

# Stock Repurchasing Bias of Mutual Funds

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## Abstract

This paper investigates whether mutual fund managers' positive emotions associated with selling a stock for a gain lead to a higher repurchasing probability of this stock in the future. Controlling for fund, stock and time fixed effects, we show that the probability of a stock being repurchased by a mutual fund is on average around 15% higher if it was previously sold for a gain rather than for a loss. This repurchasing bias is more salient when the sale of the stock was accompanied by contemporaneous inflows. The effect is less pronounced if the stock price increased after the sale of the stock. In line with positive emotions driving the repurchasing behavior, we find that when fund managers change jobs and work at a different fund, they still prefer to repurchase stocks that they sold for a gain at the fund they managed before. We find supportive evidence that this behavior is associated with lower fund performance: repurchased winners underperform repurchased losers by around 5% p.a. after the repurchase. Thus, investors should be aware that mutual fund managers' repurchasing decisions can be biased and eventually may hurt their performance.

*JEL-Classification Codes:* G11, G23, G41

*Keywords:* Stock Repurchasing, Mutual Funds, Performance, Behavioral Bias

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# 1 Introduction

The behavior and performance of mutual fund managers is crucial to the financial well-being and wealth of many households. According to the Investment Company Institute, 54.9 million households in the US owned mutual funds in 2016, while the overall investment volume in mutual funds amounted to \$15.7 trillion.<sup>1</sup> It is therefore important to understand the decisions made in delegated portfolio management, because they affect a large number of individual investors who trust that fund managers' investment decisions are for their benefit.

In this paper, we examine whether past positive or negative emotional experiences that a fund manager had with a particular stock are predictive for the stock being repurchased in the future. Specifically, we conjecture that selling a stock for a gain is associated with positive emotions like pride and happiness, while selling a stock for a loss is associated with negative emotions like regret or disappointment. In an effort to repeat the positive emotional experience and avoid the negative one, mutual fund managers may be more prone to repurchase a stock that they sold for a gain (i.e., a past "winner"), while they are less prone to repurchase a stock that they sold for a loss (i.e., a past "loser"). This bias may harm mutual fund investors if past winner stocks underperform past loser stocks.

We test this conjecture based on a large dataset of quarterly U.S. mutual fund holdings from 1980 to 2014. For each individual mutual fund-stock combination, we define winner and loser stocks as those instances where a mutual fund sold the entire stock position for a gain or a loss, respectively. We then examine whether the probability that a stock is repurchased depends on whether it has been sold for a gain or a loss. We control for various fund characteristics such as fund size, fund age and fund performance to make sure that funds are comparable in terms of their trading patterns and investment experience. We also include stock, fund and time fixed effects. This accounts for unobservable stock

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<sup>1</sup>For a detailed view on the Investment Company Institute's annual statistics on households' mutual fund holdings, see [https://www.ici.org/pdf/2016\\_factbook.pdf](https://www.ici.org/pdf/2016_factbook.pdf).

characteristics that may lead to certain stocks being more likely to repurchased, certain types of funds that may be more prone to engage in this type of behavior, or an overall time pattern in the repurchasing behavior.

Our main result shows that mutual fund managers are significantly more likely to repurchase a stock if it has been sold for a gain before. In economic terms, the probability of a past winner stock to be repurchased is about 1% larger than that the probability of a past loser stock to be repurchased. Compared to the baseline probability of a stock being repurchased, the difference between the probability to repurchase a previous winner and a previous loser is economically significant and amounts to 15%.

Alexander et al. (2006) suggest that mutual fund trades associated with contemporaneous outflows are more likely to be liquidity motivated, while mutual fund trades associated with contemporaneous inflows are more likely to be deliberate trades for valuation reasons. Therefore, we expect that our main result should be stronger if a stock was sold for a gain while the fund received contemporaneous inflows and thus voluntarily traded the stock. If a stock was sold while the fund received contemporaneous outflows, the fund manager may attribute the trade to pressure coming from investors' redemptions and thus associate weaker emotions with it. To test this conjecture, we interact our winner dummy variable with an indicator reflecting contemporaneous inflows in the respective fund. Our findings support the view that mutual funds' propensity to repurchase past winner stocks is more pronounced if the stock was sold while the fund experienced contemporaneous inflows.

In addition, we examine whether the stock's price change after the sale influences fund managers' repurchasing behavior. We find that if a stock was previously sold for a gain, it is 1.2% or 0.9% less likely to be repurchased if its price has gone up since the sale. We also find that team-managed funds exhibit a stronger repurchasing bias, which is consistent with the previous literature on the negative impact of group thinking on fund performance (Baer et al. (2005)), and the literature showing that team-managed funds are more subject to the disposition effect (Cici (2012)).

In line with the view that positive (negative) emotions associated with selling a stock for a gain (loss) drive repurchasing bias of mutual fund managers, we find that mutual fund managers carry their trading experiences with them: they are also more likely to repurchase previous winner stocks in their current portfolios, if these stocks were sold for a gain at the previous fund the manager was in charge of.

Finally, we document that repurchased winner stocks underperform repurchased loser stocks by about 5% p.a. Also, repurchased stocks' prices increase between the time they have been sold and repurchased, suggesting that mutual funds would have benefited from just keeping these stocks in their portfolios. These results suggest that repurchasing bias of mutual funds is not due to superior information and may eventually hurt mutual fund investors. The previous literature has documented that mutual fund managers suffer from various behavioral biases such as the disposition effect (Frazzini (2006)), home bias (Pool et al. (2015)), and overconfidence (Puetz and Ruenzi (2011)). However, there is little evidence that these biases lead to worse fund performance and thus harm the investor. To examine whether the repurchasing bias we document results in mutual funds' underperformance, we first sort mutual funds into quintiles according to the extent to which they engage in repurchasing behavior and then compute the difference in returns between the bottom and top quintiles. We find suggestive evidence that funds that are most heavily engaging in repurchasing behavior underperform funds that are not subject to repurchasing bias. Thus, unlike the previous literature on biased investment behavior of mutual fund managers, we find that the particular investment bias we document, i.e., mutual funds' stock repurchasing bias, is associated with lower returns for mutual fund investors.

Our paper contributes to several strands of the literature. First, we contribute to the broad literature on the impact of emotions on economic decision making (Mellers et al. (1997), Loewenstein (2000), and Frydman and Camerer (2016)). According to Mellers et al. (1997), individuals aim to maximize their expected emotional experiences when choosing between risky options. That is, they will choose the option associated with more positive emotions.

In a similar vein, Loewenstein (2000) argues that anticipated emotions predict economic decision making. This view has been supported by Frydman and Camerer (2016), who show that individuals' reluctance to repurchase stocks that have increased in price since they were sold is correlated with neural activity in areas of the brain that are associated with emotional responses. We add to this literature by showing that emotional experiences even have an impact on decisions made on behalf of others, i.e., in delegated portfolio management where the outcome of an individual trade should be more important for the fund investor rather than the fund manager herself.

We also contribute to the literature documenting that actively managed mutual funds underperform (Jensen (1968), Gruber (1996), and Carhart (1997)). This literature started with the seminal paper of Jensen (1968) showing that funds underperform their passive benchmark by approximately 1.1% per year. Similarly, Gruber (1996) provides evidence that the average mutual fund underperforms passive market indices by about 65 basis points per year. Carhart (1997) also supports these findings and shows that the more actively a mutual fund trades, the lower the fund's performance. We contribute to this literature by showing one channel through which actively managed funds may underperform: mutual fund managers' biased repurchasing behavior of stocks that they previously sold for a gain. These trades lead to higher costs for the fund which are not made up for by higher returns of the repurchased stocks. On the contrary, mutual funds would have earned more if they just kept these stocks in their portfolios, rather than traded them.

Finally, we contribute to the literature on biased investment decisions of individual and institutional investors. The previous literature has shown that behavioral biases such as the disposition effect (Odean (1998) and Frazzini (2006)), home bias (Ivković and Weisbenner (2005), Seasholes and Zhu (2010) and Pool et al. (2015)), and overconfidence (Odean (1999) and Puetz and Ruenzi (2011)) are present among both, individual investors and mutual fund managers. However, evidence that these biases hurt fund performance and thus mutual fund investors is weak at best. In contrast, we document that repurchased win-

ners significantly underperform repurchased losers by about 5% p.a. after the repurchase. Thus, trading these stocks does not seem to be due to superior information.

The paper most closely related to ours is Strahilevitz et al. (2011). The authors show that individual investors are also more likely to repurchase stocks that were previously sold for a gain rather than for a loss. They argue that this repurchasing behavior is due to positive (negative) emotions that retail investors experience when selling stocks for gains (losses). We show that stock repurchasing bias is present among institutional investors, too. While Strahilevitz et al. (2011) find no strong performance effects among individual investors, though acknowledging that these investors would be better off holding index funds, we further find that these funds would have performed better if they were not subject to this bias.

The results of our paper imply that mutual fund managers who have been viewed as a more sophisticated type of investor are subject to the same behavioral biases as retail investors and that their behavior deserves a large amount of scrutiny as it has potentially negative effects on a large amount of investors.

## **2 Data and summary statistics**

### **2.1 Data and sample selection**

We obtain quarterly stock holdings data of U.S. mutual funds from January 1980 to December 2014 from the Thomson Reuters Mutual Fund Holdings Database. We then merge the stock holdings data with the CRSP Survivorship-Bias-Free Mutual Fund Database using MFLINKS by Wermers (2000). The CRSP Mutual Fund Database contains data on fund characteristics such as total net assets (TNA), monthly returns, expense ratios and first-of-fer dates. We further merge the data with the Morningstar Direct database using TICKER and CUSIP as fund identifiers since the Morningstar database provides more accurate in-

formation on who is running a fund. We aggregate all share classes of the same fund to avoid multiple counting.

We include all actively managed, open-end domestic U.S. equity funds in the sample. As stock repurchasing bias is only relevant for actively managed funds, we exclude ETFs, index funds, and funds with an expense ratio below 0.1% p.a. We also exclude funds with total net assets in the bottom 5% of all observations to make sure that reported stock holdings do not change because of complete liquidation of the fund.<sup>2</sup>

In the next step, we merge the mutual fund data with stock information from CRSP using the report date (RDATE) and the stock identifiers (CUSIP and PERMNO) in the stock holdings. Following Daniel et al. (1997) and Wermers (1999), we only include regular common stocks traded on NYSE, AMEX or NASDAQ.

Since repurchasing decisions are only relevant when a stock has been sold by a fund before, we only keep those observations in the sample where a fund has sold a certain stock. We define the sale of a stock as clearing the entire position. According to Alexander et al. (2006), selling to zero usually represents value-based sales while selling partial positions may be caused by liquidity restrictions or portfolio rebalancing. Thus, to capture deliberate trades of fund managers that are significant enough to be associated with repurchasing bias, we focus on stocks that have been completely sold before. For each stock sold by a fund, we track it for one year to see whether the stock is repurchased by the same fund.

Our final sample consists of 7,521,881 fund-stock-quarter observations, including 4,404 distinct funds holding 18,164 distinct stocks.

## 2.2 Construction of main variables

### *Repurchasing dummy variable*

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<sup>2</sup>Including these funds with low total net assets does not materially change our main result.

For each stock sold by a fund, we check whether it re-appears in reported stock holdings of the fund within the next four quarters, i.e., one year after the sale, following Strahilevitz et al. (2011). This way, we ensure that the same managers are likely to be in charge of the fund and the emotions triggered by the previous sale are still vivid in managers' memory.<sup>3</sup> Our main dependent variable,  $Repurchase_{i,j,q}$ , is equal to one for the quarter in which a stock first re-appears in the stock holdings report of the fund after the sale. The repurchase dummy is set to zero, if the stock does not re-appear in the stock holdings report of the fund in the respective quarter within a year after selling the stock. Thus, the repurchase dummy is equal to zero for all opportunities to repurchase the stock within one year after its sale, and it is equal to one if the stock is actually repurchased in a given quarter. We do not include the stock in the sample anymore after it is repurchased and becomes part of the fund's stock holdings, i.e. the sample only comprises repurchasing activities and opportunities to repurchase. Furthermore, we exclude delisted stocks from the sample as they are no longer available for repurchasing.

Appendix B provides an overview of the top 20 funds that engage most strongly in repurchasing behavior (Panel A) and of the top 20 stocks that are most frequently purchased in our sample period (Panel B).

#### *Definition of winner and loser stocks*

We do not directly observe whether a fund sells a stock for a gain or a loss since we only observe quarterly holdings, which do not provide information on the exact trading day within the quarter. A fund may have sold a stock at any point in the time period from the last time the stock appears in the stock holdings of the fund to the next report date of the fund. Therefore, we approximate the returns of sales in two different ways to ensure the robustness of the results.

First, we define a winner dummy,  $WinnerFIFO$ , by comparing the price at the time of sale with the weighted average purchase price based on the first-in-first-out (FIFO) principle

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<sup>3</sup>In our later analysis, we explore manager changes explicitly.



following Frazzini (2006).<sup>4</sup> *WinnerFIFO* equals to one if the sale price is higher than the average purchase price of the stock, and equals zero if the sale price is lower than the average purchase price. To clearly separate repurchasing of winner and loser stocks, we do not consider cases in which a stock is sold with a zero return.<sup>5</sup>

The second definition of winner stocks takes care of the fact that fund managers may not calculate the average purchase price every time when making selling decisions. Instead, fund managers may only focus on the most recent performance of the stock. Prior studies on the disposition effect find that investors tend to sell stocks with recent gains, thus, they seem to focus on recent performance rather than historical averages (Odean (1998), Grinblatt and Keloharju (2001) and Jackson (2003)). Accordingly, our second winner dummy, *WinnerLHP*, is based on the assumption that the return of a stock sold by a mutual fund has the same sign as the return of this stock between the last two report dates. It is equal to one if the return is positive, and zero if it is negative. All other variables are described in detail in Appendix A.

## 2.3 Summary statistics

Panel A of Table 1 reports summary statistics of all variables used in our empirical analysis. We find that stocks in our sample are repurchased by the same fund within one year with a probability of 5.2% on average. According to the *WinnerFIFO* (*WinnerLHP*) measure, 50.1% (47.5%) of the stocks in our sample are sold for a gain. Furthermore, 56.5% of stocks increase in price after they have been completely sold by a fund in a given quarter. When funds clear their positions, this is accompanied by contemporaneous inflows in 42.9% of the cases.

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<sup>4</sup>Results (not reported) are robust to using the price at the last time when the stock is reported in the holdings or the first report date when the stock is no longer reported. Results in the paper are based on the assumption that the stocks are sold on the next report date of the fund after the stock's last appearance in the fund's holding.

<sup>5</sup>Our main results do not change if we include stocks sold at a zero return.

In Panel B of Table 1 we compare all control variables according to whether a stock is repurchased or not, respectively. Funds engaging in repurchasing behavior are larger, trade more and have less volatile returns. We also observe that the average values of both winner dummies differ significantly in the two groups: the average of both winner dummies is higher for the repurchased stocks than for the non-repurchased stocks. More specifically, repurchased stocks are more likely to be winner stocks with an average above 50%, while the stocks that are not repurchased are more likely to be loser stocks with an average below 50% for both proxies, *WinnerFIFO* and *WinnerLHP*.

Panel C of Table 1 shows the average difference in the control variables conditional on repurchased stocks being winner or loser stocks according to the *WinnerFIFO* measure.<sup>6</sup> We find that winner stocks are significantly more likely to be sold by larger, older, less active, and better performing funds with a lower expense ratio. We also observe that the repurchase dummy is 1.2% larger if the stock was previously sold for a gain: the probability to be repurchased is 1.2% higher if the stock is a previous winner rather than a previous loser. The difference is as high as 23.1% of the baseline repurchase probability and economically significant.

Appendix C presents correlations between all variables used in our analysis. They show that multicollinearity should not be an issue in our regressions. Our measures of winner stocks are positively and significantly correlated with a correlation coefficient of 0.630. Furthermore, the signs of correlations are all in the expected direction.

### 3 Repurchasing behavior of mutual fund managers

We start by examining whether stocks that were previously sold for a gain are more likely to be repurchased by mutual funds than stocks that were sold for a loss. Figure 1 depicts the average returns from a stock's complete sale conditional on whether this stock is re-

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<sup>6</sup>Results (not reported) are virtually identical if we use the WinnerLHP measure instead.

purchased, or not. Visual inspection already shows that returns of repurchased stocks are higher than those of stocks that are sold completely, but not repurchased. According to the *WinnerFIFO* measure, the return difference amounts to 3.51%, while according to the *WinnerLHP* measure, the return difference amounts to 2.49%. Both differences are statistically significant at the 1% level.

### 3.1 Baseline Results

To further test our hypothesis that stocks previously sold for a gain are more likely to be repurchased than stocks previously sold for a loss, we calculate the proportion of winner stocks repurchased (*PWR*) and the proportion of loser stocks repurchased (*PLR*) and compare the difference between them based on non-parametric t-tests. Following Strahilevitz et al. (2011), *PWR* and *PLR* are defined as:

$$(1) \quad PWR = \frac{NWR}{ORW},$$

$$(2) \quad PLR = \frac{NLR}{ORL},$$

where *NWR* (*NLR*) is the number of winners (losers) completely sold by a fund and then repurchased within one year after the sale. *ORW* (*ORL*) reflects the number of opportunities to repurchase previous winners (losers). It is based on the observations in the four quarters after a stock is completely sold by a fund. *NWR* (*NLR*) and *ORW* (*ORL*) are aggregated across all funds over the sample period.

Table 2 shows average differences between *PWR* and *PLR*. In column (1), winners are measured by *WinnerFIFO*, while in column (2), winners are measured by *WinnerLHP*. The difference between *PWR* and *PLR* ranges between 1.2% and 0.9%, depending on which proxy for winner stocks is used. Both differences are statistically significant at the 1%

level. Following Strahilevitz et al. (2011), to be conservative, we only assume that realized repurchases instead of all observations are independent from each other.

The difference between *PWR* and *PLR* that we document for fund managers (i.e., 1.2% and 0.9%) is economically smaller than what has been documented for retail investors, where differences range between 2.0% and 4.8% (Strahilevitz et al. (2011)). We also observe that the ratio between *PWR* and *PLR* is lower for fund managers: it ranges between 1.255 (0.059/0.047) and 1.188 (0.057/0.048) compared to a range of 1.360 to 2.356 documented for retail investors (Strahilevitz et al. (2011)). Thus, professional investors seem to be less subject to repurchasing bias than individual investors. However, the significant difference in proportions already provide evidence for the conjecture that repurchasing bias also exists among mutual fund managers.

In the next step, we test our hypothesis on the repurchasing bias among fund managers more formally and estimate the following linear probability models with fixed effects and fund characteristics as control variables:

$$\begin{aligned}
 \text{Repurchase}_{i,j,q} = & \alpha + \beta_1 \text{WinnerDummy}_{i,j,t} + \beta_2 \text{FundSize}_{i,q} + \beta_3 \text{FundAge}_{i,q} \\
 (3) \quad & + \beta_4 \text{FundTurnoverRatio}_{i,q} + \beta_5 \text{FundExpenseRatio}_{i,q} \\
 & + \beta_6 \text{FundReturnVolatility}_{i,q} + u_j + w_i + v_q + \varepsilon_{i,j,q},
 \end{aligned}$$

where  $i, j, t, q$  indicate funds, stocks, the time of sale, and the quarter of the (potential) repurchase within four quarters after the sale, respectively. The dependent variable,  $\text{Repurchase}_{i,j,q}$ , is an indicator of whether stock  $j$  sold completely by fund  $i$  is repurchased in quarter  $q$  within one year after the sale in quarter  $t$ .  $\text{WinnerDummy}_{i,j,t}$  denotes our two measures of winner stocks,  $\text{WinnerFIFO}_{i,j,t}$  or  $\text{WinnerLHP}_{i,j,t}$ , as defined in Section 2.2.

We include various fund characteristics as control variables. Fund size and fund age are included, because repurchasing activity may generally be higher for large funds with more

stocks in their portfolios that they could potentially repurchase. We also control for a fund's turnover ratio, as it may be positively correlated with repurchasing activity. A fund's expense ratio is included as another proxy for its trading activity and activeness in general. Furthermore, we include a fund's performance ranking in its segment and its return volatility, as these variables may influence the fund manager's decision to repurchase past winner stocks due to tournament incentives or window dressing (Brown et al. (1996), Kempf and Ruenzi (2008), Agarwal et al. (2014)). A more detailed definition of all variables is contained in Appendix A.

All models include stock, fund and time fixed effects to control for unobserved fund trading patterns, stock characteristics and potential time trends in repurchasing behavior. In another specification not presented in Equation 3, we further include fund times time fixed effects to control for any time-variant fund trading patterns. For example, if systematically a higher proportion of stocks a mutual fund sold before are winner stocks, the mutual fund is supposed to have a higher chance to repurchase winners. Controlling for fund times time fixed effects helps us mitigate this concern. In addition, we assume that the repurchasing behavior is independent across funds but not within funds and thus cluster standard errors by fund.<sup>7</sup> Estimation results are presented in Table 3.

In columns (1) and (4), we estimate the baseline effect without any additional control variables, while in columns (2) and (5), we control for fund characteristics. We include fund times time fixed effects in columns (3) and (6). Across all specifications, we find that mutual fund managers are significantly more likely to repurchase stocks that they previously sold for a gain. The impact of the winner dummy on the probability of a stock to be repurchased is positive and statistically significant at the 1% level in all model specifications. The effect is also economically meaningful: depending on the winner measure and the model specification, the estimates show that the probability of being repurchased for previous winners is 0.6% to 0.9% higher than for previous losers. Relative to the mean repurchasing probability of

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<sup>7</sup>In unreported robustness analysis, we cluster standard errors by both, fund and time. Results do not change.

a stock in the sample (5.2% in Panel A of Table 1), this difference corresponds to a 15% higher probability for a winner stock to be repurchased.

Coefficient estimates of most control variables on fund characteristics are also in line with expectations. We find that larger funds are significantly more likely to repurchase stocks. More active funds also tend to repurchase more stocks: the higher the turnover ratio of a fund, the more likely a fund repurchases a stock. Results also show that a better fund ranking in each sector has a negative impact on the likelihood to repurchase a stock previously sold.

We also run regressions of the repurchase dummy on dummy variables for different return intervals to examine how the magnitude of gains and losses in the previous sale influences the repurchasing bias. Regressions include the same set of fixed effects as before. We plot the corresponding coefficients for various return intervals in Figure 2. We find that the repurchasing bias is highly dependent on whether the stock was sold for a gain or for a loss before. Regardless of which measure we use for returns, the coefficient for return intervals becomes positive when the returns move from the negative domain to the positive domain. However, a stock's likelihood of being repurchased does not increase even further the higher the gain that the fund received in the previous sale, while its likelihood of being repurchased decreases even further the higher the losses the fund incurred when selling the stock before. This asymmetric impact of the magnitude of losses and gains on the repurchasing probability may be due to loss aversion: fund managers may feel more pain when selling for a loss compared to the happiness they feel when selling for the gain, even if this gain is of the same (absolute) magnitude as the loss (Tversky and Kahneman (1992) and Kahneman and Tversky (1984)). When deciding whether to repurchase a stock, the magnitude of losses and the associated pain may thus be more vivid and influence the repurchasing probability, while for gains it only seems to matter that the stock was sold with a positive return, and not so much at what magnitude.

Investors probably are not willing to repurchase stocks that were sold for a loss in the 30 days after the sale because they are not allowed to claim the capital loss for tax purposes if they

do so. In this time period, mutual funds may thus be reluctant to repurchase previous loser stocks to ensure tax benefits for their investors. To test whether these tax considerations explain our results, in a robustness test, we exclude the first quarter after the sale in our analysis. Appendix D presents the results. Even though the effect of winner dummies on repurchase becomes a little bit smaller after excluding the first quarter, it still remains statistically significant at the 1% level and accounts for more than 10% of the baseline probability of repurchase. We find evidence that the tax wash-sale rule indeed contributes slightly to the positive effect of being a previous winner on the repurchasing probability, but the effect still exists after accounting for these tax considerations.

Taken together, we find evidence that mutual fund managers are more likely to repurchase a stock if they have sold it for a gain rather than for a loss before. We argue that this pattern in repurchasing behavior is due to the impact of positive (negative) emotions associated with selling a stock for a gain (loss) on the subsequent willingness to buy this stock again.

### **3.2 The impact of fund flows on fund managers' repurchasing behavior**

In the next step, we explore the impact of fund flows on the magnitude of fund managers' repurchasing bias. We conjecture that if fund managers face outflows and thus have to trade for liquidity reasons, their emotional response to the trade will be much weaker than if they trade while experiencing inflows, i.e., without any trading pressure from the investor side. For example, if fund managers sell a stock for a loss for liquidity reasons, they may attribute the loss to their investors who made redemptions, thus experiencing less negative emotion about the stocks sold for a loss. In other words, fund managers may scapegoat the investors for the losses if they experienced an outflow when selling the stocks and believe that if they had been able to hold the stock long enough, the stock would have appreciated and could have been sold for a gain. In line with this view, previous studies find a smaller

disposition effect among investors if they make decisions through agents (Chang et al. (2016) and Shapira and Venezia (2001)).<sup>8</sup>

Thus, if mutual fund managers mentally ascribe trading outcomes to investors when encountering contemporaneous outflows, the emotions associated with these trades may be weaker, leading to a smaller repurchasing bias. On the contrary, if the fund manager encounters an inflow and sells a stock for a loss (gain), she has to take full responsibility for the trade without an opportunity to attribute the failure (success) to her investors. We expect that the disappointment and unhappiness caused by a loss will make the fund manager more reluctant to repurchase that stock, while the happiness and pride caused by a gain will make her more willing to repurchase that stock. Thus, we should observe a stronger repurchasing bias for contemporaneous inflows.

To test this conjecture, we define a contemporaneous inflow dummy,  $CInflow_{i,t}$ , which is equal to one if a fund encounters inflows when selling a stock completely, and zero if the fund encounters outflows at that point in time. As shown in Panel A of Table 1, the mean of  $CInflow$  is 0.430, indicating that, on average, mutual funds are more likely to encounter an outflow when they sell a stock completely. However, the mean  $CInflow$  does not differ significantly between the group of repurchased and non-repurchased stocks, respectively (Panel B of Table 1). It is larger when mutual funds sell winner stocks than when they sell loser stocks, with the difference being statistically significant (see Panel C of Table 1).

In order to test whether fund managers' repurchasing bias is stronger if they encounter contemporaneous inflows rather than outflows, we rerun the linear probability regression in Equation 3 with an interaction term of the winner dummies,  $WinnerFIFO$  and  $WinnerLHP$ , and the dummy variable indicating contemporaneous inflows,  $CInflow$ . Results are presented in Table 4. The coefficient estimates of the interaction terms are all larger than zero, representing a positive effect of the contemporaneous inflow on the ten-

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<sup>8</sup>Chang et al. (2016) document a reversal of the disposition effect when investors delegate money management to mutual funds. Shapira and Venezia (2001) find that with the assistance of a broker, investors display a smaller disposition effect than when they are trading by themselves.



gency to repurchase previous winners. However, they are only statistically significant if winner stocks are defined based on the *WinnerLHP* measure. The statistical significance of the interaction term disappears when we further control for fund times time fixed effects. In economic terms, results in column (4), for example, show that if stocks are sold at a time where the fund received contemporaneous inflows, the probability of repurchasing winner stocks is 0.2% higher than the probability of repurchasing loser stocks. The difference between the probability of repurchasing previous winners and repurchasing previous losers is about 0.7%. Thus, the marginal effect of contemporaneous inflows on the repurchasing probability of previous winners compared to previous losers amounts to roughly 30%, and is economically substantial.

Overall, we find only weak supportive evidence that the repurchasing bias is less severe if stocks were previously sold when the fund managers encountered outflows rather than inflows.

### **3.3 The impact of price movements after the sale on fund managers' repurchasing behavior**

In addition to the phenomenon that previous winners are more likely to be repurchased than previous losers, Strahilevitz et al. (2011) show that individual investors are less likely to repurchase a stock whose price has increased, rather than decreased since it was sold. They attribute this finding to regret aversion: if the stock price goes up after the sale, investors regret to have sold it, because they would have earned more if they had kept it in their portfolio. Thus, they attach negative feelings to the stocks if the price has gone up since the sale and are less prone to repurchase those stocks. In line with this view, Frydman and Camerer (2016) conduct an experimental study and relate this avoidance behavior to neural measures of regret.

We examine whether the price change of a stock after the sale also influences the repurchasing decision of mutual fund managers. Accordingly, we define a dummy variable,

$PriceUp_{j,t,q}$ , which is an indicator of whether the price of a stock at the sale is lower than the price of this stock in quarter  $q$ . The mean of  $PriceUp$  is 0.565 (Panel A of Table 1), which means that slightly more than half of the stocks sold by mutual funds have increased in price between the sale and repurchasing date, rather than decreased. Unconditionally, repurchased stocks are more likely to have increased in price compared to the stocks that are not repurchased, as shown in Panel B of Table 1. However, when observing the price movement of a stock after it has been sold, investors already know what they earned from the previous sale. Therefore, we focus on the impact of the price movement after the sale on the repurchasing behavior of mutual funds, conditional on being a winner or loser in the previous sale.

Based on the same linear probability model as specified in Equation 3, we add an interaction term of the winner dummy and a dummy variable capturing a stock's price change between the time when it was sold and repurchased,  $PriceUp$ . It is equal to one if the price went up after the stock has been sold, and zero otherwise. Results are presented in Table 5.

In all model specifications, the coefficient estimates of the interaction terms are negative and statistically significant at the 1% level. If a fund sold a stock for a gain, but the price of the stock went up since it was sold, it decreases the probability of repurchasing the previous winner stock by 0.9% to 1.2%, depending on the winner measure. For instance, results in column (1)-(3) show that the probability of repurchasing a previous winner whose price has increased since the sale is 1.2% lower than that of repurchasing a previous winner whose price has decreased since the sale. Given that the difference in the probability to repurchase previous winners and previous losers is 1.6% when the stock price decreases after the sale, the negative marginal effect of an increasing price after the sale amounts to 75% of the difference, which is economically significant. Thus, mutual fund managers are more likely to repurchase past winner stocks if their price has decreased after they were completely sold.

### 3.4 The impact of team effect on the repurchase behavior

Whether group decision-making leads to better decisions is widely debated in the economic and psychological literature (e.g., Lamm and Myers (1978) and Adams and Ferreira (2003)). In the mutual fund industry, Baer et al. (2005) find that team-managed funds earns slightly lower returns than single-managed funds. In light of the above discussion, we examine whether decision making in a team reduces or increases the influence of the repurchase bias.

We construct a dummy variable,  $Team_{i,j,q}$ , which is equal to one if a fund is managed by more than one fund manager in a given quarter, and zero otherwise. 60.8% of the funds in our sample are team-managed (Panel A of Table 1), and repurchasing activity is positively related to the fund being managed by a team rather than a single manager (Panel B of Table 1).

To test whether repurchasing bias is higher for team managed funds, we interact our main winner dummy variable with a variable indicating team managed funds, and include it in our baseline linear probability regression as displayed in Table 3. Results are presented in Table 6.

We find that team managed funds are significantly more likely to repurchase stocks they sold for a gain than single managed funds. The interaction term of the winner dummy and the indicator for team managed funds in columns (1) and (2) is positive and statistically significant at the 5% level. In economic terms, the coefficient on the interaction term indicates that the difference in the probability to repurchase previous winners and previous losers increases by 0.2%, if a fund is team-managed, rather than single-managed. Thus, the effect of team management on the repurchase bias accounts for 25% of the baseline difference in the probability to repurchase previous winners and previous losers. This finding suggests that group decision making in portfolio management does not reduce but rather exacerbates the influence of fund managers' repurchasing bias. This finding is consistent with Cici (2012),

who shows that the disposition effect is stronger among team-managed mutual funds than single managed funds.

## 4 Do fund manager changes mitigate the repurchasing bias?

To further establish that fund managers' repurchasing bias is due to their emotional attachment to stocks they sold for a gain or a loss, respectively, we now explore manager changes. If repurchasing bias is due to positive or negative emotions experienced when selling a stock for a gain or a loss, we expect it to be much weaker after a manager change. There still may be a small effect due to analysts or the back-office of the fund that remains the same and still remembers whether a stock was sold for a gain or loss, but we should not observe a repurchasing bias similar to a fund where no manager change took place.

Furthermore, we conjecture that fund managers should still be more likely to repurchase stocks they sold for a gain, even if they have left a fund A and now manage a new fund B. In this case, we expect them to be more likely to repurchase stocks sold for a gain at fund A such that the portfolio of fund B now contains these stocks, too.

We first examine whether fund manager changes help eliminate the repurchasing bias in a given fund. We define a dummy variable, *ManagerChange*, which is equal to one if a stock was sold before the funds' management is replaced, but the repurchase decision is made only after the new fund management has taken over. We identify complete manager changes following Jin and Scherbina (2010): a complete manager change for team managed funds begins when the first new manager arrives and ends when the last old manager leaves<sup>9</sup>; in addition, the replacement period is set to at most 90 days in order to avoid double counting of closely spaced sequential changes. Overall, there are 2.3% complete management changes in our whole sample (Panel A Table 1).

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<sup>9</sup>For single managed funds, a complete manager change begins when a new manager arrives and ends when the old manager leaves.

We then re-run our baseline linear probability models of Table 3, but additionally include an interaction term of our winner dummy with a dummy variable reflecting a complete manager change. Results are presented in Table 7. In all specifications, the coefficient estimates of the interaction term are negative, but they are only statistically significant for the *WinnerFIFO* measure. For example, the result in column (1) means that new fund managers are 0.4% less likely to repurchase previous winners sold by their predecessors than fund managers who remain in charge of the same fund. The decrease is about half of the baseline repurchase bias, according to which fund managers are 0.9% more likely to repurchase previous winners rather than previous losers. Nevertheless, we still observe a significant repurchasing bias even after a complete management change. This may be due to the fact that the new fund management is still supported by the same research and advisory team as the old fund management. This team may also be subject to repurchasing bias and thus recommend buying stocks sold for a gain more frequently than stocks sold for a loss.

In the next step, we analyze whether fund managers are still more likely to repurchase stocks they sold for a gain, even if the sale was made at an earlier fund this fund manager was in charge of before managing the current fund. In this part of our analysis, we restrict our sample to single-managed funds only, because it is less clear whether one of the managers in a team-managed fund responds strongly emotionally to a trading decision made by the team regarding a stock, and then has enough power to influence the decision to repurchase the same stock in another team.

In the following analysis, the sample consists of repurchasing activities and opportunities to repurchase stocks previously sold by a fund manager in another fund she managed before. Thus, the repurchase dummy is now defined on the fund manager level.

To account for the fact that single fund managers may be responsible for several funds at the same point in time and thus sell the same stock through different funds, we calculate previous returns of stocks sold as the average return of the stock across all funds belonging to the same single manager. We then run a regression of the repurchasing dummy on the

main winner dummy with manager fixed effects, time fixed effects and manager  $\times$  time fixed effects after a fund manager has left all funds where she sold a particular stock.

As shown in Panel A of Table 8, fund managers are still 0.2% to 0.3% more likely to repurchase previous winners rather than previous losers in a newly managed fund, even if they have already left all funds where they sold this particular stock. All coefficient estimates are statistically significant at the 1% level. Relative to the average of the repurchase dummy of 0.85% in this sample, the effect of being a previous winner accounts for about 25% of the baseline probability to repurchase a given stock. Results are very similar if we restrict the sample to cases where one manager managed only one fund when she sold a particular stock (Panel B of Table 8). This results supports the view that the repurchasing bias we document is indeed caused by positive (negative) emotions experienced when a stock was previously sold for a gain (loss).

## **5 The impact of repurchasing bias on mutual fund performance**

We now examine whether fund managers' repurchasing bias as documented in the previous section has an impact on mutual fund performance. Retail investors' repurchasing bias may still maximize their utility function if they obtain positive emotions from repurchasing stocks they have sold for a gain. Thus, even if retail investors' repurchasing bias resulted in underperformance of their portfolios, the extra utility obtained from repurchasing a past winner stock may outweigh the financial loss. In contrast, mutual fund managers are clearly supposed to maximize their investors' financial outcome, i.e., fund performance. Any utility they obtain from repurchasing past winner stocks should not lead to increased trading in these stocks, unless these stocks outperform others and thus contribute to a higher fund performance.

To investigate whether fund managers' repurchasing bias affects mutual fund performance, we compute a fund's monthly net return, and its CAPM, Fama-French three-factor and Carhart four-factor alphas as measures of fund performance.<sup>10</sup> We then sort funds into quintiles according to the extent to which they are subject to repurchasing bias. Repurchasing bias is determined by the ratio of PWR and PLR, as shown in Equation 1 and 2. Specifically, we rank funds into quintiles based on their PWR/PLR ratio in the previous quarter or in the current quarter, respectively. Funds with the highest PWR/PLR are included in the top quintiles and funds with the lowest PWR/PLR are in the bottom quintile. Portfolios are formed for each quintile and are held for three months on a quarterly rolling basis. We then compute the equal-weighted performance of the portfolios for each quintile. As shown in Table 9, the difference of returns and alphas between the top quintile and bottom quintile is negative in most cases and is statistically significant in some cases when we measure the bias level in the same quarter as the return difference. Thus, we find some, albeit weak, evidence that mutual funds that are more likely to repurchase winners perform worse.

In the next step, we switch to the stock level to examine whether repurchased winner stocks underperform repurchased loser stocks. If this is the case, we can conclude that mutual fund managers do not repurchase stocks they sold for a gain, because they possess superior information about these stocks and know that they will outperform again in the future. However, they may still repurchase these stocks because of the positive emotional experiences they made when selling them for a gain. As a result, they may even ignore negative information about this stock, which they would otherwise consider when acting purely rational.

To analyze whether stocks sold for a gain underperform stocks sold for a loss after the repurchase, we assign repurchased stocks in each mutual fund portfolio (based on the holdings report at the previous quarter end) to one of two portfolios: repurchased winners and

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<sup>10</sup>The risk factors to compute monthly alphas are obtained from Kenneth French's website: [http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data\\_library.html](http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html).

repurchased losers. Repurchased winners (losers) refer to the stocks that were repurchased within one year after the sale with a gain (loss). We compute monthly returns on the repurchased winners and repurchased losers until the quarter end if the stocks are still held in the fund portfolio during this quarter. Portfolios are rebalanced every quarter. Within a given fund portfolio, stocks are value-weighted by the fund's dollar holdings. Finally, we compute average portfolio values for all funds across time.

Results are presented in Table 10. We find that repurchased winner stocks significantly underperform repurchased loser stocks in the quarter after they are repurchased. Specifically, annual returns of repurchased winner stocks are 5.35% lower than repurchased loser stocks and the difference is statistically significant if winner stocks are defined based on the *WinnerFIFO* measure. CAPM, Fama-French three-factor, and Carhart four-factor alphas are also lower for the repurchased winner portfolio. The difference is particularly pronounced for the Carhart four-factor alpha, which accounts for the momentum effect. The Carhart four-factor alpha of the repurchased winner portfolio is more than 4% lower than that of the repurchased loser portfolio for both winner dummies, *WinnerFIFO* and *WinnerLHP*.

Finally, we examine how returns of repurchased winners and losers would have developed if a mutual fund did not sell and repurchase a particular stock, but held them in its portfolio for a longer period of time. If mutual funds are able to avoid a drop in the stock price by selling the stock and repurchasing it again later, we can regard the avoidance as timing ability of fund managers. However, if the stock price increases after the sale and mutual funds repurchase the stock at a higher price, it is surprising why a fund sells and repurchases the stock instead of just keeping it in its portfolio.

We focus on the stock returns that mutual funds have foregone between the sale and the repurchase of repurchased stocks. Specifically, we construct a portfolio with repurchased stocks in each mutual fund in the months between the sale and the repurchase of the stock. We compute monthly returns on the repurchased stocks in the fund portfolio, weighted by



the fund's dollar holdings. We then compute the average portfolio return across all funds. Results are presented in Panel A of Table 11.

Both, raw returns and alphas of the portfolio comprising repurchased stocks are positive and most of them are statistically significant, except for the Fama French three-factor alpha. The raw annual return amounts to 17.81% and the risk-adjusted alphas are about 3% p.a. This finding suggests that repurchased stocks outperform after they have been sold. Thus, a mutual fund would have benefited from keeping these stocks in its portfolio.

In the next step, we use the same portfolio construction method and form portfolios for repurchased winners and repurchased losers separately. We then test the long-short returns of these two portfolios against a zero return. As shown in Panels B and C of Table 11, the difference in returns of repurchased winner portfolio and repurchased loser portfolio is as high as 10% p.a. and is statistically significant at the 5% or 10% level. This means that mutual funds forego higher returns when they sell and repurchase previous winners. Furthermore, we observe negative risk-adjusted returns in repurchased losers but only one of them is statistically significant from zero.

Note, that the potential losses presented here can be compounded with the harm of the disposition effect and reflect that mutual funds may miss some opportunities to gain by selling winners too early. We conclude that the repurchasing bias towards stocks sold for a gain cannot be information driven, since mutual funds would have been better off if they just kept these stocks in their portfolios.

Taken together, our analysis shows that mutual fund managers' repurchasing bias does not seem to be due to superior information they possess about these stocks and harms the performance of these funds to the detriment of their investors. Besides, mutual funds would have performed better if they kept the repurchased stocks in their portfolios for a longer time period instead of selling and repurchasing the stocks.

## 6 Conclusion

This paper provides the first evidence that mutual funds are biased towards repurchasing stocks that they previously sold for a gain rather than for a loss. We conjecture that this behavior is driven by a preference to re-experience the positive emotions evoked when they sold the stock for a gain. In contrast, mutual fund managers try to avoid re-experiencing negative emotions like regret or disappointment that were triggered when a stock was sold for a loss before. In line with this view, we find that repurchasing bias at a given fund is strongly reduced after a complete replacement of the fund management. Furthermore, even after a fund manager leaves the fund where she sold a particular stock for a gain, she is still more likely to repurchase this stock at the new fund she is now in charge of.

We do not find support for the view that mutual funds are biased towards repurchasing past winner stocks because of superior information, betting on momentum, or because past winner stocks generally outperform past loser stocks. In contrast, repurchased winners underperform repurchased losers by around 5% p.a. after the repurchase.

Our results are important for investors delegating portfolio management to actively managed funds, by highlighting that mutual fund managers are subject to behavioral biases, too. The results imply that investors may be better off investing in a passively managed fund that, by definition, does not engage in this type of trading behavior.

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# Appendix

## A Variable description

This table briefly defines the main variables used in the empirical analysis. The data sources are listed as follows:

1. TR Holdings: the Thomson Reuters Mutual Funds Holdings Database
2. CRSP Stock: the CRSP U.S. Stock Database
3. CRSP Fund: the CRSP Survivorship-Bias-Free Mutual Fund Database
4. Financial Ratios: the Financial Ratios Firm Level database by WRDS
5. French Website: the Data Library on Kenneth French's website
6. Estimated: we construct the variables using the data from the corresponding databases

Variable name	Description	Data Source
$Repurchase_{i,j,q}$	Dummy variable equal to one if stock $j$ sold by fund $i$ is repurchased in quarter $q$ within one year after the sale.	TR Holdings, Estimated
$WinnerFIFO_{i,j,t}$	Dummy variable equal to one if the distribution-adjusted price of stock $j$ at the time of sale $t$ is higher than its average purchase price calculated with first-in-first-out principle.	CRSP Stock, TR Holdings, Estimated
$WinnerLHP_{i,j,t}$	Dummy variable equal to one if the return of stock $j$ in the last holding period of the fund is larger than zero.	CRSP Stock, TR Holdings, Estimated
$CInflow_{i,j,t}$	Dummy variable equal to one if fund $i$ encounters an inflow when it sells stock $j$ to zero position.	CRSP Fund, TR Holdings, Estimated
$Priceup_{i,j,q}$	Dummy variable equal to one if the price of stock $j$ sold by fund $i$ has increased since the sale.	CRSP Stock, TR Holdings, Estimated
$FundSize_{i,q}$	Logarithm of the total net assets of fund $i$ in quarter $q$ .	CRSP Fund, Estimated
$FundAge_{i,q}$	Fund age in quarter $q$ .	CRSP Fund, Estimated
$FundTurnoverRatio_{i,q}$	Fund turnover over a year.	CRSP Fund
$FundExpenseRatio_{i,q}$	Annual expense ratio of a fund.	CRSP Fund

Variable name	Description	Data Source
$FundReturnVolatility_{i,q}$	Annualized volatility of fund monthly net returns.	CRSP Fund, Estimated
$FundRanking_{i,q}$	Annual rank of a fund by ordering all funds with the same CRSP objective code.	CRSP Fund
$NWR(NLR)$	No. of Winners(Losers) Repurchased accumulated across the sample.	CRSP Stock, TR Holdings, Estimated
$ORW(ORL)$	No. of Opportunities to Repurchase Winners(Losers) accumulated across the sample.	CRSP Stock, TR Holdings, Estimated
$PWR(PLR)$	Proportion of Winners/Losers Repurchased accumulated across the sample.	CRSP Stock, TR Holdings, Estimated
$CAPM\alpha_{i,m}$	$\alpha$ from the regression of fund returns under CAPM in month $m$ .	CRSP Fund, French Website, Estimated
$FF3\alpha_{i,m}$	$\alpha$ from the regression of fund returns under Fama-French three-factor model in month $m$ .	CRSP Fund, French Website, Estimated
$Carhart4\alpha_{i,m}$	$\alpha$ from the regression of fund returns under Carhart four-factor model in month $m$ .	CRSP Fund, French Website, Estimated

## B Top 20 funds and stocks most involved in repurchasing bias

This table lists the name of 20 funds that repurchase most (Panel A) and the name of 20 stocks that are most repurchased (Panel B). In Panel A, No. of Repurchase accumulates the number of times that a fund repurchases stocks within one year after the sale and No. of Sales accumulates the number of sales of a fund across the whole sample period from 1980 to 2014. Repurchase Rate equals to No. of Repurchase divided by No. of Sales. The funds with the bottom 10% No. of Sales (less than 7) are excluded to avoid a high Repurchase Rate because of the extremely low number of observations in sales of the fund. In Panel B, No. of Repurchase accumulates the number of times a stock is repurchased and No. of Sales accumulates the number of sales of a stock across the whole sample period from 1980 to 2014. The stocks are sorted according to No. of Repurchase. Repurchase Rate equals to No. of Repurchase divided by No. of Sales.

Panel A: Top 20 Funds that Repurchase Most

Fund Name	No. of Repurchase	No. of Sales	Repurchase Rate
VOYA PARTNERS, INC: VY OPPENHEIMER GLOBAL PORTFOLIO	28	34	82%
EQ ADVISORS TRUST: EQ/INVESCO COMSTOCK PORTFOLIO	53	88	60%
OLYMPIC TRUST-SMALL CAP FUND	5	9	56%
INVESTMENT HOUSE FUNDS: INVESTMENT HOUSE GROWTH FUND	34	65	52%
CREDIT SUISSE WARBURG PINCUS VALUE II FUND	27	52	52%
ALLIANCEBERNSTEIN BLENDED STYLE SERIES, INC: ALLIANCEBERNSTEIN 2040 RETIREMENT STRATEGY	900	1877	48%
AMG FUNDS I: AMG FRONTIER SMALL CAP GROWTH FUND	73	153	48%
COLUMBIA FUNDS SERIES TRUST II: COLUMBIA GLOBAL EQUITY VALUE FUND	58	123	47%
UNION INVESTORS VALUE MOMENTUM	7	15	47%
ALLIANCEBERNSTEIN BLENDED STYLE SERIES, INC: ALLIANCEBERNSTEIN 2055 RETIREMENT STRATEGY	241	530	45%
VOYA INVESTORS TRUST: VOYA MULTI-MANAGER LARGE CAP CORE PORTFOLIO	66	148	45%
VOYA PARTNERS, INC: VY AMERICAN CENTURY SMALL-MID CAP VALUE PORTFOLIO	217	494	44%
DAVIS SERIES, INC: DAVIS APPRECIATION & INCOME FUND	23	54	43%
BLACKROCK FUNDS: BLACKROCK ENERGY & RESOURCES PORTFOLIO	62	156	40%
VOYA EQUITY TRUST: VOYA LARGE CAP VALUE FUND	44	114	39%
JACKSON NATIONAL CAP MGMT:GROWTH FUND	153	397	39%
CREDIT SUISSE TRUST: US EQUITY FLEX II PORTFOLIO	6	16	38%
MEMBERS MUTUAL FUNDS: SMALL CAP FUND	43	115	37%
VOYA INVESTORS TRUST: VOYA LARGE CAP GROWTH PORTFOLIO	40	107	37%
BLACKROCK FUNDS: GLOBAL RESOURCES PORTFOLIO	86	231	37%



Panel B: Top 20 Stocks that are Most Likely to be Repurchased

Company Name	No. of Repurchase	No. of Sales	Repurchase Rate
INTERNATIONAL BUSINESS MACHS COR	1272	11940	11%
TEXAS INSTRUMENTS INC	1241	11771	11%
INTEL CORP	1238	10593	12%
HEWLETT PACKARD CO	1228	12413	10%
MICROSOFT CORP	1067	7730	14%
PFIZER INC	1066	11425	9%
GENERAL ELECTRIC CO	1065	9598	11%
JOHNSON & JOHNSON	1052	10797	10%
MOTOROLA INC	1042	12266	8%
E M C CORP MA	1026	10503	10%
PROCTER & GAMBLE CO	995	9183	11%
HALIBURTON COMPANY	966	10312	9%
QUALCOMM INC	936	7110	13%
AMGEN INC	935	8770	11%
MORGAN STANLEY DEAN WITTER D & C	931	8268	11%
GILEAD SCIENCES INC	914	6021	15%
HOME DEPOT INC	900	9330	10%
DISNEY WALT PRODUCTIONS	895	10335	9%
GOLDMAN SACHS GROUP INC	886	7130	12%
BANK OF AMERICA CORP	880	7203	12%

## C Correlations between variables in the analysis

This table shows the pairwise correlation coefficients between variables in the analysis. Note that the variables of interest WinnerLHP and WinnerFIFO are never used in the same model so the correlation between them does not have any multicollinearity concern. The detailed description of the variables is contained in Appendix A. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	WinnerFIFO	WinnerLHP	PriceUp	CInflow	Team	Manager Change	Fund Size	Fund Age	Fund Turnover Ratio	Fund Expense Ratio	Fund Return Volatility	Fund Ranking
WinnerFIFO	1.000											
WinnerLHP	0.630***	1.000										
Price Up	0.017***	0.015***	1.000									
CInflow	0.021***	0.012***	-0.017***	1.000								
Team	0.004***	0.008***	0.010***	-0.054***	1.000							
Manager Change	-0.002***	-0.001***	0.000	-0.032***	-0.033***	1.000						
Fund Size	0.038***	0.027***	0.021***	0.046***	-0.013***	-0.004***	1.000					
Fund Age	0.024***	0.009***	0.018***	-0.148***	-0.062***	0.016***	0.388***	1.000				
Fund Turnover Ratio	-0.025***	-0.023***	-0.011***	-0.010***	-0.052***	0.019***	-0.196***	-0.109***	1.000			
Fund Expense Ratio	-0.027***	-0.027***	-0.019***	-0.007***	-0.031***	0.009***	-0.352***	-0.213***	0.295***	1.000		
Fund Return Volatility	-0.192***	-0.139***	-0.071***	-0.008***	-0.015***	0.005***	-0.081***	-0.078***	0.098***	0.074***	1.000	
Fund Ranking	0.047***	0.045***	0.043***	0.036***	-0.017***	0.002***	0.053***	0.027***	-0.064***	-0.096***	-0.137***	1.000

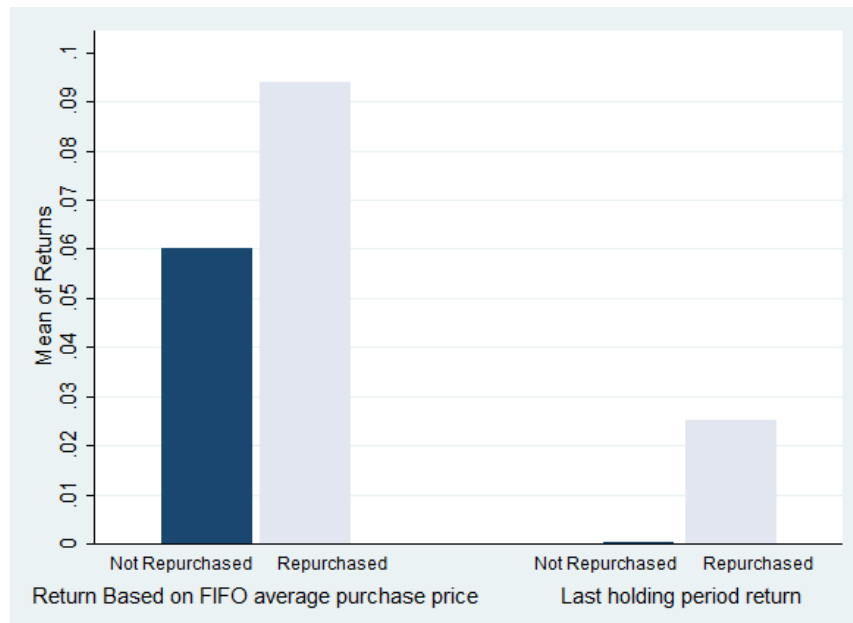
## D The tax saving wash-sale rule and the repurchasing behavior

This table examines whether the finding that previous winners are more likely to be repurchased by mutual funds is driven by the wash-sale rule. The “wash-sale rule” refers to the fact that if a stock sold for a loss is repurchased within 30 days, tax payers cannot claim the capital loss. If mutual funds try to minimize tax consequences to fund investors, they may be less likely to repurchase previous losers in the month after selling the stocks. We exclude the observations in the first quarter after the sale to address the possibility of this tax saving behavior. The table contains the result of the linear probability models the same as in Table 3. Column (1) and (4) are univariate models. Column (2) and Column (5) control for all the fund characteristics. Stock, fund and time fixed effects are included in these regressions. Column (3) and (6) further control for fund×time fixed effects. *t*-statistics are provided in parentheses. The standard errors are clustered by fund. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Winner measure: WinnerFIFO			Winner measure: WinnerLHP		
	(1)	(2)	(3)	(4)	(5)	(6)
WinnerFIFO	0.006*** (18.78)	0.007*** (18.22)	0.007*** (23.36)			
WinnerLHP				0.005*** (14.82)	0.006*** (15.11)	0.006*** (18.99)
Fund Size		0.003*** (3.86)			0.003*** (3.81)	
Fund Age		-0.000** (-2.06)			-0.000** (-2.13)	
Fund Turnover Ratio		0.004*** (6.48)			0.004*** (6.67)	
Fund Expense Ratio		0.120 (0.50)			0.169 (0.72)	
Fund Return Volatility		-0.006 (-0.62)			-0.006 (-0.64)	
Fund Ranking		-0.005*** (-3.68)			-0.005*** (-3.67)	
Stock Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Fund Fixed Effect	Yes	Yes	No	Yes	Yes	No
Time Fixed Effect	Yes	Yes	No	Yes	Yes	No
Fund×Time Fixed Effect	No	No	Yes	No	No	Yes
Observations	4896131	3988699	4887814	5087894	4128182	5080040
Adjusted $R^2$	0.031	0.032	0.084	0.031	0.032	0.084

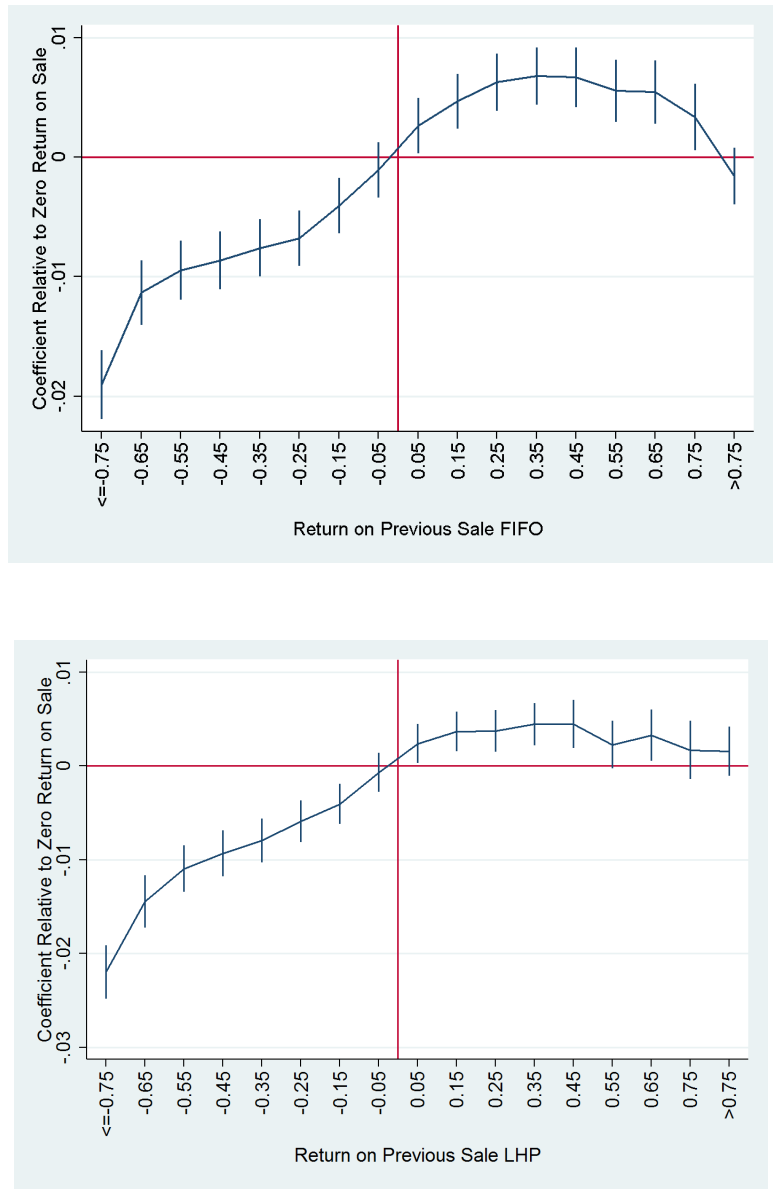
**Figure 1: Average returns of stocks sold that are (not) repurchased**

This figure plots the average returns in groups of stocks repurchased and stocks sold but not repurchased. Returns realized in the previous sale are measured by either the difference between the price at sales and the average purchase price calculated with the first-in-first-out principle (same as the winner measure, WinnerFIFO) or the recent returns in the last holding period before the sale (same as the winner measure, WinnerLHP). We sort the returns based on whether the stock is repurchased or not. A stock is defined as repurchased if it has been sold completely and then is repurchased by the same fund within one year.



**Figure 2: Coefficients for repurchasing a stock sold at various return intervals**

This figure plots the coefficients of corresponding return intervals relative to the coefficients of zero returns on the previous sales in the linear probability model with the stock, fund and time fixed effects. The vertical lines indicate the 95% confidence interval. Standard errors are clustered by fund.



**Table 1: Summary statistics**

Panel A of this table shows the descriptive statistics of variables in the sample of stocks sold by U.S actively managed equity funds from January 1980 to December 2014. The number of observations (Obs), means, medians, standard deviations (Std. Dev.), minimum (Min) and maximum (Max) are reported. The detailed description of the variables is contained in Appendix A. Panel B shows the average of winner dummies as well as the average characteristics of funds in groups of stocks repurchased and stocks sold but not repurchased. Panel C presents the average of repurchase dummies as well as the average characteristics of funds in groups of previous winners and previous losers for the WinnerFIFO measure. The difference between the average characteristics are reported under the column “Diff”. Significance is calculated based on a two-sided t-test and the standard errors are clustered by fund and time. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Descriptive Statistics						
	Obs	Mean	Median	Std. Dev.	Min	Max
Variables on the stock-fund-quarter level						
Repurchase	7,521,881	0.052	0	0.222	0	1
WinnerFIFO	6,845,158	0.501	1	0.500	0	1
WinnerLHP	7,109,272	0.475	0	0.499	0	1
Price Up	5,703,662	0.565	1	0.496	0	1
CInflow	6,467,896	0.429	0	0.495	0	1
Team	6,131,280	0.608	1	0.488	0	1
Manager Change	7,521,881	0.023	0	0.148	0	1
Variables on the fund-quarter level						
Fund Size	148,386	5.508	5.428	1.729	-5.521	12.218
Fund Age	156,763	13.905	9.833	13.310	0	90.250
Fund Turnover Ratio	139,753	0.899	0.660	0.892	0.030	6.690
Fund Expense Ratio	143,936	0.013	0.012	0.004	0	0.029
Fund Return Volatility	145,580	0.169	0.152	0.087	0.002	1.115
Fund Ranking	156,879	0.516	0.519	0.282	0.001	1
Panel B: Comparison between stocks that are (not) repurchased						
	Mean		Std. Dev.		Diff	t
	Repurchased	Not Repurchased	Repurchased	Not Repurchased		
WinnerFIFO	0.557	0.498	0.497	0.500	0.059***	7.08
WinnerLHP	0.516	0.472	0.500	0.499	0.043***	6.47
PriceUp	0.626	0.561	0.484	0.496	0.064***	9.37
CInflow	0.418	0.429	0.493	0.495	-0.011	-1.06
Team	0.639	0.606	0.480	0.489	0.033***	3.05
Manager Change	0.020	0.023	0.140	0.149	-0.003**	-2.26
Fund Size	5.874	5.697	1.684	1.693	0.177***	5.82
Fund Age	13.781	13.664	13.194	12.827	0.116	0.51
Fund Turnover Ratio	1.408	1.236	1.259	1.038	0.172***	3.49
Fund Expense Ratio	0.012	0.013	0.005	0.004	-0.001***	-2.88
Fund Return Volatility	0.168	0.175	0.086	0.088	-0.007***	-2.50
Fund Ranking	0.503	0.514	0.266	0.274	-0.010***	-3.17

Panel C: Comparison between stocks sold for a gain (loss) according to WinnerFIFO

	Mean		Std. Dev.		Diff	t
	Previous Winner	Previous Loser	Previous Winner	Previous Loser		
Repurchase	0.058	0.047	0.225	0.211	0.012***	6.59
PriceUp	0.574	0.557	0.493	0.497	0.017	1.02
Cinflow	0.428	0.407	0.495	0.491	0.021**	2.25
Team	0.614	0.610	0.487	0.488	0.004	0.57
Manaaer Change	0.022	0.023	0.148	0.150	-0.001	-0.78
Fund Size	5.821	5.692	1.685	1.680	0.129***	5.91
Fund Age	14.351	13.732	13.061	12.859	0.620***	4.47
Fund Turnover Ratio	1.213	1.266	1.021	1.056	-0.051***	-3.93
Fund Expense Ratio	0.012	0.013	0.004	0.004	-0.001***	-3.16
Fund Return Volatility	0.156	0.189	0.074	0.092	-0.033***	-7.30
Fund Ranking	0.526	0.500	0.271	0.273	0.026***	4.97

**Table 2: Repurchase of stocks previously sold for a gain versus stocks previously sold for a loss**

This table presents the difference between Proportion of Winners Repurchased (PWR) and Proportion of Losers Repurchased (PLR) aggregated in the sample. PWR (PLR) is the ratio between NWR (NLR) and ORW (OLR). NWR (NLR) and ORW (OLR), number of winners (losers) repurchased and opportunities to repurchase winners (losers) are defined in Appendix A. Winner stocks are measured by both WinnerFIFO and WinnerLHP. The t-statistics test the differences in the proportions against zero. We assume that realized repurchases are independent observations when computing the standard errors. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1) WinnerFIFO	(2) WinnerLHP
NWR	201,680	192,616
ORW	3,430,223	3,378,140
PWR	0.059	0.057
NLR	160,508	180,420
ORL	3,414,935	3,731,132
PLR	0.047	0.048
Diff (PWR-PLR)	0.012***	0.009***
t-stats (PWR=PLR)	(15.75)	(11.86)



**Table 3: Are previous winners more likely to be repurchased by funds?**

This table examines whether mutual funds are more likely to repurchase previous winners compared with previous losers with the linear probability models. The dependent variable is Repurchase, a dummy variable equal to one if the stock sold is repurchased by the fund in the quarter within one year after the sale. The variable of interest is the winner dummy, which equals one if the stock was previously sold for a gain by the fund. Panel A shows the results when winners are measured by WinnerFIFO while Panel B shows the results when winners are measured by WinnerLHP. Control variables include fund characteristics (Fund Size, Fund Age, Fund Turnover Ratio, Fund Expense Ratio, Fund Return Volatility, Fund Ranking), which are all defined in Appendix A. Column (1) and (4) are univariate models. Column (2) and Column (5) control for all the fund characteristics. Stock, fund and time fixed effects are included in these regressions. Column (3) and Column (6) further control for fund×time fixed effects. *t*-statistics are provided in parentheses. The standard errors are clustered by fund. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Winner measure: WinnerFIFO			Winner measure: WinnerLHP		
	(1)	(2)	(3)	(4)	(5)	(6)
WinnerFIFO	0.009*** (24.13)	0.009*** (22.77)	0.009*** (29.36)			
WinnerLHP				0.006*** (16.33)	0.007*** (15.87)	0.007*** (21.71)
Fund Size		0.003*** (3.22)			0.003*** (3.16)	
Fund Age		0.000 (0.16)			0.000 (0.12)	
Fund Turnover Ratio		0.005*** (7.19)			0.005*** (7.28)	
Fund Expense Ratio		-0.175 (-0.50)			-0.167 (-0.49)	
Fund Return Volatility		-0.008 (-0.70)			-0.008 (-0.72)	
Fund Ranking		-0.005*** (-2.93)			-0.005*** (-3.03)	
Stock Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Fund Fixed Effect	Yes	Yes	No	Yes	Yes	No
Time Fixed Effect	Yes	Yes	No	Yes	Yes	No
Fund×Time Fixed Effect	No	No	Yes	No	No	Yes
Observations	6,844,959	5,592,522	6,837,715	7,109,075	5,782,484	7,102,299
Adjusted $R^2$	0.039	0.040	0.115	0.038	0.040	0.114

**Table 4: The impact of fund flows on fund managers' repurchasing probability**

This table contains the results of the linear probability models with interaction terms of winner dummies and the contemporaneous inflow dummy. The dependent variable is Repurchase, a dummy variable equal to one if the stock sold is repurchased by the fund in the quarter within one year after the sale. CInflow is a dummy variable equal to one when the fund encountered an inflow when selling the stock. The winner dummy equals one if the stock was previously sold for a gain by the fund. Panel A shows the results when winners are measured by WinnerFIFO while Panel B shows the results when winners are measured by WinnerLHP. The variable of interest is the interaction term between CInflow and the winner dummy. Control variables include fund characteristics (Fund Size, Fund Age, Fund Turnover Ratio, Fund Expense Ratio, Fund Return Volatility, Fund Ranking), which are all defined in Appendix A. Column (1) and (4) are univariate models. Column (2) and Column (5) control for all the fund characteristics. Stock, fund and time fixed effects are included in these regressions. Column (3) and Column (6) further control for fund×time fixed effects. *t*-statistics are provided in parentheses. The standard errors are clustered by fund. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Winner measure: WinnerFIFO			Winner measure: WinnerLHP		
	(1)	(2)	(3)	(4)	(5)	(6)
WinnerFIFO × CInflow	0.001 (1.17)	0.001 (1.13)	0.000 (0.55)			
WinnerLHP × CInflow				0.002* (1.89)	0.002* (1.86)	0.000 (0.76)
WinnerFIFO	0.008*** (15.82)	0.009*** (16.39)	0.009*** (22.65)			
WinnerLHP				0.006*** (10.08)	0.006*** (10.64)	0.007*** (17.26)
CInflow	0.001 (0.62)	-0.001 (-0.53)	-0.003*** (-4.42)	0.001 (0.54)	-0.001 (-0.61)	-0.003*** (-4.27)
Fund Size		0.003*** (3.19)			0.003*** (3.11)	
Fund Age		0.000 (0.13)			0.000 (0.11)	
Fund Turnover Ratio		0.005*** (7.11)			0.005*** (7.23)	
Fund Expense Ratio		-0.175 (-0.50)			-0.165 (-0.49)	
Fund Return Volatility		-0.008 (-0.67)			-0.008 (-0.72)	
Fund Ranking		-0.005*** (-2.89)			-0.005*** (-3.00)	
Stock Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Fund Fixed Effect	Yes	Yes	No	Yes	Yes	No
Time Fixed Effect	Yes	Yes	No	Yes	Yes	No
Fund×Time Fixed Effect	No	No	Yes	No	No	Yes
Observations	5,982,979	5,535,542	5,977,526	6,195,385	5,717,790	6,190,138
Adjusted $R^2$	0.039	0.040	0.111	0.039	0.040	0.111

**Table 5: The impact of subsequent price changes of sold stocks on repurchasing probability**

This table contains the results of the linear probability models with interaction terms of winner dummies and the contemporaneous inflow dummy. The dependent variable is Repurchase, a dummy variable equal to one if the stock sold is repurchased by the fund in the quarter within one year after the sale. Price Up is a dummy variable equal to one if the price of the stock has increased since the sale. The winner dummy equals one if the stock was previously sold for a gain by the fund. Panel A shows the results when winners are measured by WinnerFIFO while Panel B shows the results when winners are measured by WinnerLHP. The variable of interest is the the interaction term between Price up and the winner dummy. Control variables include fund characteristics (Fund Size, Fund Age, Fund Turnover Ratio, Fund Expense Ratio, Fund Return Volatility, Fund Ranking), which are all defined in Appendix A. Column (1) and (4) are univariate models. Column (2) and Column (5) control for all the fund characteristics. Stock, fund and time fixed effects are included in these regressions. Column (3) and Column (6) further control for fund $\times$ time fixed effects.  $t$ -statistics are provided in parentheses. The standard errors are clustered by fund. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Winner measure: WinnerFIFO			Winner measure: WinnerLHP		
	(1)	(2)	(3)	(4)	(5)	(6)
WinnerFIFO $\times$ Price Up	-0.012*** (-20.74)	-0.012*** (-19.65)	-0.012*** (-23.17)			
WinnerLHP $\times$ Price Up				-0.009*** (-17.08)	-0.009*** (-16.18)	-0.009*** (-18.76)
WinnerFIFO	0.016*** (34.31)	0.017*** (33.05)	0.017*** (40.97)			
WinnerLHP				0.012*** (25.83)	0.013*** (25.05)	0.013*** (32.70)
Price Up	0.020*** (32.79)	0.021*** (32.01)	0.021*** (34.60)	0.018*** (29.34)	0.019*** (28.57)	0.019*** (31.15)
Fund Size		0.003*** (2.72)			0.003*** (2.66)	
Fund Age		0.000 (0.28)			0.000 (0.30)	
Fund Turnover Ratio		0.005*** (6.82)			0.005*** (6.86)	
Fund Expense Ratio		-0.346 (-0.95)			-0.341 (-0.96)	
Fund Return Volatility		-0.009 (-0.67)			-0.009 (-0.71)	
Fund Ranking		-0.005*** (-3.10)			-0.005*** (-3.22)	
Stock Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Fund Fixed Effect	Yes	Yes	No	Yes	Yes	No
Time Fixed Effect	Yes	Yes	No	Yes	Yes	No
Fund $\times$ Time Fixed Effect	No	No	Yes	No	No	Yes
Observations	5,303,062	4,571,412	5,295,512	5,469,479	4,703,834	5,462,128
Adjusted $R^2$	0.042	0.044	0.121	0.041	0.043	0.120

**Table 6: Team- or single- managed funds and repurchasing behavior**

This table contains the results of the linear probability models with interaction terms of winner dummies and the team dummy. The dependent variable is Repurchase, a dummy variable equal to one if the stock sold is repurchased by the fund in the quarter within one year after the sale. Team is a dummy variable equal to one if the fund is team-managed in the quarter. The winner dummy equals one if the stock was previously sold for a gain by the fund. Panel A shows the results when winners are measured by WinnerFIFO while Panel B shows the results when winners are measured by WinnerLHP. The variable of interest is the interaction terms between Team and winner dummies. Control variables include fund characteristics (Fund Size, Fund Age, Fund Turnover Ratio, Fund Expense Ratio, Fund Return Volatility, Fund Ranking), which are all defined in Appendix A. Column (1) and (4) are univariate models. Column (2) and Column (5) control for all the fund characteristics. Stock, fund and time fixed effects are included in these regressions. *t*-statistics are provided in parentheses. The standard errors are clustered by fund. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Winner measure: WinnerFIFO		Winner measure: WinnerLHP	
	(1)	(2)	(3)	(4)
WinnerFIFO × Team	0.002** (2.07)	0.002** (2.01)		
WinnerLHP × Team			0.001 (0.68)	0.001 (0.58)
WinnerFIFO	0.008*** (11.63)	0.008*** (11.10)		
WinnerLHP			0.006*** (9.78)	0.007*** (9.45)
Team	-0.001 (-0.56)	-0.001 (-0.37)	0.000 (0.04)	0.000 (0.23)
Fund Size		0.003*** (2.96)		0.003*** (2.92)
Fund Age		0.000 (0.79)		0.000 (0.74)
Fund Turnover Ratio		0.005*** (6.84)		0.005*** (6.93)
Fund Expense Ratio		-0.228 (-0.61)		-0.231 (-0.64)
Fund Return Volatility		-0.006 (-0.51)		-0.006 (-0.54)
Fund Ranking		-0.005*** (-3.02)		-0.005*** (-3.10)
Stock Fixed Effect	Yes	Yes	Yes	Yes
Fund Fixed Effect	Yes	Yes	Yes	Yes
Time Fixed Effect	Yes	Yes	Yes	Yes
Observations	5,608,530	5,287,957	5,811,030	5,464,624
Adjusted $R^2$	0.040	0.041	0.039	0.040

**Table 7: Repurchasing behavior after manager change**

This table contains the results of the linear probability models with interaction terms of winner dummies and the manager change dummy. The dependent variable is Repurchase, a dummy variable equal to one if the stock sold is repurchased by the fund in the quarter within one year after the sale. Manager change is a dummy variable equal to one if the stock was sold before a complete manager change and the quarter to make a repurchase decision is after the complete manager change. A complete manager change begins when the first new manager arrives and ends when the last old manager leaves (Jin and Scherbina (2010)). The winner dummy equals one if the stock was previously sold for a gain by the fund. Panel A shows the results when winners are measured by WinnerFIFO while Panel B shows the results when winners are measured by WinnerLHP. The variable of interest is the interaction term of Manager Change and the winner dummy. Control variables include fund characteristics (Fund Size, Fund Age, Fund Turnover Ratio, Fund Expense Ratio, Fund Return Volatility, Fund Ranking), which are all defined in Appendix A. Column (1) and (4) are univariate models. Column (2) and Column (5) control for all the fund characteristics. Stock, fund and time fixed effects are included in these regressions. Column (3) and Column (6) further control for fund×time fixed effects. *t*-statistics are provided in parentheses. The standard errors are clustered by fund. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Winner measure: WinnerFIFO			Winner measure: WinnerLHP		
	(1)	(2)	(3)	(4)	(5)	(6)
WinnerFIFO × Manager Change	-0.004** (-2.34)	-0.004** (-2.12)	-0.002* (-1.71)			
WinnerLHP × Manager Change				-0.002 (-1.05)	-0.002 (-1.10)	-0.000 (-0.14)
WinnerFIFO	0.009*** (24.01)	0.009*** (22.61)	0.009*** (29.07)			
WinnerLHP				0.006*** (16.28)	0.007*** (15.77)	0.007*** (21.31)
Manager Change	-0.001 (-0.83)	-0.000 (-0.21)	-0.001 (-0.67)	-0.003* (-1.73)	-0.001 (-0.91)	-0.002 (-1.51)
Fund Size		0.003*** (3.22)			0.003*** (3.16)	
Fund Age		0.000 (0.17)			0.000 (0.14)	
Fund Turnover Ratio		0.005*** (7.21)			0.005*** (7.30)	
Fund Expense Ratio		-0.174 (-0.50)			-0.166 (-0.49)	
Fund Return Volatility		-0.008 (-0.70)			-0.008 (-0.72)	
Fund Ranking		-0.005*** (-2.93)			-0.005*** (-3.03)	
Stock Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Fund Fixed Effect	Yes	Yes	No	Yes	Yes	No
Time Fixed Effect	Yes	Yes	No	Yes	Yes	No
Fund×Time Fixed Effect	No	No	Yes	No	No	Yes
Observations	6,844,959	5,592,522	6,837,715	7,109,075	5,782,484	7,102,299
Adjusted $R^2$	0.039	0.040	0.115	0.038	0.040	0.114

**Table 8: Repurchasing behavior after a manager leaves a single-managed fund**

This table examines whether single-managed mutual funds are more likely to repurchase previous winners sold by them in several funds (a fund) after they leaves all the funds (the fund) with the linear probability models. The dependent variable is Repurchase, a dummy variable equal to one if the stock sold is repurchased by the fund manager in the quarter within one year after the sale. The variable of interest is the winner dummy, which equals one if the stock was previously sold for a gain by the fund manager. Winners are measured by both WinnerFIFO and WinnerLHP as defined in Appendix A. Panel A shows the results when previous returns are estimated with the average returns on a stock across the funds through which a manager previously sold the stock. Panel B includes only the cases where one manager managed only one fund when they sold the stocks. Column (1) and (3) further control for manager and time fixed effects and Column (2) and Column (4) further control for manager  $\times$  time fixed effects.  $t$ -statistics are provided in parentheses. The standard errors are clustered by fund. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	Winner measure: WinnerFIFO		Winner measure: WinnerLHP	
	(1)	(2)	(3)	(4)
Panel A: Single-managed funds				
WinnerFIFO	0.003*** (3.95)	0.002*** (4.06)		
WinnerLHP			0.002*** (3.01)	0.002*** (3.11)
Observations	105289	105119	109453	109282
Adjusted $R^2$	0.093	0.196	0.091	0.191
Panel B: Single-managed funds and only managers in charge of one fund				
WinnerFIFO	0.003*** (3.92)	0.002*** (3.89)		
WinnerLHP			0.002*** (2.79)	0.002*** (2.98)
Observations	94,855	94,656	98,859	98,657
Adjusted $R^2$	0.109	0.211	0.106	0.205
Manager Fixed Effect	Yes	No	Yes	No
Time Fixed Effect	Yes	No	Yes	No
Manager $\times$ Time Fixed Effect	No	Yes	No	Yes

**Table 9: Quintile fund portfolio returns formed on PWR/PLR ratio**

This table presents the fund returns and risk-adjusted returns of quintile portfolios based on the ranking on the ratio of PWR and PLR. PWR and PLR are defined in Appendix A. At the beginning of each quarter, we rank funds into quintiles based on their PWR/PLR ratio in the previous quarter (Panel A and Panel B) or in the current quarter (Panel C and Panel D). Funds with the highest PWR/PLR are included in the top quintile and funds with the lowest PWR/PLR are included in the bottom quintile. Portfolios are formed with funds in each quintile and are held for three months on a quarterly rolling basis. Column “N” reports the number of observations in each portfolio. Monthly Return represents equal-weighted fund returns in each portfolio. CAPM $\alpha$ , FF3 $\alpha$  and Carhart $\alpha$  refers to CAPM, Fama-French three-factor (Fama and French (1993)) and Carhart four-factor (Carhart (1997)) risk-adjusted returns for each portfolio. Panel A and Panel C show the results when winners are measured by WinnerFIFO while Panel B and Panel D show the results when winners are measured by WinnerLHP. Rows of “5-1” present the difference between the top and bottom quintiles. Returns are in annual percentage. T-statistics from two-sided t tests of the difference against zero are reported and the 10% level statistical significance is indicated in bold.

Panel A: Sorting based on PWR/PLR of the previous quarter (WinnerFIFO)					
Bias Quintile	N	Monthly Return	CAPM $\alpha$	FF3 $\alpha$	Carhart $\alpha$
1	319	10.99%	-0.84%	-1.18%	-1.18%
2	261	10.03%	0.08%	-0.09%	-0.16%
3	302	11.21%	0.02%	-0.37%	-0.52%
4	312	11.31%	-0.65%	-0.81%	-1.03%
5	329	10.03%	-1.20%	-1.10%	-1.15%
5-1	319	-0.16%	-0.44%	0.00%	-0.05%
t statistics		-0.33	-0.91	-0.01	-0.10
Panel B: Sorting based on PWR/PLR of the previous quarter (WinnerLHP)					
Bias Quintile	N	Monthly Return	CAPM $\alpha$	FF3 $\alpha$	Carhart $\alpha$
1	322	10.68%	-0.76%	-1.08%	-0.95%
2	256	8.25%	-0.73%	-1.01%	-0.63%
3	298	10.26%	-0.49%	-0.97%	-0.92%
4	314	10.92%	-0.53%	-0.68%	-0.81%
5	327	10.49%	-0.99%	-0.93%	-1.29%
5-1	322	0.10%	-0.22%	0.17%	-0.32%
t statistics		0.21	-0.46	0.39	-0.75
Panel C: Sorting based on PWR/PLR of the current quarter (WinnerFIFO)					
Bias Quintile	N	Monthly Return	CAPM $\alpha$	FF3 $\alpha$	Carhart $\alpha$
1	319	11.12%	-0.45%	-0.71%	-0.64%
2	265	7.82%	-0.42%	-0.98%	-1.36%
3	306	11.28%	-0.74%	-0.99%	-1.19%
4	313	10.35%	-1.59%	-1.80%	-2.12%
5	331	9.89%	-1.56%	-1.31%	-1.55%
5-1	319	-0.65%	<b>-1.05%</b>	-0.65%	<b>-0.96%</b>
t statistics		-1.25	-2.07	-1.33	-2.01
Panel D: Sorting based on PWR/PLR of the current quarter (WinnerLHP)					
Bias Quintile	N	Monthly Return	CAPM $\alpha$	FF3 $\alpha$	Carhart $\alpha$
1	323	10.36%	-0.68%	-0.92%	-0.83%
2	256	8.80%	-1.33%	-2.02%	-2.18%
3	301	10.97%	-0.76%	-1.11%	-1.23%
4	315	10.71%	-1.19%	-1.31%	-1.49%
5	329	9.68%	-1.52%	-1.32%	-1.67%
5-1	323	-0.41%	-0.67%	-0.30%	<b>-0.74%</b>
t statistics		-0.91	-1.51	-0.71	-1.82

**Table 10: Returns on repurchased winners and repurchased losers after the repurchase**

This table contains the calendar time portfolio returns and risk-adjusted returns. At the beginning of each quarter, we assign repurchased stocks in each mutual fund portfolio (based on the report at the previous quarter end) to one of two portfolios: repurchased winners and repurchased losers. Repurchase winners (losers) refer to the stocks that were repurchased within one year after the sale with a gain (loss). We compute monthly returns on the repurchased winners and repurchased losers until the quarter end if the stocks are still in the fund portfolio. Portfolios are rebalanced every quarter and within a given fund portfolio, stocks are weighted by the fund's dollar holdings. Finally, we compute time portfolios by taking equal-weighted average across funds. We report annualized returns in this table. L/S represents the long and short portfolio that holds the repurchased winners and sell short the repurchased losers. T-statistics test the returns of the long and short portfolios against zero and the 10% level statistical significance is indicated in bold.

Panel A Winner measure: WinnerFIFO				
	Repurchased Winners	Repurchased Losers	L/S	t-statistic
Return	13.98%	19.34%	<b>-5.35%</b>	-2.00
CAPM	2.48%	7.52%	<b>-5.04%</b>	-1.88
FF3	2.15%	5.48%	-3.32%	-1.27
Carhart4	2.57%	7.38%	<b>-4.81%</b>	-1.85
Panel B Winner measure: WinnerLHP				
	Repurchased Winners	Repurchased Losers	L/S	t-statistic
Return	14.51%	18.19%	<b>-3.67%</b>	-1.74
CAPM	2.59%	5.98%	-3.39%	-1.61
FF3	2.31%	4.42%	-2.12%	-1.01
Carhart4	2.30%	6.48%	<b>-4.18%</b>	-2.06



**Table 11: Repurchased stock returns between the sale and the repurchase**

This table contains the calendar time portfolio returns and risk-adjusted returns. In Panel A, we form a portfolio with repurchased stocks in each mutual fund portfolio in the months between the previous sale and the repurchase of the stock. We compute monthly returns on the repurchased stocks in the fund portfolio, weighted by the fund's dollar holdings. And then we compute time portfolios by taking equal-weighted average across funds. T-statistics test the returns of the portfolio on repurchased stocks in the months between the sale and the repurchase against zero. In Panel B and Panel C, we assign the repurchased stocks to one of two portfolios: repurchased winners and repurchased losers. Repurchase winners(losers) refer to the stocks that were previously sold for a gain(loss) and were repurchased by the fund within one year. We compute time portfolios in the same way as in Panel A. L/S represents the long and short portfolio that holds the repurchased winners and sell short the repurchased losers. Returns are in annual percentage. T-statistics test the returns of the long and short portfolios against zero. The 10% level statistical significance is indicated in bold.

Panel A: Portfolio on repurchased stocks between the sale and the repurchase				
	Return	CAPM	FF3	Carhart4
Portfolio return	<b>17.61%</b>	<b>3.00%</b>	2.20%	<b>3.94%</b>
t-statistic	4.85	2.02	1.52	2.83
Panel B: Portfolio returns between the sale and the repurchase-WinnerFIFO				
	Repurchased Winners	Repurchased Losers	L/S	t-statistic
Return	<b>21.68%</b>	<b>11.58%</b>	<b>10.10%</b>	2.03
CAPM	<b>8.85%</b>	-2.41%	<b>11.26%</b>	2.30
FF3	<b>8.59%</b>	-3.98%	<b>12.56%</b>	2.27
Carhart4	<b>8.39%</b>	-0.42%	<b>8.81%</b>	2.31
Panel C: Portfolio returns between the sale and the repurchase-WinnerLHP				
	Repurchased Winners	Repurchased Losers	L/S	t-statistic
Return	<b>26.34%</b>	<b>11.10%</b>	<b>15.24%</b>	2.17
CAPM	<b>12.02%</b>	-4.23%	<b>16.25%</b>	2.37
FF3	<b>11.69%</b>	<b>-5.80%</b>	<b>17.49%</b>	2.14
Carhart4	<b>11.17%</b>	-1.87%	<b>13.04%</b>	1.98