Familiarity breeds short-termism*

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Abstract

Investors exhibit a robust and systematic pattern of shortening their holding period in a stock on which they execute multiple round trip trades. On average, the holding period shortens by 11% with each additional round trip. I show this tendency to be short-termed is associated with reinforcement learning. Investors are more likely to shorten the holding period after a round trip where they could have realized a better return had they sold earlier. Investors become short-termed as they become more familiar with trading a stock.

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1 Introduction

Fostering long-term financial investments has been on the agenda of regulatory policy-makers for many years.[1] Despite considerable discussion about the negative impact of short-term trading, close to nothing is known about its determinants.[2] In this paper, I show that familiarity is associated with investor short-termism.

Analyzing a large dataset covering almost 20 years of individual investors' trades from Finland, I show that investors exhibit a robust and systematic pattern of shortening their holding period in a stock on which they execute multiple round trip trades. In other words, investors become short-termed when they become more familiar with a stock.[3] On average, investors shorten their holding period by 11% with each additional round trip. These results are robust to a subsample of investors who never day trade, and are robust to investors' age and gender controls. Moreover, I document a similar pattern in the holding periods of the clients of a large retail brokerage in the US.

On the surface, the pattern of shortening the holding period with familiarity appears consistent with investors learning about the stock. In reality, they tend to lose wealth with their repeated trades, earning a four-factor alpha of -1.3%. At the same time, they exhibit an increase in the disposition effect with repeated round trips. The disposition effect of the investors doubles by the 15^{th} round trip. Taking cues from these findings, I explore whether the pattern of shortening the holding period is associated with reinforcement learning, the leading theory of heuristic learning applied to financial decisions (see, e.g., Kaustia and Knüpfer, 2008; Choi et al., 2009; Chiang et al., 2011; Malmendier and Nagel, 2011, 2015).

Theoretical frameworks of reinforcement learning posit that missed opportunities result in negative reinforcement (McAllister, 1991; Erev and Roth, 1995, 1998; Camerer

[1] See Wehinger (2011) for a summary of the OECD round-table discussions on fostering long-term financial investment and economic growth.

[2] For example, even in the survey papers on individual investor behavior (Barber and Odean, 2011; Hirshleifer, 2015), the words "short term," "horizon," and "holding period" are almost always used in the discussion on performance. Notable exceptions are Kaniel et al. (2008) and Kaniel et al. (2012), who show that individual investors' trading predicts short-term market returns, indicating a possible link between informed trading and short-termism.

[3] I use the term "familiarity" to refer to multiple round trips on a stock.

and Hua Ho, 1999). I explore whether such missed opportunities are associated with investors' short-termism. For instance, an investor having executed a round trip may be tempted to learn how to improve her performance on the next round trip. If the investor missed an opportunity for a better return by holding on to the stock for too long, the negative reinforcement from this missed opportunity could result in investors shortening the holding period on the next round trip. The negative reinforcement should be stronger when the missed opportunity also accompanies a negative realized return.

I find that investors are more likely to shorten their holding period after a round trip where they missed an opportunity to realize a better return had they sold earlier. The propensity to shorten the holding period is more prominent when the round trip returns are negative than when they are positive. Moreover, the propensity to shorten the holding period is monotonically increasing in the magnitude of the missed return opportunity. I also find the negative reinforcement of missed opportunity is persistent across multiple round trips, and it is increasing in the number of round trips. These findings provide support to the hypothesis that reinforcement learning is associated with the shortening of the holding period.

To the best of my knowledge, this paper is the first to document any trend in investor horizons. My paper also contributes to a growing literature documenting how reinforcement learning from personal experiences alter investors' decisions, such as IPO investments (Kaustia and Knüpfer, 2008; Chiang et al., 2011), savings behavior (Choi et al., 2009), and risk-taking (Malmendier and Nagel, 2011, 2015). In a related paper studying round trip trades, Strahilevitz et al. (2011) show that investors' tendency to repeat round trips is consistent with reinforcement learning. I contribute to this literature by showing that reinforcement learning is also associated with investors' short-termism.

My findings also inform a wider audience exploring the determinants of investors' trading biases. Recently, a number of alternative theories have been proposed to explain the disposition effect: realization utility (Barberis and Xiong, 2012; Ingersoll and Jin, 2013), belief revision (Ben-David and Hirshleifer, 2012), cognitive dissonance (Chang et al., 2016), and time-inconsistency (Fischbacher et al., 2017), among many others. I contribute to this literature by showing that familiarity with a stock is associated with the disposition effect as well.

The remainder of this paper is organized as follows. Section 2 describes the data. Section 3 presents the empirical results. Section 4 concludes.

2 Data

The main data used in the study are a copy of the registry of shareholdings and trades of Finnish individual investors. The data are similar to those used in Grinblatt and Keloharju (2001), except that I examine a longer period from April 1995 to December 2014. The data include stock transactions of all Finnish individual investors. Because the intra-day timestamps are not available, I aggregate each investor's transactions at the daily level. I only consider positions in a stock that are initiated by an open market purchase. Further, I restrict the data to investors with both age and gender information, and exclude accounts for which the age information indicates a minor (less than 18 years of age) holds the account. With these filters, I end up with a sample containing 308,000 accounts. For robustness tests of the main findings, I also use a dataset of investor trades from a large discount brokerage in the US.[4] These data consist of stock transactions of about 76,000 user accounts from 1991 to 1996. The filters I apply to the US data are similar to the ones I apply to the Finnish data.

The primary variable of interest is the investors' tendency to execute multiple round trips on a stock. To identify this tendency, I create a time series of the outstanding position in each stock an investor holds. I mark the first purchase and each follow-on purchase after a complete exit as initiations. A round trip is the set of transactions from initiation to the complete exit of the position. In this way, I identify the integer count of the round trip of an investor on each of her stocks.[5] To avoid outlier effects, I exclude cases in which an investor executes more than 20 round trips on a particular stock in the Finnish data and more than 10 round trips in the US data.

[4]The orginal data were used in Barber and Odean (2000) and Barber and Odean (2001). Multiple studies have since used the same data. See Barber and Odean (2011) for a list.

[5]I use the terms "round trip" to refer to initiations or repeat purchases that are entirely exited.

Table 1 reports descriptive statistics of the investors who purchase a stock repeatedly. Almost 127,000 investors (41% of the sample) purchase a stock at least a second time after they completely exit their position the first time. Although the number of investors who purchase a stock multiple times is relatively small, the amount of trading activity they generate is substantial. For example, the number of investors who purchase at least one stock for the sixth time comprises around 10% of the sample, but these investors account for 58% of the trading activity, measured in terms of the volume of stock initiations. Repeat purchasers also invest more than the average investor. For instance, investors who purchase any stock for the tenth time invest almost twice the amount of the average investor. Overall, repeat purchasers contribute substantially to the retail trading activity and investments.

Repeat purchasers hold slightly more stocks in their portfolio than the average investor. The tendency of investors to execute repeat purchases in multiple stocks increases with their tendency to purchase any one stock repeatedly. For example, investors who purchase any one stock for the 10^{th} time repeat purchase 21 stocks on average during the sample period.

Table I.A.1.1 reports on the characteristics of the US investors who repeatedly purchase a stock. Although the number of repeat purchases is smaller than in the Finnish data, it is still high considering that the number of listed stocks in the US is about 35 times larger than the number listed in Finland. Moreover, as observed in the Finnish data, the repeat purchasers in the US also account for a large proportion of the total trading activity. For example, investors who purchase a particular stock the third time account for 24% of the stock initiations in the data. The patterns observed in the Finnish data also hold for the US data. Repeat purchasers (a) are more likely to be men, (b) invest more than other investors, and (c) are more likely to repeatedly purchase multiple stocks, with a higher tendency to purchase any one stock repeatedly.

3 Results

3.1 Repeated round trips and the holding periods

3.1.1 Univariate results

Figure 1 presents univariate results on how investors' holding periods develop as a function of the number of round trips. Panel A shows the means of historical holding periods of the first N round trips on a stock conditional on the investor initiating a position in that stock for the $N+1^{th}$ time. Panel A of Figure 1 shows that, on average, investors shorten their holding period as a function of the number of round trips. For example, investors who initiate a stock position for the fifth time shorten their holding period from 120 days on their first round trip to 63 days on their fourth round trip. Panel B reports on the median holding periods and confirms that extreme values are not driving these results.

Because the data begin in April 1995, the identification of the N^{th} round trip is likely to be imprecise for some investors who executed round trips before the sample period. Such a misspecification does not alter my main findings. For robustness, Figure I.A.2.1 reports on a subsample of investors whose first trade appears at the beginning of April 1998 or later, that is, at least three years from the start of the sample period. The trend in the investor holding periods is similar to the one observed in Figure 1. Another possibility is that day traders, who get in and out of stocks very frequently, are driving the short-term trend. However, the trends in investor horizons are similar in a subsample excluding day traders (Figure I.A.2.2).

3.1.2 Regression evidence

I test the statistical validity of these univariate trends in a linear regression setting. I examine whether each additional round trip shortens the holding period. Previous research has identified many factors that are associated with a decrease in the holding period. The most important and the most persistent of them is the disposition effect

(Shefrin and Statman, 1985), which posits that investors tend to sell their winning stocks more often than their losing stocks. Hence, they are likely to have a shorter holding period when selling a stock at a profit. To control for this possibility, I include an indicator variable for gains on a round trip. Other research has indicated males are more overconfident than females and tend to trade more aggressively and frequently (Barber and Odean, 2001). The tendency to trade more can also shorten the holding period of an investor. I control for this using a dummy variable for the female investors. The realization utility model of Ingersoll and Jin (2013) predicts investors tend to have shorter holding periods if the trading costs are low. With the innovations in online trading platforms, trading costs have decreased dramatically. To control for changes in trading costs, I add time fixed effects (year-month of purchase) in the regression model. Moreover, I include stock fixed effects to control for stock-level characteristics.

In summary, I use the following regression specification:

$$\begin{aligned} log(HoldingPeriod) = & \alpha + \beta_i \times Trip_N + \beta_2 \times \textit{Gain dummy} \\ & + \beta_3 \times Age + \beta_4 \times \textit{Female dummy} \\ & + \textit{stock fixed effects} + \textit{time (year-month) fixed effects} + \epsilon, \end{aligned} \quad (1)$$

where $HoldingPeriod$ is the number of trading days the investor holds the stock, $Trip_N$ is the integer count of the round trip, and *Gain dummy* takes the value of 1 for round trip gains, and 0 otherwise. Age is measured in years at the time of each repeated purchase. In all the linear models, I cluster the standard errors at the investor, stock, and time levels using the method outlined in Cameron et al. (2011).

Data on closing prices are obtained from OMX Nasdaq Helsinki and, in some cases, from Datastream. For the US data, I use the CRSP database for the closing prices. Daily stock returns are adjusted for corporate actions such as mergers and acquisitions, stock splits, and cash dividends. I use the volume-weighted average purchase price as the reference price for calculating returns. For a round trip, I calculate the returns using the price at which the investor sells her position. For an open position where the investor does not entirely exit, I compute the returns using the closing price on the last day of the sample period. For delisted stocks, I assume investors liquidate their holdings on the last trading day.

Table 2 reports on the results of equation (1). I condition the regression models on subsamples of the data in which investors purchase a stock at least for the N^{th} time (where $N \in \{2,4,6,8\}$). Because the dependent variable is the log of the holding period, the coefficients (β_1) can be interpreted as percentage decreases in the length of the holding period when an investor executes one additional round trip. For example, conditional on an investor purchasing a stock at least for the second (eighth) time, the holding period is shortened by 16.9% (6.5%) each round trip. Averaging the coefficients across the models, I find an additional round trip is associated with a 10.7% decrease in the length of the holding period. Other explanatory variables also behave as expected. The coefficient of the variable capturing the disposition effect (*Gain dummy*) is negative and highly significant. On average, investors hold their winning stock for a 42% lower duration than their losing stocks. The holding period also increases in age, but its effects are economically insignificant. The results are qualitatively similar for the investors who first start trading after April 1998 (Table I.A.2.1) and for those investors who do not execute day trades (Table I.A.2.2). The US data show similar results (Table I.A.1.2).

Regression model (1) indicates the average effect of one additional round trip, not the effects of a particular round trip, on the investors' holding period. To measure this effect, I modify equation (1) to include categorical dummies for each round trip. Further, to avoid any look-ahead bias, I restrict the analysis to measuring the effects of past N round trips conditional on the investor purchasing the stock for the $N+1^{th}$ time.

Figure 2 reports the results of the regression models with categorical round trip dummies. All the coefficients are negative and statistically significant. Again, as with the coefficients in equation (1), one can interpret these coefficients as percentage decreases in the holding period. Investors shorten their holding period by 47% in their second round trip compared with the holding period in the first round trip. By the time they have completed their fifth round trip, they have shortened their holding period by 75%.

Linear regressions for the holding period do not account for the exit decisions of the investors. To model the exit decision of investors explicitly and for a robustness test of the main results, I use a proportional hazard model (Cox, 1972). Table I.A.2.3 shows the hazard rate of completing round trip increases as a function of the number of round trips. A coefficient value of 0.121 in the full sample indicates each additional round trip is associated with a 12.9% increase in the likelihood of exit on a trading day. Cox models with categorical dummy variables for the round trips in Figure I.A.2.3 confirm the findings of the linear models with categorical variables.

3.2 Investor performance on the round trips

In this section, I shed light on the investors' performance on their repeated round trips. First, I explore whether the round trips generate wealth for the investors in terms of alphas. Investors might also have reasons other than wealth creation for the multiple round trips. Short-term traders are known to provide liquidity to institutional demands, and to execute timed trades around the earnings announcements (Kaniel et al., 2008, 2012). Therefore, I also explore whether the multiple round trips strategy and the associated short-termism are related to improvements in the investors' market-timing ability.

3.2.1 Return performance

Table 3 reports the average gross returns and alphas on the multiple round trips. The gross returns are the weighted average returns the investor realizes on a round trip, weighted by the sale volume in case of multiple sells. To calculate alphas, I first generate a time series of expected returns. For each stock i and trading day t, I estimate the parameters of the four-factor model (Fama and French, 1993; Carhart, 1997) over a window of $t-251$ to $t-1$. I also shrink the factor betas to account for systematic biases using the method outlined in Vasicek (1973). Using these parameters, I measure the expected return for stock i on trading day t. The alpha of the round trip is the gross return less the buy-and-hold expected return during the holding period. Strahilevitz et al. (2011) show investors have a reduced tendency to repeat purchase after a negative return experience. To explore this aspect, I also show the performance measures for (a) round trips that are followed by another repeat purchase and (b) round trips that are the last.

On average, investors earn positive gross returns on the round trips. Although these return figures appear large, they are comparable to a simple buy-and-hold strategy in the market index (11% CAGR during the sample period). Moreover, the net-return performance is likely to be lower because of the transaction costs over multiple round trips. The alphas in most round trips are negative or insignificant. Averaging across all round trips, investors earn an annualized alpha of −1.3% per round trip. The split of alphas into final and non-final trips sheds additional light on the investors' losses. The overall alphas are negative due to the final round trips where the alphas are substantially negative. Qualitatively similar results on performance are observed with the US data (Table I.A.1.3).[6]

The performance appears to be even more negative using alternate performance measures, such as excess returns and market model alphas (Table I.A.2.4). These inferences provide additional support to earlier findings that trading is detrimental to individual investors' wealth (see, e.g., Barber and Odean, 2000, for the earliest evidence).

3.2.2 Are investors learning to time the market?

If the investors time the market on their round trips, they should be purchasing the stock when the institutions are selling, and exiting when the institutions are buying. I construct a measure of net institutional trading similar to the net individual trading measure in Kaniel et al. (2008). Net institutional trading (NIT) is defined as

$$NIT_{i,t} = \frac{\text{Institutional buy dollar volume}_{i,t} - \text{Institutional sell dollar volume}_{i,t}}{\text{Average daily dollar volume in previous year}_{i,t}},$$

where i represents the stock and t the trading day. The denominator is the average dollar volume for the period $t-251$ to $t-1$. If the investors are timing the market during

[6]In the US, investors earn high gross returns on their non-final trips. However, these return figures are not surprising given that the broader market (S&P 500) more than doubled during the sample period (1991 to 1996).

these round trips, the NIT_{end} at the end of a round trip should be higher than NIT_{start} at the start of the round trip. I measure market-timing ability as

$$\text{Market timing ability} = NIT_{end} - NIT_{start}.$$

Figure I.A.2.4 reports the average market-timing ability of the investors as a function of the number of round trips. First, the mean values are negative and are not significant (even at the 90% confidence level) in most round trips. Second, no trend is apparent in the market-timing ability of the investors. The results are similar in the non-final round trips where investors earn positive alphas. Regression models in which the dependent variable is market-timing ability (or $NIT_{start/end}$) and the explanatory variable is the integer value of the round trip also show similar results (Table I.A.2.5). In summary, investors do no appear to be timing the market with repeated round trips.

3.2.3 Repeated round trips and the disposition effect

Individual investors are prone to trading biases that affect their performance negatively (Barber and Odean, 2011). Because the multiple round trip trading strategy is associated with poor performance, I explore whether this strategy is also related to investor biases, in particular to the disposition effect. This effect is widely considered one of the most prominent trading mistakes of individual investors (see Hirshleifer, 2015, for a review).

I analyze an investor's propensity to sell on the days in which she makes a sell on any of her portfolio stocks, and test whether the disposition effect is higher in the familiar stocks. Following recent studies (e.g., Birru, 2015; Chang et al., 2016), I use a linear model for the disposition effect, except that I interact the positive return indicator with a measure of familiarity in a stock as below:

$$\begin{aligned} \textit{Sell dummy}_{i,t} = \alpha + \beta_1 \times \textit{Gain dummy}_{i,t} + \beta_{2N} \times \textit{Trip dummy}_{N,i} \\ + \beta_{3N} \times \textit{Gain dummy}_{i,t} \times \textit{Trip dummy}_{N,i} \\ + \textit{stock fixed effects} + \textit{time (year-month) fixed effects} \\ + \textit{investor fixed effects} + \epsilon, \end{aligned} \tag{2}$$

where i is the indicator for the stock in the investor's portfolio, t is the indicator for trading day, the *Sell dummy* takes the value of 1 on the trading days when the stock is sold, and 0 otherwise, the *Gain dummy* is 1 for paper gains on the trading day and 0 otherwise, and $\textit{Trip dummy}_{N,i}$ is the categorical dummy variable for the N^{th} round trip on the stock i. In this model, the value of β_{3N} measures the increase in the disposition effect with familiarity in a stock.

Figure 3 shows the coefficients β_{3N} of equation (2). The coefficient values measure increases in the disposition effect from the base disposition effect of 18.3% in the first round trip. First, all the coefficient values are positive and highly significant. Second, familiarity appears to be positively associated with the disposition effect. For example, the disposition effect almost doubles by the 15^{th} round trip. In other words, investors are more likely to exit a familiar stock than an unfamiliar one when they both have a paper gain. It appears the stock familiarity is also associated with increases in the investors' trading mistakes.

3.3 Reinforcement learning

What drives this trend in the holding periods? On the surface, the pattern of shortening the holding period with familiarity is consistent with investors learning about the stock. However, I find no clear evidence of investors learning to time the market and trade skillfully in a stock. Therefore, I explore whether the pattern of shortening the holding period is associated with reinforcement learning, the leading theory of heuristic learning applied to financial decisions (see, e.g., Kaustia and Knüpfer, 2008; Choi et al., 2009; Chiang et al., 2011; Malmendier and Nagel, 2011, 2015). Strahilevitz et al. (2011) show the tendency of investors to repeatedly execute round trips is consistent with reinforcement learning. Reinforcement learning, therefore, might also be associated with the investor horizons when they repeat purchase.

According to the theory of reinforcement learning, economic agents are more (less) likely to repeat an action that has resulted in favorable (unfavorable) payoffs (Cross, 1973). Many researchers have extended the original theory to include foregone payoffs during a game (McAllister, 1991; Erev and Roth, 1995, 1998; Camerer and Hua Ho, 1999). Foregone payoffs relate to missed opportunities of a better payoff had the agent chosen some other course of action. In these models, even though agents are more likely to repeat the same game with an overall positive payoff, they are less likely to repeat the same strategy if they experienced a foregone payoff. In other words, a missed opportunity provides a negative reinforcement.

Consider an investor who has completed a round trip and is contemplating another one. Suppose the investor missed an opportunity for a better return by holding on to the stock for too long. That is, on some trading days before the exit, the investor could have realized a better return. The negative reinforcement from this lost opportunity could result in an investor learning to shorten the holding period on the next round trip. The negative reinforcement should be stronger when the missed opportunity also accompanies a negative realized return on the round trip.

3.3.1 Tests of the reinforcement-learning hypothesis

I test the reinforcement-learning hypothesis by examining investors' propensity to shorten their holding period on their next round trip, given that they missed an opportunity for a better return. First, I have to address the mechanical relation between the duration of a round trip and the likelihood of observing a shorter holding period in a subsequent one. For example, a round trip that was 120 days can be followed by a shorter round trip in 119 different ways, whereas a round trip that was 30 days can be followed by a shorter one only in 29 different ways.[7] To account for this mechanical link, I create a variable for the propensity to shorten the holding period that is orthogonal to the length of the holding period. That is, I specify $\textit{Shorten dummy}_{N+1}^{residual}$ as the residual obtained from the following regression:[8]

$$\textit{Shorten dummy}_{N+1} = \alpha + \beta \times log(HoldingPeriod) + \epsilon, \tag{3}$$

where $\textit{Shorten dummy}_{N+1}$ takes the value of 1 if an investor shortens her holding period on the $N+1^{th}$ round trip compared with the holding period on the N^{th} round trip, and 0 otherwise.

I use this derived variable, $\textit{Shorten dummy}_{N+1}^{residual}$, as the dependent variable in all the tests of the reinforcement-learning hypothesis. In the first test, I examine whether an instance of lost opportunity increases the propensity to shorten the holding period, and whether this increase is greater if the round trip returns are negative. I use the following regression setting for the test:

$$\begin{aligned}\textit{Shorten dummy}_{N+1}^{residual} = \alpha &+ \beta_1 \times \textit{Lost return dummy}_N + \beta_2 \times \textit{Negative return dummy}_N \\ &+ \beta_3 \times \textit{Lost return dummy}_N \times \textit{Negative return dummy}_N \\ &+ \textit{investor characteristics} + \textit{round trip fixed effects} \\ &+ \textit{stock fixed effects} + \textit{time fixed effects} + \epsilon,\end{aligned} \tag{4}$$

where $\textit{Lost return dummy}_N$ takes the value of 1 if the maximum return the investor could have achieved during the round trip was greater than the actual round trip return, and 0 otherwise. Maximum return is measured using returns only on trading days in which the investor trades on one of her portfolio stocks. $\textit{Negative return dummy}_N$ is 1 for losses on the N^{th} round trip, and 0 otherwise. In this model, β_1 captures the effect of a lost return opportunity when the round trip returns are positive, and β_3 captures the

[7] Table I.A.2.6 shows this mechanical relation using regression models.

[8] In a robustness test, I specify $\textit{Shorten dummy}_{N+1}^{residual}$ using categorical dummies for the holding period as the explanatory variable for $\textit{Shorten dummy}_{N+1}$.

differential effect when the round trip returns are negative. I hypothesize that both β_1 and β_3 are positive.

Table 4 reports the results of regression equation (4). As posited by the reinforcement-learning hypothesis, investors are more likely to shorten the holding period after they missed a better return opportunity on a round trip. Both coefficients β_1 and β_3 are positive and highly significant. These coefficient values can be interpreted as percentage increases in the propensity to shorten the holding period from the mean likelihood of 0%.[9] Averaging across models, an instance of a lost return opportunity increases the propensity to shorten the holding period by 9.6% for a positive round trip return, and by an additional 4.9% if the return were negative instead.

Another prediction from the reinforcement-learning theory is that the negative reinforcement should be increasing in the magnitude of the lost return opportunity (Camerer and Hua Ho, 1999). Therefore, the propensity to shorten the holding period should increase with the magnitude of lost return opportunities. I specify the magnitude of the lost return opportunity as

$$Lost\ return_N = \frac{Max\ return_N - Round\ trip\ return_N}{1 + Round\ trip\ return_N}, \tag{5}$$

where $Max\ returns_N$ is the maximum return the investor could have achieved on the round trip, and $Round\ trip\ return_N$ is the realized round trip return.

Measuring the magnitude of lost returns using equation (5) takes into account two aspects of investor behavior. First, for the same lost return percentage (numerator), investors would be more affected if the overall returns were negative (smaller denominator). Second, investors are less likely to be concerned about a small percentage lost opportunity when their overall gains are substantial. That is, an investor would be less concerned about a lost opportunity of 5% if she made an overall gain of 100% than if she made a gain of 10%.[10]

[9]The mean unconditional likelihood is zero by construction as the dependent variable is the residual from a regression model.

[10]Loughran and Ritter (2002) derive the psychological basis for this behavior using prospect theory (Kahneman and Tversky, 1979), and show that IPO issuers are willing to leave money on the table if their overall wealth gains are substantial.

Figure 4 shows the results of a regression model where I use categorical dummies for the deciles of *Lost return*$_N$ on a round trip as the explanatory variable for the propensity to shorten the holding period ($Shorten\ dummy^{residual}_{N+1}$). First, all the coefficients are positive and significant. Second, the coefficients are monotonically increasing as a function of the lost return deciles, providing further support to the reinforcement-learning hypothesis. The results in Table 4 and Figure 4 are robust to an alternate regression specification for the residual $Shorten\ dummy^{residual}_{N+1}$ (Table I.A.2.7 and Figure I.A.2.5). Qualitatively similar results are also observed with the US data (Table I.A.1.4).

In the reinforcement-learning tests, I assume the price path to a particular return does not affect the experience of the investor. Suppose an investor missed an opportunity for a better return but also recovered from losses; she would be less likely to show a regret from losing the opportunity. Table I.A.2.8 shows the experience of a negative return during the holding period does not seem to affect the negative reinforcement from missed return opportunities (positive and significant coefficients of $Lost\ return\ dummy_N$).

3.3.2 Reinforcement learning and the realized returns

In the tests for the reinforcement-learning hypothesis, I have used a dummy variable to capture the round trip return. Another prediction can be made using the reinforcement-learning theory for the different levels of round trip returns. Consider an investor who lost an opportunity for a better return that was also positive. Let us compare a case in which the investor realized a small gain (say, +0.1%) versus a case in which she realized a small loss (say, −0.1%). The regret and negative reinforcement associated with losing the positive return is likely to be more pronounced when her realized return was −0.1% than when it was +0.1%. Therefore, we should expect to see a discontinuity in the propensity to shorten the holding period around zero realized return when the investor loses an opportunity for a better positive return.

I fit a regression model where the dependent variable is $Shorten\ dummy^{residual}_{N+1}$, and the main explanatory variables are categorical dummies for each 1% round trip return interval from −20% to +20%. The regression model also controls for the round trip, investor, stock, and time (year-month of next initiation) fixed effects. The sample for the analysis is limited to round trips where the investor lost an opportunity for a better positive return by not selling the stock earlier. Figure 5 shows the coefficients of this regression. A perceptible discontinuity appears to exist in the propensity to shorten the holding period as the round trip return moves from a small positive value to a small negative value. I also formally measure the discontinuity around zero[11] and find it to be statistically significant (Table I.A.2.9). The discontinuity provides additional support to the hypothesis that reinforcement learning is associated with investor short-termism.

3.3.3 Persistence of the reinforcement learning in various round trips

Is the reinforcement learning mechanism persistent across the multiple round trips? For investors to exhibit a trend in short-termism, there should be evidence of reinforcement learning in each one of the round trips. To shed light on this persistence, I execute a regression where $Shorten\ dummy^{residual}_{N+1}$ is the dependent variable, and the explanatory variables are the interaction terms of (a) lost returns on the N^{th} round trip ($Lost\ Return_N$) and (b) categorical dummies for the first 20 round trips.

Figure 6 reports the coefficients of the interaction terms of $Lost\ Return_N$ and the round trip categories. First, almost all the coefficient values are positive and significant at the 0.1% level. Second, the lost returns are more strongly associated with the propensity to shorten the holding period with more round trips. For instance, a one standard deviation increase in $Lost\ Return_N$ increases the likelihood of shortening the holding period by 9.9% (16.2%) in the fifth (10^{th}) round trip as compared to the first round trip. In summary, the shortening in the holding period with an additional round trip appears consistent with the investors learning through reinforcement in each of their round trips.

3.3.4 Learning from experience or learning from observation

In the sections above, I establish a link between the lost return opportunities and investor short-termism. However, investors might perceive lost opportunities even after

[11]Specifically, I use a test similar to the one in Table 2 of Ben-David and Hirshleifer (2012).

the completion of a round trip. If an investor observes that stock prices have gone up since her exit from the stock, she might regret having sold the stock earlier. Hence, the negative reinforcement from prices going up could lead to a lengthening of the holding period on the next round trip. The lost opportunities from price increases after the exit are purely observational, not experienced directly. Literature shows that decision-makers overweigh personally experienced information over observed information (see, e.g., Fazio et al., 1978; Simonsohn et al., 2008). Therefore, lost opportunities experienced during the round trip should have stronger effects on the investors' decisions than those observed after the round trip. I run a simple horse-race to test this hypothesis.

Similar to the variable $\textit{Lost return}_N$ in equation (5), I create a variable $\textit{Lost return after round trip}_N$ that measures the lost return opportunity between the trading day of exit and the next round trip. That is, for $\textit{Lost return after round trip}_N$, the $\textit{Max return}_N$ is measured on trading days in which the investor trades on one of her portfolio stocks between the exit of the N^{th} round trip and the beginning of the $N+1^{th}$ round trip. Table 5 reports the results of the horse-race regressions. The results show that although price increases after exit are associated with decreases in the propensity to shorten the holding period, the effect sizes are much smaller than those of $\textit{Lost return}_N$. An experience-based negative reinforcement appears thus to be stronger than a purely observation-based negative reinforcement.

4 Conclusion

In this paper, I document that investors shorten their holding periods in a stock in which they repeatedly execute round trips. I show this trend is associated with reinforcement learning: investors are more likely to shorten their holding period after a round trip where they could have earned a higher return had they sold the stock earlier.

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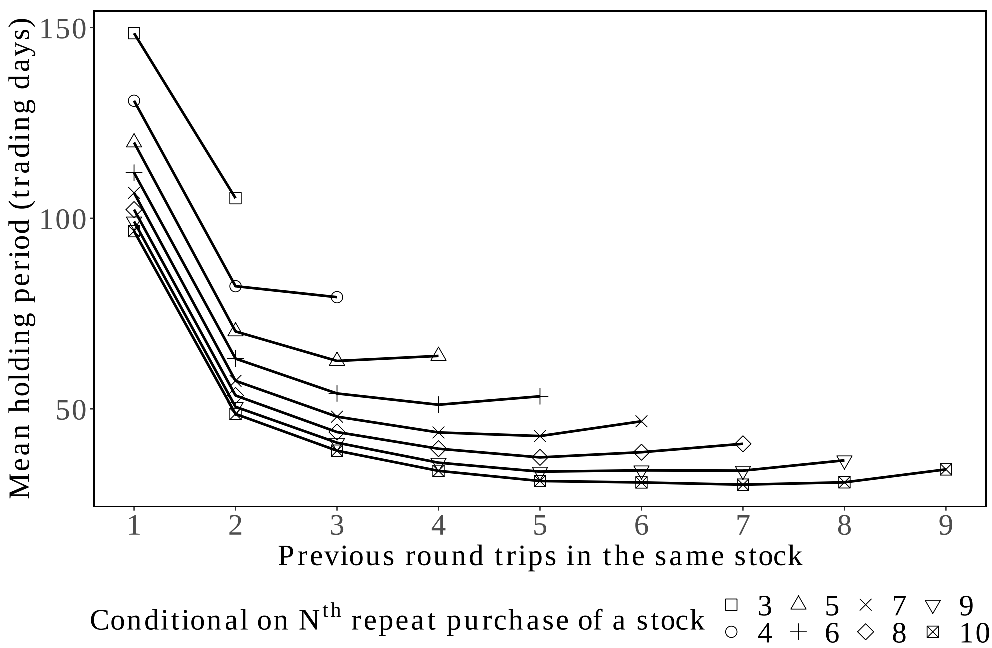
Figure 1: Univariate results

This figure presents univariate results of the main findings. Each line in the figure traces investors' holding periods of their first $N-1$ round trips on a stock when they initiate a position on the stock the N^{th} instance ($N \in \{3,4,...,10\}$). Panel A reports the mean holding periods of the investors, and Panel B shows the median holding periods.

Panel A: Mean holding periods



Panel B: Median holding periods

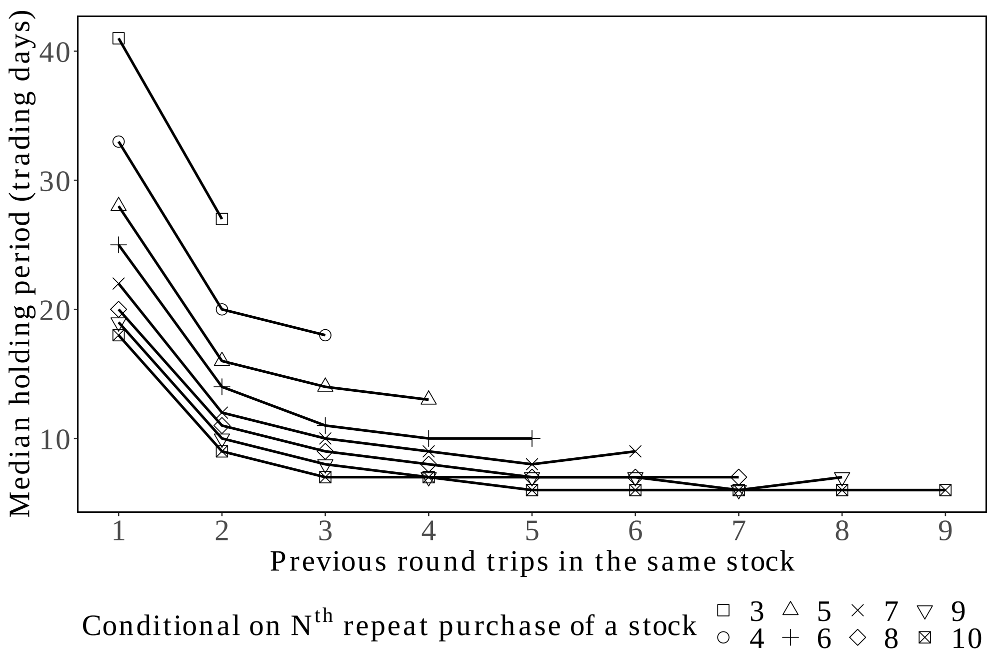


Figure 2: Round trips and the holding periods

This figure reports the results of regression models with $log(HoldingPeriod)$ as the dependent variable. The main explanatory variables are the categorical indicator variables for each of the first $N-1$ round trips on a stock when the investor initiates a position on the stock the N^{th} instance ($N \in \{4,6,8,10\}$). The model also controls for the disposition effect-related decrease in the holding period and investor characteristics (age and gender). In the regression models, I also control for stock and time (year-month of initiation) fixed effects. Each coefficient value measures the percentage change in the holding period in the corresponding round trip from the holding period in the first round trip (base category). The gray region represents the 99.9% confidence intervals around the coefficient values calculated with standard errors clustered at the investor, stock, and time levels.

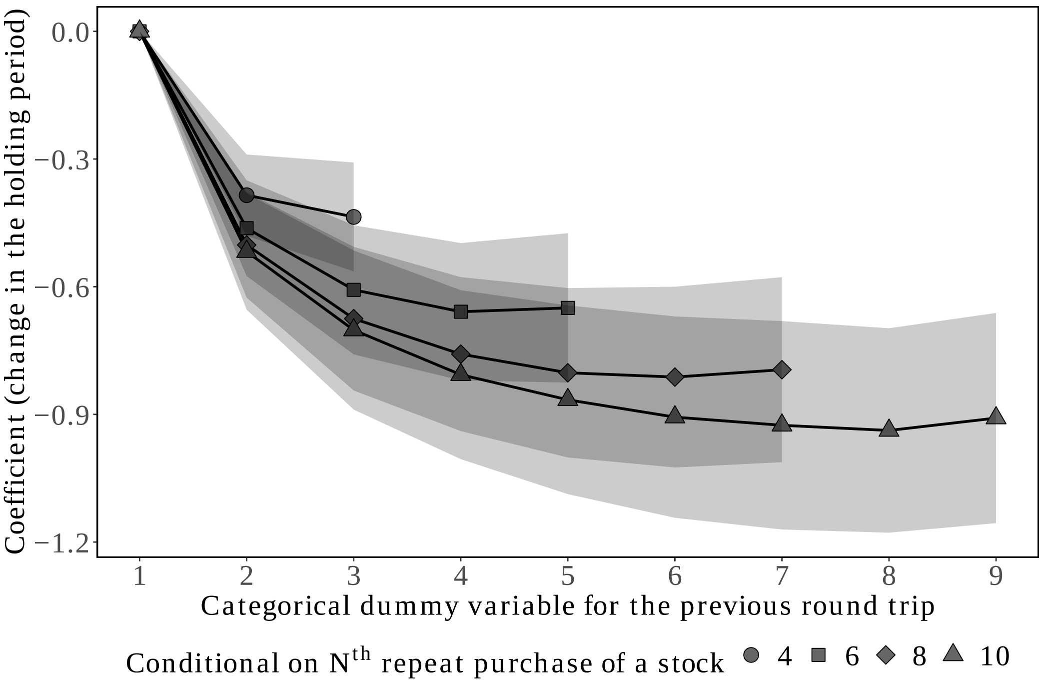


Figure 3: Round trips and the disposition effect

This figure reports the results of a regression model with a sell dummy as the dependent variable. The independent variables are the interaction terms of (a) an indicator variable for holding-period winners (*Gain dummy*) and (b) categorical dummies for the N^{th} round trip on a stock. The sample comprises investor-stock-day observations for each stock in the investor's portfolio on trading days in which the investor sells at least one of her stocks. The regression model also controls for the investor, stock, and time (year-month of the trading day) fixed effects. The line shows the coefficients of the interaction terms. Each coefficient value measures the increase in the disposition effect in the corresponding round trip from the base disposition effect of 18.31% in the first round trip (base category). The gray region represents the 99.9% confidence intervals around the coefficient values calculated with the standard errors clustered at the investor, stock, and time levels.

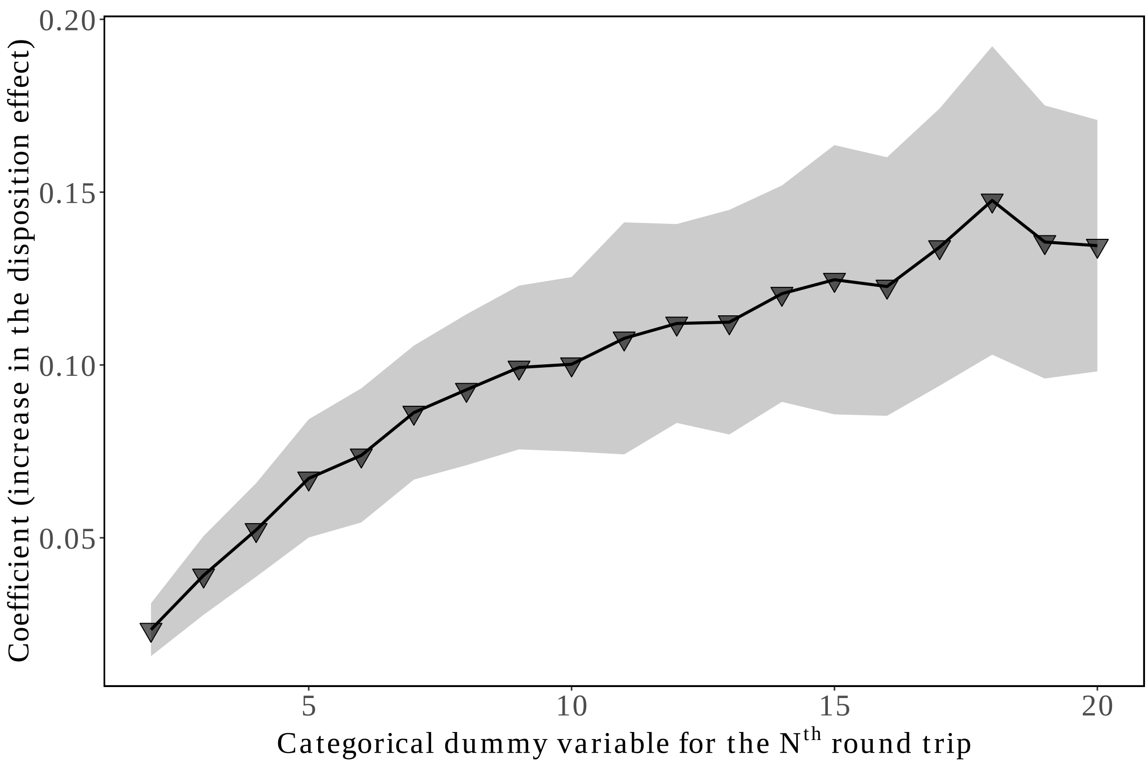


Figure 4: Propensity to shorten the holding period as a function of the lost returns

This figure reports the results of a regression model with the propensity to shorten the holding period as the dependent variable. The dependent variable, $Shorten\ dummy_{N+1}^{residual}$, is the residual from the regression model $Shorten\ dummy_{N+1} = \alpha + \beta \times log(HoldingPeriod) + \epsilon$, where $Shorten\ dummy_{N+1}$ takes the value of 1 if an investor shortens her holding period on the $N+1^{th}$ round trip as compared to the holding period on the N^{th} round trip, and 0 otherwise. $log(HoldingPeriod)$ is the natural logarithm of the holding period on the N^{th} round trip. The primary explanatory variables are the decile categories of the lost return opportunity on the N^{th} round trip. The lost return opportunity is computed as $Lost\ return_N = (Max\ return_N - Round\ trip\ return_N)/(1 + Round\ trip\ return_N)$, where $Max\ returns_N$ is the maximum return the investor could have achieved on the round trip, and $Round\ trip\ return_N$ is the realized round trip return. The maximum return is calculated using returns on the trading days in which the investor trades on any of the portfolio stocks during the holding period of the round trip. The regression model also controls for the round trip, investor, stock, and time (year-month of next initiation) fixed effects. The gray region represents the 99.9% confidence intervals around the coefficient values calculated with the standard errors clustered at the investor, stock, and time levels.

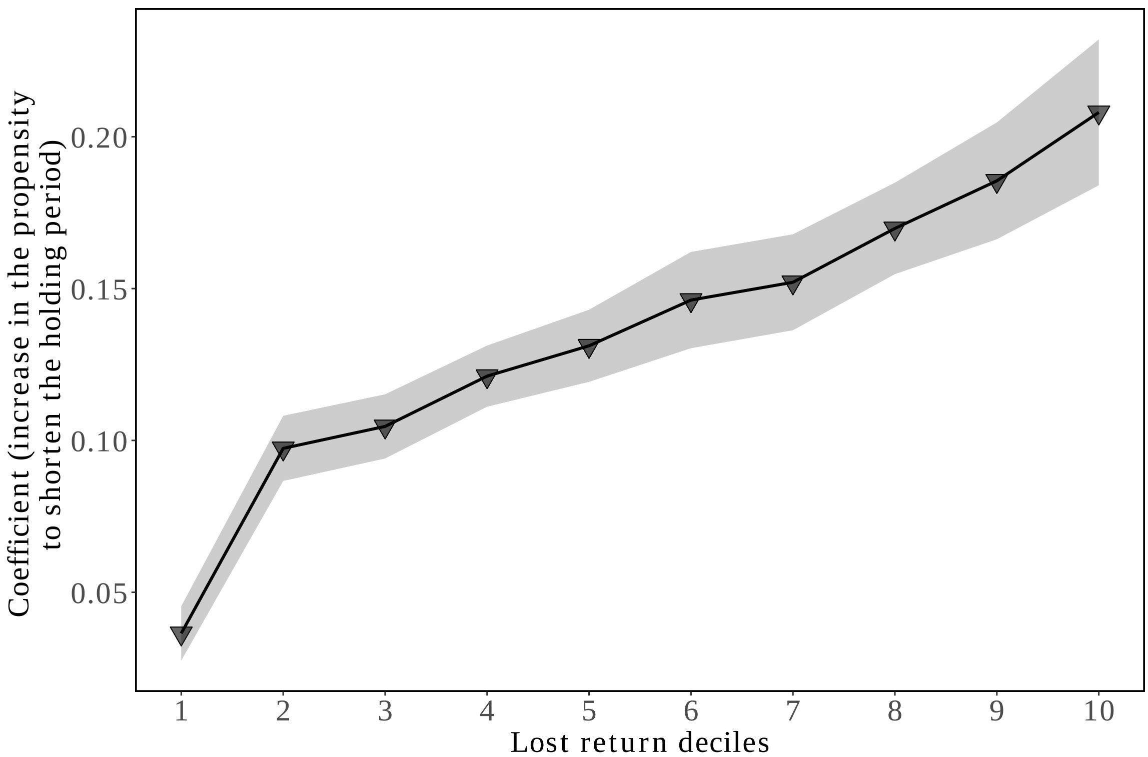


Figure 5: Propensity to shorten the holding period for positive and negative round trip returns

This figure reports the results of a regression model with the propensity to shorten the holding period as the dependent variable. The dependent variable, $Shorten\ dummy_{N+1}^{residual}$, is the residual from the regression model $Shorten\ dummy_{N+1} = \alpha + \beta \times log(HoldingPeriod) + \epsilon$, where $Shorten\ dummy_{N+1}$ takes the value of 1 if an investor shortens her holding period on the $N+1^{th}$ round trip as compared to the holding period on the N^{th} round trip, and 0 otherwise. $log(HoldingPeriod)$ is the natural logarithm of the holding period on the N^{th} round trip. The main explanatory variables are categorical dummies for each 1% round trip return interval from -20% to $+20\%$. The regression model also controls for the round trip, investor, stock, and time (year-month of next initiation) fixed effects. The sample for the analysis is limited to cases in which the investor lost an opportunity for a better positive return by not selling the stock earlier. The base category is the [19%,20%) round trip return interval. The gray region represents the 99.9% confidence intervals around the coefficient values calculated with the standard errors clustered at the investor, stock, and time levels.

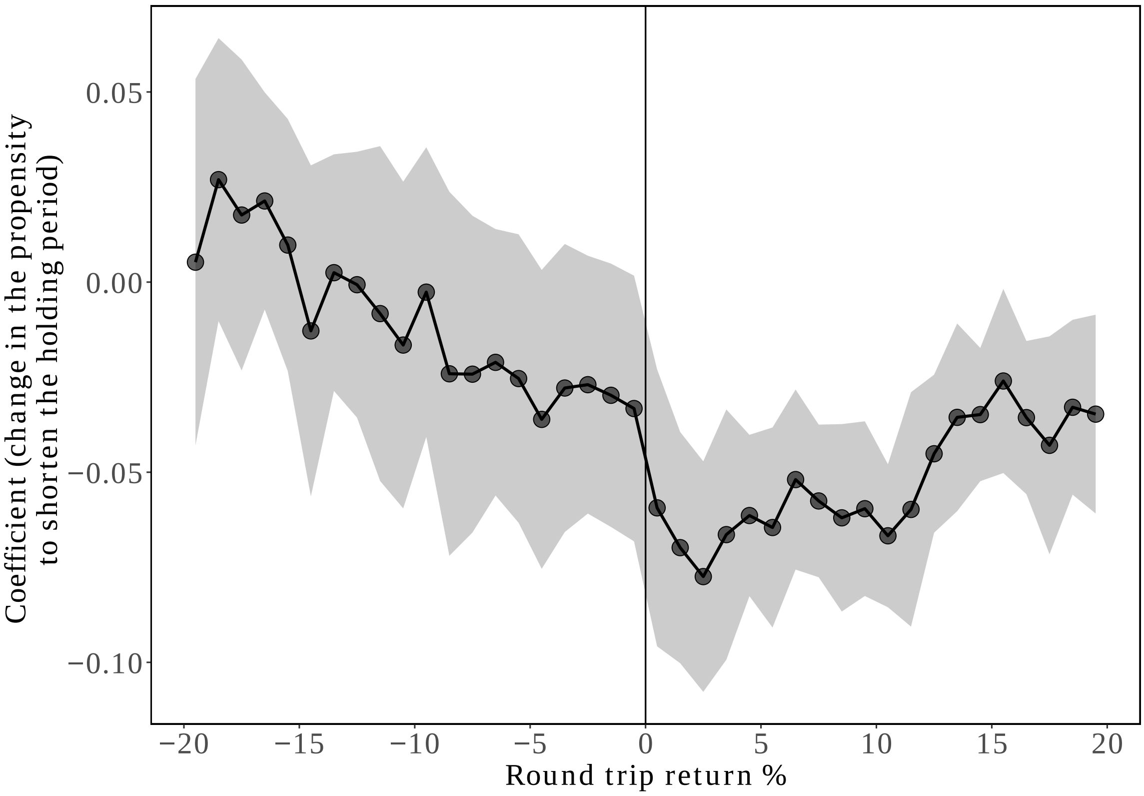


Figure 6: Lost returns and the propensity to shorten the holding period as a function of the number of round trips

This figure reports the results of a regression model with the propensity to shorten the holding period as the dependent variable. The dependent variable, $Shorten\ dummy^{residual}_{N+1}$, is the residual from the regression model $Shorten\ dummy_{N+1} = \alpha + \beta \times log(HoldingPeriod) + \epsilon$, where $Shorten\ dummy_{N+1}$ takes the value of 1 if an investor shortens her holding period on the $N+1^{th}$ round trip as compared to the holding period on the N^{th} round trip, and 0 otherwise. $log(HoldingPeriod)$ is the natural logarithm of the holding period on the N^{th} round trip. The main explanatory variables are the interaction terms of (a) lost returns on the N^{th} round trip ($Lost\ Return_N$) and (b) categorical dummies for N^{th} round trip. The lost return opportunity is computed as $Lost\ return_N = (Max\ return_N - Round\ trip\ return_N)/(1 + Round\ trip\ return_N)$, where $Max\ returns_N$ is the maximum return the investor could have achieved on the round trip, and $Round\ trip\ return_N$ is the realized round trip return. The maximum return is calculated using returns on the trading days in which the investor trades on any of the portfolio stocks during the holding period of the round trip. The regression model also controls for the investor, stock, and time (year-month of next initiation) fixed effects. The figure shows the coefficient values of the interaction terms of $Lost\ Return_N$ and round trip categories. The gray region represents the 99.9% confidence intervals around the coefficient values calculated with the standard errors clustered at the investor, stock, and time levels.

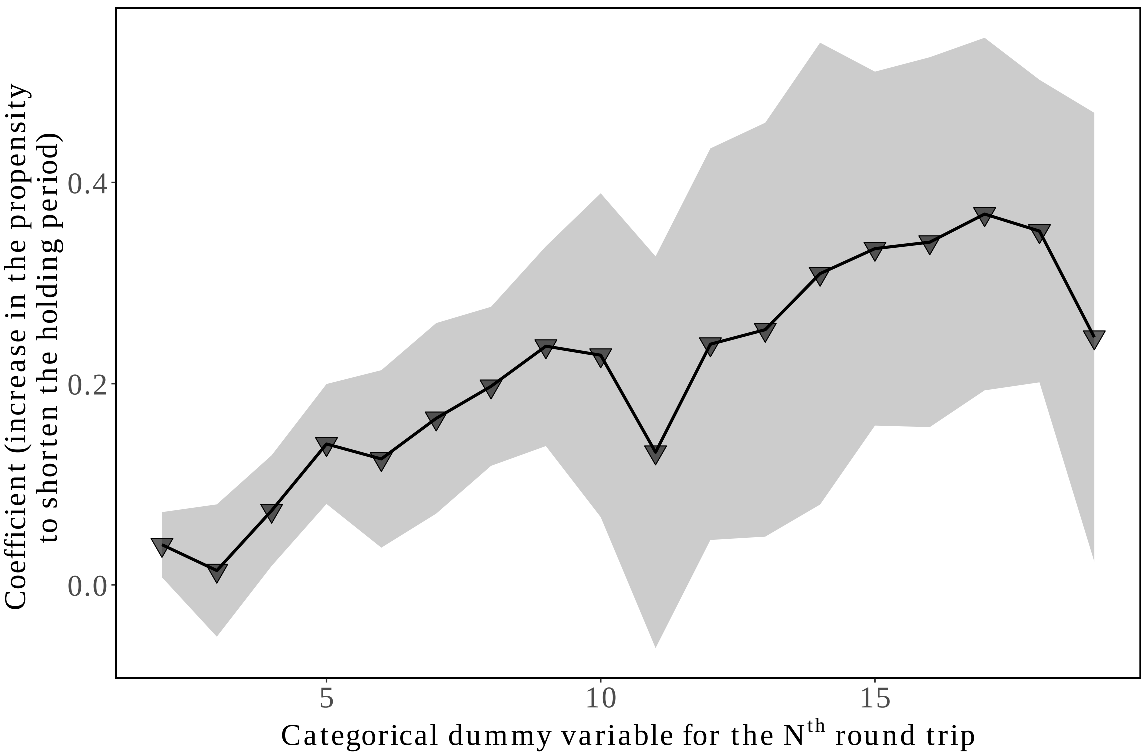


Table 1: Descriptive statistics on the repeat purchasers of stocks

This table reports on the characteristics of Finnish investors who purchase the same stock repeatedly. The sample includes all Finnish individual investors for the April 1995 - December 2014 period. Initiations refer to either the first-time purchase of a stock or subsequent follow-on purchases after complete exit from a position. Familiar stocks are those in which the investor has two or more initiations. The amount invested in each stock and the number of stocks in the portfolio are first averaged over time and then averaged over the investors. Median values are provided in parentheses.

Variable	Investors who initiate a position on the stock for the:			
	All data	2nd time	6th time	10th time
Number of investors	308,066	127,277	32,495	16,895
Investor age in years	48.2 (48.0)	48.5 (49.0)	49.5 (50.0)	49.9 (50.0)
Female investors (%)	26.7	18.5	14.2	13.3
Number of initiations	5,454,103	4,885,384	3,180,105	2,341,385
As a percentage of total	100.0	89.6	58.3	42.9
Investment per stock (Eur 1,000)	8.8 (3.4)	10.4 (4.9)	14.4 (7.4)	17.0 (8.8)
Stocks in the portfolio	4.9 (3.8)	6.2 (4.9)	6.6 (5.3)	6.4 (5.1)
Stocks familiarized over time	6.7 (3.0)	6.7 (3.0)	16.5 (13.0)	21.1 (17.0)

Table 2: Round trips and the investor holding periods

This table reports the results of regression models with $log(HoldingPeriod)$ as the dependent variable. The main explanatory variable is the integer value of the round trip on a stock ($Trip_N$). The model also controls for the disposition effect-related decrease in the holding period (*Gain dummy*) and investor characteristics (age and gender). Each column represents a regression model where the data are limited to investor-stock combinations in which the investor initiates a position on the stock at least for the N^{th} time ($N \in \{2,4,6,8\}$). In the regression models, I also control for stock and time (year-month of initiation) fixed effects. t-statistics are in parentheses and are measured with the standard errors clustered at the investor, stock, and time levels.

	Dependent variable: $log(HoldingPeriod)$				
	Investor initiates a position on the stock for the:				
Independent variables	2nd time	2nd time	4th time	6th time	8th time
$Trip_N$	-0.164^{***}	-0.169^{***}	-0.112^{***}	-0.083^{***}	-0.065^{***}
	(-40.50)	(-42.60)	(-33.28)	(-24.77)	(-19.85)
Gain dummy		-0.505^{***}	-0.426^{***}	-0.385^{***}	-0.357^{***}
		(-5.39)	(-5.45)	(-5.56)	(-5.69)
Age (years)		0.018^{***}	0.020^{***}	0.020^{***}	0.020^{***}
		(22.04)	(22.10)	(20.61)	(18.66)
Female dummy		0.087^{***}	0.017	−0.004	−0.019
		(4.58)	(0.77)	(-0.17)	(-0.72)
Time FE	Y	Y	Y	Y	Y
Stock FE	Y	Y	Y	Y	Y
Num. obs.	3,454,382	3,454,382	2,140,787	1,556,546	1,214,159
Adj. R^2	0.158	0.185	0.156	0.143	0.137

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

Table 3: Investor performance on the round trips

This table reports on the performance of investors on the different round trips. The table presents the mean round trip returns for the first 20 round trips on a stock. Return performance is measured using two methods. The first method reports the average of the gross returns on the round trips. The second method reports the mean α generated in each round trip. I calculate the daily expected return of a stock with a four-factor model (Fama and French, 1993; Carhart, 1997) estimated using a rolling window of 12-month daily past returns of the stock and the factors. I use the European factors in the model. To account for systematic biases in the factor betas, I shrink the betas using the method outlined in Vasicek (1973). α measures the gross round trip return less the buy-and-hold expected return during the holding period. The table reports the results separately for all round trips, non-final trips, and final trips. Non-final trips refer to round trips that are followed by another initiation on the stock. Final round trips are round trips where the investor does not initiate a position on the same stock again. All return figures are annualized using the average holding periods of the round trips.

N^{th} round trip	Gross returns			Four factor α		
	All Trips	Non-final trip	Final trip	All Trips	Non-final trip	Final trip
1	7.5%***	16.8%***	5.9%***	-0.9%***	6.4%***	-2.1%***
2	6.3%***	14.0%***	3.3%***	-1.9%***	4.6%***	-4.4%***
3	6.3%***	12.6%***	2.4%***	-1.6%***	4.0%***	-5.1%***
4	6.6%***	12.3%***	2.1%***	-1.3%***	4.1%***	-5.5%***
5	6.9%***	12.0%***	2.0%***	-0.8%***	4.2%***	-5.6%***
6	7.2%***	11.6%***	2.2%***	-0.2%	4.2%***	-5.2%***
7	7.2%***	11.9%***	1.4%***	-0.3%	4.3%***	-6.2%***
8	7.8%***	11.8%***	2.1%***	0.3%	4.2%***	-5.2%***
9	8.0%***	11.7%***	2.1%***	0.6%*	4.3%***	-5.5%***
10 to 20	8.2%***	11.3%***	1.4%***	0.9%***	4.0%***	-5.9%***

***$p < 0.001$, **$p < 0.01$, *$p < 0.05$

Table 4: Lost returns and the propensity to shorten the holding period

This table reports the results of a regression model with the propensity to shorten the holding period as the dependent variable. The dependent variable, *Shorten* $dummy^{residual}_{N+1}$, is the residual from the regression model *Shorten* $dummy_{N+1} = \alpha + \beta \times log(HoldingPeriod) + \epsilon$, where *Shorten* $dummy_{N+1}$ takes the value of 1 if an investor shortens her holding period on the $N+1^{th}$ round trip as compared to the holding period on the N^{th} round trip, and 0 otherwise. $log(HoldingPeriod)$ is the natural logarithm of the holding period on the N^{th} round trip. The main explanatory variables are the interaction terms of (a) an indicator variable for a lost return opportunity on the round trip (*Lost return* $dummy_N$) and (b) an indicator variable for negative returns on the N^{th} round trip. *Lost return* $dummy_N$ takes the value of 1 if the maximum return the investor could have achieved during the round trip was greater than the actual round trip return, and 0 otherwise. Maximum return is measured using returns only on trading days in which the investor executes trades on one of her portfolio stocks. *Negative return* $dummy_N$ is 1 for losses on the N^{th} round trip, and 0 otherwise. Each column shows the results of models with different control variables. t-statistics are in parentheses and are measured with the standard errors clustered at the investor, stock, and time (year-month of next initiation) levels.

Independent variables	Dependent variable: *Shorten* $dummy^{residual}_{N+1}$			
	(1)	(2)	(3)	(4)
Lost return $dummy_N$ (β_1)	0.097***	0.085***	0.086***	0.115***
	(42.31)	(38.12)	(38.76)	(36.67)
Negative return $dummy_N$ (β_2)		0.023**	0.019*	−0.019*
		(2.69)	(2.22)	(−2.41)
Lost return $dummy_N$		0.014**	0.018***	0.050***
×*Negative return* $dummy_N$ (β_3)		(2.74)	(3.56)	(11.56)
Age(years)			−0.002***	
			(−17.06)	
Female dummy			−0.013***	
			(−5.22)	
Trip FE	Y	Y	Y	Y
Time FE	Y	Y	Y	Y
Stock FE	Y	Y	Y	Y
Investor FE				Y
Num. obs.	2,394,401	2,394,401	2,394,401	2,394,401
Adj. R^2	0.045	0.045	0.048	0.121

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

Table 5: Lost returns during and after a round trip and the propensity to shorten the holding period

This table reports the results of a regression model with the propensity to shorten the holding period as the dependent variable. The dependent variable, $Shorten\ dummy^{residual}_{N+1}$, is the residual from the regression model $Shorten\ dummy_{N+1} = \alpha + \beta \times log(HoldingPeriod) + \epsilon$, where $Shorten\ dummy_{N+1}$ takes the value of 1 if an investor shortens her holding period on the $N+1^{th}$ round trip as compared to the holding period on the N^{th} round trip, and 0 otherwise. $log(HoldingPeriod)$ is the natural logarithm of the holding period on the N^{th} round trip. The main explanatory variables are (a) lost returns during the N^{th} round trip and (b) lost returns after the N^{th} round trip but before the $N+1^{th}$ round trip. The lost returns are computed as $Lost\ return_N = (Max\ return_N - Round\ trip\ return_N)/(1 + Round\ trip\ return_N)$, where $Max\ returns_N$ is the maximum return the investor could have achieved during or after the round trip, and $Round\ trip\ return_N$ is the realized round trip return. For $Lost\ return\ after\ round\ trip_N$, the $Max\ return_N$ corresponds to the maximum return the investor could have achieved had she sold the stock in the time between the N^{th} and the $N+1^{th}$ round trip. Maximum returns during and after the round trips are measured only on trading days in which the investor trades on one of her portfolio stocks. t-statistics are in parentheses and are measured with the standard errors clustered at the investor, stock, and time (year-month of next initiation) levels.

Independent variables	Dependent variable: $Shorten\ dummy^{residual}_{N+1}$		
	(1)	(2)	(3)
$Lost\ return_N$ (β_1)	0.020^{**}		0.020^{**}
	(2.59)		(2.65)
$Lost\ return\ after\ round\ trip_N$ (β_2)		-0.004^{**}	-0.005^{***}
		(−3.00)	(−4.21)
Trip FE	Y	Y	Y
Time FE	Y	Y	Y
Stock FE	Y	Y	Y
Investor FE	Y	Y	Y
Num. obs.	2,394,401	1,875,937	1,875,937
Adj. R^2	0.104	0.105	0.106

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

Internet Appendix: US data

Table I.A.1.1: Descriptive statistics on the repeat purchasers of stocks - US discount brokerage data

This table reports on the characteristics US discount brokerage investors who purchase a same stock repeatedly. The sample contains trades of investors for the January 1991 - December 1996 period. Initiations refer to either the first-time purchase of a stock or subsequent follow-on purchases after complete exit from a position. Familiar stocks are those in which the investor has two or more initiations. The amount invested in each stock and the number of stocks in the portfolio are first averaged over time and then averaged over the investors. Median values are provided in parentheses.

Variable	Investors who purchase any stock for the:			
	All data	2nd time	3rd time	4th time
Number of investors	76,373	13,601	4,190	1,752
With age and gender information	37,616	6,788	2,131	876
Investor age in years	50.1 (50.0)	50.4 (50.0)	50.4 (50.0)	50.6 (50.0)
Female investors (%)	10.8	9.1	7.6	6.8
Number of initiations	445,770	221,864	107,704	59,770
As a percentage total	100.0	49.8	24.2	13.4
Investment per stock (USD 1,000)	9.5 (5.0)	15.5 (8.3)	21.7 (12.2)	27.9 (16.2)
Stocks in the portfolio	1.4 (1.0)	1.9 (1.6)	2.1 (1.7)	2.2 (1.8)
Stocks familiarized over time	2.3 (1.0)	2.3 (1.0)	4.2 (3.0)	6.0 (4.0)

Table I.A.1.2: Round trips and the investor holding periods - US evidence

This table reports the results of regression models with $log(HoldingPeriod)$ as the dependent variable. The main explanatory variable is the integer value of the round trip on a stock ($Trip_N$). The model also controls for the disposition effect-related decrease in the holding period (*Gain dummy*) and investor characteristics (age and gender). Each column represents a regression model where the data are limited to investor-stock combinations in which the investor initiates a position on the stock at least for the N^{th} time ($N \in \{2,3,4\}$). In the regression models, I also control for stock and time (year-month of initiation) fixed effects. t-statistics are in parentheses and are measured with the standard errors clustered at the investor, stock, and time levels.

	Dependent variable: $log(HoldingPeriod)$			
	Investor initiates a position on the stock for the:			
Independent variables	2nd time	2nd time	3rd time	4th time
$Trip_N$	-0.135^{***}	-0.124^{***}	-0.059^{***}	-0.028
	(-9.40)	(-8.07)	(-4.25)	(-1.88)
Gain dummy		0.168^{**}	-0.054	-0.140
		(2.87)	(-0.77)	(-1.63)
Age (average household in years)		0.100^{**}	0.068	0.045
		(2.86)	(1.32)	(0.62)
Female dummy		-0.050	-0.008	0.068
		(-0.65)	(-0.08)	(0.51)
Time FE	Y	Y	Y	Y
Stock FE	Y	Y	Y	Y
Num. obs.	76,367	37,419	14,687	7,226
Adj. R^2	0.215	0.235	0.228	0.230

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

Table I.A.1.3: Investor performance on the round trips - US evidence

This table reports on the performance of investors on the different round trips. The table presents the mean round trip returns for the first 10 round trips on a stock. Return performance is measured using two methods. The first method reports the average of the gross returns on the round trips. The second method reports the mean α generated in each round trip. I calculate the daily expected return of a stock with a four-factor model (Fama and French, 1993; Carhart, 1997) estimated using a rolling window of 12-month daily past returns of the stock and the factors. To account for systematic biases in the factor betas, I shrink the betas using the method outlined in Vasicek (1973). α measures the gross round trip return less the buy-and-hold expected return during the holding period. The table reports the results separately for all round trips, non-final trips, and final trips. Non-final trips refer to round trips that are followed by another initiation on the stock. Final round trips are round trips where the investor does not initiate a position on the same stock again. All return figures are annualized using the average holding periods of the round trips.

N^{th} round trip	Gross returns			Four factor α		
	All Trips	Non-final trip	Final trip	All Trips	Non-final trip	Final trip
1	13.2%***	39.1%***	11.2%***	-3.7%***	19.6%***	-5.5%***
2	15.1%***	34.7%***	10.0%***	-2.2%***	15.7%***	-6.8%***
3	16.4%***	32.8%***	9.4%***	-1.6%	12.9%***	-7.7%***
4	17.7%***	33.5%***	7.5%***	-0.3%	13.8%***	-9.5%***
5	18.2%***	32.2%***	7.5%*	-0.2%	12.3%**	-9.5%*
6	24.2%***	37.5%***	15.7%**	5.8%	17.7%*	-1.8%
7	24.0%***	33.4%***	9.2%	4.9%	16.0%*	-12.7%
8	19.7%*	26.4%*	7.2%	-1.7%	4.4%	-12.9%
9	21.4%*	40.1%*	-10.7%	0.6%	17.9%	-29.2%
10	16.3%*	37.4%**	-4.3%	-6.2%	17.6%	-29.5%

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

Table I.A.1.4: Lost returns and the propensity to shorten the holding period - US evidence

This table reports the results of a regression model with the propensity to shorten the holding period as the dependent variable. The dependent variable, *Shorten* $dummy^{residual}_{N+1}$, is the residual from the regression model *Shorten* $dummy_{N+1} = \alpha + \beta \times log(HoldingPeriod) + \epsilon$, where *Shorten* $dummy_{N+1}$ takes the value of 1 if an investor shortens her holding period on the $N+1^{th}$ round trip as compared to the holding period on the N^{th} round trip, and 0 otherwise. $log(HoldingPeriod)$ is the natural logarithm of the holding period on the N^{th} round trip. The main explanatory variables are the interaction terms of (a) a lost return dummy (*Lost return* $dummy_N$) and (b) an indicator variable for negative returns on the N^{th} round trip. *Lost return* $dummy_N$ takes the value of 1 if the maximum return the investor could have achieved during the round trip was greater than the actual round trip return, and 0 otherwise. Maximum return is measured using returns only on trading days in which the investor executes trades on one of her portfolio stocks. *Negative return* $dummy_N$ is 1 for losses on the N^{th} round trip, and 0 otherwise. Each column shows the results of models with different control variables. t-statistics are in parentheses and are measured with the standard errors clustered at the investor, stock, and time (year-month of next initiation) levels.

Independent variables	Dependent variable: *Shorten* $dummy^{residual}_{N+1}$			
	(1)	(2)	(3)	(4)
Lost return $dummy_N$ (β_1)	0.046***	0.041***	0.046***	0.077***
	(7.44)	(6.59)	(5.12)	(9.41)
Negative return $dummy_N$ (β_2)		0.007	0.008	−0.036**
		(0.69)	(0.55)	(−2.81)
Lost return $dummy_N$		0.008	0.016	0.045**
×*Negative return* $dummy_N$		(0.62)	(0.85)	(2.84)
Age (years)			−0.014	
			(−1.69)	
Female dummy			−0.007	
			(−0.47)	
Time FE	Y	Y	Y	Y
Stock FE	Y	Y	Y	Y
Investor FE				Y
Num. obs.	45,310	45,310	22,254	45,310
Adj. R^2	0.075	0.075	0.076	0.099

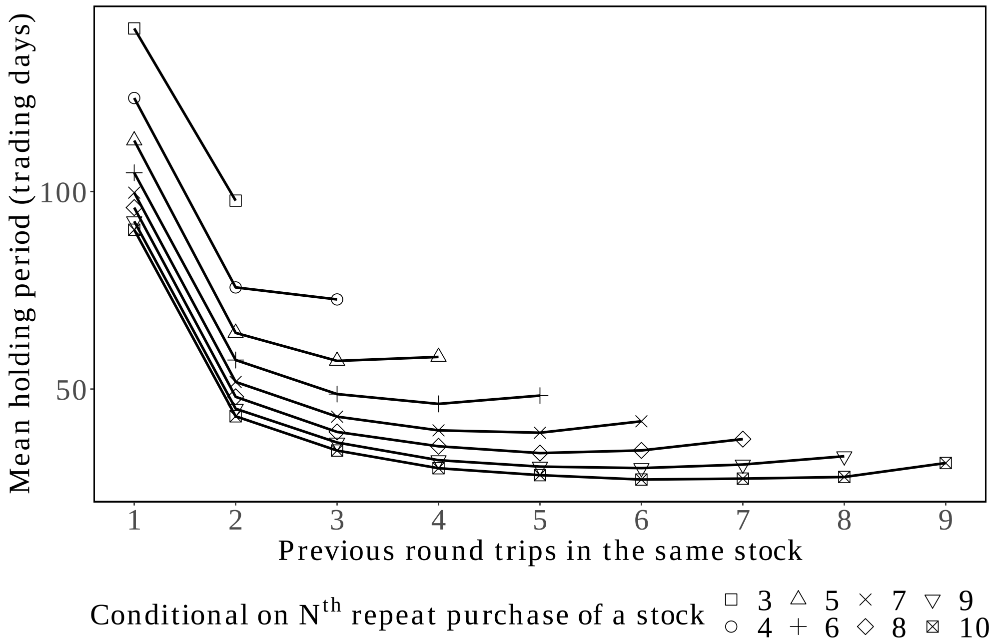
$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

Internet Appendix: Finnish data

Figure I.A.2.1: Univariate results for investors with first trade from April 1998

This figure presents univariate results of the main findings with a subset of investors whose first trading activity begins after April 1998. Each line in the figure traces investors' holding periods of their first $N-1$ round trips on a stock when they initiate a position on the stock the N^{th} instance ($N \in 3,4,\ldots,10$). Panel A reports the mean holding periods of the investors, and Panel B shows the median holding periods.

Panel A: Mean holding periods



Panel B: Median holding periods

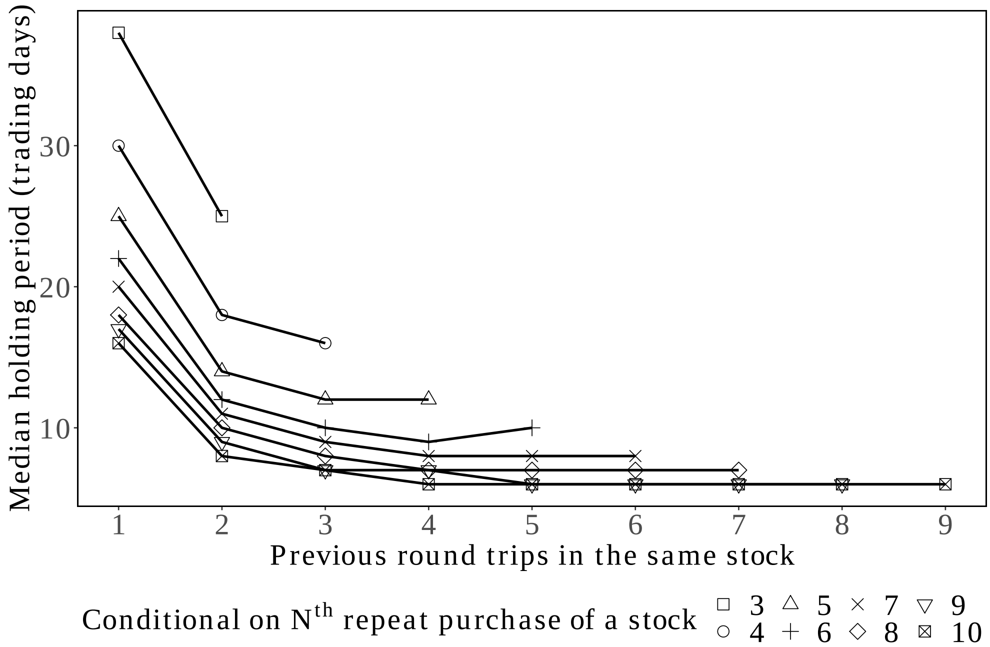
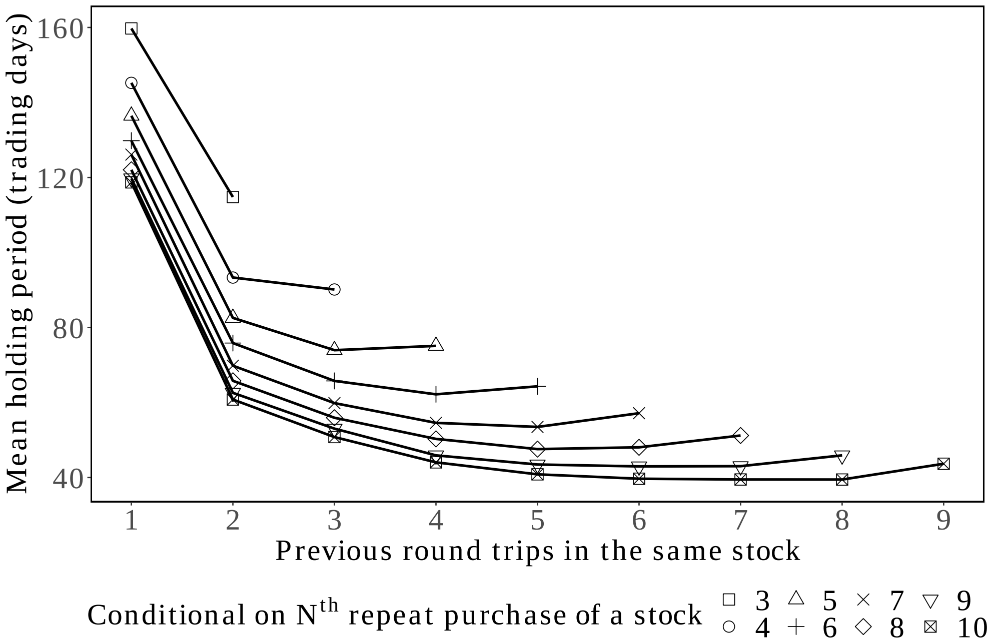


Figure I.A.2.2: Univariate results excluding day traders

This figure presents univariate results of the main findings excluding investors who day trade. Each line in the figure traces investors' holding periods of their first $N-1$ round trips on a stock when they initiate a position on the stock the N^{th} instance ($N \in 3,4,\ldots,10$). Panel A reports the mean holding periods of the investors, and Panel B shows the median holding periods.

Panel A: Mean holding periods



Panel B: Median holding periods

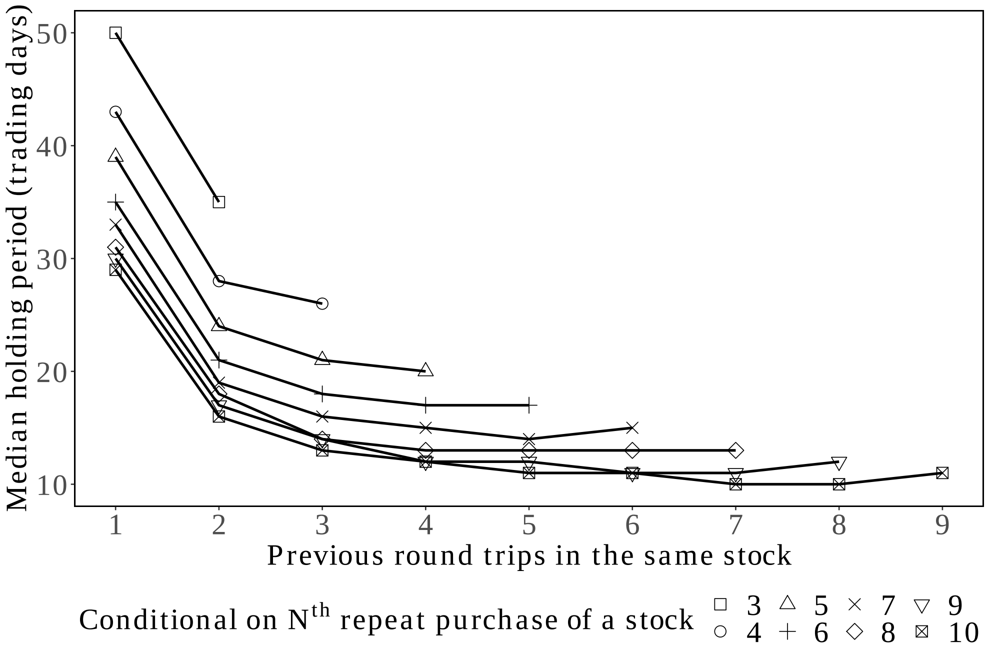


Figure I.A.2.3: Round trips and the hazard rate of exits

This figure reports the results of Cox proportional hazard models. I use complete exit of a position from a stock as the survival event in the hazard models. The main explanatory variables are the categorical dummy variables for N^{th} round trip on a stock. The model also controls for the disposition effect-related decrease in the holding period (non-negative return dummy) and investor characteristics (age and gender). Each line in the figure corresponds to a model fitted for those investor who purchase any of their stock for the N^{th} time. The base hazard rate in each model is stratified at stock and time (year-month of initiation) levels. The gray region represents the 99.9% confidence intervals around the coefficient values. The confidence intervals are tighter as compared to the ones in the linear models as the standard errors are *not* clustered in these models.

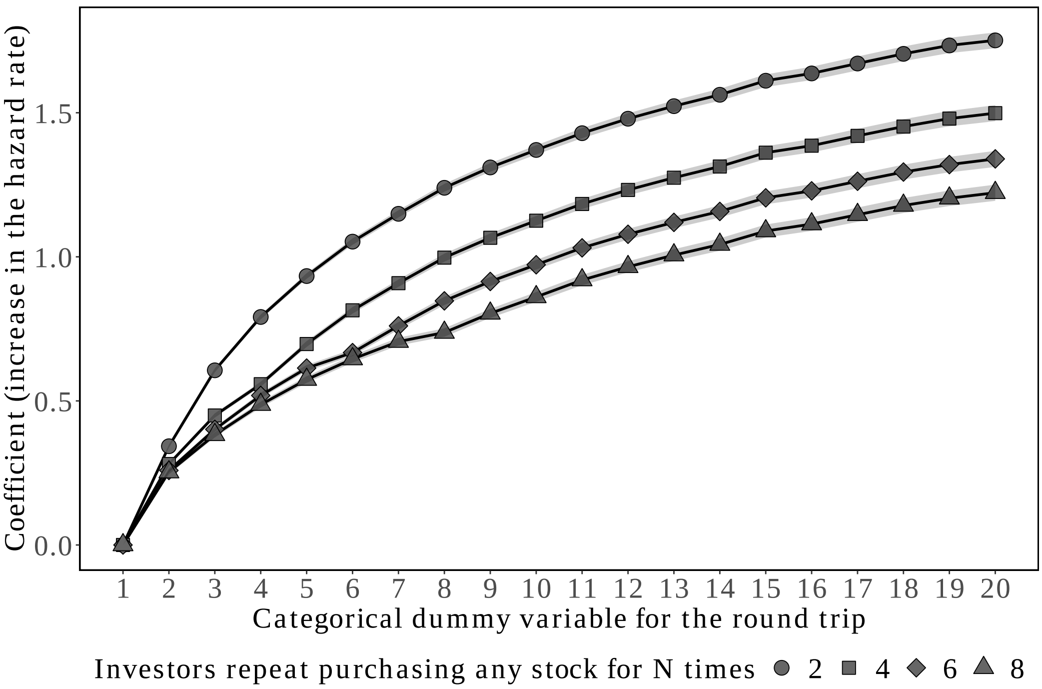


Figure I.A.2.4: Market-timing ability of the investors on the round trips

This figure reports the average market-timing ability of investors as a function of the number of round trips on a stock. Market-timing ability is the difference in the values of net institutional trading (NIT) at the end of the round trip and the beginning of the round trip. NIT on any trading day for a given stock is measured as $NIT_{i,t} = \frac{\text{Institutional buy dollar volume}_{i,t} - \text{Institutional sell dollar volume}i,t}{\text{Average daily dollar volume in previous year}_{i,t}}$, where i represents the stock and t represents the trading day. The market-timing ability is shown separately for non-final trips that are followed by another initiation on the stock. The gray region represents the 90% confidence intervals around the mean values.

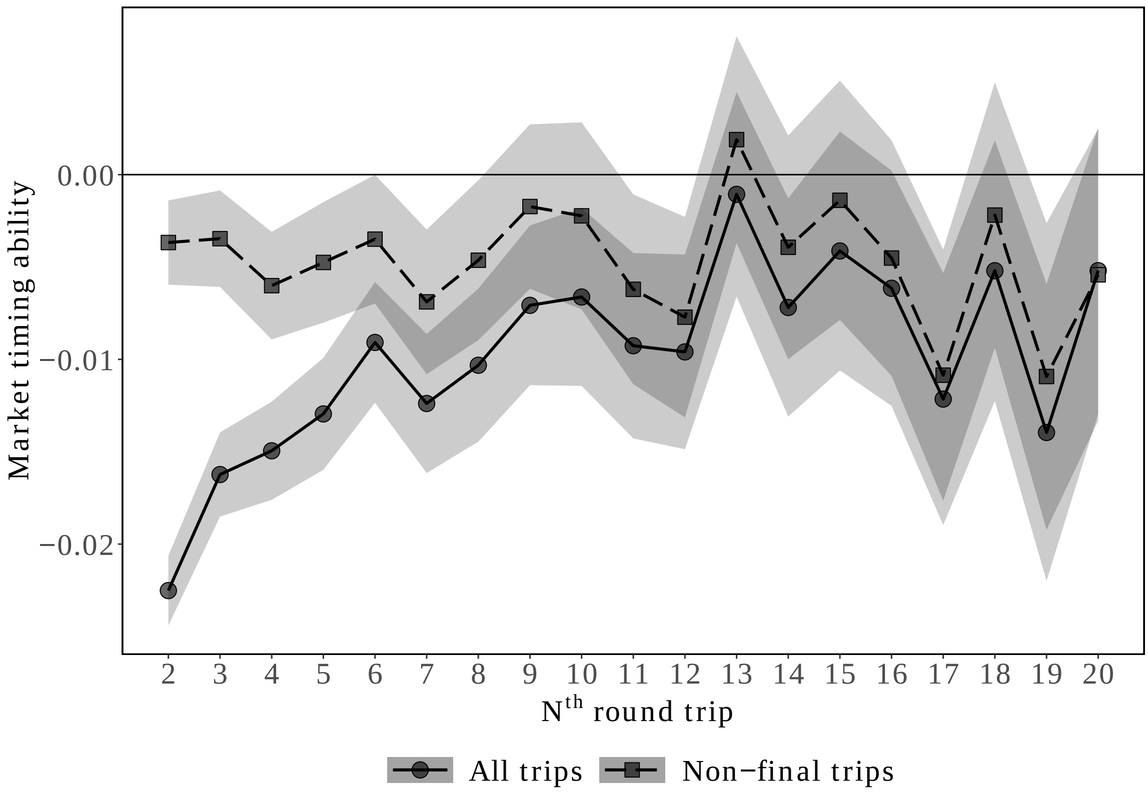


Figure I.A.2.5: Propensity to shorten the holding period as a function of the lost returns - Alternate specification for the residual

This figure reports the results of a regression model with the propensity to shorten the holding period as the dependent variable. The dependent variable, $Shorten\ dummy^{residual}_{N+1}$, is the residual from the regression model $Shorten\ dummy_{N+1} = \alpha + \beta_i \times Holding\ period\ category_i + \epsilon$, where $Shorten\ dummy_{N+1}$ takes the value of 1 if an investor shortens her holding period on the $N+1^{th}$ round trip as compared to the holding period on the N^{th} round trip, and 0 otherwise. $Holding\ period\ category_i$ is a categorical dummy for the holding period of length i in the N^{th} round trip. There is a categorical dummy for each of the first 500 days of the holding period, and a single categorical dummy for holding periods exceeding 500 days. The primary explanatory variables are the decile categories of the lost return opportunity on the N^{th} round trip. The lost return opportunity is computed as $Lost\ return_N = (Max\ return_N - Round\ trip\ return_N)/(1 + Round\ trip\ return_N)$, where $Max\ returns_N$ is the maximum return the investor could have achieved on the round trip, and $Round\ trip\ return_N$ is the realized round trip return. The maximum return is calculated using returns on the trading days in which the investor trades on any of the portfolio stocks during the holding period of the round trip. The regression model also controls for the round trip, investor, stock, and time (year-month of next initiation) fixed effects. The gray region represents the 99.9% confidence intervals around the coefficient values calculated with the standard errors clustered at the investor, stock, and time levels.

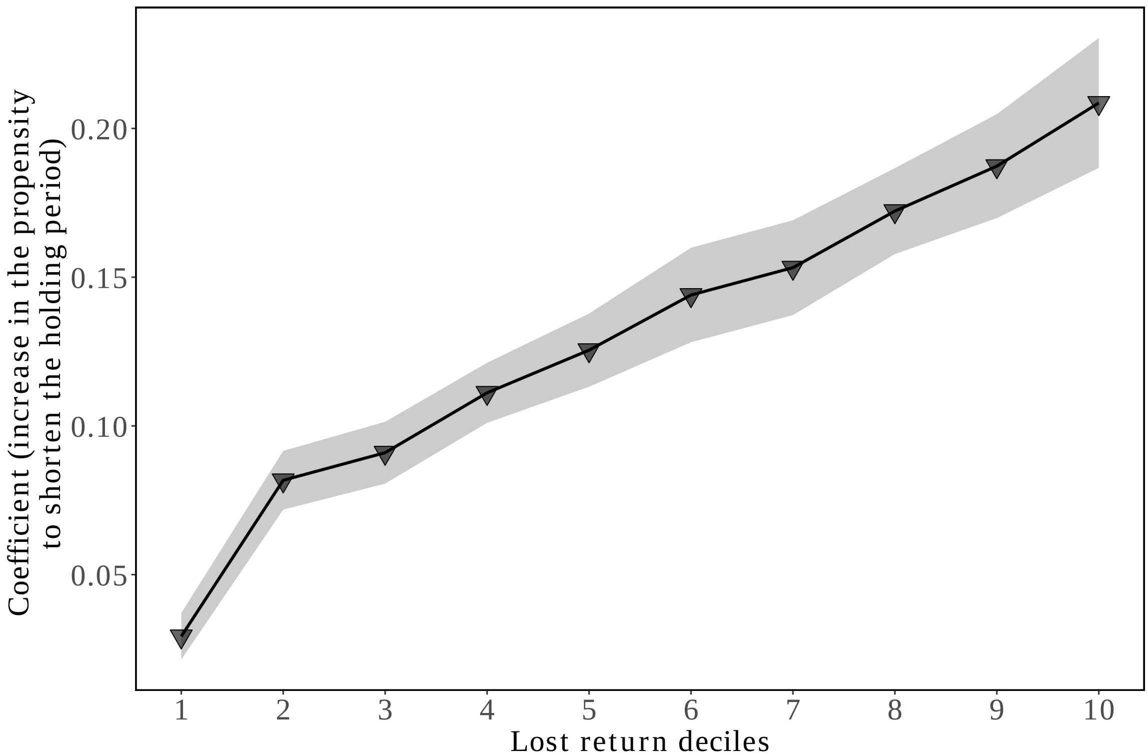


Table I.A.2.1: Round trips and the holding periods - For investors with first trade from April 1998

This table reports the results of regression models with $log(HoldingPeriod)$ as the dependent variable. The main explanatory variable is the integer value of the round trip on a stock ($Trip_N$). The model also controls for the disposition effect-related decrease in the holding period (*Gain dummy*) and investor characteristics (age and gender). Each column represents a regression model where the data are limited to investor-stock combinations in which the investor initiates a position on the stock at least for the N^{th} time ($N \in \{2, 4, 6, 8\}$). In the regression models, I also control for stock and time (year-month of initiation) fixed effects. The sample is restricted to investors whose first trading activity begins after April 1998. t-statistics are in parentheses and are measured with the standard errors clustered at the investor, stock, and time levels.

	Dependent variable: $log(HoldingPeriod)$				
	Investor initiates a position on the stock for the:				
Independent variables	2nd time	2nd time	4th time	6th time	8th time
$Trip_N$	-0.167^{***}	-0.171^{***}	-0.112^{***}	-0.082^{***}	-0.064^{***}
	(−38.54)	(−40.31)	(−30.73)	(−23.05)	(−18.83)
Gain dummy		-0.463^{***}	-0.381^{***}	-0.342^{***}	-0.318^{***}
		(−4.77)	(−4.84)	(−4.88)	(−4.99)
Age (years)		0.016^{***}	0.018^{***}	0.018^{***}	0.018^{***}
		(19.84)	(19.36)	(17.86)	(16.14)
Female dummy		0.079^{***}	0.017	0.003	−0.008
		(3.82)	(0.69)	(0.12)	(−0.27)
Time FE	Y	Y	Y	Y	Y
Stock FE	Y	Y	Y	Y	Y
Num. obs.	2,468,983	2,468,983	1,494,998	1,074,341	832,659
Adj. R^2	0.157	0.180	0.151	0.138	0.133

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

Table I.A.2.2: Round trips and the holding periods - Excluding intra-day traders

This table reports the results of regression models with $log(HoldingPeriod)$ as the dependent variable. The main explanatory variable is the integer value of the round trip on a stock ($Trip_N$). The model also controls for the disposition effect-related decrease in the holding period (*Gain dummy*) and investor characteristics (age and gender). Each column represents a regression model where the data are limited to investor-stock combinations in which the investor initiates a position on the stock at least for the N^{th} time ($N \in \{2,4,6,8\}$). In the regression models, I also control for stock and time (year-month of initiation) fixed effects. The sample is restricted to investors who never execute day trades in their stocks. t-statistics are in parentheses and are measured with the standard errors clustered at the investor, stock, and time levels.

	Dependent variable: $log(HoldingPeriod)$				
	Investor initiates a position on the stock for the:				
Independent variables	2nd time	2nd time	4th time	6th time	8th time
$Trip_N$	-0.128^{***}	-0.133^{***}	-0.076^{***}	-0.046^{***}	-0.028^{***}
	(−35.08)	(−35.66)	(−26.95)	(−18.55)	(−11.50)
Gain dummy		-0.460^{***}	-0.385^{***}	-0.339^{***}	-0.308^{***}
		(−4.64)	(−4.16)	(−3.83)	(−3.64)
Age (years)		0.011^{***}	0.012^{***}	0.012^{***}	0.011^{***}
		(21.61)	(18.99)	(16.21)	(13.34)
Female dummy		0.069^{***}	0.016	−0.001	−0.014
		(4.88)	(0.87)	(−0.05)	(−0.54)
Time FE	Y	Y	Y	Y	Y
Stock FE	Y	Y	Y	Y	Y
Num. obs.	2,469,399	2,469,399	1,297,779	817,795	562,994
Adj. R^2	0.122	0.143	0.121	0.114	0.110

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

Table I.A.2.3: Round trips and the hazard rate of exit

This table reports the results of Cox proportional hazard models. The survival events in the hazard models are the complete exit of a position from the stock. The main explanatory variable is the integer value of the round trip on a stock ($Trip_N$). The model also controls for the disposition effect-related decrease in the holding period (*Gain dummy*) and investor characteristics (age and gender). The first column shows the result with all investors in the data. Column 2-5 show the results for a subsample of investors who purchase at least one of their stocks for the N^{th} time ($N \in \{2,4,6,8\}$). The base hazard rate in each model is stratified at the stock and time (year-month of initiation) levels. z-scores are reported in parentheses and are *not* based on clustered standard errors.

	Dependent variable: Hazard rate				
	Investors who initiate a position on the stock for the:				
Independent variables	All data	2nd time	4th time	6th time	8th time
$Trip_N$	0.121***	0.111***	0.091***	0.078***	0.069***
	(160.40)	(155.34)	(138.08)	(124.36)	(114.07)
Gain dummy	0.257***	0.226***	0.183***	0.162***	0.147***
	(16.22)	(16.08)	(14.70)	(13.92)	(13.24)
Age (years)	−0.006***	−0.007***	−0.008***	−0.009***	−0.010***
	(−99.26)	(−115.00)	(−128.38)	(−130.80)	(−126.63)
Female dummy	−0.133***	−0.063***	−0.016***	−0.001	0.003
	(−77.55)	(−38.05)	(−8.27)	(−0.36)	(1.23)
Time strata	Y	Y	Y	Y	Y
Stock strata	Y	Y	Y	Y	Y
Num. obs.	5,454,103	4,885,384	3,856,747	3,180,105	2,697,895
R^2	0.137	0.123	0.099	0.085	0.074

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

Table I.A.2.4: Investor performance on the round trips - Other performance measures

This table reports on the performance of the investors in the various round trips on their familiar stocks. The table presents the mean round trip returns for the first 20 round trips on a stock. Return performance is measured using two methods. In the first method, the excess returns is measured as the gross return from the round trip less the buy-and-hold market return during the holding period. Market return refer to OMX-Helsinki Cap index returns. The second method reports the mean α generated in each round trip. I calculate the daily expected return of a stock with a market model estimated using a rolling window of 12-month daily past returns of the stock. α measures the gross round trip return less the buy-and-hold expected return during the holding period. The table reports the results separately for all round trips, non-final trips, and final trips. Non-final trips refer to round trips that are followed by another initiation on the stock. Final round trips are round trips where the investor does not initiate a position on the same stock again. All return figures are annualized using the average holding periods of the round trips.

N^{th} round trip	Excess returns			Market model α		
	All Trips	Non-final trip	Final trip	All Trips	Non-final trip	Final trip
1	-2.3%***	1.7%***	-3.0%***	-2.8%***	1.4%***	-3.5%***
2	-4.0%***	1.1%***	-6.1%***	-4.7%***	0.5%***	-6.7%***
3	-4.7%***	0.2%	-7.6%***	-5.4%***	-0.6%***	-8.4%***
4	-5.0%***	-0.2%	-8.7%***	-5.7%***	-1.0%***	-9.5%***
5	-4.9%***	-0.3%	-9.3%***	-5.7%***	-1.1%***	-10.1%***
6	-5.1%***	-1.1%***	-9.6%***	-5.9%***	-2.0%***	-10.4%***
7	-5.5%***	-1.3%***	-10.8%***	-6.3%***	-2.1%***	-11.7%***
8	-5.4%***	-1.9%***	-10.3%***	-6.2%***	-2.8%***	-11.0%***
9	-4.8%***	-1.1%*	-10.7%***	-5.6%***	-2.0%***	-11.6%***
10 to 20	-4.8%***	-1.6%***	-11.8%***	-5.5%***	-2.3%***	-12.6%***

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

Table I.A.2.5: Round trips and the market-timing ability of investors

This table reports the results of a regression model with investors' market-timing ability as the dependent variable. Market-timing (MT) is measured the as the difference in the values of net institutional trading (NIT) at the end of the round trip (NIT_{end}) and the beginning of the round trip (NIT_{start}). NIT on any trading day for a given stock is measured as $NIT_{i,t} = \frac{\text{Institutional buy dollar volume}_{i,t} - \text{Institutional sell dollar volume}i,t}{\text{Average daily dollar volume in previous year}_{i,t}}$, where i represents the stock and t represents the trading day. The main explanatory variable is the integer value of the round trip ($Trip_N$) in a stock. The results for market-timing ability is reported separately for non-final trips where the round trip of the investor is followed by another round trip. In the regression models, I control for the investor, stock and time (year-month of initiation) fixed effects. t-statistics are in parentheses and are measured with the standard errors clustered at the investor, stock and time levels.

	All round trips			Non-final trips		
Independent variables	NIT_{start}	NIT_{end}	MT	NIT_{start}	NIT_{end}	MT
$Trip_N$	0.001	0.037	0.036	0.025	0.058^{**}	0.033
	(0.02)	(0.78)	(0.72)	(0.55)	(3.01)	(0.83)
Investor FE	Y	Y	Y	Y	Y	Y
Stock FE	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y
Num. obs.	3,796,597	3,796,597	3,796,597	2,012,198	2,012,198	2,012,198
Adj. R^2	0.017	0.111	0.065	0.020	0.004	0.013

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

Table I.A.2.6: The length of the holding period and the likelihood of shortening it on the next round trip

This table reports the results of a regression model with *Shorten* $dummy_{N+1}$ as the dependent variable. *Shorten* $dummy_{N+1}$ takes the value of 1 if an investor shortens her holding period on the $N+1^{th}$ round trip as compared to the holding period on the N^{th} round trip, and 0 otherwise. The main explanatory variable is the natural logarithm of the holding period on the N^{th} round trip ($log(HoldingPeriod)$). Each column shows the results of models with different control variables. t-statistics are in parentheses and are measured with the standard errors clustered at the investor, stock and time (year-month of next initiation) levels.

Independent variables	Dependent variable: *Shorten* $dummy_{N+1}$			
	(1)	(2)	(3)	(4)
$log(HoldingPeriod)$	0.112***	0.113***	0.128***	0.187***
	(52.81)	(52.54)	(68.67)	(53.86)
Stock FE	Y	Y	Y	Y
Time FE	Y	Y	Y	Y
Age and gender controls		Y	Y	Y
Trip FE			Y	Y
Investor FE				Y
Num. obs.	2,394,401	2,394,401	2,394,401	2,394,401
Adj. R^2	0.149	0.150	0.169	0.268

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

Table I.A.2.7: Lost returns and the propensity to shorten the holding period - Alternate specification for the residual

This table reports the results of a regression model with the propensity to shorten the holding period as the dependent variable. The dependent variable, $\textit{Shorten dummy}^{residual}_{N+1}$, is the residual from the regression model $\textit{Shorten dummy}_{N+1} = \alpha + \beta_i \times \textit{Holding period category}_i + \epsilon$, where $\textit{Shorten dummy}_{N+1}$ takes the value of 1 if an investor shortens her holding period on the $N+1^{th}$ round trip as compared to the holding period on the N^{th} round trip, and 0 otherwise. $\textit{Holding period category}_i$ is a categorical dummy for the holding period of length i in the N^{th} round trip. There is a categorical dummy for each of the first 500 days of the holding period, and a single categorical dummy for holding periods exceeding 500 days. The main explanatory variables are the interaction terms of (a) a lost return dummy ($\textit{Lost return dummy}_N$) and (b) an indicator variable for negative returns on the N^{th} round trip. $\textit{Lost return dummy}_N$ takes the value of 1 if the maximum return the investor could have achieved during the round trip was greater than the actual round trip return, and 0 otherwise. Maximum return is measured using returns only on trading days in which the investor executes trades on one of her portfolio stocks. $\textit{Negative return dummy}_N$ is 1 for losses on the N^{th} round trip, and 0 otherwise. Each column shows the results of models with different control variables. t-statistics are in parentheses and are measured with the standard errors clustered at the investor, stock, and time (year-month of next initiation) levels.

Independent variables	Dependent variable: $\textit{Shorten dummy}^{residual}_{N+1}$			
	(1)	(2)	(3)	(4)
$\textit{Lost return dummy}_N$ (β_1)	0.092***	0.083***	0.083***	0.111***
	(38.55)	(37.39)	(38.17)	(37.632)
$\textit{Negative return dummy}_N$ (β_2)		0.033***	0.029***	−0.009
		(4.34)	(3.85)	(−1.25)
$\textit{Lost return dummy}_N$		0.001	0.005	0.038***
$\times\textit{Negative return dummy}_N$ (β_3)		(0.29)	(1.27)	(10.65)
Age(years)			−0.002***	
			(−16.87)	
Female dummy			−0.013***	
			(−5.17)	
Trip FE	Y	Y	Y	Y
Time FE	Y	Y	Y	Y
Stock FE	Y	Y	Y	Y
Investor FE				Y
Num. obs.	2,394,401	2,394,401	2,394,401	2,394,401
Adj. R^2	0.044	0.045	0.047	0.121

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

Table I.A.2.8: Lost returns and the propensity to shorten the holding period - Cases with negative returns during holding period

This table reports the results of a regression model with the propensity to shorten the holding period as the dependent variable. The dependent variable, $Shorten\ dummy_{N+1}^{residual}$, is the residual from the regression model $Shorten\ dummy_{N+1} = \alpha + \beta \times log(HoldingPeriod) + \epsilon$, where $Shorten\ dummy_{N+1}$ takes the value of 1 if an investor shortens her holding period on the $N+1^{th}$ round trip as compared to the holding period on the N^{th} round trip, and 0 otherwise. $log(HoldingPeriod)$ is the natural logarithm of the holding period on the N^{th} round trip. The main explanatory variable is an indicator variable for the lost return opportunity on a round trip ($Lost\ return\ dummy_N$). $Lost\ return\ dummy_N$ takes the value of 1 if the maximum return the investor could have achieved during the round trip was greater than the actual round trip return, and 0 otherwise. Each column shows the results of the regression with a different subsample. Sample A comprises round trips where minimum return during the holding period was negative. Sample B comprises round trips where minimum return during the holding period was negative, and this negative return occurs before the maximum return during the round trip. Sample C comprises round trips where minimum return during the holding period was negative, and this negative return occurs after the maximum return during the round trip. The maximum and minimum return during the round trips are measured only on trading days in which the investor executes trades on one of her portfolio stocks. t-statistics are in parentheses and are measured with the standard errors clustered at the investor, stock and time levels.

Independent variables	Dependent variable: $Shorten\ dummy_{N+1}^{residual}$		
	Sample A	Sample B	Sample C
$Lost\ return\ dummy_N$ (β_1)	0.104***	0.104***	0.051***
	(42.57)	(31.50)	(4.96)
Trip FE	Y	Y	Y
Time FE	Y	Y	Y
Stock FE	Y	Y	Y
Investor FE	Y	Y	Y
Num. obs.	1,457,399	966,795	490,604
Adj. R^2	0.133	0.127	0.156

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

Table I.A.2.9: Test for a discontinuity in the propensity to shorten the holding period in the negative return domain

This table reports the results of a two-stage test for a discontinuity in the propensity to shorten the holding period at just below the zero round trip return point. The test comprises the following steps. First, I restrict the sample to round trips where the investor lost an opportunity for a better positive return during the round trip, and the round trip returns fall within ±0.5 (or ±0.25) standard deviations around zero. Second, I fit a polynomial model of the order P ($P \in \{3,4,5\}$) with the propensity to shorten the holding period as the dependent variable. The propensity to shorten the holding period is measured as the residual from the regression model $Shorten\ dummy_{N+1} = \alpha + \beta \times log(HoldingPeriod) + \epsilon$, where $Shorten\ dummy_{N+1}$ takes the value of 1 if an investor shortens her holding period on the $N+1^{th}$ round trip as compared to the holding period on the N^{th} round trip, and 0 otherwise. $log(HoldingPeriod)$ is the natural logarithm of the holding period on the N^{th} round trip. The explanatory variables are the polynomial expressions of the round trip returns. In the model, I also control for the round trip, investor, stock, and time (year-month) fixed effects. Finally, I calculate the discontinuity in the propensity to shorten the holding period as the mean residual in the loss domain less the mean residual in the gain domain (including zero). t-statistics for the difference in means are reported with standard errors clustered at the investor level, following the procedure outlined in Donner et al. (1981). Panel A reports the residuals from the first-stage regressions executed with ±0.5 standard-deviation limits. Panel B reports the residuals with ±0.25 standard-deviation limits.

	First-stage polynomial regression of:						
	3rd order		4th order		5th order		
Variable	Mean	t-stats	Mean	t-stats	Mean	t-stats	N
Panel A: Residuals around zero ±0.5 standard deviations							
Loss residuals (a)	0.69%	7.21	0.65%	6.79	0.52%	5.48	192,156
Gain residuals (b)	-0.28%	-4.47	-0.27%	-4.21	-0.22%	-3.40	465,423
Difference (a-b)	0.97%	8.13	0.92%	7.65	0.74%	6.18	657,579
Panel A: Residuals around zero ±0.25 standard deviations							
Loss residuals (a)	0.60%	5.36	0.55%	4.88	0.35%	3.14	140,612
Gain residuals (b)	-0.25%	-3.37	-0.23%	-3.07	-0.15%	-1.98	333,814
Difference (a-b)	0.86%	6.07	0.78%	5.52	0.50%	3.56	474,426