Month-End Liquidity Needs and the Predictability of Stock Returns

15 March 2015

Kalle Rinne
Matti Suominen
Lauri Vaittinen

Abstract. This paper uncovers strong return reversals in the US value weighted stock market index around the last monthly settlement day, *T*-3, which guarantees liquidity for month-end cash distributions. Similar reversals in market returns around *T-3* are documented internationally. The return reversals are stronger in countries where the mutual fund ownership is large, and in the US they have become stronger over time as the mutual fund ownership of stocks has increased. Using data that contains all trades of a subset of institutional investors, we show direct evidence that institutional trading contributes to the market reversals. Finally, we find that in the cross-section of stocks, return reversals around the turn of the month are stronger for stocks more commonly held by mutual funds and for liquid stocks. These market reversals help explain the previously documented abnormally high market returns around the turn of the month.

Key words: asset pricing, limits of arbitrage, mutual funds, short-term reversals, turn-of-the-month effect

JEL classification: G10, G12, G13

* We are most grateful to Erkko Etula for his significant contribution. We also thank Thierry Foucault, Matti Keloharju, Rajnish Mehra, Christopher Parsons, Ioanid Rosu, and the seminar participants at the Aalto University (Helsinki), HEC (Paris), the Luxembourg School of Finance, Mannheim University and the McGill University. Contact information. Kalle Rinne: Luxembourg School of Finance / University of Luxembourg, 4 Rue Albert Borschette, L-1246 Luxembourg, Luxembourg, E-mail: kalle.rinne@uni.lu, Tel: +352-46-66445274; Matti Suominen: Aalto University School of Business, P.O. Box 21210, FI-00076 Aalto, Finland, E-mail: matti.suominen@aalto.fi, Tel: +358-50-5245678; Lauri Vaittinen: Etera Mutual Pension Insurance Company, Palkkatilanportti 1, 00240 Helsinki, Finland, Tel: +358 10 553 3336, E-mail: lauri.vaittinen@etera.fi. We are grateful to Joona Karlsson, Antti Lehtinen, Mikael Paaso, and Mounir Shal for excellent research assistance.

1. Introduction

It is surprising how little attention academic literature has devoted to understand equity market returns around the turn of the month, despite the observations of Lakonishok and Smidt (1988) and McConnell and Xu (2008), among others, that historically most of the equity returns have accrued during a four-day period, from the last trading day to the third trading day of the month. Even less attention has received the fact that in more recent samples the market returns are abnormally high also on the last three trading days *before* the turn of the month. In fact, combining the two observations, we find that since July 1926, one could have held the US value-weighted stock index (CRSP) for only seven days a month and pocketed the entire market excess return with nearly fifty percent lower volatility compared to a buy and hold strategy. The negative excess returns outside the seven day turn of the month period are driven by dismal stock returns during the five trading days that immediately precede the high turn of the month return period (see Figure 1).[1] [2]

[INSERT FIGURE 1 HERE]

Following Odgen (1990), we find that the origin of the turn of the month return patterns lies in the monthly economic payment cycle – the fact that disproportionate part of the monthly payments in the US economy, for instance those by pension funds (pensions), corporate treasuries (dividends), and mutual funds (distributions) take place precisely at the turn of the month, as we document below. Given this payment cycle, every month potentially billions of dollars invested in the financial market, including in the stock market, first gets liquidated some time prior to the month end; then distributed as cash to pensioners and equity and mutual fund investors (among others) at the month end; only to be later re-invested back into the financial market by the recipients of the month end cash payments. Evidencing the magnitude of the payment cycle, we find that the deposits in the US commercial banks rise visibly on the last day of the month and then decline during the first few days of the month.

Consistent with the payment cycle, we uncover strong return reversals in the aggregate stock market around key dates near the turn of the month. In addition, we present empirical evidence that crisply links the stocks' turn of the month return patterns to institutional investors' buy-sell ratios, mutual fund holdings, stock-level liquidity and volatility, and to the funding conditions in the capital market. Time-varying betas of mutual funds and hedge funds provide additional supporting evidence. Taken

[1] From now on we will refer to "trading days" simply as "days" although all countings of days in this paper refer to countings of trading days.

[2] McConnell and Xu (2008) and Cadsby and Ratner (1992) show that the turn of the month returns are high in most developed markets. Dzhabarov and Ziemba (2010) show that also US equity index futures exhibit a similar turn of the month effect.

together, our results suggest a coherent heuristic framework that ties the turn-of-the-month return patterns to the institutional payment cycle coupled with market-wide limits of arbitrage.

Our first observation is that due to the current 3-day settlement period in the US equity market (this settlement period is the most common one in stocks also internationally) the investors' turn of the month liquidity related selling of stocks must come to an end three days prior to the turn of the month. Let us label this critical day *T-3*, where *T* denotes the last day of the month. Under perfectly efficient markets, market makers and speculators would ensure that prices are not affected by this type of liquidity related sell orders, which do not reflect any investment views. However, in the absence of sufficient speculative capital, see e.g. Grossman and Miller (1988), Gromb and Vayanos (2002) and Brunnermeier and Pedersen (2009), it is likely that market prices prior to *T-3* get temporarily depressed due to the selling pressure, and that it takes some time for the prices to revert back to their fundamental values. This is the main hypothesis of our paper. As Odgen (1990) argues, in the beginning of the month there should in turn be positive price pressure in the stock market as the recipients of the month end cash payments invest new money into the stock market. Our second hypothesis is therefore that the beginning of the month buying pressure temporarily elevates the stock prices above fundamentals, and that there is return reversal after the buying pressure subsumes.[3]

Surprisingly, we find that many of the turn of the month return patterns that we document have become *more* pronounced over time, and the strength of these phenomena seems to be related to the proportion of institutional investors in the market. One potential explanation to this is that although the payments by individuals are also likely to be clustered at the month end, this is especially the case for institutions. There is, however, also another route through which the increased role of institutions in the stock market may have affected the turn of the month phenomenon. Namely, we find that the institutional investors seem to avoid risk taking near the month ends. Given this, it is possible that the increased role of institutions has not only led to additional selling pressure prior to *T-3* (by the institutions with month end liquidity needs), but also to a decreased willingness among market participants to accommodate any selling pressure near the month end. [4] [5]

[3] For evidence that the 3-day settlement convention is most common internationally, see e.g. Thomas Murray Ltd. 2014 report "CMI In Focus: Equities Settlement Cycles." In the US, the 3-day settlement convention was adopted in June 1995.

[4] One reason why the mutual funds seem to reduce their risks near the month end can be their window dressing ahead of their month end reporting. Mutual funds' window dressing is discussed e.g. in Lakonishok, Shleifer, Thaler and Vishny (1991).

[5] Seasonalities in institutional investors' portfolio rebalancing, due e.g. to popularity of asset allocation meetings near the month ends, can yet be another factor that amplifies the investors' selling pressure near the month end and buying pressure in the beginning of the month.

Our empirical evidence related to the turn of the month returns, the market return reversals, and the institutions role in causing the turn of the month return patterns, can be divided into four main categories:

1. **Evidence from market returns.** Looking at aggregate market prices alone, we find significant predictability in the stock market returns around the third business day before the month end. The market returns on the five business days preceding *T-3* are negative, in contrast to the subsequent three business days' returns, which have been highly positive. One of our main findings is to show that lower than average market returns before *T-3* tend to be followed by higher than average subsequent returns, thus providing evidence of market return reversals around *T-3*. Our evidence on return reversals around *T-3* is not limited to the US: In all 24 markets that we survey, there is evidence of return reversals around *T-3,* and in 18 of the 24 markets the return reversals are statistically significant. Furthermore, in line with our second hypothesis, we find that higher than average returns on the first three business days of the month are followed by lower than average returns on the following five days. These return reversals following the first 3 days' returns are statistically significant in 12 out of the 24 countries. This evidence on return reversals is consistent with the idea that payment cycle and the limits of arbitrage affect the turn of the month returns as we discussed earlier.[6] [7]

2. **Evidence from trading data for institutional investors.** To find support for the hypothesis that the turn of the month return patterns are in part caused by the price pressure from institutional investors' liquidity related trading, we study a data set (obtained from Abel Noser Solutions) that contains trade-level observations for hundreds of different institutional investors (mutual funds, hedge funds, pension funds, and other asset managers). This dataset is considered to be highly representative sample of institutional investors' trading in the US stock market.

   Our analysis reveals that there are indeed significant seasonalities in the institutions' relative tendency to submit buy and sell orders. It appears that, consistent with our hypothesis, institutions are first net sellers in the market up to *T-3*, and later net buyers on the last two

[6] Interestingly, the return reversal phenomenon is not equally consistently present in emerging markets. This could be due to different shareholder structure in the emerging markets, where the role of mutual funds and other institutional investors is smaller, or due to liquidity and transaction cost concerns.

[7] As a robustness check, to further test the idea that the payment cycle contributes to the turn of the month patterns, we show in Table A1 in the Appendix that similar but less pronounced patterns in market returns in the US are observed around another common payment date, the 15th of each month. In addition, we find that in the US, the abnormally negative returns prior to the high turn of the month return period have moved closer to the turn of the month since the shortening of the settlement period from four to three in June 1995.

days of the month, and on the first few days of the month. These findings are direct evidence to support the idea that institutional trading affects stock returns around turn of the month. As additional support for the idea that the institutions' trading causes the high returns prior to the turn of the month, we document using regression analysis that their net sales on days *T-5* to *T-4* (normalized by the stock market capitalization) significantly impact the subsequent stock market returns on days *T-3* to *T-1*.

Combining the evidence regarding the market returns around the turn of the month and the institutional investors' trading patterns leads us to conclude that the institutions suffer from mistiming their trades around the turn of the month. These costs are eventually borne by the pensioners and the investors that invest through the institutions.[8]

3. **Evidence related to mutual funds and the cross section of stocks.** We studied further the role of institutional investors using data on mutual fund holdings and by looking at the turn of the month patterns in the cross-section of stocks. First, we link in the cross-section of stocks the stocks' month end return reversals to mutual funds' holdings. Our findings indicate that stocks held in greater proportions by mutual funds exhibit more pronounced turn of the month patterns: more negative returns between *T-8* to *T-4* and more positive returns from *T-3* to *T-1*. In addition, those stocks exhibit greater return reversals around *T-3*. Furthermore, in an international sample, we find that the market return reversals around *T-3* are stronger in countries with larger mutual fund sectors. Finally, we show that the strength of the return reversal around *T-3* in the US stock market has varied over time with the proportion of the market held by the mutual fund industry.

   Other pieces of evidence lend further support to the link between the turn of the month return patterns and mutual funds. For example, consistent with the idea that there are cash transfers in and out of the mutual fund sector around the turn of the month, we find that the average market beta of the mutual fund industry varies near the month end and is significantly lower than average at time *T-3*. Furthermore, consistent with the idea that mutual funds reduce risks towards the end of the month (either to increase their cash holdings in order to meet their end of month payments or for agency reasons), we find that

[8] We made a back of the envelope calculation where we compared the actual trading of the institutions in our sample to hypothetical trading of same size but with better market timing. In particular, we considered a scenario had those institutions made at *T* both all the (net) purchases that they in fact made during the days *T+1* to *T+3* and all the (net) sales that they in fact made during the days *T-8* to *T-3*. To ease the calculation, we made a simplifying assumption that all prices would have moved in line with the market during those days. This calculation led to an estimate that during our sample period from 1999 – 2013 the institutions included in our dataset alone would have lost roughly 1.3 billion US dollars due to mistiming their trades around the turn of the month.

mutual funds' average return volatility declines towards the end of the month although there is no observable decline in the volatility of the stock returns in general towards the month end.

We also find evidence that the turn of the month returns and return reversals vary as a function of stocks' liquidity. In particular, we find that month-end reversals are statistically more significant for larger and more liquid stocks, which is consistent with the idea that turn of the month patterns are tied to investors liquidity needs, and that investors respond to month-end outflows and cash needs conscious of transaction costs. Similarly, we find that following the end of the month, the first three days' returns revert only for liquid stocks. For illiquid stocks, it seems that the investors' purchases are more gradual and continue past the first three days, causing positive, not negative autocorrelation in returns between the first three days' returns and the returns thereafter. This again is consistent with the idea that market participants are conscious of their price impact in the stock market when taking positions in the beginning of each month.[9]

Finally, we present evidence that the mutual funds' turn of the month trading patterns affects their alpha. For instance, we find that mutual funds' Carhart four factor alpha is significantly positive for the two highest deciles of funds with historically highest correlation in their *T-8* to *T-4* and *T-3* to *T-1* returns (alpha being negative for all other funds).

4. **Evidence related to hedge funds and funding conditions.** Surprisingly, we find little evidence that hedge funds would mitigate the month-end return patterns. Akin to our results for mutual funds, we find that the market betas of most hedge funds vary around the turn of the month, so that they are smaller before the month end than at the beginning of the month. These patterns are stronger for funds with less frequent redemption cycles. Our results therefore suggest that most hedge funds are also plagued by similar month-end cash and agency concerns as mutual funds. As hedge funds are typically the institutions that supply liquidity in the stock markets, see e.g. Aragon and Strahan (2012) and Jylhä, Rinne and Suominen (2014), the hedge funds' unwillingness or inability to take long positions near the month end, despite the selling pressure from mutual funds, can lead to low liquidity in the

[9] Finally, controlling for liquidity, we find that the reversal patterns are stronger for more volatile stocks, which is consistent with the idea that speculators' risk bearing ability is limited around the end of the month.

market prior to the month end. Consistent with this, we document a decrease in market trading volume around *T-3*.[10]

Finally, our time-series evidence lends support to the idea that institutions' funding conditions in the credit market affect the month-end return reversals in the stock market: poor funding conditions, as indicated by an elevated TED-spread are associated with greater return reversals around *T-3* (TED-spread is a common proxy for the hedge funds' ability to leverage their positions). This result is consistent with the limits of arbitrage literature and in particular the idea presented in Brunnermeier and Perdersen (2009) that speculators' funding constraints affect their ability to supply liquidity (in our case to those institutions with turn of the month liquidity needs).

The intuition that asynchronously arriving sellers and buyers to the stock market cause short-term return reversals in equity returns has been present in the literature for a long time, see e.g., Grossman and Miller (1988). However, only limited empirical support for the idea that investors' aggregate buying and selling pressures would lead to market level short-term return reversals has been presented. To our knowledge only two papers show evidence on this. First, Campbell, Grossman and Wang (1997) show that high trading volume in the stock market (signaling buying or selling pressure from some groups of investors in their model) reduces the otherwise positive autocorrelation in stock index returns in their sample. Second, Ben-Raphael, Kandel, and Wohl (2011) provide evidence that aggregate mutual fund flows in Israel created price pressure in the aggregate stock market leading to market level short-term return reversals. However, they do not tie these market level short-term return reversals to the turn of the month time period. Given this, our finding that the investors' systematic selling and buying pressures around the turn of the month cause short-term return reversals at a market level is new to the literature. Importantly, our findings help tie the anomalous turn-of-the-month returns to the standard theories on imperfectly functioning financial markets and limits of arbitrage (see Gromb and Vayanos, 2012, for a survey of this literature).[11]

[10] If we look at each hedge fund category separately, we find that funds in only two hedge fund categories (managed futures and global macro) seem to provide liquidity to other market participants prior to the turn-of-the month: funds in those categories increase their market betas significantly at *T-3* on average. Even here, the evidence is weak for the global macro funds.

[11] In the Campbell, Grossman and Wang (1997) model return reversals are associated with large volume as the investors' selling pressure in their model is time varying, while the market making capacity is not. Our research suggests that in the stock market around the turn of the month the selling pressure, the buying pressure, and the market making capacity are all time varying, explaining why large reversals may be associated with low volume (as we find is the case around T-3). Other closely related papers include Duffie (2010), which presents several examples of return reversals due to supply and demand shocks in various markets, including in the cross section of stocks, and Mou (2010) which presents similar systematic calendar related return reversals due to investor rebalancing in the commodity markets.

Our results contribute to the vast existing literature on turn of the month effects that dates back at least to the seminal paper of Ariel (1987). Taken together, these studies report abnormally high returns over the four-day period from the last to the third trading day of the month. To the best of our knowledge, our study is the first one to focus on market behavior around the last day of the month that guarantees settlement before the month end. Also, we believe we are the first ones to link the turn of the month return patterns crisply to institutional investors' buy-sell ratios, the mutual fund holdings, stocks' liquidity and volatility, the mutual and hedge funds' time varying betas, and to the funding conditions in the capital market.

The remainder of the paper is organized as follows. Section 2 describes the data used in our research. Sections 3-7 present our main empirical results that cover the cross-sectional and time-series dimensions of the data. Section 8 concludes.

2. Data on returns, mutual funds and hedge funds

The country index return data are from Datastream, except in the case of the US value-weighted index, which is obtained from CRSP. Our US index return data are from January 1980 through January 2014. Our international sample consists of the benchmark indexes of G10 countries in addition to other selected industrialized countries. For many countries the sample period starts later than 1980, when the relevant data becomes available. Most of the international index returns include dividends, but due to lack of data some of them are partly based on price indexes to maximize the country specific sample periods. In case of Israel, the price index is used for the entire sample period as the return index is not available in Datastream.

Our cross-sectional stock data are from CRSP. The sample period is equal to the index sample except that our individual stock return data ends in December 2013. Our mutual fund holdings data is from Thomson Reuters Mutual Fund Holdings database. The sample period is from January 1980 to December 2013. MFLINKS is used to combine different mutual fund classes. Mutual fund betas are estimated using daily mutual fund returns from the CRSP U.S. Mutual Fund database. The data on Hedge fund AUM is estimated similarly as that in Jylhä and Suominen (2011). Finally the hedge fund betas are estimated using the LIPPER TASS data on individual funds' monthly returns.

3. Turn of the month stock returns in the US and internationally

We begin our investigation by determining the relevant time periods before and after the event date, *T-3*. Theoretically, an institution facing cash liabilities at the month end could sell his stocks as late as at the close of *T-3* and still receive the cash in time for his month end payment. However, illiquidity and risk considerations are likely to deter most institutions with month end liquidity needs

from selling stocks only at the close of *T*-3, but rather encourage it to distribute its equity sales over the preceding hours and days. In fact, judging also from the market returns, it seems that the price pressure from the institutional investors' turn of the month selling is at its highest one day prior to *T-3*, on day *T-4*. We later provide direct evidence from institutions trading to support this assumption. For these reasons, we begin our analysis by considering the five business days, *T-8* to *T-4* as the period over which we expect the most negative price pressure in the stock market due to the equity sales by the institutions facing month-end cash liabilities.

Following the month-end settlement, part of the cash distributed to salaried employees and pensioners gets reinvested in the stock market via 401k contributions (often automatic) and self-directed investments. This effect has been studied extensively in the existing literature, see e.g. Odgen (1990), which reports above-average stock returns from the last business day of the month until the third business day of the month, i.e. from *T* to *T+3* (see e.g., McConnell and Xu, 2008). We include this period as part of our study but separate it from the days before the month end and the returns after *T+3*.

We illustrate some key events of our study in Figure 2 along with the daily average returns of the CRSP value weighted stock index for each business day surrounding the month end. Consistent with our understanding of the events, average returns are low from *T-8* to *T-4* (selling pressure) and high from *T-3* to *T-1* (return reversal). As money begins to get reinvested in the market at the month end and shortly after the month end, returns are again high from *T* to *T+3* (buying pressure) and low from *T+4* to *T+8* (return reversal). The differences in returns are economically meaningful: for example, the average annualized S&P 500 return from *T-8* to *T-4* is -3.4% versus 28.6% from *T-3* to *T+3*.[12]

[INSERT FIGURE 2 HERE]

We can observe similar return patterns in other developed markets, as those displayed in Table 1. For all of the 24 markets in our sample, returns are statistically indistinguishable from zero over the selling pressure periods (*T-8* to *T-4*) and positive and statistically significant over the reversal/buying pressure period from *T-3* to *T+3*. Importantly, in Table 2 we establish a time-series relationship between low returns over the selling pressure period of *T-8* to *T-4* and the returns over the reversal

[12] Interestingly, the average excess returns that accrue to investors during the seven business days around the turn of the month cannot be explained by exposures to well-known risk factors: the CAPM alpha of the strategy is 5.6% per annum, the Fama and French (1993) three-factor alpha is 6.2% per annum; and the alpha with respect to a five-factor model that also includes the momentum factor of Carhart (1997) and the liquidity factor of Pastor and Stambaugh (2003) is 6.3% per annum. All alphas are statistically significant at the 1% level. Results are qualitatively similar if instead of the CRSP value weighted index returns we use the S&P 500 index returns in the alpha calculations.

period *T-3* to *T-1*: in all of the 24 markets the correlation of returns between these two periods is negative and in 18 out of 24 markets the correlation is statistically significant. This evidence suggests that the below-average returns over the selling pressure periods are associated with above-average subsequent return reversals. Similarly the time-series correlation between the returns on days *T* to *T+3* and the subsequent five days' returns is either insignificant or negative and statistically significant (in 12 of the 24 markets). These negative correlations are consistent with our hypothesis that there is initially selling pressure and then buying pressure from investors around the turn of the month.[13] [14]

[INSERT TABLE 1 AND 2 HERE]

4. Direct evidence from institutional investors' trades

To find support for the price pressure hypothesis as an explanation for the turn of the month returns, we study a data set that contains trade-level observations for hundreds of different institutions (hedge funds, mutual funds, pension funds, and other money managers). Our data is from Abel Noser Solutions (ANcerno) and it covers the years from 1999 to 2013. According to Pucket and Yan (2011), this data includes the trades of many of the largest institutional investors such as CalPERS, the YMCA retirement fund, Putman Investments, and Lazard Asset Management. It has been used in extensively in academic research papers recently as it provides a highly representative sample of the institutional fund management. During our sample period the institutions covered in this dataset account for nearly 6% of the daily volume in CRSP.

Using the ANcerno data we find that indeed there are significant seasonalities in the institutions' buy-sell ratios, so that consistent with our hypothesis the institutions in the ANcerno data seem to submit more sell than buy orders in the week that precedes *T-3*, and more buy than sell orders in the days *T-1* to *T+4*. On several days, such as *T-5* to *T-3*, *T-1* to *T*, and *T+3* and *T+5*, the buy ratios (based on dollar volumes of trade) differ statistically significantly from their unconditional mean. The averages of the abnormal buy ratios on various days around the turn of the month are presented in Figure 3.

[13] The results from the emerging markets are mixed. We regard this as evidence in favor of our hypothesis that the observed return reversals in developed markets are driven by efficient balance sheet management by institutional investors who are conscious of transaction costs and liquidity issues. We discuss these considerations in the next section. The unreported results from the emerging markets are available from the authors.

[14] The return patterns around *T-3* documented in Tables 1 and 2 are robust to excluding from the sample the observations that correspond with year ends, quarter ends, observations that immediately precede the FED announcements (that have been found to significantly affect expected returns in Lucca and Moench, 2015) or observations overlapping with macro-economic announcement dates (that have been found to significantly affect returns in Savor and Wilson, 2013).

[INSERT FIGURE 3 HERE]

In line with the stock return patterns, the buy ratio calculated using the dollar volumes suggests that the selling pressure from institutions is at its highest on day *T-4*. Note however from Figure 3 that the institutions' selling seems to continue on day *T-3*, even though the returns (measured from the closing prices) suggest that the price pressure from selling starts to ease already on that day. These observations can be consistent with each other, however. There are at least two reasons why we should expect that the price pressure from institutions selling would subsume some time prior to the close of the day *T-3*. As we argued in the introduction, liquidity and risk considerations most likely prevent institutions from leaving large orders related to their turn of the month payment needs to the close of the day *T-3*. Secondly, the speculators' stock demand can be expected to increase during the day *T-3*, as after that day the selling pressure is expected to subside and the stocks are likely to rise (if our reasoning is correct). Looking at the institutional investors' execution times in the ANcerno data within the day *T-3*, we find that institutions are net sellers in the morning of *T-3* (this finding is statistically significant at a 1% level), while in the afternoon of *T-3* the number of buy orders from institutions already roughly equals that of their sell orders. For these reasons, it is understandable that, on average, by the end of the day *T-3* the prices have started their recovery from the turn of the month related selling pressure.

ANcerno data provides additional direct evidence of the effect of institutions on the turn of the month return patterns. In Table 3, we show that the institutions' cumulative net sales during the days *T-5* to *T-4* (normalized by the stock market capitalization) negatively affect the stock market returns on days *T-3* to *T-1*.

[INSERT TABLE 3 HERE]

Next we will try to confirm the large role of institutions in the creation of the selling and buying pressure around the turn of the month by looking at a different set of data related to the mutual fund industry. We will also investigate in which types of stocks the turn of the month phenomena is the strongest.

5. Cross-sectional evidence

5.1 Return reversals in the cross-section of stock returns

We begin our cross-sectional investigation with a straightforward extension of our aggregate stock market study. Concretely, we sort the stocks in the CRSP universe each month based on their

performance over the period where we expect selling pressure, *T-8* to *T-4*, and observe their average returns over the subsequent three days where we expect reversals, *T-3* to *T-1*, and over the subsequent four days, *T* to *T+3*, which includes the month end and days where we expect reinvestment-driven buying pressure. The results, displayed in Table 4 demonstrate that stocks with the poorest performances over the selling pressure period tend to exhibit best average performances over the subsequent three and seven days. The relationship holds monotonically across our decile portfolios, formed based on stocks' each month's *T-8* to *T-4* returns. The difference in average returns between the lowest and the highest decile portfolios is both statistically and economically significant: 0.8% over the three-day period *T-3* to *T-1*, and 0.5% over the next four-day period *T* to *T+3*.[15]

[INSERT TABLE 4 HERE]

For completeness, we also conduct an analogous exercise for the period *T+4* to *T+8*, where we expect reversal from the beginning of the month buying pressure. The results, displayed also in Table 4, demonstrate that the *T+4* to *T+8* average returns across the decile portfolios sorted based on *T* to *T+3* returns decline in the *T* to *T+3* returns with a large and statistically significant difference in average returns between the extreme deciles.

We conclude that the month-end return patterns we observed for aggregate market indices also hold for portfolios of individual stocks and the strength of return reversals is inversely proportional to the stocks' performance over the selling/buying pressure periods.

5.2 Mutual fund ownership and month-end stock returns

We proposed that the return reversals in aggregate stock returns at the turn of the month are likely driven by sales of stocks by institutional investors with month-end cash liabilities. If so, we would expect the stocks owned in greater proportions by such investors to exhibit stronger return reversals. While we do not directly observe the holdings of pension funds, whose payment obligations are predominantly clustered at the month end (Figure 4A), we do observe the holdings of their agents, mutual funds, which provide an easy and efficient implementation vehicle for diversified equity investments for pension funds. In addition to the pension funds' payment schedule, the dividend payments of mutual funds themselves also tend to cluster around the turn of the month (Figure 4B).[16] Furthermore, the dividends of corporations received by mutual funds are also predominantly paid

[15] In our sample we eliminate penny stocks and the smallest market capitalization stocks out of our cross-sectional sample, by requiring that the stock price is at least $5 and the stock's market capitalization is above the 10th percentile of the NYSE listed stocks on the 10th trading day of the corresponding month.
[16] The only exception is the month of December where the dividend payments are more evenly distributed.

around the turn of the month (Figure 4C). For all of these reasons we suspect that the turn of the month effects are more pronounced in the stocks that are commonly held by mutual funds.

[INSERT FIGURES 4A to 4C]

To investigate the link between mutual fund ownership and month-end return patterns, we sort the US stocks in each month by mutual funds' collective ownership percentage in the previous month and form decile portfolios. We then compute the average returns of these portfolios near the turn of the month. The results are displayed in Figure 5. Consistent with our hypothesis, the stocks that are held to a greater extent by mutual funds in a given month tend to experience monotonically lower returns over the selling pressure periods, from *T-8* to *T-4*. These same stocks also experience greater returns over the subsequent three days from *T-3* to *T-1*, and again monotonically lower average returns from *T+4* to *T+8*. Finally, the correlation between *T-8* to *T-4* and *T-3* to *T-1* returns is more negative for those stocks that are more commonly held by mutual funds.

[INSERT FIGURE 5 HERE]

In addition, the correlation between the *T* to *T+3* and *T+4* to *T+8* returns is negative only for the value weighted portfolios of stocks in the six highest deciles of mutual fund ownership. All these pieces of evidence suggest that mutual funds, and other institutions with a month-end payment cycle, are a major force in the turn of the month phenomenon. It is therefore possible that the increase in the size of the mutual fund industry is an important factor contributing to the fact that the turn of the month return patterns, including the return reversals around the turn of the month, have become if anything *more* pronounced over the years. In what follows, we present some additional evidence to support this hypothesis.

Figure 6 displays the correlations of *T-8* to *T-4* returns and the *T-3* to *T-1* returns for different equity indices across countries along with the percentage of the market capitalization that is held by mutual funds within each country. It seems that the return reversals around *T-3* are indeed larger in countries where mutual funds are more prevalent. Using regression analysis we confirm that this negative relationship between mutual fund ownership and the degree of market return reversal around T-3 is statistically significant at a 1% level (results are available upon request).

[INSERT FIGURE 6 HERE]

Finally we use regression analysis to study if there is a time-series relation between the return reversals around T-3 and the size of the US mutual fund industry. Our results, presented in Table 5,

show that indeed the size of the mutual fund industry (normalized by stock market capitalization) statistically significantly affects the degree of market return reversal around *T-3* (this is observable from the coefficient of the interaction term where the size of the mutual fund industry is interacted with the *T-8* to *T-4* returns). The result holds for both a value weighted stock index of the US market as well as for the S&P 500 index.

[INSERT TABLE 5 HERE]

5.3. Other evidence that mutual funds affect the turn of the month patterns

To further investigate the reasons why return patterns at the turn of the month may be related to mutual fund ownership, we turn to the agency relationship between the mutual fund manager and the end investor. Because of this agency relationship, mutual fund managers might become unwilling to take risk near the month end due to the monthly reporting cycle in mutual funds. For instance, to avoid the risk of having to report excessively poor returns that might spark outflows (see e.g. Sirri and Tufano, 1998). Given such agency problems, it is plausible that mutual funds' willingness to take risk is decreased as the month goes by. This unwillingness to take risk may lead to additional selling pressure prior to *T-3*, and it may explain why those funds that do not have month end liquidity needs do not agree to trade against the liquidity based sellers prior to *T-3*.

Our evidence presented in Table 6 and Figure 7 support this idea of month-end risk reduction. In Table 6, we show that the average betas of mutual funds are abnormally low from *T-5* to *T-3*. As discussed, this result can arise from the average mutual fund's need to sell assets prior to *T-3* to meet its month-end cash demands, or it can be a reflection of funds willingness to take less risk near the end of the month. The finding in Figure 7 that mutual funds' volatility decreases as the month goes by can also be linked to either the average fund's willingness to take less risk or its tendency to accumulate cash to meet its payments near the month end. Irrespective of which one of these two forces affects more the mutual funds' behavior near the month end, such behavioral patterns can contribute to the predictability of stock market returns around *T-3* that we documented in Section 3.

[INSERT TABLE 6 AND FIGURE 7 HERE]

5.4 The effect of stock characteristics on the turn of the month returns

If the behavior of sophisticated investors is indeed inducing patterns in the turn of the month stock returns, these investors should at least be trying their best to avoid it. That is, any month-end liquidity needs should be met with sales of liquid stocks, with minimal price impact and transaction

costs. To investigate this hypothesis, we sort the stocks in the CRSP universe based on different characteristics that could be associated with transaction costs. The results are shown in Table 7.

[INSERT TABLE 7 HERE]

Consistent with the idea that mutual funds seek to meet their liquidity needs with minimal transaction costs, we find that the correlation between *T-8* to *T-4* and *T-3* to *T-1* returns is most negative for the most liquid, large cap stocks. Similarly, the return reversals around *T+3* are only significant for the largest and most liquid stocks.[17]

Furthermore, if the patterns we observe are in part due to mutual funds' eagerness to reduce risk near the month end, they should do so by reducing their holdings of risky but liquid stocks. We investigate this idea in Table 8, which reports returns and correlations around the month end within quartiles of stocks sorted by volatility, controlling for liquidity. Consistent with our intuition, we find that return reversals around *T-3* are most pronounced for the most volatile, yet liquid stocks.

[INSERT TABLE 8 HERE]

6. Mutual fund alphas and their exposure to the turn of the month returns?

In this section we show that mutual funds seem to suffer from their exposure to the return reversals around *T-3* (presumably evidencing their tendency to sell prior to *T-3*). If we sort the mutual funds by the two year average correlation in their *T-8* to *T-4* returns and their *T-3* to *T-1* returns, we find that the funds in the two highest correlation deciles have a significantly positive four factor alpha, while the alpha is negative for all the other funds. The alphas are presented in Figure 8.

[INSERT FIGURE 8 HERE]

Double sorting these returns with the funds' historical two-year flow volatility reveals that the differences across correlation deciles are larger for the funds with high flow volatility (the results are available from the authors upon request). In other unreported tests (also available from the authors

[17] For smaller and less liquid stocks return correlations between *T* to *T+3* and *T+4* to *T+8* are positive. This suggests that the institutions purchasing the least liquid stocks in the beginning of the month make their purchases gradually, continuing past the first three days of the month. Thus, again, they appear to operate conscious of transaction costs. Previously, a different linkage between liquidity and the turn of the month returns has been studied in Booth, Kallunki and Martikainen (2001). They present evidence that stocks' liquidity increases after the turn of the month, possibly contributing to the positive returns after the turn of the month.

upon request) we find that the mutual fund four factor alphas rise linearly in the funds' past two years' average returns on either the dates *T-8* to *T-4* or *T+4* to *T+8*, suggesting also that the funds selling prior to the turn of the month and their buying at the beginning of the month affects negatively their alphas.

7. Hedge Funds and Funding Constraints

7.1 Do hedge funds mitigate turn of the month return reversals?

In this section we investigate the behavior of hedge funds near the month end, looking for evidence on hedge funds' ability to mitigate the predictable patterns in market returns. Our evidence on this is mixed at best. First, in Table 9, we show that the average market beta of hedge funds near the month end behaves similarly to the average beta of mutual funds. This suggests that hedge funds do not provide liquidity to those mutual funds that sell to reduce their risks near the month end, as one might have expected. In case of hedge funds, the month end patterns in betas may be related not only to their concerns related to their own monthly return reporting cycles, but also to the fact that their infrequent subscription and redemption times are commonly set at the ends of calendar months. This further increases their concerns about their returns near the end of the month, and it leads to a vigorous month end cash cycle in hedge funds. Supporting the latter reason for the time variation in hedge funds' market betas, we find that the patterns in hedge fund betas are more pronounced for those funds with less frequent redemption periods (and presumably larger in- and outflows at times of subscription and redemption). Therefore, it appears that cash cycle constraints and concerns related to fund flows affects the hedge funds' ability and willingness to take risk around the turn of the month very much in the same way as they affected the mutual funds.

[INSERT TABLE 9 HERE]

If neither hedge funds nor mutual funds can or want to take risk near the month end, we would expect the stock market turnover to decrease also. We confirm this intuition in Figure 9; trading volume is substantially lower during the last few trading days of the month than on average on other days.[18]

[INSERT FIGURE 9 HERE]

While the hedge fund industry in aggregate does not seem to accommodate market-wide selling pressure near the month end, it is possible that a subset of hedge funds do so. Indeed, we study the

[18] More detailed analysis reveals evidence that the drop in the trading volume between *T-4* to *T-1* is larger for the half of the stocks that are more commonly held by mutual funds.

behavior of different hedge fund strategies and find that Managed Futures and Global Macro funds have abnormally large positive exposures to the market on day *T-3* (see Table 10). This suggests that at least some hedge funds do provide liquidity prior to *T-3*, counterbalancing the selling pressure from other institutions. The evidence regarding liquidity supply around *T-3* is especially strong for the Managed Futures funds that have significantly positive excess betas also on days *T-4* and *T-5*.

[INSERT TABLE 10 HERE]

7.2. Funding Constraints and turn of the month returns

We find evidence, reported in Table 11, that high TED-spread significantly increases the return reversals around *T-3* (this is observable from the coefficient of the interaction term where TED-spread is interacted with the *T-8* to *T-4* returns). This result provides evidence that funding constraints for the institutional investors are an important cause behind the return reversals around *T-3*. It seems that when institutions have good access to the debt capital markets (as proxied by low TED spread) they rely less on selling and buying of stocks to manage their turn of the month liquidity needs.

TED-spread is commonly used as a proxy for especially the hedge funds' funding liquidity (see e.g. Brunnermeier, Nagel and Pedersen (2009)). Therefore let us investigate the idea if the TED-spread affects the return reversals primarily via the hedge funds, by considering a related variable "hedge funds' cost of leverage," which is a variable where the TED-spread is multiplied with the hedge funds' AUM (scaled by the market capitalization of the US stocks). We find that the interaction of hedge funds' cost of leverage and the return from *T-8* to *T-4* is a statistically significant predictor of the returns from *T-3* to *T*-1, but only slightly more significant than the TED-spread interaction term alone. These findings provide evidence that when TED spread is low, at least hedge funds (but possibly other institutions as well) are better able to counterbalance month-end selling pressure using leverage. The results are reported in Table 11.

[INSERT TABLE 11 HERE]

8. Conclusion

In this paper, we attempt to provide a comprehensive analysis of month-end equity return patterns and tie them to the literature on limits of arbitrage. We are the first to document a strong market return reversal around the most common last settlement day of the month, *T-3*, which guarantees cash for month-end distributions. This return reversal exists both in the time series of US stock index returns, in the cross-section of US stock returns and in the time series of most of the developed

markets' stock indices. We argue that the reversal is caused mainly by the month-end cash cycle – which, as previously argued by Odgen (1990), is also the likely cause of the abnormally high returns on the last and on the first three trading days of the month. Our findings support the idea that both the return reversal after the selling pressure that precedes *T-3* and the beginning of the month buying pressure in combination lead to the exceptionally high returns during the seven days around the turn of the month.

To shed some light on the underlying market dynamics, we present extensive evidence that links the return reversals around *T-3* to institutional investors' and in particular the mutual funds' trading, and their reduced willingness to take risks near the month end. For example, within the cross-section of individual stocks, we show that the turn of the month return reversals are more pronounced among stocks that are more commonly held by mutual funds, and stocks that are arguably easier to use for cash management, such as large and liquid stocks. Controlling for liquidity, we find that the reversals are stronger for more volatile stocks, consistent with the idea that institutional investors seek to reduce portfolio risk toward the month end for agency reasons. At an aggregate level, we show that the return reversals near the turn of the month have only intensified as mutual funds' AUM as a proportion of the overall stock market has increased. Also in international samples, the return reversals seem to be more pronounced in countries with larger mutual fund sectors.

Using data on institutional investors trading we find additional, direct evidence to support the idea that institutions' trading contribute to the turn of the month return predictability. Namely, we find that the institutions whose trades are included in the ANcerno data set are on average net sellers prior to *T-3*, but net buyers at the end of the month and on the first few days of the month. This finding, in combination with the return patterns around the turn of the month implies that institutions (eventually the pensioners and the investors behind the institutions) lose significantly from liquidity related trading around the turn of the month. In line with this, we present evidence that the mutual funds' historical return patterns around the turn of the month (which point out to funds' costs from their turn of the month trading) significantly affect their future alphas.

Our results contribute to the academic literature by tying the large existing literature on the turn of the month return anomalies to rational models of markets with temporally segmented investors. In addition, our findings have significant practical implications for the institutions that currently mismanage their turn of the month liquidity related trading. Finally, our findings can contribute to the debate about the benefits of the shortening the settlement window in stock trading.

References

Amihud, Y. “Illiquidity and Stock Returns: Cross-section and Time-series Effects.” *Journal of Financial Markets* 5 (2002): 31-56.

Aragon, G. O. and Strahan P. E. “Hedge funds as liquidity providers: evidence from Lehman bankruptcy.” *Journal of Financial Economics* 103 (2012), 570-587.

Ariel, R.A. "A monthly effect in stock returns." *Journal of Financial Economics* 18 (1987): 161-174.

Ben-Rephael, A., S. Kandel, and A. Wohl, “The price pressure of aggregate mutual fund flows.” *Journal of Financial and Quantitative Analysis* 46 (2011): 585-603.

Booth, G. G., J.-P. Kallunki, and T. Martikainen. "Liquidity and the turn-of-the-month effect: evidence from Finland." *Journal of International Financial Markets, Institutions and Money* 11 (2001): 137-146.

Brunnermeier, M., and L.H. Pedersen. “Market liquidity and funding liquidity.” *Review of Financial Studies* 22 (2009): 2201-2238.

Brunnermeier, M., S. Nagel, and L.H. Pedersen. “Carry trades and currency crashes.” *NBER Macroeconomics Annual* 2008 23 (2009): 313-347.

Cadsby, C. B., and R. Mitchell. "Turn-of-month and pre-holiday effects on stock returns: Some international evidence." *Journal of Banking & Finance* 16 (1992): 497-509.

Campbell, J., S. Grossman, and J. Wang. “Trading volume and serial correlation in stock returns.” *Quarterly Journal of Economics* 108 (1993): 905-939.

Carhart, M. “On persistence in mutual fund performance.” *Journal of Finance* 52 (1997): 57-82.

Duffie, D. “Presidential Address: Asset Price Dynamics with Slow-moving Capital.” *Journal of Finance* 65 (2010): 1237-1267.

Dzhabarov, C., and W. T. Ziemba. "Do seasonal anomalies still work?" *The Journal of Portfolio Management* 36 (2010): 93-104.

Fama, E., and K. French. “The cross-section of expected stock returns.” *Journal of Finance* 47 (1992): 427-465.

Gromb, D., and D. Vayanos. “Limits of arbitrage: the state of the theory.” *Annual Review of Financial Economics* 2 (2012): 251-275.

Grossman, S., and M. Miller. “Liquidity and market structure.” *Journal of Finance* 43(1988): 617-633.

Jylhä, P., and M. Suominen. “Speculative capital and currency carry trades.” *Journal of Financial Economics* 99 (2011): 60–75.

Jylhä, P., K. Rinne, and M. Suominen. “Do Hedge Funds Supply or Demand Liquidity?” *Review of Finance* 18 (2014): 1259-1298.

Lakonishok, J., A. Shleifer, R. Thaler, and R. W. Vishny. “Window dressing by pension fund managers.” *American Economic Review* 81 (1991): 227–231.

Lakonishok, J., and S. Smidt. "Are seasonal anomalies real? A ninety-year perspective." *Review of Financial Studies* 1 (1988): 403-425.

Lucca, D., and E. Moench. “The Pre-FOMC announcement drift.“ *Journal of Finance* 70 (2015): 329–371.

McConnell, J. J., and W. Xu. "Equity returns at the turn of the month." *Financial Analysts Journal* 64 (2008): 49-64.

Mou, Y. “Limits to arbitrage and commodity index investment: front-running the Goldman Roll,” Working paper Columbia University (2011).

Ogden, J. P. "Turn-of-month evaluations of liquid profits and stock returns: a common explanation for the monthly and January Effects." *The Journal of Finance* 45 (1990): 1259-1272.

Pastor, L., and R. Stambaugh. “Liquidity risk and expected stock returns.” *Journal of Political Economy* 111 (2003): 642-685.

Puckett, A., and X. Yan. “The interim trading skills of institutional investors.” *Journal of Finance* 66

(2011):601–633.

Savor, P. and M. Wilson. “How much do investors care about macroeconomic risk? Evidence from scheduled economic announcements.” *Journal of Financial and Quantitative Analysis* 48 (2013): 343 – 375.

Sirri, E., and P. Tufano. “Costly search and mutual fund flows.” *Journal of Finance* 53 (1998):1589–1622.

Figure 1

Cumulative returns around the turn of the month

This figure shows the cumulative excess returns (R_m-R_f) from investing in the CRSP value weighted total return stock index only on days *T-3* to *T+3* around the turn of the month, where *T* refers to the last day of the month and e.g. *T+3* to the third business day of the month. It shows also the returns from investing in the same index only on days *T-8* to *T-4,* only on days *T+4* to *T+8,* and only on days outside *T-8* to *T+8*. Sample period is from July 1926 to December 2013. Logarithmic scale.

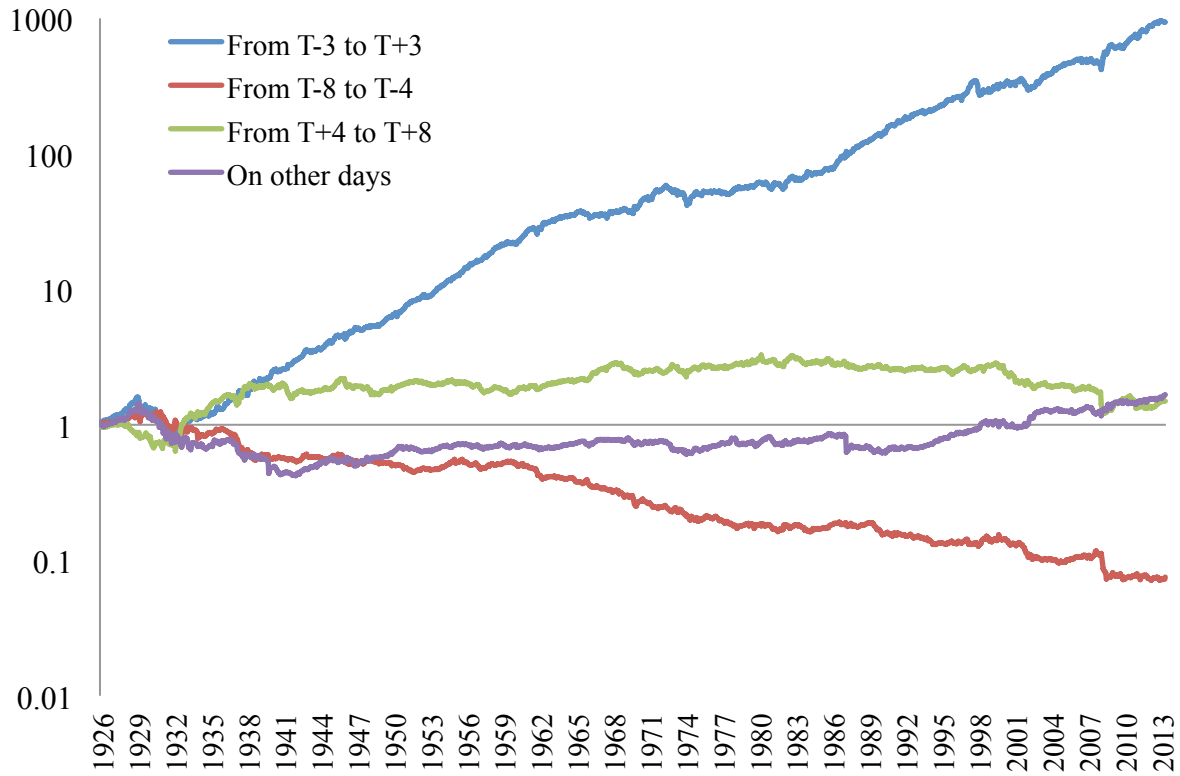


Figure 2

Daily returns around the turn of the month

This figure shows the average daily returns on the CRSP value weighted stock index around the turn of the month. Day *T* denotes the last trading day of the month and *T-1* the trading day preceding that, and so on. The sample period is from January 1980 to the end of 2013.

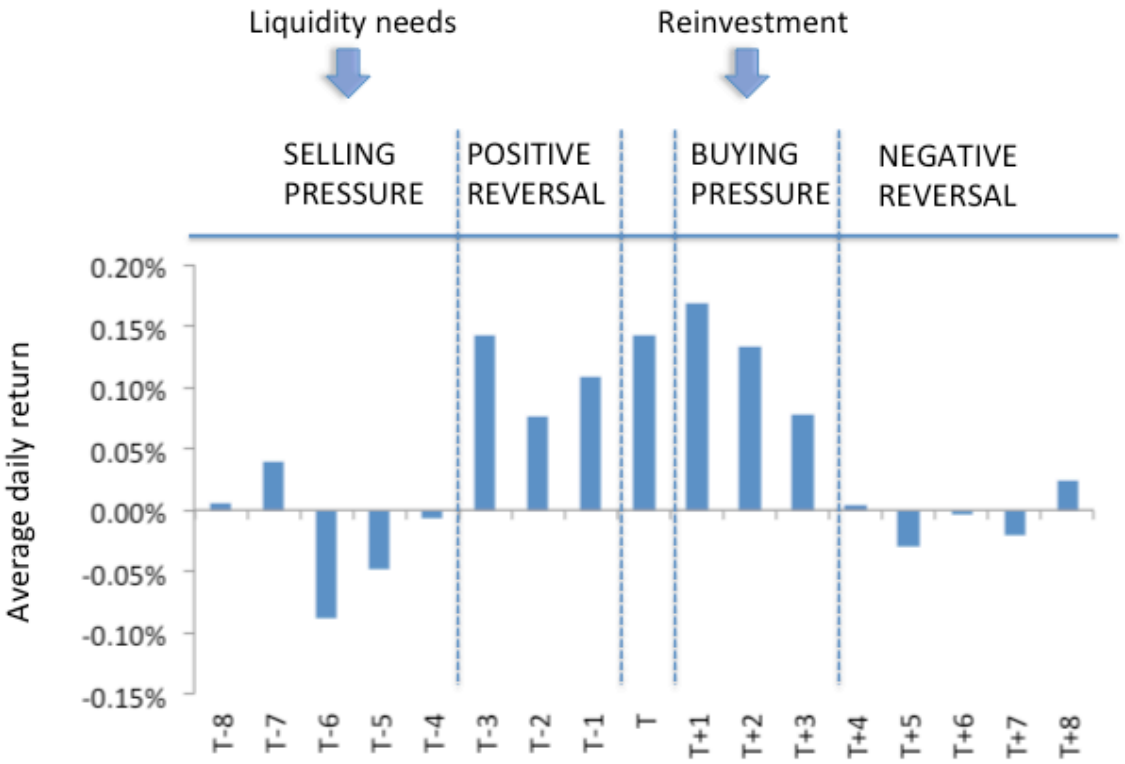


Figure 3

Institutions' buy ratios around the turn of the month

This figure shows the buy ratios for a sample of US institutions' around the turn of the month in excess of their average buy ratio in our sample. Day *T* denotes the last trading day of the month and *T-1* the trading day preceding that, and so on. The buy ratio refers to the number of institutions' buy transactions divided by total number of institutional transactions. Buy ratio USD is the value of the institutions' buy transactions in USD divided by the total value of the institutions' buy and sell transactions. The data is from ANcerno and the sample period is from January 1999 to the end of 2013. *, ** and *** denote the statistical significance at the 10%, 5% and 1% level, respectively.

Figure 4A

Pension fund payment dates around the turn of the month

This figure shows the proportion of pension payment dates of the largest US public pension plans around the turn of the month. Day *T* denotes the last trading day of the month and *T-1* the trading day preceding that, and so on. The data, obtained from Pension & Investment 300 Analysis (2012) by Tower Watson and individual pension fund websites, include 15 of the 19 largest US public pension plans. An assumption has been made that the most recent reported payment dates have remained the same from January 1980 to December 2013.

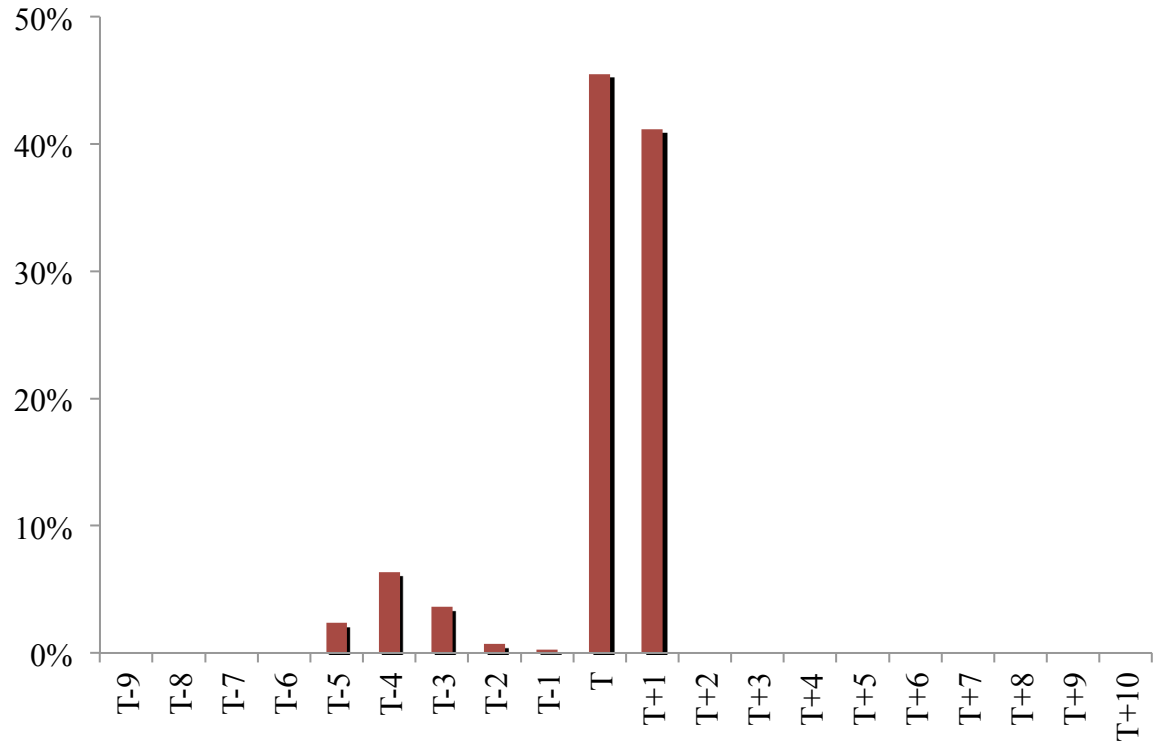
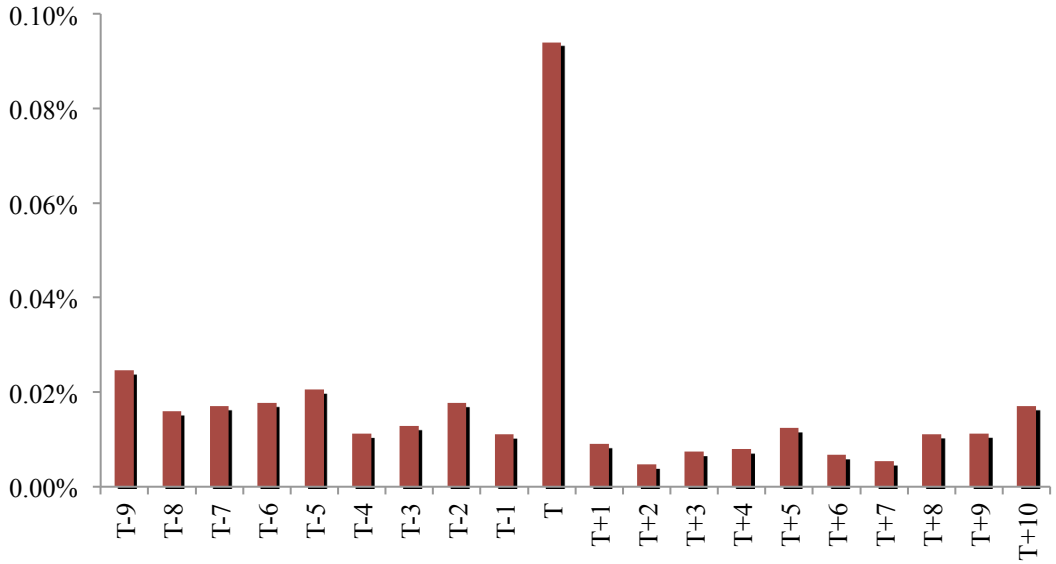


Figure 4B

Mutual fund distributions around the turn of the month

This figure displays mutual funds' distributions around the turn of the month. Day *T* denotes the last trading day of the month and *T-1* the trading day preceding that, and so on. The distributions are normalized by the aggregate mutual funds' assets under management. The sample consists of all the funds in the CRSP US Mutual Fund database. The sample period is from January 1980 to December 2013. The first panel shows the mutual funds' distributions based on all months and the second panel excludes the December observations.

All months



Excluding Decembers

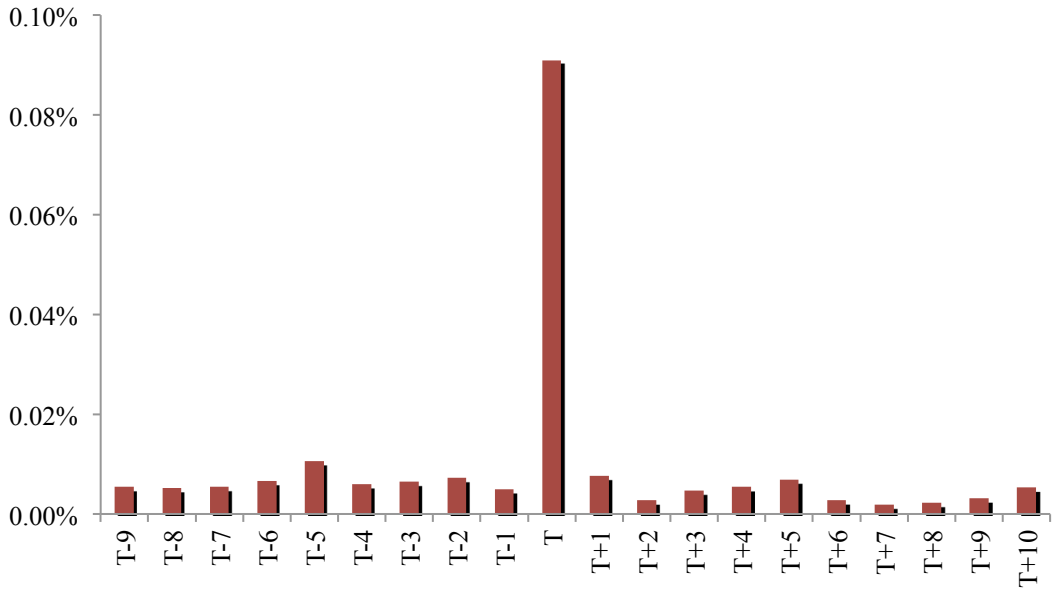


Figure 4C

Corporate dividend payment dates around the turn of the month

The figure shows the proportion of annual dividend payments (in dollars) by CRSP companies occurring around the turn of the month. Day *T* denotes the last trading day of the month and *T-1* the trading day preceding that, and so on. The sample period is from January 1980 to December 2013.

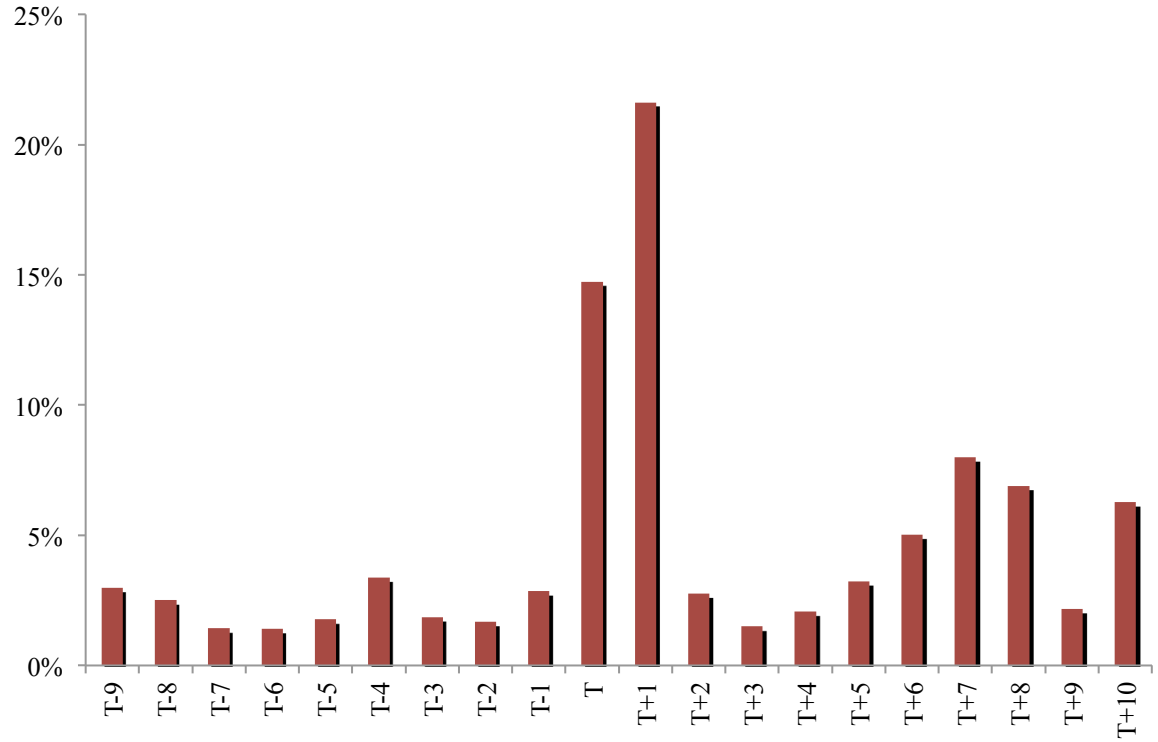


Figure 5

The effect of mutual fund holdings on the turn of the month patterns

This figure shows value- and equal-weighted returns around the turn of the month in deciles of stocks based on our estimates of the mutual funds' total ownership percentages of stocks in the previous month. Our sample consists of all CRSP stocks owned by at least one mutual fund (in Thomson Reuters Mutual Fund Holdings database). Sample period is from January 1980 until December 2013. Panel A documents the returns from *T-8* until *T-4*, Panel B the returns from *T-3* to *T-1*, Panel C the returns from *T* to *T+3* and Panel D the returns from *T+4* to *T+8*. Finally, Panel E shows the correlation of *T-8* to *T-4* and *T-3* to *T-1* returns and Panel F the correlation of *T* to *T+3* and *T+4* to *T+8* returns in different mutual fund ownership deciles. 10 = highest ownership decile.

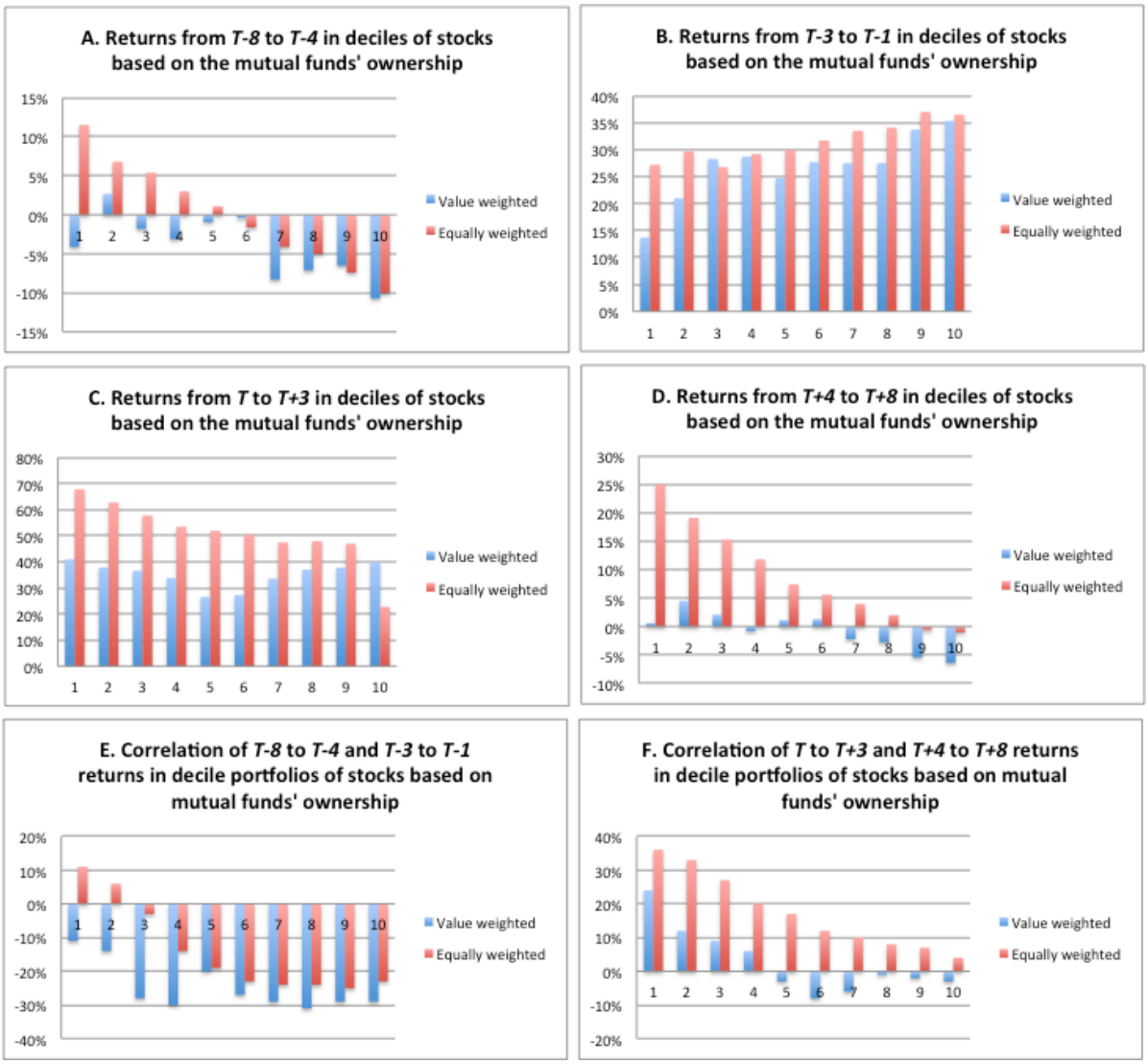
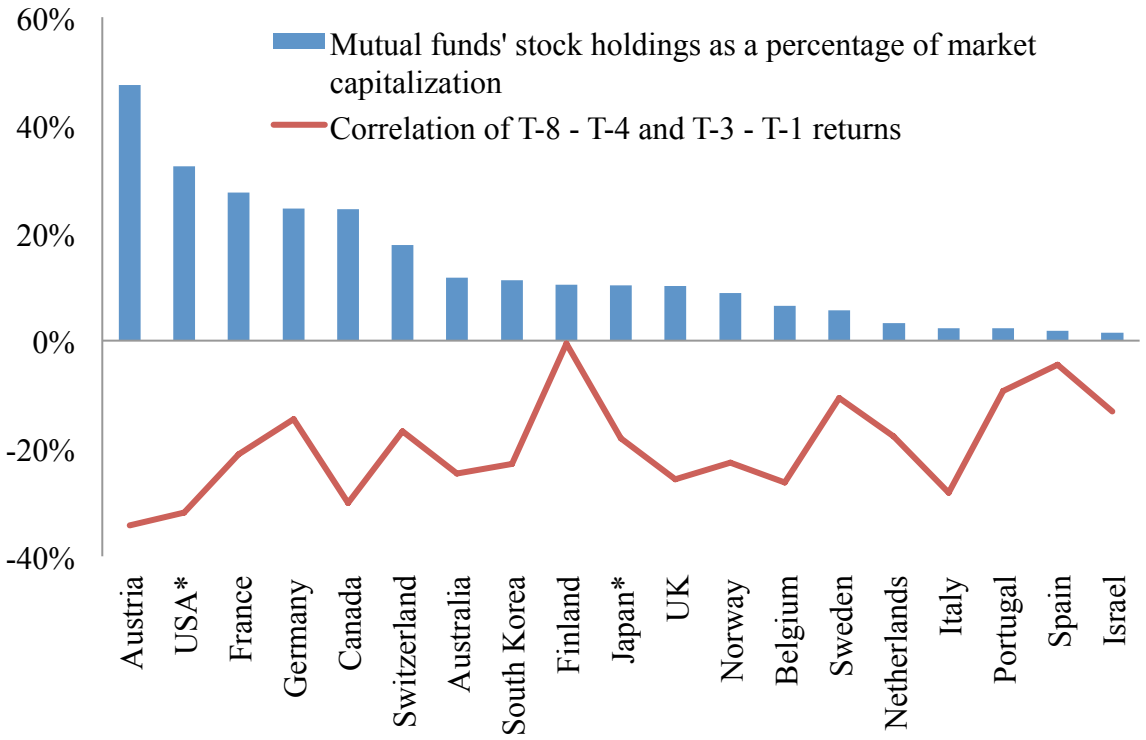


Figure 6

Mutual funds' ownership and the correlation of *T-8* to *T-4* and *T-3* to *T-1* returns across countries

This figure shows the mutual funds' domestic stock holdings as a percentage of total market capitalization of the country and the correlation of *T-8* to *T-4* and *T-3* to *T-1* returns, reprinted from Table 2. The stock holdings percentage is an average of annual observations from 2008 until 2012. Our sample includes all countries from Table 2 for which the relevant data are available from OECD's Institutional Investor assets database. Total market capitalizations are from World Bank. For some countries, only total stock holdings (i.e. holdings including both domestic and foreign stock holdings) by mutual funds are available. Out of these countries, we have included USA and Japan (denoted with star in the figure) due to their large domestic equity markets. Denmark and Ireland, where only the mutual funds' total stock holdings are available are excluded. Finally, Luxembourg is excluded as the domestic stock holdings reported exceed the total market capitalization of the Luxembourg stock exchange.



* Includes both stocks issued by residents and non-residents

Figure 7

Mutual funds' return volatility relative to average daily return volatility

This figure shows how mutual funds' return volatility behaves throughout the month by showing the funds' average volatilities observed during each trading day of the month (*T+1* being the first trading day of the month), normalized by the funds' average daily return volatility. The daily mutual fund returns are from CRSP. The sample period is from September 1998 until December 2013. Note that the number of observations decreases when the number of business days from the start of the month increases.

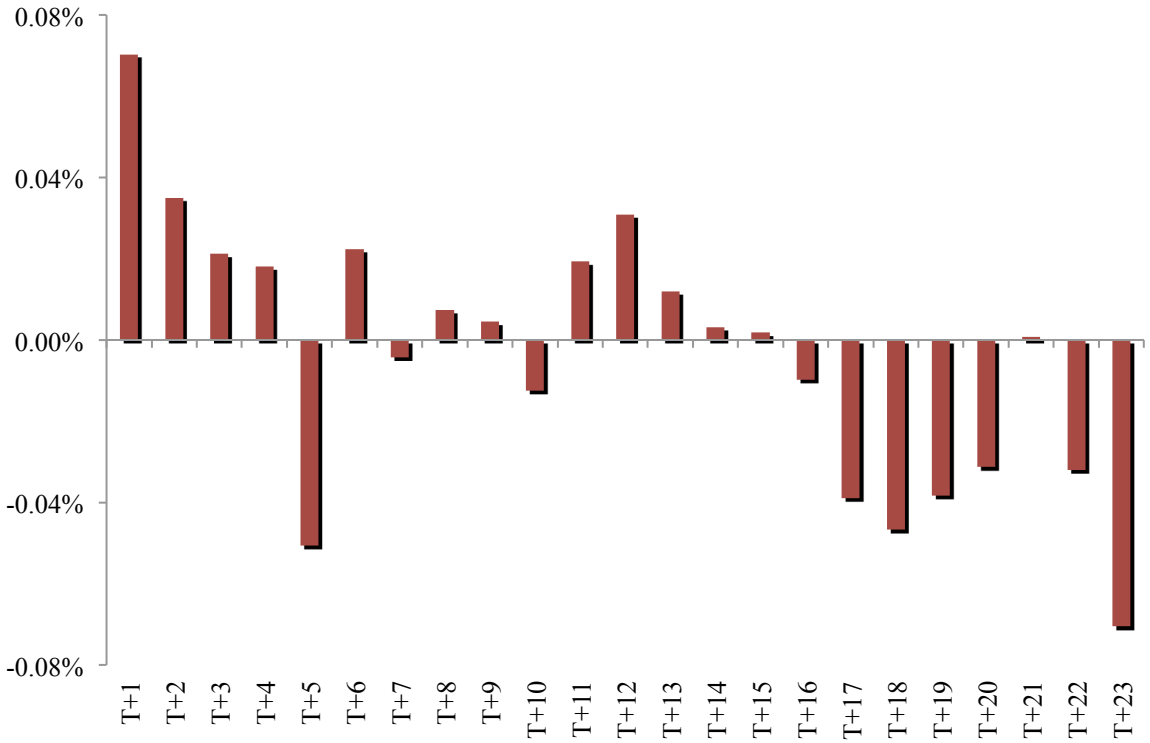


Figure 8

Mutual funds' alphas and fund specific correlations between *T-8* to *T-4* returns and *T-3* to *T-1* returns

This figure shows the mutual funds' four factor alphas conditional on the fund specific past two years' correlation between the fund's *T-8* to *T-4* and *T-3* to *T-1* returns. More specifically funds are divided into deciles every year (at the end of December) based on this correlation. Four factor alphas are calculated using the next year's daily returns controlling for Fama and French 3-factors and Carhart's Momentum factor. Decile 10 includes mutual funds with the highest correlation in their *T-8* to *T-4* and *T-3* to *T-1* returns. The daily mutual fund returns are from CRSP. The sample period is from January 1999 until December 2013.

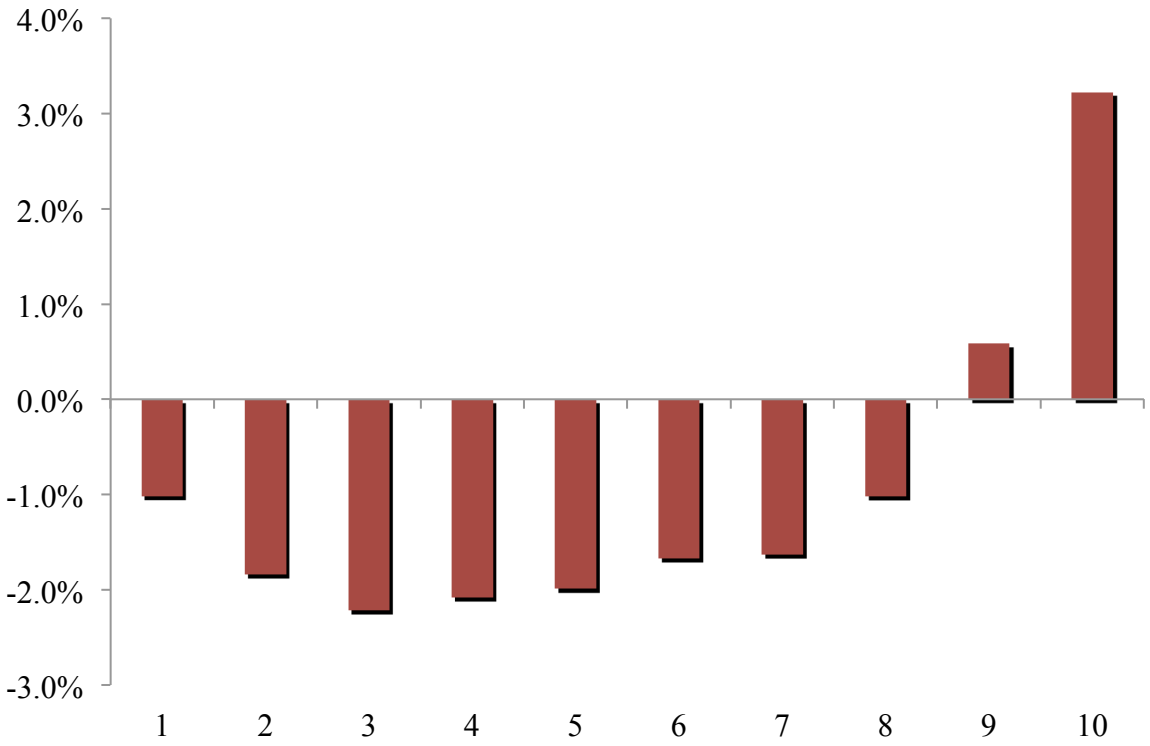


Figure 9

Turnover around the turn of the month

This figure shows the stocks' average daily turnover on days around the turn of the month in excess of the average daily turnover outside the turn of the month. Day *T* denotes the last trading day of the month and *T-1* the trading day preceding that, and so on. The average daily turnover outside the turn of the month refers to the average turnover on days from *T+11* of the ending month to *T-8* of that month, and from *T+5* to *T+10* of the month that begins. Turnover is estimated as the CRSP total trading volume in USD divided by the CRSP total market capitalization of the previous day. Our sample period is from January 1980 to December 2013.

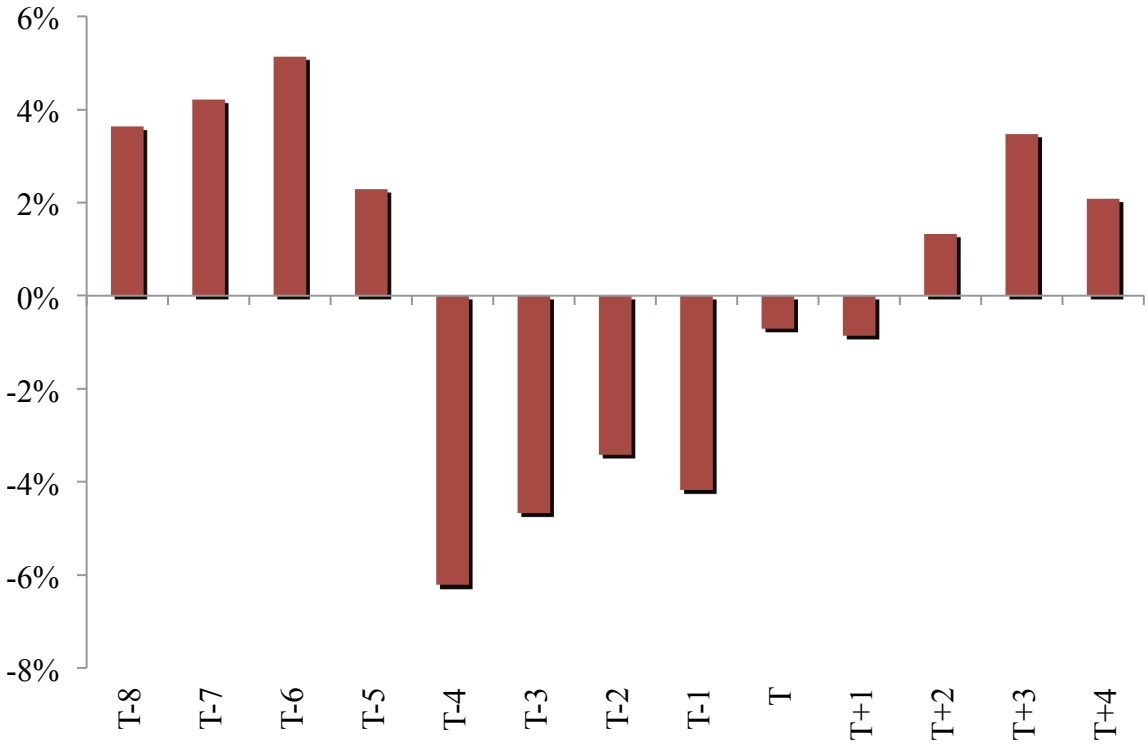


Table 1

Annualized returns around the turn of the month

This table presents the annualized returns around the turn of the month in G-10 countries as well as in several other industrialized countries. *T* refers to the last trading day of the month. Our sample starts in January 1980 or later when the relevant data becomes available, and runs until the end of 2013 (to be precise, until the 8th trading day of 2014). All figures that statistically significantly differ from zero at a 5% significance level are bolded.

Country	Index	Sample starts	Annualized return *T-3 - T-1*	Annualized return *T*	Annualized return *T+1 - T+3*	Annualized return *T-8 - T-4*	Annualized return *T+4 - T+8*	Annualized return on other days
United States	S&P500	Jan-80	**27.1%**	20.3%	**33.1%**	-3.4%	-1.9%	**17.5%**
United States	CRSP VW	Jan-80	**27.3%**	**35.6%**	**32.4%**	-4.7%	-2.1%	**14.6%**
Other G10 countries								
Belgium	BEL20	Jan-90	16.1%	**50.0%**	**37.0%**	-13.0%	-6.4%	15.4%
Canada	S&P/TSX C	Jan-86	16.6%	**58.8%**	**24.9%**	-5.0%	-1.8%	7.6%
France	CAC40	Jan-88	**35.4%**	**49.2%**	**33.7%**	-5.8%	-12.2%	14.7%
Germany	DAX	Jan-80	14.0%	**39.0%**	**53.2%**	-8.6%	-10.4%	**18.4%**
Italy	FTSE MIB	Jan-98	30.0%	21.9%	21.2%	-13.8%	-17.7%	15.5%
Japan	NIKKEI225	Jan-80	**28.4%**	27.6%	18.3%	1.6%	-14.0%	2.1%
Netherlands	AEX	Jan-83	**17.9%**	**36.4%**	**45.2%**	-1.3%	-5.7%	**19.5%**
Sweden	OMXS30	Jan-86	**29.6%**	**39.5%**	**51.5%**	-8.1%	-0.6%	11.9%
Switzerland	SMI	Jul-88	**23.0%**	27.1%	**37.1%**	-10.4%	-1.9%	14.3%
UK	FTSE100	Jan-86	**26.6%**	23.7%	**37.4%**	-11.7%	-0.8%	**19.2%**
Other industrialized countries								
Australia	S&P/ASX200	Jun-92	**29.2%**	**37.8%**	**21.3%**	2.7%	-7.3%	11.4%
Austria	ATX	Jan-91	**34.3%**	**43.1%**	**45.3%**	0.2%	-15.5%	-10.2%
Denmark	OMXC20	Dec-89	18.4%	**34.4%**	**44.3%**	-14.5%	0.8%	19.0%
Finland	OMXH25	Jan-91	29.7%	**81.7%**	**41.2%**	-3.5%	-4.9%	11.9%
Hong Kong	HSI	Jan-80	20.3%	**65.8%**	**39.0%**	-2.5%	7.9%	**28.6%**
Ireland	ISEQ OVER	Jan-88	8.3%	**64.1%**	**41.5%**	-6.0%	-4.1%	13.6%
Israel	TA-25	Jan-92	19.8%	41.5%	**43.6%**	-0.9%	10.4%	-0.1%
Luxembourg	LUXX	Jan-99	25.5%	**51.7%**	21.9%	-8.6%	1.1%	-7.3%
New Zealand	NZX50	Jan-01	**29.8%**	**63.7%**	16.6%	-0.5%	-10.8%	4.8%
Norway	OBX	Jan-87	18.6%	**64.3%**	**42.5%**	-4.1%	-3.7%	12.5%
Portugal	PSI-20	Jan-93	9.6%	17.7%	**41.3%**	-11.2%	6.7%	2.2%
Singapore	STI	Sep-99	24.0%	**42.2%**	**37.4%**	-5.7%	2.3%	-19.2%
South Korea	KOSPI	Jan-80	3.2%	**84.0%**	**42.2%**	1.2%	9.1%	-12.7%
Spain	IBEX35	Mar-87	20.5%	**38.6%**	**36.3%**	-10.4%	-1.8%	**30.3%**
Average of all indexes			22.4%	44.6%	36.1%	-5.7%	-3.3%	9.8%

Table 2

Correlations around the turn of the month

This table presents the correlation of the returns from *T-8* to *T-4* and *T-3* to *T-1*; as well as the correlation of the returns from *T* to *T+3* and *T+4* to *T+8*. Here *T* refers to the last trading day of the month. Our sample period starts in January 1980 or when the relevant data becomes available. The sample runs until end of 2013 (to be precise, until the 8th trading day of 2014). All figures that statistically significantly differ from zero at a 5% significance level are bolded.

Country	Index	Sample starts	Correlation of *T-8 - T-4* and *T-3 - T-1* returns	Correlation of *T - T+3* and *T+4 –T+8* returns	Daily return auto-correlation	Weekly return auto-correlation
United States	S&P500	Jan-80	**-0.30**	-0.09	**-0.03**	**-0.05**
United States	CRSP VW	Jan-80	**-0.32**	-0.03	0.01	-0.02
Other G10 countries						
Belgium	BEL20	Jan-90	**-0.26**	**-0.23**	**0.07**	-0.03
Canada	S&P/TSX C	Jan-86	**-0.30**	0.05	**0.03**	-0.05
France	CAC40	Jan-88	**-0.21**	**-0.20**	-0.01	-0.04
Germany	DAX	Jan-80	**-0.15**	**-0.15**	0.00	-0.02
Italy	FTSE MIB	Jan-98	**-0.28**	-0.04	0.00	-0.01
Japan	NIKKEI225	Jan-80	**-0.18**	0.00	-0.02	-0.02
Netherlands	AEX	Jan-83	**-0.18**	**-0.21**	0.00	0.03
Sweden	OMXS30	Jan-86	-0.11	**-0.11**	**0.04**	-0.02
Switzerland	SMI	Jul-88	**-0.17**	**-0.24**	**0.03**	**-0.07**
United Kingdom	FTSE100	Jan-86	**-0.26**	**-0.20**	0.00	-0.05
Other industrialized countries						
Australia	S&P/ASX200	Jun-92	**-0.25**	**-0.12**	-0.01	-0.04
Austria	ATX	Jan-91	**-0.34**	-0.07	**0.08**	0.01
Denmark	OMXC20	Dec-89	**-0.38**	-0.02	**0.06**	-0.05
Finland	OMXH25	Jan-91	-0.01	**-0.19**	**0.04**	0.02
Hong Kong	HSI	Jan-80	**-0.19**	-0.04	**0.03**	**0.08**
Ireland	ISEQ OVER	Jan-88	-0.11	**-0.25**	**0.07**	0.00
Israel	TA-25	Jan-92	**-0.13**	-0.08	0.02	**-0.07**
Luxembourg	LUXX	Jan-99	**-0.23**	-0.14	**0.07**	0.07
New Zealand	NZX50	Jan-01	-0.03	0.05	**0.05**	0.04
Norway	OBX	Jan-87	**-0.23**	-0.10	**0.03**	0.02
Portugal	PSI-20	Jan-93	-0.09	**-0.15**	**0.11**	**0.07**
Singapore	STI	Sep-99	**-0.35**	-0.06	0.03	0.03
South Korea	KOSPI	Jan-80	**-0.23**	-0.07	**0.06**	**-0.07**
Spain	IBEX35	Mar-87	-0.04	**-0.20**	**0.05**	-0.02
Average of all indexes			-0.20	-0.11	0.03	-0.01

Table 3

The effect of institutional trading on the market returns from *T-3* to *T-1*

This table shows the results from a regression in which the US equity market index returns from *T-3* to *T-1* are regressed on the *T-8* to *T-4* returns to the same index, and on the institutional investors' cumulative selling pressure from *T-5* to *T-4*. Here *T* refers to the last trading day of the month. Institutional investors' selling pressure is defined to be the difference between the value of their stock sales and purchases (normalized by the US total stock market capitalization at time *T-6*) when the sales exceed the purchases, and to be zero otherwise. Our institutional investors' trade data is from ANcerno and the sample period is from January 1999 to December 2013. The returns in the first, third and fifth column are those of the CRSP value-weighted index, while in the second, fourth and sixth column they are those of the S&P 500 index. T-statistics based on Newey-West standard errors are shown below the coefficients. All figures that statistically significantly differ from zero at a 5% significance level are bolded.

y = returns *T-3 – T-1*

Market return *T-8 - T-4*	**-0.352**	**-0.333**			**-0.344**	**-0.326**
	(-2.68)	(-2.60)			(-2.89)	(-2.79)
Institutional investors'			**117.25**	**113.51**	**111.09**	**108.53**
sell pressure			(2.42)	(2.45)	(3.34)	(3.23)
Intercept	**0.003**	0.003	0.000	-0.000	-0.001	-0.001
	(2.29)	(1.88)	(-0.09)	(-0.27)	(-0.53)	(-0.81)
R^2	0.184	0.163	0.084	0.084	0.259	0.240
Index	CRSP VW	S&P 500	CRSP VW	S&P 500	CRSP VW	S&P 500

Table 4

Cross-sectional return reversal around the turn of the month

Panel A shows evidence of cross-sectional return reversals around the turn of the month by showing the returns from *T–3* to *T–1* and from *T* to *T+3* for the deciles of stocks based on their *T-8* to *T-4* returns. Here *T* refers to the last trading day of the month. In Panel B, the table shows the stocks' returns from *T+4* to *T+8* in the deciles of stocks based on their *T* to *T+3* returns. Our sample includes all US stocks in CRSP that have a share price above USD 5, and a market capitalization that exceeds the NYSE 10th market capitalization percentile on the 10th trading day of the corresponding month. The sample period is from January 1980 until December 2013. The last column shows the difference in the returns between the two extreme deciles. T-statistics are provided in the parenthesis. All figures that statistically significantly differ from zero at a 5% significance level are bolded.

A: Deciles based on returns from *T-8* to *T-4*

	1	2	3	4	5	6	7	8	9	10	1-10
Return	**0.92%**	**0.54%**	**0.43%**	**0.39%**	**0.37%**	**0.34%**	**0.33%**	**0.31%**	**0.27%**	0.09%	**0.84%**
T-3 - T-1	(5.79)	(4.37)	(3.91)	(3.94)	(4.00)	(3.79)	(3.65)	(3.41)	(2.83)	(0.75)	(8.14)
Return	**0.98%**	**0.80%**	**0.73%**	**0.64%**	**0.61%**	**0.59%**	**0.59%**	**0.54%**	**0.56%**	**0.49%**	**0.49%**
T - T+3	(5.28)	(5.57)	(5.85)	(5.71)	(5.66)	(5.64)	(5.63)	(4.93)	(4.74)	(3.36)	(4.33)

B: Deciles based on returns from *T* to *T+3*

	1	2	3	4	5	6	7	8	9	10	1-10
Return	**0.38%**	0.08%	0.03%	0.00%	0.03%	0.01%	0.03%	-0.01%	-0.09%	**-0.37%**	**0.75%**
T+4 - T+8	(2.07)	(0.55)	(0.23)	(0.03)	(0.21)	(0.11)	(0.23)	(-0.06)	(-0.67)	(-2.29)	(7.19)

Table 5

The effect of mutual funds on the turn of the month patterns

This table shows the results from a regression in which the US equity market index returns from *T-3* to *T-1* are regressed on the *T-8* to *T-4* returns to the same index, and on the mutual fund industry's assets under management, and its interaction with the *T-8* to *T-4* index returns. Here *T* refers to the last trading day of the month. Mutual fund industry assets under management is the sum of all equity mutual funds' assets under management based on the CRSP mutual fund database, normalized by the US total stock market capitalization. The returns in the first and the third column are those for the CRSP value-weighted index, while in the second and the fourth column they are those for the S&P 500 index. T-statistics based on Newey-West standard errors are shown below the coefficients. All figures that statistically significantly differ from zero at a 5% significance level are bolded.

y = returns *T-3 - T-1*				
Market return *T-8 - T-4*	**-0.255**	**-0.241**	**0.535**	0.477
	(-2.63)	(-2.72)	(1.99)	(1.79)
Mutual fund industry AUM			-0.002	-0.006
			(-0.17)	(-0.44)
Interaction of mutual fund industry AUM and market return *T-8 - T-4*			**-3.289**	**-3.076**
			(-2.43)	(-2.31)
Intercept	**0.003**	**0.003**	0.004	0.005
	(3.69)	(3.65)	(1.38)	(1.52)
R^2	0.102	0.088	0.184	0.170
Index	CRSP VW	S&P 500	CRSP VW	S&P 500
Sample	1/1980-12/2013	1/1980-12/2013	2/1991-4/2013	2/1991-4/2013

Table 6

Mutual funds' market betas around the turn of the month

This table shows mutual funds' average market betas on various days around the turn of the month relative to their market betas on all other days. The average market betas are obtained from fund specific regressions where mutual funds' daily returns are regressed on daily S&P 500 index returns, dummies for days corresponding to their location relative to the turn of the month, and their interactions. In the second column, the days *T* and *T+1* are pooled as there is evidence of abnormally significant return reversal (potentially due to window dressing) following the last day of the month that otherwise biases downwards the estimates of the daily betas for those days. Here *T* refers to the last trading day of the month. The mutual funds' daily returns are from the CRSP mutual fund database. The sample period is from September 1998 to December 2013. All figures that statistically significantly differ from zero at a 5% significance level are bolded.

		Coefficient	t-stat	Coefficient	t-stat
Interactions of time period dummies and daily S&P500 returns	*T-5*	**-0.019**	(-12.54)	**-0.019**	(-12.53)
	T-4	**-0.026**	(-15.41)	**-0.026**	(-15.51)
	T-3	**-0.056**	(-36.43)	**-0.056**	(-36.58)
	T-2	-0.001	(-0.79)	-0.002	(-0.84)
	T-1	**-0.004**	(-3.03)	**-0.004**	(-3.31)
	T	**-0.076**	(-54.38)	0.000	(0.05)
	T+1	0.006	(1.74)		
	T+2	**0.040**	(18.24)	**0.039**	(18.23)
	T+3	**0.019**	(9.00)	**0.019**	(8.99)
	T+4	**-0.008**	(-5.51)	**-0.008**	(-5.52)
	T+5	**-0.029**	(14.17)	**-0.029**	(-14.41)
Daily S&P500 return		**0.836**	(181.40)	**0.837**	(183.51)
Intercept		**0.000**	(-12.37)	**0.000**	(-12.38)
Time period dummies		**Yes**		**Yes**	
Number of funds		6715		6709	

Table 7

Liquidity, size and return reversals around the turn of the month

A. This table shows the effect of liquidity on the turn of the month return patterns. Our sample, covering data from January 1980 to December 2013, includes all stocks in CRSP listed in the NYSE and the Amex, that have share price above USD 5 on the 10th trading day of corresponding month and a market capitalization that exceeds the NYSE 10th market capitalization percentile. Amihud (2002) *ILLIQ* measure is calculated as a rolling one year average until the 10th trading day of corresponding month. For stocks sorted into deciles based on their Amihud measure (10th being the most illiquid), the table shows the annualized value-weighted returns on the relevant dates, and the correlations between *T-8* to *T-4* and *T-3* to *T-1* returns and *T* to *T+3* and *T+4* to *T+8* returns, respectively. Here *T* refers to the last trading day of the month. All figures that statistically significantly differ from zero at a 5% significance level are bolded.

Amihud Decile	Annualized return *T-3 - T-1*	Annualized return *T*	Annualized return *T+1 - T+3*	Annualized return *T-8 - T-4*	Annualized return *T+4 - T+8*	Annualized return on other days	Correlation of *T-8 - T-4* and *T-3 - T-1* returns	Correlation of *T - T+3* and *T+4 - T+8* returns
1	**27.5%**	13.4%	**31.6%**	-3.9%	-1.3%	**17.1%**	**-0.29**	-0.10
2	**32.4%**	**46.2%**	**32.4%**	-5.4%	-3.3%	**16.0%**	**-0.29**	-0.04
3	**34.8%**	**53.6%**	**35.1%**	-8.2%	-3.0%	**18.2%**	**-0.29**	-0.03
4	**35.2%**	**60.8%**	**31.4%**	-10.4%	-0.6%	**18.4%**	**-0.28**	0.04
5	**37.4%**	**65.5%**	**33.2%**	-8.9%	-1.2%	**14.0%**	**-0.28**	0.03
6	**40.1%**	**73.7%**	**32.6%**	-9.3%	-1.6%	**15.1%**	**-0.28**	0.02
7	**32.7%**	**72.9%**	**32.4%**	-9.0%	0.8%	11.6%	**-0.23**	0.07
8	**35.6%**	**76.2%**	**28.6%**	-8.1%	2.7%	**14.5%**	**-0.26**	0.08
9	**33.7%**	**76.4%**	**31.0%**	-5.5%	3.6%	**15.1%**	**-0.24**	0.07
10	**30.3%**	**72.7%**	**31.9%**	-2.1%	3.9%	9.6%	**-0.18**	**0.10**
Average	34.0%	61.1%	32.0%	-7.1%	0.0%	14.9%	-0.26	0.02

B. This table shows the effect of market capitalization on the turn of month patterns. Our sample, covering data from January 1980 to December 2013, includes all stocks from CRSP that have a share price above USD 5 on the 10th trading day of corresponding month and a market capitalization that exceeds the NYSE 10th market capitalization percentile. For stocks sorted into deciles based on their market capitalization (10th being the largest), the table shows the annualized value-weighted average returns on the relevant dates, and the correlations between the corresponding *T-8* to *T-4* and *T-3* to *T-1* returns and *T* to *T+3* and *T+4* to *T+8* returns, respectively. Here *T* refers to the last trading day of the month. All figures that statistically significantly differ from zero at a 5% significance level are bolded.

Size Decile	Annualized return *T-3 - T-1*	Annualized return *T*	Annualized return *T+1 - T+3*	Annualized return *T-8 - T-4*	Annualized return *T+4 - T+8*	Annualized return on other days	Correlation of *T-8 - T-4* and *T-3 - T-1* returns	Correlation of *T - T+3* and *T+4 - T+8* returns
1	**25.8%**	**77.0%**	**19.6%**	-4.1%	2.8%	10.1%	**-0.18**	**0.11**
2	**27.6%**	**76.7%**	**22.5%**	-6.5%	2.7%	11.9%	**-0.16**	**0.12**
3	**32.1%**	**84.7%**	**25.1%**	-7.9%	1.3%	9.1%	**-0.16**	**0.13**
4	**33.5%**	**76.2%**	**25.3%**	-5.9%	0.6%	11.5%	**-0.18**	**0.12**
5	**31.1%**	**73.1%**	**29.8%**	-8.2%	0.3%	11.1%	**-0.17**	0.08
6	**35.2%**	**75.0%**	**31.1%**	-10.7%	1.0%	12.1%	**-0.21**	0.05
7	**34.6%**	**73.1%**	**33.9%**	-9.8%	-1.0%	13.0%	**-0.22**	0.03
8	**34.6%**	**60.8%**	**35.9%**	-9.7%	-0.8%	14.0%	**-0.28**	0.04
9	**32.2%**	**56.4%**	**35.2%**	-8.1%	-1.8%	14.0%	**-0.28**	-0.01
10	**26.5%**	18.0%	**33.4%**	-3.5%	-2.1%	**17.1%**	**-0.29**	-0.08
Average	31.3%	67.1%	29.2%	-7.4%	0.3%	12.4%	-0.21	0.06

Table 8

The effect of volatility on the turn of the month patterns

This table shows the effect of the stocks' past 6-month return volatility on their turn of month patterns. To control for the fact that liquidity and volatility are correlated we condition our volatility estimates on liquidity. Our sample, covering data from 1980 to 2013, includes all stocks in CRSP listed in NYSE and Amex that have share price above USD 5 on the 10th trading day of corresponding month, and a market capitalization that exceeds the NYSE 10th market capitalization percentile. Amihud (2002) *ILLIQ* measure is calculated as a rolling one year average until the 10th trading day of corresponding month. Stocks fulfilling the requirements stated above are first dividend into Amihud-illiquidity quartiles; quartile 1(4) denoting the most liquid (illiquid) stocks. Then every Amihud-illiquidity quartile is divided into volatility quartiles; quartile 1 (4) denoting the least (most) volatile stocks within the Amihud-illiquidity quartile. The reported results relate to the value-weighted returns of the Amihud-Volatility sorted portfolios. All figures that statistically significantly differ from zero at a 5% significance level are bolded. Here *T* refers to the last trading day of the month.

Amihud	**Volatility**	Annualized return *T-3 - T-1*	Annualized return *T*	Annualized return *T+1 - T+3*	Annualized return *T-8 - T-4*	Annualized return *T+4 - T+8*	Annualized return on other days	Correlation of *T-8 - T-4* and *T-3 - T-1* returns	Correlation of *T - T+3* and *T+4 - T+8* returns
1	1	**23.1%**	15.0%	**25.2%**	-1.4%	1.3%	**18.1%**	**-0.18**	**-0.12**
1	2	**33.9%**	16.0%	**30.8%**	-2.7%	0.0%	**20.9%**	**-0.24**	-0.09
1	3	**31.7%**	24.7%	**35.7%**	-6.5%	-3.0%	14.8%	**-0.33**	-0.02
1	4	**30.5%**	**41.6%**	**41.2%**	-10.2%	-8.4%	8.4%	**-0.40**	-0.04
2	1	**32.7%**	**47.1%**	**29.5%**	-3.2%	1.3%	**20.4%**	**-0.22**	0.07
2	2	**36.2%**	**61.8%**	**29.6%**	-7.5%	-0.9%	**19.1%**	**-0.24**	0.05
2	3	**38.0%**	**67.5%**	**34.9%**	-11.0%	-3.8%	**16.5%**	**-0.30**	0.03
2	4	**41.2%**	**73.7%**	**38.4%**	-17.8%	-4.5%	13.6%	**-0.33**	-0.01
3	1	**31.5%**	**52.6%**	**30.2%**	-1.6%	2.0%	**16.0%**	**-0.23**	0.07
3	2	**36.7%**	**65.4%**	**30.4%**	-10.0%	3.0%	**18.6%**	**-0.26**	0.06
3	3	**43.5%**	**83.1%**	**33.1%**	-11.8%	-3.1%	11.9%	**-0.25**	0.04
3	4	**37.7%**	**105.1%**	**35.1%**	-16.7%	-7.4%	4.1%	**-0.29**	0.06
4	1	**25.2%**	**53.3%**	**27.4%**	0.5%	7.8%	**17.6%**	**-0.17**	**0.14**
4	2	**36.6%**	**68.1%**	**28.9%**	-3.6%	5.4%	**16.7%**	**-0.24**	0.09
4	3	**32.2%**	**91.9%**	**30.4%**	-6.7%	1.9%	**17.1%**	**-0.27**	0.06
4	4	**42.8%**	**100.0%**	**30.0%**	-10.3%	-0.2%	2.3%	**-0.21**	0.06
Average		34.6%	60.4%	31.9%	-7.5%	-0.5%	14.7%	-0.26	0.03

Table 9

Hedge funds' excess market betas and redemption frequencies

This table shows the hedge funds' average excess market betas around the turn of the month and the hedge funds' average excess market betas depending on the hedge funds' redemption frequency (we have excluded all categories with less than 200 observations). Hedge funds' market betas are based on fund-specific regressions in which hedge fund's (monthly) return is regressed on daily S&P 500 returns around the turn of the month and the return on the S&P500 index outside the turn of the month period. Excess market betas are calculated as a difference of the fund's estimated beta for any given day and its beta for the outside the turn of the month period. Hedge fund data is from TASS and our sample period is from January 1994 to December 2013. T-statistics are shown below the coefficients. All figures that statistically significantly differ from zero at a 5% significance level are bolded. Here *T* refers to the last trading day of the month.

	All funds	Monthly	Quarterly	Semi-Annually	Annually
T-5	**-0.110**	**-0.123**	**-0.110**	-0.039	**-0.103**
	(-15.43)	(-11.60)	(-9.32)	(-0.99)	(-4.04)
T-4	**-0.089**	**-0.081**	**-0.118**	-0.092	**-0.113**
	(-12.04)	(-7.54)	(-10.43)	(-1.78)	(-3.65)
T-3	**-0.017**	0.012	**-0.058**	**-0.121**	**-0.112**
	(-2.54)	(1.22)	(-5.61)	(-2.87)	(-3.40)
T-2	**-0.088**	**-0.097**	**-0.083**	-0.057	-0.010
	(-13.26)	(-9.96)	(-8.27)	(-1.23)	(-0.39)
T-1	**-0.061**	**-0.041**	**-0.065**	**-0.097**	**-0.132**
	(-10.46)	(-5.05)	(-7.28)	(-2.37)	(-5.28)
T	**-0.176**	**-0.173**	**-0.176**	**-0.121**	**-0.093**
	(-21.86)	(-14.81)	(-12.98)	(-2.54)	(-2.98)
T+1	**0.142**	**0.134**	**0.171**	**0.112**	**0.163**
	(21.64)	(14.56)	(16.35)	(2.85)	(7.11)
T+2	**0.250**	**0.227**	**0.260**	**0.355**	**0.348**
	(32.86)	(20.42)	(22.47)	(6.58)	(10.32)
T+3	**0.164**	**0.141**	**0.188**	**0.241**	**0.238**
	(24.01)	(13.78)	(17.81)	(5.26)	(7.74)
T+4	**0.106**	**0.079**	**0.145**	**0.125**	**0.121**
	(16.04)	(8.73)	(12.65)	(2.96)	(3.36)
T+5	0.038	0.017	**0.071**	**0.091**	**0.146**
	(4.89)	(1.54)	(5.85)	(2.10)	(3.55)
Average *T-5 - T-3*	-0.072	-0.064	-0.095	-0.084	-0.109
Average *T-2 - T+5*	0.047	0.036	0.064	0.081	0.097
Difference in averages	0.119	0.100	0.159	0.165	0.207
N	7,810	3,817	2,714	208	322

Table 10

Hedge funds' excess market betas and style

This table shows the hedge funds' average excess market betas around the turn of the month in certain hedge fund style categories. Hedge funds' average excess market betas are based on fund-specific regressions in which hedge fund's (monthly) return is regressed on the daily S&P 500 returns around the turn of the month and the return on the S&P500 index outside the turn of the month period. Excess market betas for any given fund are calculated as a difference of its estimated beta for any given day and its beta outside the turn of the month period. Hedge fund data is from TASS and our sample period is from January 1994 to December 2013. T-statistics are shown below the coefficients. All figures that statistically significantly differ from zero at a 5% significance level are bolded. Here *T* refers to the last trading day of the month.

	Global Macro	Managed Futures	Other styles
T-5	-0.024	**0.147**	**-0.134**
	(-0.62)	(3.85)	(-18.66)
T-4	-0.077	**0.102**	**-0.104**
	(-1.63)	(2.35)	(-14.40)
T-3	**0.106**	**0.424**	**-0.057**
	(2.36)	(9.95)	(-8.94)
T-2	-0.062	-0.052	**-0.092**
	(-1.88)	(-1.49)	(-13.56)
T-1	**0.091**	-0.065	**-0.068**
	(2.35)	(-1.77)	(-12.01)
T	**-0.143**	**-0.092**	**-0.185**
	(-3.03)	(-2.14)	(-22.61)
T+1	0.052	**0.191**	**0.142**
	(1.39)	(4.74)	(22.06)
T+2	0.066	**0.213**	**0.261**
	(1.42)	(5.44)	(33.99)
T+3	**0.100**	**0.089**	**0.173**
	(2.21)	(2.14)	(25.98)
T+4	0.044	-0.053	**0.121**
	(1.09)	(-1.40)	(18.54)
T+5	-0.025	-0.046	**0.047**
	(-0.67)	(-0.93)	(6.19)
Average *T-5 - T-3*	0.001	0.224	-0.098
Average *T-2 - T+5*	0.016	0.023	0.050
Difference in averages	0.014	-0.201	0.148
N	314	538	6,958

Table 11

Funding conditions and the turn of the month returns

This table shows the results from a regression in which the *T-3* to *T-1* stock market returns are regressed on the *T-8* to *T-4* market returns, a measure of cost of leverage, and its interaction with the *T-8* to *T-4* returns. In the first two columns cost of leverage is measured with the TED spread (the difference between the 3-month Eurodollar and the Treasury rates). In the third and fourth column we modify the cost of leverage measure by multiplying the TED spread by the hedge fund industry's assets under management and call this *Hedge Funds' Cost of Leverage*. Hedge funds' assets under management is the sum of all hedge funds' assets under management based on TASS database divided by US stock market capitalization. The returns in the first and the third column are those of the CRSP value-weighted index, while in the second and the fourth column they are those of the S&P 500 index. T-statistics based on Newey-West standard errors are shown below the coefficients. All figures that statistically significantly differ from zero at a 5% significance level are bolded. Here *T* refers to the last trading day of the month.

y = Return *T-3 - T-1*

Return *T-8 - T-4*	-0.068	-0.072	-0.075	-0.082
	(-1.17)	(-1.24)	(-1.36)	(-1.44)
Cost of Leverage	0.004	0.004		
	(1.37)	(1.24)		
Interaction of TED spread and the *T-8 - T-4* return	**-0.148**	**-0.152**		
	(-5.79)	(-5.68)		
Hedge funds' Cost of Leverage			0.020	0.015
			(0.69)	(0.53)
Interaction of hedge funds' Cost of Leverage and the *T-8 - T-4* return			**-1.566**	**-1.628**
			(-5.96)	(-5.93)
Intercept	**0.002**	0.001	**0.003**	**0.002**
	(1.15)	(1.07)	(2.25)	(2.12)
R^2	0.273	0.254	0.283	0.263
Index	CRSP VW	S&P 500	CRSP VW	S&P 500
Sample	2/1991-12/2013	2/1991-12/2013	2/1991-12/2013	2/1991-12/2013

APPENDIX

Figure A1

Deposits around the turn of the month

This figure shows the deposits in US Commercial banks relative to their two month average surrounding the observation date, on various trading days around the turn of the month. Here day *T* is the last day of the month. The sample period is from January 1980 to December 2013.Data source: FRED database.

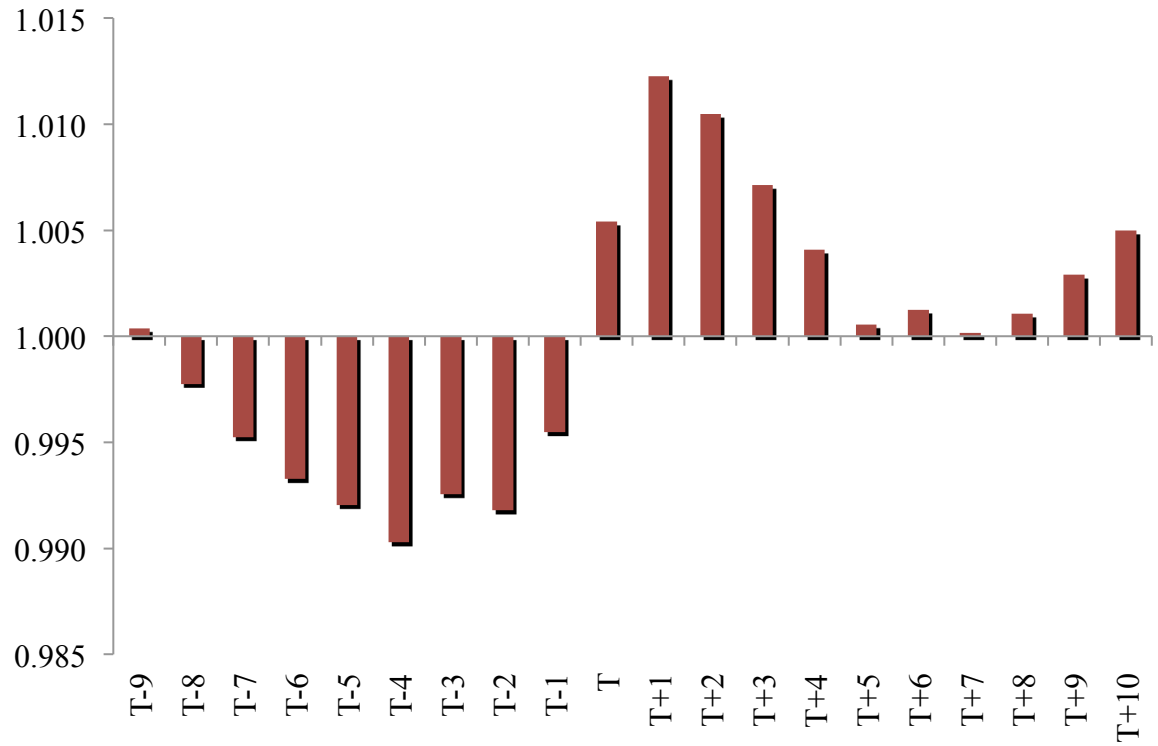


Table A1

Return patterns around the 15th (calendar) day of the month

Let *S* refers to the last trading day of the month that equals or follows the 15th calendar day of the month. This table presents annualized returns around the day *S* in G-10 countries as well as in several other industrialized countries. In addition, the table presents the correlation of the returns from *S-8* to *S-4* and *S-3* to S-*1*; as well as the correlation of the returns from *S* to *S+3* and *S+4* to *S+8*. Our sample starts in January 1980 or later when the relevant data becomes available, and runs until the end of 2013. All figures that statistically significantly differ from zero at a 5% significance level are bolded.

Country	Index	Sample starts	Annualized return *S-3 - S-1*	Annualized return *S*	Annualized return *S+1 - S+3*	Annualized return *S-8 - S-4*	Annualized return *S+4 - S+8*	Correlation of *S-8 - S-4* and *S-3 - S-1* returns	Correlation of *S - S+3* and *S+4 - S+8* returns
United States	S&P500	Jan-80	**18.7%**	3.5%	11.4%	1.6%	7.0%	**-0.17**	-0.04
United States	CRSP VW	Jan-80	**16.6%**	1.1%	7.9%	2.0%	7.1%	**-0.16**	-0.01
Other G10 countries									
Belgium	BEL20	Jan-90	5.5%	8.6%	5.1%	4.4%	-7.6%	-0.11	0.09
Canada	S&P/TSX C	Jan-86	1.3%	-3.6%	7.4%	3.7%	5.9%	-0.10	-0.02
France	CAC40	Jan-88	-5.8%	1.9%	3.1%	7.8%	4.0%	**-0.15**	-0.01
Germany	DAX	Jan-80	2.4%	13.6%	14.5%	11.4%	-4.3%	**-0.12**	0.04
Italy	FTSE MIB	Jan-98	9.1%	-25.2%	12.7%	-9.2%	-5.1%	**-0.28**	0.06
Japan	NIKKEI225	Jan-80	-11.1%	**35.3%**	-4.3%	3.9%	6.5%	**-0.10**	0.03
Netherlands	AEX	Jan-83	2.1%	16.4%	12.2%	12.7%	1.5%	**-0.17**	0.10
Sweden	OMXS30	Jan-86	6.3%	-4.2%	8.8%	17.7%	6.4%	**-0.16**	0.00
Switzerland	SMI	Jul-88	3.2%	6.6%	2.2%	11.0%	-1.7%	**-0.17**	0.10
United Kingdom	FTSE100	Jan-86	0.8%	5.3%	7.8%	11.2%	-1.1%	**-0.19**	0.10
Other industrialized countries									
Australia	S&P/ASX200	Jun-92	-5.6%	16.6%	8.1%	0.7%	9.9%	-0.02	-0.01
Austria	ATX	Jan-91	-13.9%	-13.8%	8.4%	9.6%	7.5%	**-0.12**	-0.03
Denmark	OMXC20	Dec-89	9.2%	11.2%	6.1%	8.5%	-6.6%	-0.10	0.05
Finland	OMXH25	Jan-91	-5.1%	-4.7%	23.2%	17.2%	7.8%	-0.11	-0.05
Hong Kong	HSI	Jan-80	4.8%	38.2%	4.6%	**20.9%**	8.5%	0.00	0.10
Ireland	ISEQ OVER	Jan-88	-10.8%	8.1%	16.6%	12.4%	-4.3%	**-0.13**	0.03
Israel	TA-25	Jan-92	-9.2%	37.7%	13.1%	**23.3%**	5.9%	-0.02	**-0.15**
Luxembourg	LUXX	Jan-99	-1.2%	-20.0%	-4.3%	-1.5%	1.6%	-0.05	0.04
New Zealand	NZX50	Jan-01	-3.1%	-1.7%	4.4%	0.9%	10.0%	-0.02	0.01
Norway	OBX	Jan-87	7.1%	-0.3%	-0.5%	5.6%	7.0%	**-0.12**	-0.04
Portugal	PSI-20	Jan-93	0.6%	-13.0%	3.1%	**22.8%**	-9.9%	-0.03	0.03
Singapore	STI	Sep-99	-1.8%	-17.3%	-22.6%	7.9%	3.1%	0.05	**0.18**
South Korea	KOSPI	Jan-80	-0.6%	-2.9%	-2.6%	**19.7%**	-7.4%	**-0.12**	0.03
Spain	IBEX35	Mar-87	8.7%	-2.9%	19.8%	16.3%	-7.5%	-0.11	0.07
Average of all indexes			1.1%	3.6%	6.4%	9.3%	1.7%	-0.11	0.03