To Sell or Not to Sell? Disposition Effect and Investment Style

Can Yilanci*

First version: January 28, 2022

This version: December 13, 2023

Abstract

I show that investors implementing a value strategy as in Fama and French (1993) inevitably exhibit a disposition effect. Value investors must hold on to "loser" stocks and sell "winner" stocks. Consequently, I find a strong disposition effect for value funds but I find no disposition effect for growth funds. Focusing on a subsample of managers who manage value and growth funds at the same time, I find that these managers show a disposition effect for their value funds but no disposition effect for their growth funds. I make similar findings when focusing on a sample of passive index funds. My findings imply that professional investors might be prone to the disposition effect because they follow specific investment styles.

Keywords: Mutual Funds, Disposition Effect
JEL Classifications: G11, G23, G40

*University of Mannheim, *can.yilanci@uni-mannheim.de*.

I thank Sabine Bernard, Justin Birru, Carina Cuculiza Reyes (discussant), Ralf Elsas, Joachim Grammig, Thomas Johann, Pascal Kieren, Lukas Mertes, Clemens Müller, Tatjana Puhan, Raghavendra Rau, Stefan Ruenzi, David Solomon, Erik Theissen, Jiri Tresl, Tereza Tykvova (discussant), Martin Weber, and Leah Zimmerer for helpful suggestions. Further, I thank seminar participants at the University of Mannheim, and conference participants at the Annual Meeting of the Financial Management Association in Atlanta and at the Annual Meeting of the German Finance Association in Hohenheim.

1 Introduction

The term "disposition effect" refers to the behavior of investors to show a higher propensity to sell stocks trading at a gain ("winner stocks") than to sell stocks trading at a loss ("loser stocks") (Shefrin and Statman 1985). Remarkably, not only retail investors but also professional investors are prone to the disposition effect.[1] As existing evidence shows that the disposition effect hurts the overall investment performance (Odean 1998; Frazzini 2006), it is important to understand the causes of the disposition effect.

So far, most existing studies seem to agree that the disposition effect is a behavioral bias. However, existing studies rarely construct a benchmark for investors' trading behavior and rarely address the question which stocks investors should sell.[2] To emphasize the importance of constructing such a benchmark, value and growth investors can serve as examples. Assuming that the return-generating process is unknown, some investors might believe in mean reversion of returns (value investors) whereas others might believe in return continuation (growth investors). As a consequence, while value investors sell winner stocks and hold loser stocks, growth investors do the opposite. It comes as no surprise that value investors then exhibit a disposition effect, whereas growth investors do not. In this example, the disposition effect can only be attributed to a behavioral bias if the belief formation process of value investors is biased itself. However, it is well known in the asset pricing literature that value stocks outperform growth stocks.[3]

This paper introduces a new benchmark for the disposition effect to contribute to a deeper understanding of what actually causes investors to show a disposition effect. In

[1] See Odean (1998), Shapira and Venezia (2001), Grinblatt and Keloharju (2001), Feng and Seasholes (2005), Chen et al. (2007), Calvet et al. (2009), Ben-David and Hirshleifer (2012), Grinblatt et al. (2012), Birru (2015), Chang et al. (2016), and Bernard et al. (2021) for retail investors and see Grinblatt and Keloharju (2001), Garvey and Murphy (2004), Locke and Mann (2005), Frazzini (2006), Chen et al. (2007), and Cici (2012) for professional investors.

[2] The study of Weber and Camerer (1998) is one of the notable exceptions. In their experimental setting, it is always clear which assets rational investors should (not) sell.

[3] The Fama and French (1993) value factor (HML) has delivered a mean return of approximately 4.2% and 1.6% annually for the periods from 1927-2021 and 2000-2021, respectively.

particular, I show that the existence of the disposition effect among a sample of value and growth funds is a mere consequence of factor investing. Focusing on this subset of funds, I can make clear predictions about the expected trading behavior, as value (growth) funds are expected to hold value (growth) stocks. Value stocks are stocks associated with high book-to-market ratios (Fama and French 1993). These stocks have often experienced low returns in the past. Growth stocks, by contrast, are stocks associated with low book-to-market ratios. These stocks have often experienced high returns in the past. Hence, value and growth investing represent different schools of thought regarding the return-generating process (mean reversion vs. return continuation). While value strategies require selling past winner stocks, growth strategies require selling past loser stocks. Hence, funds implementing a value style should be more prone to the disposition effect than funds implementing a growth style.[4]

My empirical results are consistent with the hypothesis outlined above. The trading behavior of value funds reveals a strong disposition effect whereas the trading behavior of growth funds reveals a reverse disposition effect. Focusing on a subsample of managers who manage value and growth funds at the same time, I find that these managers show a disposition effect for their value funds but no disposition effect for their growth funds. I make similar findings when focusing on a sample of passive index funds. As the disposition effect is a mere consequence of factor investing in my sample of value and growth funds, it comes as no surprise that I fail to find a significant relation between disposition effect and fund performance. My findings call into question the traditional understanding of the disposition effect as a behavioral bias.

I start my analysis by creating holdings of two hypothetical "buy-and-hold" funds. These funds then serve as benchmarks for the actual trading behavior. The first fund

[4]This hypothesis is in line with the findings of the experimental study of Kubińska et al. (2012) who show that contrarian investors who expect the stock price to fall after a positive return are more prone to the disposition effect.

holds shares of value stocks and only sells them when a stock is delisted or re-classified as a blend or growth stock. This fund is designed to reflect the aggregate holdings of value funds. Alternatively, this fund can be thought of as the long leg of the value factor used in the Fama and French (1993) three-factor model. Similarly, I create holdings of a hypothetical growth fund that is designed to reflect the aggregate holdings of growth funds. Again, this fund can be alternatively thought of as the short leg of the value factor used in the Fama and French (1993) three-factor model. I then calculate the disposition effect for both funds. The results suggest that while value funds should exhibit a disposition effect, growth funds should exhibit a reverse disposition effect. This finding is not surprising as value investing requires to hold on to previous loser stocks whereas growth investing requires to hold on to previous winner stocks (the opposite of the disposition effect).

In the empirical analysis, I then take the benchmark predictions to "real" data. I calculate the disposition effect for 1,042 value funds and 1,357 growth funds.[5] I find that the empirical results are in line with the predictions. Value funds show a positive disposition effect of 2.7 percentage points (t-ratio: 3.61) and growth funds show a reverse disposition effect of -3.8 percentage points (t-ratio: -5.66). The effect is not caused by the rebalancing of positions but rather by position sell-offs. I highlight the main results in Figure 1.

If the disposition effect for my sample of value and growth funds is indeed caused by funds' investment style, there should be no relation between disposition effect and fund performance. When I regress fund returns on a Fama and French (1993) three-factor model augmented by a momentum factor (Jegadeesh and Titman 1993; Carhart 1997), I find no differences in alpha for value and growth funds.

[5]My sample of value and growth funds covers a sizeable fraction of the CRSP survivor-bias-free mutual fund database. The sample covers more than 40% of assets under management for funds in the CRSP mutual fund database that also have valid quarterly holdings data in the Thomson/Refinitiv S12 mutual fund holdings database.

[Please insert Figure 1 over here.]

I extend the main analysis in various ways to show that the disposition effect in my sample of mutual funds is indeed driven by investment style. It is not clear to what extent cross-sectional variation in manager characteristics explains the results. For instance, growth fund managers might be more skilled than value fund managers and beware of behavioral biases that seemingly hurt fund performance. In an effort to show that the results are not driven by manager skill, I keep managers and manager teams that manage at least one value fund and one growth fund in the same quarter. I then re-estimate the disposition effect. I find that the disposition effect is 2.6 percentage points (t-ratio: 3.61) for value funds and insignificant for growth funds. In other words, the same managers that exhibit a disposition effect for their value funds do not exhibit a disposition effect for their growth funds.

Further, to reduce the effect of manager activeness, I focus on a set of index funds. These funds follow passive investment strategies that do not require the fund manager to trade actively (Chang et al. 2016). I make similar findings as in the main analysis. The disposition effect is 3.8 percentage points (t-ratio: 5.47) for value index funds and -2.1 percentage points (t-ratio: -3.01) for growth index funds. Again, observing a disposition effect for value index funds and a reserve disposition effect for growth index funds casts doubt on whether the disposition effect really constitutes a behavioral bias in the context of my sample of value and growth funds.

I also exclude tax-loss selling as an alternative explanation of the findings. Growth funds might show a disposition effect that is similar in magnitude to the disposition effect of value funds throughout the first three quarters of the year but might realize tax losses more aggressively than value funds in the last quarter of the year. I find that value funds show a consistently stronger disposition effect throughout the entire year. I conclude that the findings are unlikely to be driven by aggressive tax-loss selling of growth funds in the

last quarter of the year. Taken together, the results suggest that the disposition effect is driven to a large extent by investment styles as the disposition effect only persists in the subsample of value funds.

This paper contributes to the large literature on the disposition effect. Frazzini (2006) is the first to show the existence of a disposition effect for US mutual funds. Cici (2012) documents that disposition-prone funds tilt towards a value-style, and Andreu et al. (2020) show that stocks with low portfolio weights and stocks with low past returns are disposition-prone. However, it is a puzzle why institutional investors like mutual funds should display a disposition effect. Potential explanations for investors exhibiting a disposition effect date as far back as the study of Shefrin and Statman (1985). While Shefrin and Statman (1985) and Odean (1998) view the disposition effect as a potential implication of the prospect theory of Kahneman and Tversky (1979), Kaustia (2010) and Hens and Vlcek (2011) cast doubt on whether prospect theory explains the disposition effect. Barberis and Xiong (2012) develop a model of realization utility, but Ben-David and Hirshleifer (2012) find little empirical support for realization utility explaining the disposition effect. The most recent studies consider social interaction (Heimer 2016), cognitive dissonance (Chang et al. 2016), hedonic mental accounting (An et al. 2019), and market cycles (Bernard et al. 2021) as potential explanations for the disposition effect. Yet, there still exists no agreed-upon explanation. I contribute to the literature in the following way. I show that a fund's investment style significantly influences the magnitude of the disposition effect. Investors that follow factor strategies that require selling past winner stocks will inevitably show a disposition effect.

The paper continues as follows. I describe the data in Section 2, and I describe the methodology in Section 3. I present the main results in Section 4. I extend the main analysis and test for robustness in Section 5. I conclude in Section 6.

2 Data

Stock return data is from CRSP and accounting data is from CRSP/Compustat merged. Fund summary data is from the CRSP survivor-bias-free mutual fund database and holdings data is from the Thomson/Refinitiv S12 mutual fund holdings database. I describe firm data in Section 2.1, and I describe fund data in Section 2.2.

2.1 Firm Data

I download stock return data from CRSP. I focus on ordinary common shares (share code 10 or 11) that are traded on the NSYE, AMEX, or NASDAQ (exchange code 1, 2, or 3). Further, I require that CUSIP and ticker are non-missing.[6] I merge stock return data with accounting data from the CRSP/Compustat merged database.

To identify value and growth stocks, I then calculate book equity for all firms in my sample. Book equity is stockholder's equity minus redemption value of preferred stock plus balance-sheet deferred taxes (Fama and French 1993, 2015a, 2015b). I replace missing values of stockholder's equity by the par value of preferred stock plus common equity or assets minus liabilities (in that order). I replace missing values of redemption value of preferred stock by the liquidation value of preferred stock or the par value of preferred stock (in that order). I replace missing values of deferred taxes by zero. Further, I assume that data on book equity becomes available with a lag of two quarters to avoid look-ahead bias and that book equity changes linearly throughout the year to obtain quarterly estimates. I keep firms with non-missing and non-negative book equity. I divide book equity by market equity to obtain book-to-market ratios. I use NYSE breakpoints when I calculate book-to-market breakpoints. Value (growth) stocks are stocks with book-to-market ratio above the 70th (below the 30th) percentile (Fama and French 1993). In total, I have data on 12,218 stocks for the period from January 2000

[6] This restriction is necessary to match stock return data with fund holdings data.

until December 2021.

2.2 Fund Data

Fund summary data is from the CRSP survivor-bias-free mutual fund database. I drop index funds (index fund flag "B", "D", or "E") and I only keep domestic equity funds (CRSP objective code "ED") in the sample. I identify value and growth funds by their names. Value (growth) funds are those funds whose names contain "value" or "val" ("growth", "gr", and "grth") (Cooper et al. 2005).[7] I drop funds that are identified as having both value and growth styles as for these funds I cannot identify investment styles unambiguously. I merge CRSP data with holdings data by using the MFLINKS table provided by Russ Wermers and WRDS.

I obtain holdings data from the Thomson/Refinitiv S12 mutual fund holdings database. The holdings data allows to observe how many shares a fund held for a specific stock on the reporting date. However, I do not observe transaction prices for these holdings. I use CRSP closing prices on the reporting date as proxies for transaction prices. This is in line with existing studies (Frazzini 2006). To reduce noise in the proxy for transaction prices, I focus on quarterly reports. I only keep holdings that are reported every 60 to 120 days (Hartzmark and Solomon 2019). I assume that a stock is liquidated if it is not reported in the next quarter. I drop the first year of holdings data for each fund to avoid incubation bias. Last but not least, I screen out erroneous observations by following Frazzini (2006). I drop observations whenever (i) a fund reports that it holds more shares in a firm than there are total shares outstanding, (ii) a fund reports a position in one asset that is larger than the total asset value of the fund, (iii) an asset has zero shares outstanding, (iv) or a

[7]There is evidence that funds misclassify their style (Cooper et al. 2005). SEC rule 35d-1 ("Names Rule") applies for asset classes, but it does not apply for investment styles. Hence, I cannot rely on fund names being accurate descriptors of fund styles per se. I use characteristics of portfolio holdings to verify that fund names are accurate descriptors of fund styles. I find that value funds on average hold stocks with high book-to-market ratio whereas growth funds on average hold stocks with low book-to-market ratio.

fund's total asset value reported by Thomson/Refinitiv differs from the value reported by CRSP by more than 100%. I focus on the period from 2000 until 2021 as there are only relatively few value and growth funds with valid holdings data available for the period before 2000. I merge fund holdings data with firm data using CUSIP and ticker.

I have 1,042 distinct value funds and 1,357 distinct growth funds in my sample. This number compares well with the total number of funds in the CRSP survivor-bias-free mutual fund database that report quarterly holdings in the Thomson/Refinitiv database (5,241). I provide more detailed information on the funds in my sample in Table 1. I have 207 value funds and 404 growth funds in my sample in 2000. The growth funds in my sample are considerably larger than the value funds. In 2000, value funds have on average 578 million USD under management and growth funds have on average 1,001 million USD under management. The number of value funds increases to 503 in 2008 and decreases thereafter. Similarly, the number of growth funds increases to 597 in 2008 and then starts to decline. I have 467 value funds and 540 growth funds in my sample in 2021. The growth funds remain considerably larger than the value funds. In 2021, value funds have on average 1,299 million USD under management and growth funds have on average 3,644 million USD under management.

[Please insert Table 1 over here.]

3 Methodology

The Thomson/Refinitiv S12 mutual fund holdings database reports fund holdings on a quarterly level. This means that I do not observe actual buying and selling prices. Hence, I need to make the following assumptions for the empirical analysis. First, I use CRSP closing prices on the reporting date as proxies for transaction prices (Frazzini 2006). Second, fund managers have reference prices that are equal to the volume-weighted

average purchase prices (Frazzini 2006). Third, fund managers use weighted-average cost accounting whenever a stock is bought and sold in a series of transactions.[8] A stock is said to trade at a gain if its price is above its reference price.

I then estimate the disposition effect by the following linear regression model that follows Birru (2015) and Chang et al. (2016), i.e.

$$Sale_{i,j,t} = \beta_0 + \beta_1 * Gain_{i,j,t} + \epsilon_{i,j,t}, \tag{1}$$

where the subscripts i, j, and t refer to funds, stocks, and quarters. $Sale_{i,j,t}$ is a binary variable indicating whether fund i reports lower holdings in stock j in quarter t than in the previous quarter. I consider both partial sales and entire sell-offs. I only consider quarters in which at least one sale takes place (Frazzini 2006). $Gain_{i,j,t}$ is a binary variable indicating whether stock j is trading at a gain for fund i in quarter t. β_0 measures the propensity to sell a stock that is trading at a loss and $\beta_0 + \beta_1$ measures the propensity to sell a stock that is trading at a gain. β_1 is a direct measure of the disposition effect. Hence, if funds are more likely to sell stocks trading at a gain, β_1 should be positive and significant.

I estimate the above model for value and growth funds separately. In addition, to test whether the disposition effect for value and growth funds is significantly different from each other, I also employ the following regression model that is similar in spirit to the models used by Chang et al. (2016), An et al. (2019), and Bernard et al. (2021), i.e.

$$Sale_{i,j,t} = \beta_0 + \beta_1 * Gain_{i,j,t} + \beta_2 * Gain_{i,j,t} * Value_{j,t} + \beta_3 * Value_{j,t} + \epsilon_{i,j,t}, \tag{2}$$

[8]Consider the following example. Fund A buys 10 shares of company B for a price of \$10. Subsequently, fund A buys another 10 shares of company B for a price of \$12. The reference price will then be \$11. If fund A then sells 10 shares of company B, I assume that fund A sells 5 shares bought for a price of \$10 and \$12 each. Hence, the reference price still is \$11. Cici (2012) reports only small differences between using first-in-first-out, last-in-first-out, and weighted-average accounting methods in the context of the disposition effect.

where $Value_{j,t}$ is a binary variable indicating a value fund. β_0 measures the propensity to sell a stock that is trading at a loss for growth funds and $\beta_0 + \beta_3$ measures the propensity to sell a stock that is trading at a loss for value funds. Likewise, $\beta_0 + \beta_1$ measures the propensity to sell a stock that is trading at a gain for growth funds and $\beta_0 + \beta_1 + \beta_2 + \beta_3$ measures the propensity to sell a stock that is trading at a gain for value funds. Hence, β_1 is an estimate of the disposition effect for growth funds and $\beta_1 + \beta_2$ is an estimate of the disposition effect for value funds. A positive and significant coefficient for β_2 indicates that value funds show a significantly stronger disposition effect than growth funds.

While Equations 1 and 2 present the baseline estimations of the disposition effect, I include further controls and various fixed effects in additional analyses to make sure that the findings are not driven by unobserved stock and fund characteristics. In particular, I include the controls of Ben-David and Hirshleifer (2012), i.e. two proxies for the magnitude of the return, a binary variable indicating a zero return, the square root of the time the stock has been in the portfolio, the logarithm of the buying price, and two proxies for volatility. I include stock and fund fixed effects to control for stock and fund characteristics that are time-invariant. I include quarter fixed effects to control for general time trends. I cluster the standard errors by fund and quarter.

4 Main Results

In Section 4.1, I derive theoretical predictions on the magnitude of the disposition effect for value and growth funds. I construct holdings of two hypothetical buy-and-hold value and growth funds and calculate the "style-driven" disposition effect. In Section 4.2, I show that value funds display a strong disposition effect whereas growth funds rather show a reverse disposition effect. In Section 4.3, I focus on the effect of rebalancing. The difference in the disposition effect across value and growth funds is entirely attributable

to the effect of position sell-offs. Last but not least, in Section 4.4, I show that there is no relation between disposition effect and fund performance.

4.1 The Style-driven Disposition Effect

I start analyzing the disposition effect by focusing on the following questions. What magnitude of the disposition effect should be expected for value funds? And what magnitude of the disposition effect should be expected for growth funds? To answer these questions, I construct holdings of two hypothetical buy-and-hold funds. The first fund holds value stocks. It buys shares of all available value stocks and holds a constant number of shares in each stock. Hence, it does not need to rebalance its holdings. It sells stocks only (i) when a stock is delisted or (ii) when a stock is re-classified as a blend or growth stock. This fund is not designed to mirror the holdings of an active value fund but rather should resemble the aggregate holdings of value funds. Alternatively, this fund can be thought of as the long leg of the value factor used in the Fama and French (1993) three-factor model. It should provide an estimate of the disposition effect for an investor who engages in factor investing. The second fund holds growth stocks and follows the same principles as the value fund when buying and selling growth stocks. It should resemble the aggregate holdings of growth funds. Again, this fund can be alternatively thought of as the short leg of the value factor used in the Fama and French (1993) three-factor model. I then calculate the disposition effect for each of the hypothetical funds.

I show results in Table 2. All coefficients are significant at the 1% level. Hence, in the description of results, I rather focus on coefficient size than on significance. The first column shows results for the value fund. The constant is 0.121. Hence, the propensity to sell a stock trading at a loss is 12.1%. The coefficient of the binary variable indicating a gain is 0.023. Hence, the propensity to sell a stock trading at a gain is 14.4%. In other words, value funds that follow buy-and-hold strategies are expected to show a disposition

effect of around 2.3 percentage points. Put differently, an investor who implements the long leg of the value factor used in the Fama and French (1993) three-factor model shows a disposition effect of around 2.3 percentage points. This number compares surprisingly well with previous estimates of the disposition effect for mutual funds. For instance, Frazzini (2006) finds a disposition effect in the order of 2.3-3.1 percentage points.

The second column shows results for the growth fund. The constant is 0.159 and suggests that the propensity to sell a stock trading at a loss is 15.9%. By contrast to the value fund, the coefficient of the binary variable indicating a gain is -0.070 for the growth fund. Hence, the propensity to sell a stock trading at a gain is only 8.9%. Growth funds that follow buy-and-hold strategies are expected to show a reverse disposition effect of around -7.0 percentage points. Put differently, an investor who implements the short leg of the value factor used in the Fama and French (1993) three-factor model shows a reverse disposition effect of around 7.0 percentage points.

The third column assesses the differences between the value fund and the growth fund. It reiterates the results from the previous columns. The coefficient of the interaction term is 0.092 and describes the difference in the magnitude of the disposition effect between value and growth fund. The disposition effect is larger by 9.2 percentage points for the value fund than for the growth fund.

The results suggest that the existence of a disposition effect does not necessarily imply that fund managers are subject to behavioral biases. In Table 2, the disposition effect is caused by factor investing. The disposition effect is a direct implication of following a value style. One interesting question in this context is whether it is then rational for investors to show a disposition effect. The Fama and French (1993) value factor (HML) has delivered a mean return of approximately 4.2% and 1.6% annually for the periods from 1927-2021 and 2000-2021, respectively. In other words, value stocks have outperformed growth stocks. In this specific context, neither is the disposition effect

caused by a behavioral bias nor is the portfolio performance hurt by it.

[Please insert Table 2 over here.]

4.2 The Disposition Effect for Value and Growth Funds

I start by assessing fund holdings data in Table 3. In total, the sample consists of 3,626,353 quarterly observations. I have 1,762,660 quarterly observations for value funds. The unconditional probability of observing a sale for value funds is 39.8%. Conditioning on the sign of the return, the probability of observing a sale is 40.7% (38.0%) for assets trading at a gain (loss). This implies that value funds show a disposition effect of 2.7 percentage points. I have an even larger number of observations for growth funds. The number of quarterly observations for growth funds is 1,863,693. The unconditional probability of observing a sale for growth funds is 45.4%. It seems that growth funds trade more actively than value funds. Conditioning on the sign of the return, the probability of observing a sale is 44.1% (47.9%) for assets trading at a gain (loss). This implies that growth funds show a reverse disposition effect of -3.8 percentage points.

[Please insert Table 3 over here.]

I show regression results in Table 4. Panel A presents the baseline specification. It reiterates the results from the previous table as the regressions only include binary variables. For that reason, the coefficient estimates equal the subsample means of the dependent variable.

The first column shows results for value funds. The coefficient of the binary variable indicating a gain is 0.027, and it is also statistically significant at the 1% level (t-ratio: 3.61). I conclude that value funds are significantly more likely to sell an asset trading at a gain than to sell an asset trading at a loss. In short, value funds show a significant disposition effect.

The second column shows results for growth funds. The coefficient of the binary variable indicating a gain is -0.038, and it is also statistically significant at the 1% level (t-ratio: -5.66). Hence, growth funds are significantly more likely to sell an asset trading at a loss than to sell an asset trading at a gain. In short, growth funds show a significant reverse disposition effect.

The third column assesses whether value funds show a significantly stronger disposition effect than growth funds. Please note that the constant and the coefficient of the binary variable indicating a gain depict the propensities to sell an asset trading at a loss or gain for growth funds. They equal the estimates presented in the second column as the regression does not include any additional controls or fixed effects. The coefficient of the interaction term is 0.065, and it is statistically significant at the 1% level (t-ratio: 8.84). Value funds are 6.5 percentage points more likely to sell an asset trading at a gain than growth funds. Overall, the results are in line with the results derived in the previous section, i.e. value funds show on aggregate a disposition effect but growth funds show on aggregate a reverse disposition effect.

The baseline specification provides an estimate of the total magnitude of the disposition effect. It remains, however, unclear to what extent differences in the disposition effect can be explained by different holding characteristics. For instance, holdings might be different with respect to volatility and magnitude of the return. Panel B includes the controls of Ben-David and Hirshleifer (2012) and stock, fund, and quarter fixed effects. In the first column, the coefficient of the binary variable indicating a gain remains large and significant for value funds (0.053, t-ratio: 10.57). Hence, value funds show on aggregate a disposition effect of 5.3 percentage points after controlling for holding characteristics. In the second column, the coefficient of the binary variable indicating a gain becomes positive and significant for growth funds (0.010, t-ratio: 2.21). It seems that the reverse disposition effect for growth funds might be explained by stock and holding characteris-

tics.[9] In the third column, the coefficient of the binary variable indicating a gain looses its significance again (-0.002, t-ratio: -0.44). Taken together, it remains unclear whether growth funds show a disposition effect, a reverse disposition effect or no disposition effect at all. The coefficient of the interaction term remains large and significant (0.069, t-ratio: 11.55). Value funds show a significantly stronger disposition effect than growth funds after including the controls of Ben-David and Hirshleifer (2012) and various fixed effects.[10]

[Please insert Table 4 over here.]

4.3 The Effect of Rebalancing

The analysis of the style-driven disposition effect in Section 4.1 suggests that growth funds should show on average a reverse disposition effect. However, the analysis in Section 4.2 suggests that the reverse disposition effect among growth funds can be explained entirely by stock and fund characteristics. Differences might be explained by the role of rebalancing. Managers might sell shares after an asset has increased in value to restore diversification (Lakonishok and Smidt 1986). Rebalancing activities can then induce a disposition effect. To analyze the effect of rebalancing, I modify the regressions as follows. Instead of using a binary variable indicating a sale, I use a binary variable indicating a partial sale and a binary variable indicating an entire sell-off as dependent variables in the regressions.

I show results in Table 5. In both columns, I use data for value and growth funds. In the first column, I use the binary variable indicating a partial sale as the dependent variable. The coefficient of the binary variable indicating a gain is 0.041, and it is sig-

[9] In the next section, I discuss in more detail why column (2) in Panel B shows a positive coefficient of the gain dummy for growth funds.

[10] Please note that the coefficients in column 3 are no longer equal to the (sum of) coefficients in columns 1 and 2 as the regression includes controls and fixed effects.

nificant at the 1% level (t-ratio: 12.01). Hence, growth funds are more likely to partly sell a position for assets trading at a gain than for assets trading at a loss. The coefficient of the interaction term is 0.002, and it is not statistically different from zero at any reasonable significance level (t-ratio: 0.43). Value funds do not show a higher propensity than growth funds to partly sell a position trading at a gain. Both value and growth funds show a disposition effect when considering partial sales. If they want to keep a constant share of their portfolio invested in an asset, they need to reduce position size after observing a positive return.

In the second column, I use the binary variable indicating an entire sell-off as the dependent variable. In sharp contrast to the results in column 1, the coefficient of the binary variable indicating a gain is -0.044. It is significant at the 1% level (t-ratio: -9.55). While growth funds show a disposition effect when rebalancing their portfolios, they actually show a reverse disposition effect when they sell an asset entirely. They show a higher propensity to sell off positions that are trading at a loss than positions that are trading at a gain. The coefficient of the interaction term is 0.068, and it is significant at the 1% level (t-ratio: 13.36). Value funds still show a disposition effect of around 2.4 percentage points.

When excluding sales that occur due to rebalancing, the observed magnitude of the disposition effect is broadly in line with the predictions derived earlier. The buy-and-hold estimates of the disposition effect are 2.3 and -7.0 percentage points for value and growth funds, respectively (compare Section 4.1). Comparing it with the estimates of the disposition effect in the second column, the observed disposition effect of value funds is surprisingly close to the disposition effect implied by a buy-and-hold value strategy (2.3 vs. 2.4).

[Please insert Table 5 over here.]

4.4 The Effect on Fund Performance

If the disposition effect is induced by investment style, value funds should not perform worse than growth funds. However, if the disposition effect for my sample of value and growth funds is a behavioral bias, then value funds that show a strong disposition effect might underperform growth funds that show a reverse disposition effect. In a first step, I plot the cumulative return of value and growth funds to have a closer look at their performance over time. Figure 2 shows results for value-weighted returns.

Value funds have a monthly mean return of 0.75%. This return is equivalent to an annual return of 9.38%. By contrast, growth funds have a monthly mean return of only 0.69%, which is equivalent to an annual return of 8.60%. An investment of $100 would have resulted in a terminal value of $569 for value funds and $477 for growth funds. The finding that value funds outperformed growth funds is anything but surprising as value stocks tend to outperform growth stocks (Fama and French 1993). In fact, value stocks have outperformed growth stocks by 1.6% annually over my sample period from 2000-2021.[11]

[Please insert Figure 2 over here.]

It remains an open question how the performance of value and growth funds looks like after adjusting for risk. For that reason, I regress the time-series of returns of value and growth funds on the market factor, the Fama and French (1993) size and value factors, and a momentum factor (Jegadeesh and Titman 1993; Carhart 1997). My choice of factors is based on the fact that this set of factors was available to investors in real time at the beginning of my sample period. This analysis allows to draw conclusions on whether the return difference between value and growth funds only originates from the value factor or also from other sources.

[11]The difference in the performance of value and growth funds is likely smaller than the difference in performance of value and growth stocks as funds might not capitalize on high returns of very small stocks.

I show results in Table 6. I show results for value funds, growth funds, and a zero-investment portfolio that goes long value funds and short growth funds (Value-Minus-Growth, "VMG"). The regression coefficients reveal that value funds have significantly lower exposure to market risk and momentum and higher exposure to the size and value factors. Most importantly, alpha is indistinguishable from zero for both value and growth funds. Hence, the high raw return of value funds can be attributed to a larger exposure to the size and value factors. There are, however, no differences in alpha. In other words, neither value nor growth funds out- or underperform after risk adjustment. This finding is contrary to the common notion that the disposition effect hurts investment performance (Odean 1998; Frazzini 2006).[12]

[Please insert Table 6 over here.]

5 Extensions

In this section, I extend the main analysis. In Section 5.1, I focus on managers who manage both value and growth funds to show that the results are not driven by manager characteristics. In Section 5.2, I focus on a sample of index funds to reduce the influence of activeness. Last but not least, in Section 5.3, I show that the results are not driven by heavy tax-loss selling in the last quarter of the year.

5.1 Manager Skill

Feng and Seasholes (2005) document that investor sophistication reduces the disposition effect, and Grinblatt et al. (2012) find that high-IQ investors show a lower disposition effect. If, on average, managers of growth funds are more skilled than managers of value

[12]My result is independent of the factor model I choose. I get similar results when I use a q-factor model (Hou et al. 2015) or a q^5 model (Hou et al. 2015; Hou et al. 2021).

funds or beware of behavioral biases, the results might be a rediscovery of the findings of Feng and Seasholes (2005) and Grinblatt et al. (2012). To address this concern, I modify the sample as follows. I drop all funds for which I cannot unambiguously identify the managers.[13] I keep managers and management teams that manage at least one value fund and one growth fund in the same quarter. This allows me to exclude manager skill and other manager characteristics as alternative explanations for the findings. The modified sample includes 111 managers and management teams that manage 90 value funds and 85 growth funds.

I show results in Table 7. I include controls and stock, manager, and quarter fixed effects in all specifications. In the first column, I report results for value funds. The coefficient of the gain variable is 0.026, and it is statistically significant at the 1% level (t-ratio: 3.61). Hence, the disposition effect remains both economically and statistically significant in this subsample of value funds. Managers who manage value and growth funds at the same time show a disposition effect of 2.6 percentage points for their value funds. In the second column, I report results for growth funds. The coefficient of the gain variable is 0.001, and it is not significantly different from zero (t-ratio: 0.09). Hence, the very same managers who do show a disposition effect for their value funds do not show a disposition effect for their growth funds.

In the third column, I analyze value and growth funds jointly. The coefficient of the binary variable indicating a value fund is -0.044 (t-ratio: -3.14). It indicates that the managers are less likely to sell a stock trading at a loss for their value fund than for their growth fund. The coefficient of the gain variable is still not significant in the third specification. The coefficient of the interaction term, however, is 0.047, and it remains statistically significant at the 5% level (t-ratio: 2.53). The value funds display a significantly stronger disposition effect than the growth funds. I conclude that manager

[13] I drop all funds that report generic names in CRSP's manager name variable, i.e. I drop funds that report the manager names using the words "team", "multiple managers", or "committee".

characteristics are unlikely to drive the results. Again, the results support the conclusion that the disposition effect is not driven by a behavioral bias but rather by the investment style.

[Please insert Table 7 over here.]

5.2 Manager Activeness

I focus on a set of index funds to reduce the influence of activeness. Managers of index funds only have a small role and do not trade actively (Chang et al. 2016).[14] Hence, focusing on index funds allows to disentangle the effects of activeness and investment style. I modify the sample as follows. I start with the universe of all funds in the CRSP survivor-bias-free mutual fund database. I still identify style funds by their names, but I only keep funds with index fund flag "B", "D", or "E". This leaves me with 131 value funds and 100 growth funds.

I show results for the sample of index funds in Table 8. In the first column, I show results for value funds. The coefficient of the gain variable is 0.038, and it is significant at the 1% level (t-ratio: 5.47). Even for the sample of index funds I find a significant disposition effect for value funds. In the second column, I show results for growth funds. The coefficient of the gain variable is -0.021, and it is also significant at the 1% level (t-ratio: -3.01). The coefficient estimate supports the previous findings. Growth index funds might show a higher propensity to sell loser stocks and might show a reverse disposition effect.

In the third column, I analyze value and growth funds jointly.[15] The coefficient of

[14]Please note how the analysis is different from the analysis of Chang et al. (2016). Chang et al. (2016) focus on the question whether retail investors show a disposition effect in trading index funds. I rather focus on whether index funds themselves show a disposition effect.

[15]Please note that the binary variable indicating a value fund is reported as 0.000 because I include fund fixed effects. In the previous specifications I had a small number of funds that were value and growth funds at different points in time. For that reason, the binary variable indicating a value fund has been included in previous tables.

the gain variable is now -0.032 (t-ratio: -3.60). It is different from the estimate in the second column because by including both value and growth funds in the analysis the fixed effects are different. This specification still supports the notion that growth index funds show a reverse disposition effect. Most importantly, the coefficient of the interaction term is 0.074, and it is significant at the 1% level (t-ratio: 5.98) as well. This specification suggests an even higher disposition effect of 4.2 percentage points than the specification in the first column. Overall, the results for the sample of index funds are similar to the results for the sample of active funds. I regard this as further evidence that it is indeed the funds' investment styles that cause managers to (not) show a disposition effect.

[Please insert Table 8 over here.]

5.3 Tax-loss Selling

In an effort to illustrate that the findings are not caused by aggressive tax-loss selling of growth funds in the last quarter of the year, I analyze the disposition effect throughout the year. If the results were driven by tax-loss selling in the last quarter of the year, value and growth funds would show a disposition effect of similar magnitude throughout the quarters from January until September, but value funds would show a significantly stronger disposition effect than growth funds in the quarter from October until December (Constantinides 1984; Odean 1998).

I show results in Table 9. Columns 1, 2, 3, and 4 consider observations for the first, second, third, and fourth quarter of the year, respectively. Growth funds do not show a significant disposition effect in any of the quarters. The gain variable is insignificant across all specifications. The interaction term remains large and significant across all columns. Value funds show a stronger disposition effect than growth funds in all quarters. In particular, the disposition effect is stronger by 6.3, 7.9, 7.2, and 6.2 percentage points in the first, second, third, and fourth quarter of the year, respectively. Hence, the results

are unlikely to be driven by tax-loss selling.

[Please insert Table 9 over here.]

6 Conclusion

I show that value funds show a strong disposition effect and that growth funds do not show a disposition effect. Cross-sectional differences in the skill of managers or in the activeness of funds are unlikely to explain the results. I make similar findings when I focus on fund managers who manage both value and growth funds or when I focus on a sample of value and growth index funds. The disposition effect seems to be a direct implication of following an investment style with a value focus. Put differently, following an investment strategy that requires selling winners leads fund managers to show a disposition effect. This finding implies that the disposition effect might be wrongly thought of as a behavioral bias in the context of mutual funds.

References

An, L., J. Engelberg, M. Henriksson, B. Wang, and J. Williams. 2019. "The Portfolio-Driven Disposition Effect". *Working Paper*.

Andreu, L., C. Ortiz, and J. L. Sarto. 2020. "Disposition effect in fund managers. Fund and stock-specific factors and the upshot for investors". *Journal of Economic Behavior & Organization* 176:253–268.

Barberis, N., and W. Xiong. 2012. "Realization utility". *Journal of Financial Economics* 104 (2): 251–271.

Ben-David, I., and D. Hirshleifer. 2012. "Are Investors Really Reluctant to Realize Their Losses? Trading Responses to Past Returns and the Disposition Effect". *Review of Financial Studies* 25 (8): 2485–2532.

Bernard, S., B. Loos, and M. Weber. 2021. "The disposition effect in boom and bust markets". *Working Paper*.

Birru, J. 2015. "Confusion of Confusions: A Test of the Disposition Effect and Momentum". *The Review of Financial Studies* 28 (7): 1849–1873.

Calvet, L. E., J. Y. Campbell, and P. Sodini. 2009. "Fight Or Flight? Portfolio Rebalancing by Individual Investors". *Quarterly Journal of Economics* 124 (1): 301–348.

Carhart, M. M. 1997. "On Persistence in Mutual Fund Performance". *The Journal of Finance* 52 (1): 57–82.

Chang, T. Y., D. H. Solomon, and M. Westerfield. 2016. "Looking for Someone to Blame: Delegation, Cognitive Dissonance, and the Disposition Effect". *The Journal of Finance* 71 (1): 267–302.

Chen, G., K. A. Kim, J. R. Nofsinger, and O. M. Rui. 2007. "Trading performance, disposition effect, overconfidence, representativeness bias, and experience of emerging market investors". *Journal of Behavioral Decision Making* 20 (4): 425–451.

Cici, G. 2012. "The Prevalence of the Disposition Effect in Mutual Funds' Trades". *Journal of Financial and Quantitative Analysis* 47 (4): 795–820.

Constantinides, G. M. 1984. "Optimal stock trading with personal taxes". *Journal of Financial Economics* 13 (1): 65–89.

Cooper, M. J., H. Gulen, and P. R. Rau. 2005. "Changing Names with Style: Mutual Fund Name Changes and Their Effects on Fund Flows". *The Journal of Finance* 60 (6): 2825–2858.

Fama, E. F., and K. R. French. 1993. "Common risk factors in the returns on stocks and bonds". *Journal of Financial Economics* 33 (1): 3–56.

— . 2015a. "A five-factor asset pricing model". *Journal of Financial Economics* 116 (1): 1–22.

— . 2015b. "Dissecting Anomalies with a Five-Factor Model". *Review of Financial Studies* 29 (1): 69–103.

Feng, L., and M. S. Seasholes. 2005. "Do Investor Sophistication and Trading Experience Eliminate Behavioral Biases in Financial Markets?" *Review of Finance* 9 (3): 305–351.

Frazzini, A. 2006. "The Disposition Effect and Underreaction to News". *The Journal of Finance* 61 (4): 2017–2046.

Garvey, R., and A. Murphy. 2004. "Are Professional Traders Too Slow to Realize Their Losses?" *Financial Analysts Journal* 60 (4): 35–43.

Grinblatt, M., and M. Keloharju. 2001. "What Makes Investors Trade?" *The Journal of Finance* 56 (2): 589–616.

Grinblatt, M., M. Keloharju, and J. T. Linnainmaa. 2012. "IQ, trading behavior, and performance". *Journal of Financial Economics* 104 (2): 339–362.

Hartzmark, S. M., and D. H. Solomon. 2019. "The Dividend Disconnect". *The Journal of Finance* 74 (5): 2153–2199.

Heimer, R. Z. 2016. "Peer Pressure: Social Interaction and the Disposition Effect". *Review of Financial Studies* 29 (11): 3177–3209.

Hens, T., and M. Vlcek. 2011. "Does Prospect Theory Explain the Disposition Effect?" *Journal of Behavioral Finance* 12 (3): 141–157.

Hou, K., H. Mo, C. Xue, and L. Zhang. 2021. "An Augmented q-Factor Model with Expected Growth". *Review of Finance* 25 (1): 1–41.

Hou, K., C. Xue, and L. Zhang. 2015. "Digesting Anomalies: An Investment Approach". *Review of Financial Studies* 28 (3): 650–705.

Jegadeesh, N., and S. Titman. 1993. "Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency". *The Journal of Finance* 48 (1): 65–91.

Kahneman, D., and A. Tversky. 1979. "Prospect Theory: An Analysis of Decision under Risk". *Econometrica* 47 (2): 263–292.

Kaustia, M. 2010. "Prospect Theory and the Disposition Effect". *Journal of Financial and Quantitative Analysis* 45 (3): 791–812.

Kubińska, E., Ł. Markiewicz, and T. Tyszka. 2012. "Disposition Effect Among Contrarian and Momentum Investors". *Journal of Behavioral Finance* 13 (3): 214–225.

Lakonishok, J., and S. Smidt. 1986. "Volume for Winners and Losers: Taxation and Other Motives for Stock Trading". *The Journal of Finance* 41 (4): 951–974.

Locke, P. R., and S. C. Mann. 2005. "Professional trader discipline and trade disposition". *Journal of Financial Economics* 76 (2): 401–444.

Odean, T. 1998. "Are Investors Reluctant to Realize Their Losses?" *The Journal of Finance* 53 (5): 1775–1798.

Shapira, Z., and I. Venezia. 2001. "Patterns of behavior of professionally managed and independent investors". *Journal of Banking & Finance* 25 (8): 1573–1587.

Shefrin, H., and M. Statman. 1985. "The Disposition to Sell Winners Too Early and Ride Losers Too Long: Theory and Evidence". *The Journal of Finance* 40 (3): 777–790.

Weber, M., and C. F. Camerer. 1998. "The disposition effect in securities trading: an experimental analysis". *Journal of Economic Behavior & Organization* 33 (2): 167–184.

A Appendix - Figures and Tables

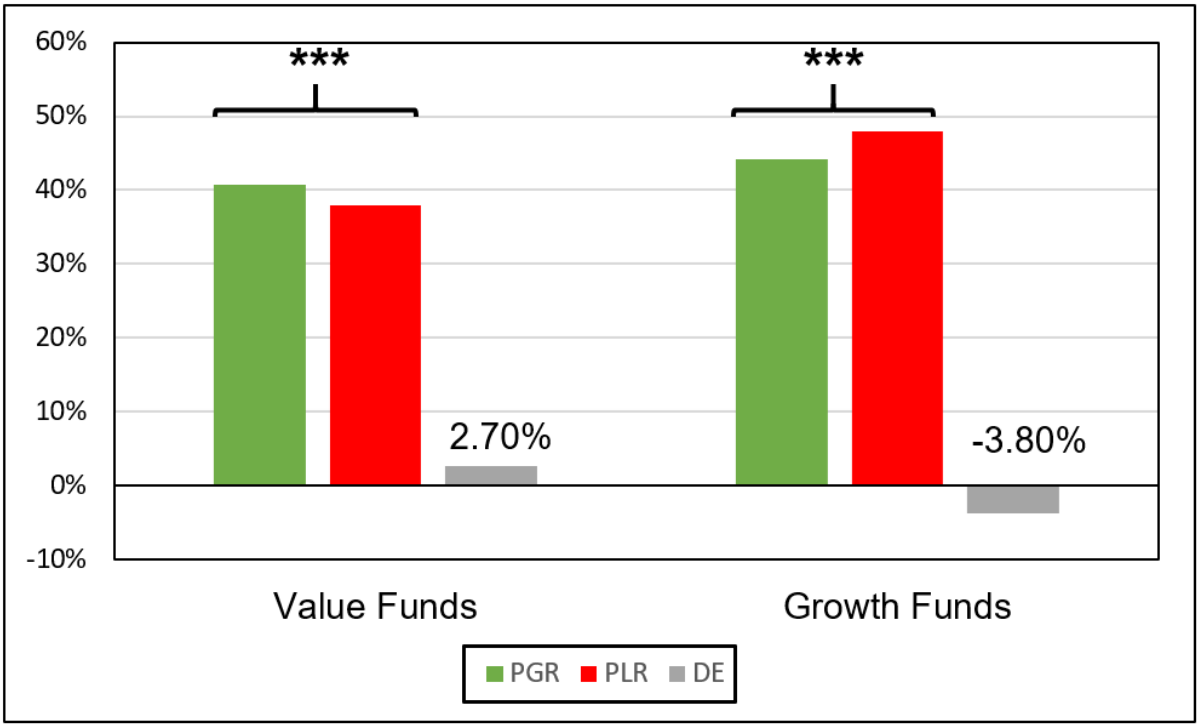

Figure 1: The Disposition Effect for Value and Growth Funds

This figure shows the magnitude of the disposition effect for value and growth funds. The green bars denote the propensity to sell stocks trading at a gain. The red bars denote the propensity to sell stocks trading at a loss. The disposition effect is the difference between the propensity to sell stocks trading at a gain and the propensity to sell stocks trading at a loss. The grey bars denote the disposition effect.

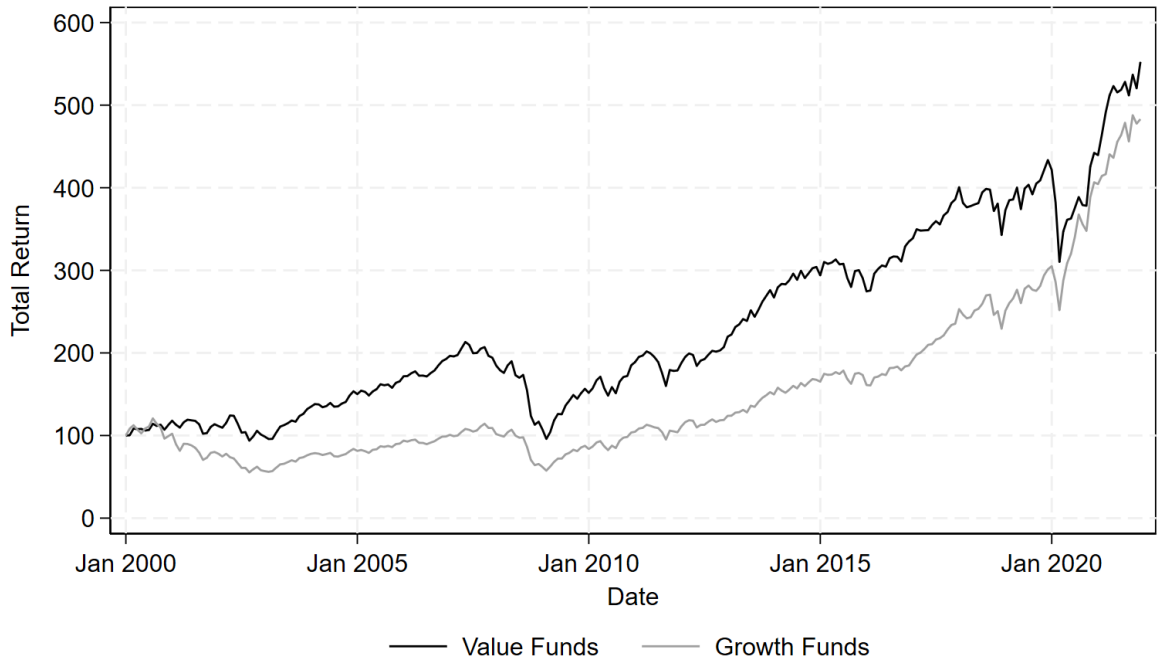

Figure 2: Performance of Value and Growth Funds

This figure shows the performance of value and growth funds for the period from 2000-2021. The black line indicates the cumulative return of value funds. The grey line indicates the cumulative return of growth funds. All returns are value-weighted.

Table 1: Summary Statistics Funds

This table shows summary statistics for all funds in my sample. I show the number of funds per year. In addition, I show average, median, and total assets under management (in Mil. USD). I use total net assets from CRSP for the calculation of assets under management. The sample spans the period from 2000 until 2021.

	# Value	Assets (in Mil. USD)			# Growth	Assets (in Mil. USD)		
	Funds	Mean	Median	Total	Funds	Mean	Median	Total
2000	207	578	95	119,560	404	1,001	265	404,461
2001	243	456	119	110,906	412	709	164	292,073
2002	277	439	114	121,583	435	571	141	248,177
2003	289	345	110	99,592	457	665	133	304,064
2004	381	565	170	215,320	560	1,015	166	568,479
2005	394	733	227	288,928	574	1,030	168	591,131
2006	402	932	265	374,599	552	1,157	191	638,780
2007	432	1,011	272	436,798	541	1,326	180	717,529
2008	503	675	173	339,413	597	956	144	570,693
2009	500	582	147	290,843	574	842	142	483,242
2010	429	754	206	323,678	470	1,140	206	535,974
2011	452	853	243	385,526	514	1,195	230	614,388
2012	444	837	225	371,581	501	1,322	246	662,211
2013	421	1,019	316	429,076	463	1,646	294	762,159
2014	410	1,214	345	497,816	447	1,932	362	863,689
2015	409	1,125	300	460,059	441	2,016	386	888,882
2016	420	1,098	261	461,125	436	1,968	343	857,885
2017	394	1,270	310	500,517	412	2,343	410	965,286
2018	405	1,178	287	476,989	411	2,612	441	1,073,703
2019	383	1,216	296	465,575	397	2,947	520	1,169,817
2020	487	952	266	463,498	548	2,844	486	1,558,288
2021	467	1,299	388	606,459	540	3,644	597	1,967,930

Table 2: Style-driven Disposition Effect

This table shows the style-driven disposition effect. I construct holdings of two hypothetical value and growth funds. These funds hold a constant number of shares of all value and growth stocks, respectively. They do not rebalance their holdings. They sell stocks only (i) when a stock is delisted or (ii) when a stock's book-to-market ratio changes so that the stock is re-classified as a blend stock. The funds are designed to make predictions about what magnitude of the disposition effect can be expected for value and growth funds. I estimate the disposition effect by regressing a binary variable indicating a sale on a binary variable indicating whether the stock is trading at a gain. The coefficient of the gain variable is then a direct measure of the disposition effect.

	(1) Value	(2) Growth	(3) Both
Gain	0.023***	-0.070***	-0.070***
	(10.73)	(-33.84)	(-33.84)
Gain x Value Fund			0.092***
			(31.36)
Value Fund			-0.038***
			(-16.68)
Constant	0.121***	0.159***	0.159***
	(80.99)	(92.73)	(92.73)
R^2	0.001	0.011	0.007
Adjusted R^2	0.001	0.011	0.007
Observations	103,628	106,318	209,946

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Summary Statistics Holdings

This table shows summary statistics for the holdings of value and growth funds. In Panel A, I show the total number of observations, the number of sales, the fraction of sales, and the magnitude of the disposition effect. In Panel B, I show summary statistics for returns. I show the mean and the 10th, 50th, and 90th percentile of returns. I show summary statistics for the entire sample, and I show summary statistics for value and growth funds separately.

		Value Funds			Growth Funds		
	Full Sample	All	Gains	Losses	All	Gains	Losses
Panel A: Holdings							
N	3,626,353	1,762,660	1,162,014	600,646	1,863,693	1,239,389	624,304
Sell Obs.	1,547,005	701,142	472,826	228,316	845,863	546,542	299,321
Sell Percent	.427	.398	.407	.380	.454	.441	.479
Disp. Effect	-.006	.027			-.038		
Panel B: Returns							
Mean	.252	.227	.450	-.204	.275	.514	-.200
10%	-.255	-.260	.040	-.475	-.251	.041	-.463
Median	.104	.101	.247	-.146	.107	.259	-.145
90%	.803	.755	.981	-.022	.851	1.125	-.022

Table 4: Disposition Effect

This table shows empirical results for the disposition effect. Column 1 (2) shows results for value (growth) funds. I regress a binary variable indicating a sale on a binary variable indicating whether the stock is trading at a gain. The coefficient of the gain variable is a direct measure of the disposition effect. Column 3 shows results for the entire sample. I include a binary variable indicating a value fund and I include an interaction term. The interaction term assesses whether value funds show a stronger disposition effect than growth funds. Panel A shows results for the baseline specification. Panel B includes the controls of Ben-David and Hirshleifer (2012) and stock, fund, and quarter fixed effects. All standard errors are clustered by fund and quarter.

	(1) Value	(2) Growth	(3) Both
Panel A: Baseline specification			
Gain	0.027***	-0.038***	-0.038***
	(3.61)	(-5.66)	(-5.66)
Gain x Value Fund			0.065***
			(8.84)
Value Fund			-0.099***
			(-8.00)
Constant	0.380***	0.479***	0.479***
	(38.22)	(57.85)	(57.85)
R^2	0.001	0.001	0.004
Adjusted R^2	0.001	0.001	0.004
Observations	1,762,660	1,863,693	3,626,353
Panel B: Controls & fixed effects			
Gain	0.053***	0.010**	-0.002
	(10.57)	(2.21)	(-0.44)
Gain x Value Fund			0.069***
			(11.55)
Value Fund			-0.060
			(-1.44)
Constant	0.368***	0.490***	0.474***
	(16.34)	(22.01)	(16.27)
Controls	Yes	Yes	Yes
Stock FE	Yes	Yes	Yes
Fund FE	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes
R^2	0.111	0.104	0.105
Adjusted R^2	0.106	0.100	0.103
Observations	1,762,346	1,863,335	3,626,058

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: The Effect of Rebalancing

This table shows empirical results for the disposition effect when a binary variable indicating a partial sale (column 1) or a binary variable indicating a sell-off (column 2) is used as a dependent variable. I regress a binary variable indicating a sale on a binary variable indicating whether the stock is trading at a gain. The coefficient of the gain variable is a direct measure of the disposition effect for growth funds. I include a binary variable indicating a value fund and I include an interaction term. The interaction term assesses whether value funds show a stronger disposition effect than growth funds. I include the controls of Ben-David and Hirshleifer (2012) and stock, fund, and quarter fixed effects. All standard errors are clustered by fund and quarter.

	(1) Rebalancing	(2) Sell-off
Gain	0.041***	-0.044***
	(12.01)	(-9.55)
Gain x Value Fund	0.002	0.068***
	(0.43)	(13.36)
Value Fund	-0.039	-0.021
	(-0.89)	(-0.73)
Constant	0.225***	0.249***
	(8.22)	(15.04)
Controls	Yes	Yes
Stock FE	Yes	Yes
Fund FE	Yes	Yes
Quarter FE	Yes	Yes
R^2	0.096	0.100
Adjusted R^2	0.093	0.098
Observations	3,626,058	3,626,058

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Fund Performance

This table shows the performance of value and growth funds for the period from 2000-2021. I regress the value-weighted fund returns on the market factor, the Fama and French (1993) size and value factors, and a momentum factor (Jegadeesh and Titman 1993; Carhart 1997). VMG ("Value-minus-Growth) is the return of a portfolio that goes long value funds and short growth funds.

	(1) Value	(2) Growth	(3) VMG
Market factor	0.916***	1.002***	-0.086***
	(60.30)	(77.09)	(-4.53)
Size factor	0.141***	0.090***	0.051**
	(7.00)	(5.22)	(2.03)
Value factor	0.326***	-0.215***	0.541***
	(17.43)	(-13.45)	(23.20)
Momentum factor	-0.041***	0.026**	-0.067***
	(-3.18)	(2.33)	(-4.15)
Alpha	-0.000	-0.000	0.000
	(-0.13)	(-0.67)	(0.35)
R^2	0.956	0.969	0.719
Adjusted R^2	0.955	0.968	0.714
Observations	264	264	264

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Fund Managers

This table shows empirical results for the disposition effect for managers who manage both value and growth funds at the same time. Column 1 (2) shows results for value (growth) funds. I regress a binary variable indicating a sale on a binary variable indicating whether the stock is trading at a gain. The coefficient of the gain variable is a direct measure of the disposition effect. Column 3 shows results for the entire sample. I include a binary variable indicating a value fund and I include an interaction term. The interaction term assesses whether value funds show a stronger disposition effect than growth funds. I include the controls of Ben-David and Hirshleifer (2012) and stock, manager, and quarter fixed effects. All standard errors are clustered by fund and quarter.

	(1) Value	(2) Growth	(3) Both
Gain	0.026***	0.001	-0.013
	(3.61)	(0.09)	(-1.02)
Gain x Value Fund			0.047**
			(2.53)
Value Fund			-0.044***
			(-3.14)
Constant	0.364***	0.478***	0.446***
	(7.94)	(12.42)	(14.58)
Controls	Yes	Yes	Yes
Stock FE	Yes	Yes	Yes
Manager FE	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes
R^2	0.207	0.207	0.169
Adjusted R^2	0.179	0.173	0.149
Observations	127,705	100,282	228,598

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Index Funds

This table shows empirical results for the disposition effect for a subsample of index funds. I only keep funds with index fund flag "B", "D", or "E" in the CRSP survivor-bias-free mutual fund database. Column 1 (2) shows results for value (growth) funds. I regress a binary variable indicating a sale on a binary variable indicating whether the stock is trading at a gain. The coefficient of the gain variable is a direct measure of the disposition effect. Column 3 shows results for the entire sample. I include a binary variable indicating a value fund and I include an interaction term. The interaction term assesses whether value funds show a stronger disposition effect than growth funds. I include the controls of Ben-David and Hirshleifer (2012) and stock, fund, and quarter fixed effects. All standard errors are clustered by fund and quarter.

	(1) Value	(2) Growth	(3) Both
Gain	0.038***	-0.021***	-0.032***
	(5.47)	(-3.01)	(-3.60)
Gain x Value Fund			0.074***
			(5.98)
Value Fund			0.000
			(0.00)
Constant	0.308***	0.585***	0.397***
	(11.05)	(18.26)	(17.96)
Controls	Yes	Yes	Yes
Stock FE	Yes	Yes	Yes
Fund FE	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes
R^2	0.164	0.153	0.143
Adjusted R^2	0.158	0.144	0.138
Observations	821,818	516,395	1,338,432

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Tax-loss Selling

This table shows empirical results for the disposition effect for subsamples based on quarters. Columns 1, 2, 3, and 4 use observations for the first, second, third, and fourth quarter of each year, respectively. I regress a binary variable indicating a sale on a binary variable indicating whether the stock is trading at a gain. The coefficient of the gain variable is a direct measure of the disposition effect. I include a binary variable indicating a value fund and I include an interaction term. The interaction term assesses whether value funds show a stronger disposition effect than growth funds. I include the controls of Ben-David and Hirshleifer (2012) and stock, fund, and quarter fixed effects. All standard errors are clustered by fund and quarter.

	(1)	(2)	(3)	(4)
	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
Gain	-0.003	-0.005	-0.002	-0.007
	(-0.35)	(-0.68)	(-0.23)	(-0.74)
Gain x Value Fund	0.063***	0.079***	0.072***	0.062***
	(8.26)	(9.18)	(10.30)	(7.60)
Value Fund	-0.070**	-0.031	-0.010	-0.069
	(-2.13)	(-0.54)	(-0.16)	(-1.27)
Constant	0.485***	0.493***	0.419***	0.472***
	(12.01)	(13.30)	(12.40)	(11.34)
Controls	Yes	Yes	Yes	Yes
Stock FE	Yes	Yes	Yes	Yes
Fund FE	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
R^2	0.130	0.122	0.129	0.137
Adjusted R^2	0.121	0.113	0.121	0.129
Observations	875,708	909,134	920,960	918,238

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$