Bachelor thesis

The disposition effect among short sellers: a position-level analysis

BSc in Economie en Bedrijfseconomie

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Table of contents

List of tables

Summary

Individual investors are most sensitive to make mistakes and some common mistakes investors make are called behavioural biases (Shapira and Venezia, 2001). A common behavioral bias is the disposition effect, which is "the tendency of investors to hold losing stocks too long and sell winning stocks too soon" (Shefrin and Statman, 1985). This study investigates if the disposition effect exists among short sellers. The analysis is based on investor-stock level and only consists of Dutch Stocks. The final sample consists of 60,906 total daily observations in the period 01/11/2012 – 08/04/2018. The first hypothesis predicts that the Proportions of Gains Realized (PGR) are higher than the Proportions of Losses Realized (PLR) because short sellers are eager to be risk-seeking in their losses and risk-averse in their gains. However, the results show that PLR is bigger than PGR. This can be explained by short-sellers being information traders that take benefits of price declines (Karpoff and Lou, 2010; Kecskés, Mansi and Zhang, 2012; Lynch, Nikolic, Yan and Yu, 2014; Liu, Ma and Zhang, 2012). Suggesting that I did not find clear evidence that the disposition effect exists. However, I expect a more significant disposition effect in the months January till November because short sellers will realize their losses in December due to tax-loss selling (Dyl, 1977). I find that the difference in proportions is higher in December compared to the remaining months. Although, I still do not find a disposition effect by excluding the month of December. Additionally, I run a z-test on investor type. Significant results are found for the investor types Bank, Corporate and "Mutual and pension fund/ Nominee/ Trust/ Trustee". The investor type Bank and Corporate realize their gains and hold their losses, which can indicate a disposition effect. Tax-loss selling is found in the investor type Corporate. The results of the investor type "Mutual and pension fund/ Nominee/ Trust/ Trustee" are the same as the results for the whole sample. Furthermore, I examine if the results differ based on the country in which the fund is headquartered. The three most dominant countries in the sample are the United Kingdom, the United States and France. Irish funds are more willing to hold their losses and to realize their gains. The opposite is true for the funds headquartered in the United Kingdom, Sweden and Hong Kong. For the other countries, I do not find significant results or not all the required data is available. Moreover, I investigate the price and returns. I find proof that with a higher relative price drop short sellers are selling their stocks immediately, whereas they are more hesitant to sell their stocks at a smaller relative price drop. This can also be explained by short sellers being information traders (Karpoff and Lou, 2010; Kecskés et al., 2012; Lynch et al., 2014; Liu et al., 2012).

Keywords: Disposition effect, Short sellers, Information traders, Investor type, Prospect theory

Chapter 1 - Introduction

With the decline of the interest rate, a lot of people in the Netherlands have entered the stock market to invest their money. The research of Kantar TNS (2017) showed a resurgence of Dutch individual investors in the stock market. The article by Shapira and Venezia (2001) indicates that these individual investors are most sensitive to make mistakes and some common mistakes investors make are called behavioural biases. The disposition effect is an example of a behavioural bias, which will be examined in this paper. The disposition effect, discussed by Shefrin and Statman (1985), refers to "the tendency of investors to hold losing stocks too long and sell winning stocks too soon". In the paper of Shefrin and Statman (1985) the disposition effect is explained by the prospect theory, which states that people are risk-averse in their gains and risk-seeking in their losses. A lot of academic papers about the disposition effect acknowledge the existence of the disposition effect among investors. However, for instance, the papers of Odean (1998) and Schlarbaum, Lewellen and Lease (1978) do not focus on professional investors. The papers of Feng and Seasholes (2005) and Boehmer and Wu (2012) state that professional investors are less susceptible to behavioural biases. One might argue that short sellers are perceived as the most professional investors in the market, who mostly rebalance the efficiency of the financial markets (Boehmer and Wu, 2012). Short sellers are perceived by academics as refined and informed traders, who benefits from stock prices declines (French, Lynch and Yan, 2012). Previous academic studies have found significant proof that short sellers are trading on information. For instance, short sellers anticipate on financial misconduct (Karpoff and Lou, 2010), facilitate creditors with inside information of the bond market (Kecskés et al., 2012), anticipate on macroeconomic news (Lynch et al., 2014) and predict the returns of short interests (Liu et al., 2012).

In this paper, I will extend on the research of Odean (1998), but I will use a unique dataset which focuses only on short sellers as used in the paper of Jank and Smaljbegovic (2017). With this dataset, I can make a clear distinction between the characteristics of short sellers, and test if there are significant differences between groups. This thesis investigates if short sellers fall for the disposition effect. This leads to the following research question:

Analysed on investor-stock level, do short sellers fall for the disposition effect?

The final sample consists of 60,906 total daily observations between the period 01/11/2012 – 08/04/2018. I investigate if the short sellers are realizing their gains quicker than they realize their losses by calculating the difference in proportions of the gains and losses realized in terms of the total observations of gains or losses. In the same way, I examine the difference in the Proportions Gains Realized (PGR) and Proportions Losses Realized (PLR) of the months January till November and the PGR and PLR of December. To calculate if there is a possible disposition effect in my sample, I run a one-tailed Z-test on the differences in proportions between the PGR and PLR. I perform this test on both the total sample and on an investor and country level to determine if there is a possible effect within those groups. In general, I did not find a clear indication that short sellers fall for the disposition effect. Although, I found significant differences between investor types and investor countries.

My thesis aims to deliver a contribution to the literature on the disposition effect. The studies of Shefrin and Statman (1985), Badrinath and Lewellen (1991) and Odean (1998) investigate the disposition effect. However, I use a unique dataset that provides me with data about short sellers and the characteristics of the funds.

I structure my thesis in the following way: Chapter 2 provides literature about the prospect theory, behavioral theory, tax effect and findings of previous literature. In chapter 2, I also describe the development of my hypotheses. Section 3 is about the data collection method and the research design. Chapter 4 describes and explains the results. Finally, section 5 consists of the conclusions, limitations and implications for further research.

Chapter 2 – Literature and hypothesis development

2.1. Prospect theory

The article of Kahneman and Tversky (1979) describes the prospect theory as an explanatory theory of decision-making under uncertainty. The disposition effect is an extension of the prospect theory of Kahneman and Tversky (1979) when the prospect theory is enlarged to investments. Decision makers behave under the prospect theory in order to maximize the S-shaped valuation function. To maximize their value function decision makers are in the losses area risk-seeking, whereas in the gains area decision makers are risk averse. The reference point used in the function is essential to determine the gains and losses. In most cases, the reference point is equal to the status quo. Although, people can value their reference points in different ways. In this study, the clearest proxy of the reference point is used, which is the average purchase price. The average purchase price is a moving average of the purchase price of a certain security adjusted after every change in the short position (Odean, 1998; Kahneman and Tversky, 1979; Shefrin and Statman, 1985).

2.2. Behavioral theory

A possible explanation for the existence of the disposition effect is that investors are unwilling to admit that they made a bad investment. Investors will hold on to their losses because they believe that there might be a possibility of price reversal. This will result in the quicker realization of the gains and postponement of realizing the losses. If investors look at the price levels in this way, then they discard the proper valuations of the stock prices and they think they are misvalued by the market (Odean, 1998).

2.3. Tax effect

In the month December investors realize their taxable losses, whereas they defer their taxable gains for tax purposes (Odean, 1998). This is in contradiction with the assumption that there are efficient capital markets (Dyl, 1977). The article of Dyl (1977) investigates if capital gains taxes affect investors' market behavior. The taxes of capital gains provide investors with a stimulus to postpone gains and to realize losses. The findings support the prediction that capital gain taxes affect the decisions an investor made at the end of the year and this is visible in the volumes of trading stocks in the month December. There is a probable lock-in effect of the capital gains at the year-end, whereas the losses are probably sold in December (Dyl, 1977).

The article of Lakonishok and Smidt (1986) also investigates taxation as a motivation of stock trading. In line with the study of Dyl (1977), they also find that investors realize their

losses and postpone the realized gains. Although they found proof that tax incentives have an effect on the volume of trading, there are also other non-tax related motives. For example, a theory of psychology or a trading strategy based on historical prices (Lakonishok and Smidt, 1986).

Additionally, the article of Badrinath and Lewellen (1991) examines the influence of capital gain taxes on trading behavior. They find a pattern where at the end of the year a significant amount of loss realization occurs, whereas a significant number of gains realizations take place at the beginning of the year (Badrinath and Lewellen, 1991).

Shefrin and Statman (1985) explain the fact that investors necessitate realizing losses in December with the term "self-control". They argue that an investor is unwilling to sell a stock for a loss. However, investors know that there are tax incentives related to realizing losses in December. Therefore, investors defer the realized losses until the end of the year. The article concludes that the patterns of the realization of gains and losses cannot be explained alone by taxes. The pattern is a combined influence of taxes and the settlement to hold losers and sell winners (Shefrin and Statman, 1985; Odean, 1998).

2.4. Previous literature

The study of Odean (1998) provides an analysis of the investor-stock level of the disposition effect among individual investors. He investigates the disposition effect through investigating trading records from a large discount brokerage house in the period 1987 and 1993. The article finds evidence that investors prefer to sell winners and hold losers throughout the year, except for the month of December. In the month December investors have a tax motivation to sell. The behavior of investors is explained by portfolio performance and investors are not motivated by rebalancing portfolios or avoidance of high trading costs for stocks having a low price. However, the paper does not make a clear distinction between individual and professional investors. This study focuses only on professional investors, who probably are less affected by behavioral biases.

The study of Jank and Smajlbegovic (2017) also focus on professional investors. They use newly available data, which I also use in my thesis to investigate the disposition effect. On the first of November 2012, it became mandatory in the European Union (EU) to disclose a uniform short position when crossing 0.50% of outstanding shares traded on European exchanges. Additionally, it is also compulsory to disclose the short position when the short position increases with every 0.10%. The new requirement aims to improve the transparency of short positions kept by investors in EU securities. The disclosure should include the short

position date and disclosure, ISIN code, the shorted stock name and the scope of the position shown as a percentage of outstanding shares and the investor name, which is stated in Article 9 of Regulation (EU) No236/2012.

2.5. Hypothesis 1

In this article, I will investigate if the short sellers sell their winners too early and hold their losers too long. I use the same methodology as Odean (1998). However, I focus on short sellers, which means that when the average purchase price of a security is higher (lower) than both the daily high and daily low price then this is defined as a gain (loss). I expect that the short sellers will realize their gains quicker and hold on to their losses according to the prospect theory of Kahneman and Tversky (1979). According to the existence of the disposition effect, I expect that short sellers are eager to be risk-seeking in their losses and risk-averse in their gains (Odean, 1998; Kahneman and Tversky, 1979; Shefrin and Statman, 1985). This results in the following hypotheses:

Hypothesis 1: *PGR > PLR*
The null hypothesis is: *PGR $\leq$ PLR*

2.6. Hypothesis 2

The studies of Dyl (1977), Lakonishok and Smidt (1986) and Badrinath and Lewellen (1991) found proof that more losing investments are sold in the month of December. Investors will realize their losses in December, because of the phenomenon tax-loss selling. With the exclusion of the month December, I expect a more significant disposition effect in the months January till November because I exclude the higher expected percentage of realized losses in the month December. This leads to the following hypotheses:

Hypothesis 2: *PLR – PGR in December > PLR – PGR in January-November*
The null hypothesis is: *PLR - PGR in December ≤ PLR - PGR in January- November.*

Chapter 3 – Methodology

3.1. Data collection method

The sample period starts on the first of November 2012 because on this date it became mandatory in the EU to disclose a uniform short position when crossing 0.50% of outstanding shares traded on European exchanges according to Article 9 of Regulation (EU) No236/2012. Additionally, it is also compulsory to disclose the short position when the short position increases with every 0.10%. The sample period ends on eight April 2018 being the last recorded active short position change in the data.

In my study, I use three different datasets and the merging of those three datasets results in a unique dataset. The first dataset is obtained from the Autoriteit Financiële Markten (AFM), which provides data about historical and actual short positions on Dutch stocks. I collect the fund name, short position level, ISIN code of the stock and the position day. Certain short positions went below the threshold of 0.50 and the same funds went a couple of days later above the threshold of 0.50. If I keep the data of these positions in my sample, it would have caused invalid data. This is because I cannot make any assumptions about the short positions which are below the threshold of 0.50. According to the new short position requirements, it is not mandatory to disclose short positions, which are below the threshold of 0.50. To solve this issue, I create a short position ID that gives a unique value when a company takes a position of 0.50 in a security, and the short position stays above the threshold. The last observation of an ID is the day a company's short position goes below the 0.50 threshold. With the usage of the ISIN codes of the AFM dataset, I gather my second dataset out of Compustat. Compustat provides daily data on the corresponding stocks, which exists of the (high, low and close) price, dividends and the adjustment factor. I drop the stocks with missing values of daily prices, dividends or the adjustment factor. The last dataset comes out of Orbis, which provides static data of the investor type and the country where the fund is headquartered. I hand-collected this data out of Orbis based on the company name, which is provided by the AFM sheet. I drop the companies which did not provide any characteristic data on the investor in Orbis. In Stata, I merge the AFM data with the Compustat data, based on the position date and ISIN code. Then, I merge this data with the data of Orbis based on company numbers, which I numbered myself. This results in a final sample of 60,906 total daily observations.

3.2. Research design

In this paper, I use the same formula as Odean (1998) to calculate if the short sellers sell their winners too early and keep their losers too long and combine this formula with the newly available data on short sellers. I add an open-close indicator to my master file, as well as some dummy variables, which I further discuss in chapter 3.3, to determine if it is either a realized gain, realized loss, paper gain or paper loss. When the Average purchase price of a position is higher (lower) than both the daily high as the daily low price then I record this as a gain (loss). When an investor makes the decision to sell when their stock records a gain (loss), this will be defined as a realized gain (loss). However, when an investor does not act on the opportunity to realize this gain (loss), this will be defined as a paper gain (loss). I record neither a gain or a loss on the days that the average purchase price lies between the daily high or the daily low price. In this paper, I make the assumption that short sellers have the ability to either realize their gains and losses on a daily basis because short sellers are actively rebalancing their portfolio on a daily basis. This is a fair assumption because the short sellers are perceived as the most professional investor in the market that mostly rebalance the efficiency in the financial markets (Boehmer and Wu, 2012). In this paper, I will not corporate the borrowing cost and the dividends into the daily prices, because this will not have any effect on the decision to either sell or hold that security (Odean, 1998). However, the stock prices are adjusted for stock splits, with the daily adjustment factor.

3.2.1. Hypothesis one

The first hypothesis investigates if the PGR is higher than the PLR. To investigate the first hypothesis, I calculate if the short sellers are realizing their gains quicker than they realize their losses. I do this by calculating the difference in proportions of the gains and losses realized in terms of the total observations of gains or losses. I use the same formula as Odean (1998) leading to the following formulas:

Realized Gains ÷ (Realized Gains + Paper Gains)=PGR (1)
Realized Losses÷(Realized Losses + Paper Losses)=PLR (2)

3.2.2. Hypothesis two

The second hypothesis examines the difference in proportions of the PGR and PLR of January till November and the PGR and PLR of December. I do this to calculate if short sellers are more eager to realize their losses in December in comparison to the other months. I use the

same formula as Odean (1998), as shown in section 3.2.1 but specified the formula by January-November and December.

3.2.3. Z-test

To calculate if there is a possible disposition effect in my sample, I will run a one-tailed Z-test on the differences in proportions between the PGR and PLR. I will perform this test on both the total sample and on an investor and country level, to determine if there is a possible effect within those groups. Within this sample, I will use a significance level of **0.05.** This leads to the following hypotheses in those tests.

H0: PGR = PLR

H1: PGR ≥ PLR

Results, which show that the PGR ≥ PLR will be marked with *.

The z-statistic and the significance of the Z-tests will be implemented within my results. However, when the Z-test provides a significance level with an output, which is bigger than **0.95**, I assume with a certainty of 95 percent that the PLR is bigger than the PGR. When this happens then this contradicts with my expectation about the results of the disposition effect. Although these results would not result in any proof of the existence of a disposition effect among short sellers. These results might provide other evidence surrounding investment patterns of short sellers. This results in the following hypotheses:

H0: PGR is equal to PLR

H1: PGR ≤ PLR

Results which show that the PGR ≤ PLR will be marked with **.

3.2.4. Additional analyses

In this thesis, I also want to test if there is a difference between the PGR and PLR by calculating the difference in investor type and investor country. This will give a deeper analysis of the disposition effect on the investor-stock level. To test this, I will calculate the effect on both hypothesis 1 and hypothesis 2 and test if there is a categorical difference in investor type or investor country.

3.3. Description variables

Table 3.1. shows the variables which I use in order to investigate the hypotheses.

Table 3-1. Description variables

Variable	Description
Proportions of gains realized (PGR)	PGR is the outcome of realized gains divided by realized gains and paper gains (Odean, 1998). *Realized Gains÷ (Realized Gains + Paper Gains)*
Proportions of losses realized (PLR)	PLR is the outcome of realized losses divided by realized losses and paper losses (Odean, 1998). *Realized Losses÷(Realized Losses + Paper Losses)*
HLC price	The daily average of the high, low and close price of a security (Milton, 2017)
Average purchase price	The moving average of the purchase price of a certain security adjusted after every change in the short position.
Absolute Return	The absolute value of the Average purchase price minus the HLC price.
Open	A dummy variable equal to one when a fund takes a bigger short position in a certain security, and zero otherwise.
Close	A dummy variable equal to one when a fund takes a smaller short position in a certain security, and zero otherwise.
Papergain	A dummy variable equal to one when both the following two conditions are satisfied: (1) The average purchase price is higher than both the daily high and close price, (2) the dummy variable close is equal to zero.
Realizedgain	A dummy variable equal to one when both the following two conditions are satisfied: (1) The average purchase price is higher than both the daily high and close price, (2) the dummy variable close is equal to one.
Paperloss	A dummy variable equal to one when both the following two conditions are satisfied: (1) The average purchase price is lower than both the daily high and close price, (2) the dummy variable close is equal to zero.
Realizedloss	A dummy variable equal to one when both the following two conditions are satisfied: (1) The average purchase price is lower than both the daily high and close price, (2) the dummy variable close is equal to one.
Investor country	The country where the headquarter of a fund is located.
Investor type	A categorical variable: (1) bank, (2) corporate, (3) financial company, (4) hedge fund, (5) mutual and pension fund/ nominee/ trust/ trustee, (6) private equity firm.
Stock position ID	An identifier that gives a unique value when a company takes a position of 0.50 in a security and the short position stays above the threshold. The last observation of an ID is the day a company's short position goes below the 0.50 threshold.

3.4. Descriptive statistics

The final sample consists of 60,906 total daily observations, 149 funds, 66 stocks and 920 ID positions. However, with 149 unique companies holding 920 unique ID's this creates the statistic that a fund has a mean of 6.18 suggesting that one fund has on average 6.18 stocks. Additionally, a fund has a median of 2, which means that the median is smaller than the median and skews to the right. This is caused by a few funds holding a large amount of ID's.

There are six different investor types: bank, corporate, financial company, hedge fund, mutual and pension fund/nominee/ trust/ trustee and private equity firms. Table 3.2. indicates the descriptive statistics of each investor type. The mean is 66.20 suggesting that an ID is kept circa 66 days. A hedge fund kept an ID circa 164 days, which is approximately two and a half times higher than the total mean. Additionally, the median is approximately four times higher than the total mean of 25. A possible explanation is that the investor type hedge fund only has 6 observations, which have a few outliners, e.g. one hedge fund has 478 observations.

Table 3-2 Descriptive statistics specified by investor type

Investor type	N	Days that an ID is kept by an entity number	
		Mean	Median
Bank	80	55.50	26.50
Corporate	54	69.33	16.50
Financial Company	87	47.84	16.00
Hedge Fund	6	164.00	105.50
Mutual and pension fund/ Nominee/ Trust/ Trustee	621	64.48	26.00
Private equity firm	72	104.60	38.00
Total	920	66.20	25.00

The 920 ID positions are headquartered in fifteen countries (see table 3.3.) The three biggest countries in this sample account for 90.33% of all the ID's. Hypothesis 2 and the alternative test on the country level will only be tested on the country types: United Kingdom, United States and France. This is due to the fact that the other countries will not have enough observations to perform a solid test on a country level.

Table 3-3. Location of the headquarter

Investor country	N	Total observations gains	Total observations losses
United Kingdom	432	11,735	13,449
Netherlands	5	281	110
United States	358	11,132	11,855
Bermuda	2	19	17
Sweden	1	6	48
Hong Kong	12	263	233
Ireland	10	108	217
France	41	978	1,468
Canada	18	405	549
Switzerland	6	165	171
Cayman Islands	5	64	464
Australia	16	97	75
Brazil	1	1	0
Belgium	2	55	96
Monaco	2	6	0
Total	920	25,315	28,752

Chapter 4 – Results

4.1. Hypothesis 1

To test the first hypothesis on the whole sample, I perform a one-tailed Z-test on the difference in proportions between PGR and PLR (see table 4.1.). The Z-statistic in this test is 2.261 with a significance of 0.988. These results are not in line with hypothesis 1 that the PGR $\geq$ PLR. However, I can conclude with a significance level of 0.95 that the PLR $\geq$ PGR. A possible explanation for this phenomenon is that the short sellers take a short position when they get information on future price drops of a security. However, once the security they have invested records a loss, the short sellers might be misinformed about these price drops and realize their losses as soon as they can. However, when they take a short position in these stocks and the information about the stock prices are correct, they are more willing to wait to realize their gains to make more profit on these price drops and realize their gains somewhat later. Suggesting that the short sellers are holding their gains and realizing their losses. This is in line with the articles of Christophe, Ferri and Hsieh (2010), Karpoff and Lou (2010), Kecskés et al. (2012), Lynch et al. (2014) and Liu et al. (2012), which provides evidence that short-sellers are informed traders and try to take advantage of price drops.

Table 4-1. Difference in proportions between PGR and PLR

	Whole Year	December	Jan. – Nov.
PLR	0.053	0.047	0.054
PGR	0.049	0.039	0.050
Difference in proportions	0.004	0.008	0.004
Z-statistic	2.261	1.336	1.963
Significance level	0.988**	0.909	0.975**

(*significance level<0.05, **significance level>0.95). See Appendix for additional information

4.2. Hypothesis 2

To test the second hypothesis on the whole sample, I performed a one-tailed Z-test on the difference on proportions between PGR and PLR for December and the PGR and PLR for the months January until November (see table 4.1.). Both the PGR as the PLR decreased in the month December, while I expected an increase in PLR and a decrease in PGR. The results of the month of December are not significant, so they do not provide any evidence of tax-loss selling among short sellers. Although the difference in proportions in December is higher than the difference in proportions in the months January till November, the result is not significant and thus rejects hypothesis 2. For the other eleven months, there was no significant change in the proportions compared to the proportions of hypothesis 1.

4.3. Investor type

Table 4.2. tests if there is a disposition effect among certain types of investors by performing a one-tailed Z-test. To investigate the disposition effect, I calculate the PLR and PGR for the whole year, December and January-November. The results in table 4.2. show no significant results for the investor types: Financial Company, Hedge funds and Private equity firm. There is not a significant difference between the PGR and the PLR of these investors. For three investors types the test shows significant results: Bank, Corporate and "Mutual and pension fund/ Nominee/ Trust/ Trustee".

Firstly, I will discuss the results of Bank, as the Z-statistic of -2.308 of the whole year indicates that the investor type Bank is realizing their gains and holding their losses, which can indicate a disposition effect. When excluding the month December, the results remain the same and are significant in the months January till November. However, the results of the month December are not significant and there is no sign of tax-loss selling.

Secondly, the results of Corporate indicate that the investor type Corporate also realizes their gains and hold their losses, which indicates a disposition effect. However, Corporate also shows differences in the proportions between December and January-November. The results of December are insignificant (0.679) with a difference of 0.10 between PLR and PGR, but the results of January-November are significant (0.009) with a difference of -0.16 between PLR and PGR. These results can indicate that the investor type Corporate is overall reluctant in selling their losses and holding their gains, with the exception of December. In December they are realizing their losses and holding their gains, because of the phenomenon tax-loss selling as explained by Dyl (1977).

Lastly, the results of Mutual and pension fund/ Nominee/ Trust/ Trustee are insignificant (1.000) with a difference of 0.08 between the PLR and PGR and a Z-Statistic of 3.555. The same assumptions can be made as I did for the test on the whole sample, discussed in section 4.2. The reason for this is that they have the biggest impact on the sample with 67.5% of the ID's. The results of the whole sample show this effect solely due to the existence of this effect in the investor type Mutual and pension fund/ Nominee/ Trust/ Trustee.

A possible explanation why the effect is different between these investors is that either the Mutual and pension fund/ Nominee/ Trust/ Trustee are more risk-averse in their losses with a PLR of 0.59 to the PLR of 0.48 and 0.30 of Bank and Corporate. Another possible explanation is that the investor type Mutual and pension fund/ Nominee/ Trust/ Trustee have more uncertainty around their information than banks and corporate investors, and will realize their losses earlier than the other investors.

17

Table 4-2. Difference in proportions between PGR and PLR specified by investor type

	Whole Year	December	Jan. – Nov.
Investor type = Bank			
PLR	0.045	0.019	0.048
PGR	0.063	0.043	0.066
Difference in proportions	-0.018	-0.024	-0.018
Z-statistic	-2.308	-1.347	-2.088
Significance level	0.011*	0.089	0.018*
Investor type = Corporate			
PLR	0.030	0.036	0.030
PGR	0.044	0.026	0.046
Difference in proportions	-0.014	0.010	-0.016
Z-statistic	-2.118	0.465	-2.364
Significance level	0.017*	0.679	0.009*
Investor type = Financial Company			
PLR	0.060	0.054	0.060
PGR	0.052	0.038	0.054
Difference in proportions	0.008	0.016	0.006
Z-statistic	0.968	0.711	0.794
Significance level	0.834	0.761	0.786
Investor type = Hedge fund			
PLR	0.033	0.036	0.033
PGR	0.028	0.000	0.033
Difference in proportions	0.005	0.036	0.000
Z-statistic	0.385	1.291	-0.012
Significance level	0.650	0.902	0.495
Investor type = Mutual and pension fund/ Nominee/ Trust/ Trustee			
PLR	0.058	0.049	0.059
PGR	0.050	0.040	0.051
Difference in proportions	0.008	0.009	0.008
Z-statistic	3.555	1.272	3.370
Significance level	1.000**	0.898	1.000**
Investor type = Private equity firm			
PLR	0.041	0.061	0.040
PGR	0.040	0.052	0.040
Difference in proportions	0.001	0.010	0.000
Z-statistic	0.255	0.460	0.168
Significance level	0.601	0.677	0.567

(*significance level <0.05, **significance level >0.95)
See Appendix for additional information

4.4. Alternative test by investor type

Table 4.3. shows the results of a T-test on equal means. In this test, I calculated the PGR and PLR on every ID. For this alternative test, I perform a two-sample T-test with equal variances, where H0: PLR = PGR and H1: PGR ≥ PLR. The test provides 659 accounts that record a PLR and 651 accounts that record a PGR. The PLR records a mean of 0.160 and the PGR records a mean of 0.139. The T-value on this test is 1.488 with a significance of 0.932. With these results, I cannot discard the H0, so there is no significant difference between the means of the PGR and PLR of all the accounts. Table 4.3. also provides the results of a T-test on equal means on investor type level. However, the results of this test do not provide extra insights on the disposition effect on investor level. This is because all the significance levels of the investor types are within the range of 0.05-0.95. There is no significant difference between the means per account on investor type level between PGR and PLR.

In this test, the accounts are all equally weighted, which means that I test the average PLR and average PGR of all the accounts. With this test, I take a different approach on the assumption of independence, which now shifted from an independence on transaction level to an independence on account level. Table 4.3 shows that there is a difference between the PLR and PGR, but the difference is not significant. In comparison to the other test, the results have shown that the significance of these tests have changed in value, which can be explained by having some accounts with a significant impact on the sample as a whole in the other test. These same accounts in this alternative test have a lower impact on the PGR and PLR. Another explanation for these results can be that the sample is too small to show a significant effect, because the difference between the PLR and PGR did increase in comparison to the other test. Although this test can be a great addition to this paper it makes the assumption that the PGR and PLR are homoskedastic, while they show clear signs of being heteroskedastic.

Table 4-3. Alternative test by investor type

Investor type	PLR (N)	PGR (N)	Degrees of freedom	T- Statistic	Significance
Bank	0.112 (59)	0.139 (58)	115	-0.644	0.261
Corporate	0.180 (31)	0.167 (33)	62	0.186	0.574
Financial company	0.199 (58)	0.135 (59)	115	1.202	0.884
Hedge fund	0.054 (4)	0.042 (5)	7	0.245	0.593
Mutual and pension fund/ Nominee/ Trust/ Trustee	0.165 (453)	0.141 (444)	895	1.388	0.917
Private equity firm	0.126 (54)	0.115 (52)	104	0.266	0.605
Total	0.160 (659)	0.139 (651)	1,308	1.488	0.932

See Appendix for additional information

4.5. Investor country

Table 4.4. shows the returns when I test the difference in proportions between PLR and PGR examined on the country level within my sample. With these results, there are eleven country types where I cannot make any assumption on because of a significance level within the range of 0.05-0.95 or missing data. The nine country types that show a significance level within the range of 0.05-0.95 are the Netherlands, United States, Bermuda, France, Canada, Switzerland, Cayman Islands, Australia and Belgium, which implies that PLR and PGR of these country types are equal. The two country types with missing data are Brazil and Monaco. The missing data in this sample implies that Brazil and Monaco missed at least a Paper gain, Paper loss, Realized gain or Realized loss. There is just one country which shows a sign of a disposition effect on country level. This is Ireland, which means that the PGR $\geq$ PLR with a significance of 0.034 and a z-value of -1.825. Of the remaining three country types, United Kingdom, Sweden and Hong Kong, I imply that the PLR $\geq$ PGR, because the significance is $\geq$ 0.95. The countries the United Kingdom, the United States and France account for 90.33% of all the ID's. The results of the United States and France are not significant. However, I do find significant results for the United Kingdom and I can conclude that these results have a big impact on the results of the whole sample, which also indicates that the PLR $\geq$ PLG.

With these results, I can make the assumption that funds which are headquartered in Ireland are more willing in holding their losses and realizing their gains. They are risk seeking

in their losses and risk-averse in their gains. The opposite accounts for funds which are headquartered in the United Kingdom, Sweden and Hong Kong. They are more willing in realizing their losses and holding their gains. This implies that they are risk averse in their losses and risk seeking in their gains. This can also be caused by Irish funds having more faith in their information on price drops or they are more willing in taking the risk of holding their losses.

Table 4-4. Difference in proportions between PGR and PLR specified by country

Investor country	PLR	PGR	Z-statistic	Significance
United Kingdom	0.058	0.050	2.854	0.998**
Netherlands	0.055	0.025	1.470	0.929
United States	0.050	0.049	0.554	0.710
Bermuda	0.059	0.053	0.081	0.532
Sweden	0.063	0.000	1.738	0.959**
Hong Kong	0.137	0.030	4.364	1.000**
Ireland	0.018	0.056	-1.825	0.034*
France	0.045	0.056	-1.260	0.104
Canada	0.027	0.012	1.596	0.945
Switzerland	0.023	0.030	-0.392	0.347
Cayman Islands	0.013	0.031	-1.125	0.130
Australia	0.160	0.186	-0.438	0.331
Brazil	.	1.000	.	.
Belgium	0.021	0.000	1.077	0.859
Monaco	.	0.167	.	.

(*significance level <0.05, **significance level >0.95) See Appendix for additional information

Table 4.5. shows the results of the test on the differences in proportions on a country level of the three biggest countries where funds are headquartered between the PGR and PLR of December and the PGR and the PLR of January-November. In the United Kingdom, there is only an effect on the proportions of January-November, which contradicts with my expectations for this test. The significance of 0.998 shows a significant difference between the PLR and the PGR, which concludes that in the months of January till November the PLR ≥ the PGR. The results do not show a significance level higher than 0.95 in December, which is not in line with the prediction of hypothesis 2.

In the United States, there is a big difference of 0.018 between PLR and PGR of December with a significance of 0.982. However, this cannot be caused by tax-loss selling because the PLR of December is as big as the PLR of January-November. Suggesting that investors in the United States are not realizing their gains in December.

In France, the results do not show any difference in proportions between the PGR and PLR of December (-0.010) and January-November (-0.009). Additionally, the results are not significant.

Table 4-5. Difference on proportions between PGR and PLR for Dec and Jan - Nov

	December	Jan. – Nov.
United Kingdom		
PLR	0.049	0.059
PGR	0.046	0.050
Difference in proportions	0.003	0.009
Z-statistic	0.316	2.891
Significance level	0.624	0.998**
United States		
PLR	0.050	0.050
PGR	0.032	0.051
Difference in proportions	0.018	0.001
Z-statistic	2.100	-0.058
Significance level	0.982**	0.477
France		
PLR	0.029	0.047
PGR	0.039	0.058
Difference in proportions	-0.010	-0.009
Z-statistic	-0.408	-1.222
Significance level	0.342	0.111

*(*significance level <0.05, **significance level >0.95)*
See Appendix for additional information

4.6. Alternative test investor country

Table 4.6. shows the results of the two- sample T-test on equal means on a country-level. However, all the results within this test where insignificant so there is no significant difference between the average PLR and the average PGR on a country level. The null hypothesis that the average PLR = average PGR holds in this case. The change in value of the significance level in this test, in comparison to the Z-test can be explained by a lower sample, or that some accounts now have less impact on the sample as a whole.

Table 4-6. Alternative test investor country

Investor country	PLR (N)	PGR (N)	Degrees of freedom	T- Statistic	Significance
United Kingdom	0.161 (325)	0.137 (310)	633	1.173	0.879
United States	0.156 (245)	0.152 (262)	505	0.162	0.564
France	0.142 (32)	0.120 (28)	58	0.372	0.644

See Appendix for additional information

4.7. Price and returns

Table 4.7. provides the results of a one-tailed Z-test on the differences in proportions between PLR and PGR with the absolute returns and stock price as group variables. This test provides us with data on the PGR and PLR if the short sellers are making relatively higher losses or gains. The table shows that for prices ≤ 10, the PLR is bigger than the PGR with a significance level >0.95. Only the absolute returns $0.15 <[R] \leq 0.30$, are showing a significance level <0.95. With these statistics, I assume that short sellers are more willing to realize their losses as opposed to their gains for low price level stocks because the returns are absolute, which means that the gains and losses are relatively high in terms of the price levels. This can be due to the fact that the short sellers took a significant loss holding this security, so they might be misinformed about future price drops of this security. This is in line with the assumption that short sellers are information traders (Karpoff and Lou, 2010; Kecskés et al., 2012; Lynch et al., 2014; Liu et al., 2012).

When the stock price level lies between €10 > Price $\leq$ €25 the results do not show any significant returns. There is, however, a slight difference between the proportions of PGR and PLR. This suggest that for small returns short sellers are more willing to realize their gains, and for high returns short sellers are more willing to realize their losses. However, these results are not significant so based on these results, I assume that the PGR and the PLR are equal when the price level lies between the 10 and 25 euros.

For the stock level prices which are > 25, there is a significant effect on the returns of $0.15 <[R] \leq 0.30$. The short-sellers are more willing to realize their gains as opposed to their losses. An explanation for this can be that the short sellers made a relatively small loss and are still willing to wait and see if their information was right about the future price drops. For a higher amount of returns, the PLR = PGR again, because of a significance between 0.05 and 0.95.

The results in table 4.7 are in line with the explanation that short sellers are information traders which indicates that the PLR > PGR for a lot of short sellers is justified. This is shown that with a higher relative price drop, the short sellers are selling their stocks right-away. While they are still eager to wait when the relative price drop is small, which is why PLR > PGR for low priced stocks and that the PGR > PLR for the high-priced stocks with small relative losses.

Table 4-7. Price and returns

	[R]≤0.15	0.15 <[R] ≤0.30	0.30 <[R] ≤0.50	0.50≤[R]
Price ≤€10				
PLR	0.074	0.064	0.065	0.062
PGR	0.057	0.054	0.041	0.050
Difference	0.017	0.010	0.024	0.012
Z-statistic	1.792	1.119	2.700	2.149
Significance	0.963**	0.869	0.997**	0.984**
€10 > Price ≤€25				
PLR	0.041	0.042	0.056	0.058
PGR	0.081	0.056	0.046	0.056
Difference	-0.040	-0.014	0.010	0.002
Z-statistic	-1.141	-0.977	0.874	0.615
Significance	0.127	0.167	0.809	0.731
Price>€25				
PLR	.	0.018	0.048	0.043
PGR	.	0.065	0.038	0.043
Difference	.	-0.047	0.010	0.000
Z-statistic	.	-1.777	0.599	-0.085
Significance	.	0.038*	0.725	0.466

*(*significance level <0.05, **significance level >0.95)*
See Appendix for additional information

Chapter 5 – Conclusion

This thesis provides deeper insights into the existence of the disposition effect among short sellers on the investor-stock level. The results of my study have not shown a clear sign of a disposition effect among short sellers in general. However, a deeper analysis of investor type and country level showed significant differences within those groups. A possible explanation could be the following: by certain investor types being more risk averse or risk seeking than other investor types (Kahneman and Tversky, 1979); by certain investors types being better informed than other investor types (Christophe et al., 2010; Karpoff and Lou, 2010; Kecskés et al., 2012; Lynch et al., 2014; Liu et al., 2014) or different investors using other strategies within their company (Dyl, 1977). However, the alternative test which made an assumption on the independence on an account level, did not show any difference between the PGR and PLR. For future research, one should try to get a hold of the real purchase price and not use the weighted average of the high, low and close price, which I did in this thesis. Another calculation for the gains and losses would be more accurate with the use of daily returns of the securities. Another recommendation for further research in this area is to use a more accurate database on investor type. The database should consist of time series data instead of static data. This can provide historical characteristically data on funds for the period they are actively holding their short position, e.g. data on their employees, data on their equity level or data on their company value. Another limitation is that this study is only focused on Dutch stocks and to increase the generalizability further research may use EU stocks. Although this paper did not provide clear evidence on the existence of the disposition effect among short sellers. This paper can be an example of short sellers being information traders that try to act on price deductions, which is in line with the articles of Christophe et al. (2010), Karpoff and Lou (2010), Kecskés et al. (2012), Lynch et al. (2014) and Liu et al. (2012). Future studies can use this thesis as a guideline to investigate the existence of behavioral biases among short sellers on investor-stock level.

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Appendix

Additional information table 4.1.

	Whole year	December	Jan- Nov
Paper gain	24,080	2,182	21,898
Realized gain	1,235	89	1,146
Paper loss	27,226	2,431	24,795
Realized loss	1,526	120	1,406
Total observations gains	25,315	2,271	23,044
Total observations losses	28,752	2,551	26,201

Additional information table 4.2. and 4.3.

	Whole Year	December	Jan. – Nov.
Investor type = Bank			
Paper gain	1,033	112	921
Realized gain	70	5	65
Paper loss	2,626	260	2,366
Realized loss	125	5	120
Total observations gains	1,103	117	986
Total observations losses	2,751	265	2,486
Investor type = Corporate			
Paper gain	1,795	188	1,607
Realized gain	83	5	78
Paper loss	1,391	80	1,311
Realized loss	43	3	40
Total observations gains	1,878	193	1,685
Total observations losses	1,434	83	1,351
Investor type = Financial Company			
Paper gain	1,702	175	1,527
Realized gain	94	7	87
Paper loss	1,748	175	1,573
Realized loss	111	10	101
Total observations gains	1,796	182	1,614
Total observations losses	1,859	185	1,674

Investor type = Hedge fund

Paper gain	312	46	266
Realized gain	9	0	9
Paper loss	532	27	505
Realized loss	18	1	17
Total observations gains	321	46	275
Total observations losses	550	28	522

Investor type = Mutual and pension fund/ Nominee/ Trust/ Trustee

Paper gain	16,316	1,440	14,876
Realized gain	857	60	797
Paper loss	17,215	1,659	15,556
Realized loss	1,069	86	983
Total observations gains	17,173	1,500	15,673
Total observations losses	18,284	1,745	16,539

Investor type = Private equity firm

Paper gain	2,922	221	2,791
Realized gain	122	12	110
Paper loss	3,714	230	3,484
Realized loss	160	15	145
Total observations gains	3,044	233	2,811
Total observations losses	3,874	245	3,629

Additional information table 4.4. and 4.6.

Investor country	Paper Gain	Realized Gain	Total observations gains	Paper loss	Realized loss	Total observations losses
United Kingdom	11,151	584	11,735	12,670	779	13,449
Netherlands	274	7	281	104	6	110
United States	10,590	542	11,132	11,259	596	11,855
Bermuda	18	1	19	16	1	17
Sweden	6	0	6	45	3	48
Hong Kong	255	8	263	201	32	233
Ireland	102	6	108	213	4	217
France	923	55	978	1,402	66	1,468
Canada	400	5	405	534	15	549
Switzerland	160	5	165	167	4	171
Cayman Islands	62	2	64	458	6	464
Australia	79	18	97	63	12	75
Brazil	0	1	1	0	0	0
Belgium	55	0	55	94	2	96
Monaco	5	1	6	0	0	0

Additional information table 4.5.

	December	Jan. – Nov.
United Kingdom		
Paper gain	935	10216
Realized gain	45	539
Paper loss	1130	11540
Realized loss	58	721
Total observations gains	980	10755
Total observations losses	1188	12261
United States		
Paper gain	1031	9559
Realized gain	34	508
Paper loss	966	10293
Realized loss	51	545
Total observations gains	1065	10067
Total observations losses	1017	10838
France		
Paper gain	100	823
Realized gain	4	51
Paper loss	134	1268
Realized loss	4	62
Total observations gains	104	874
Total observations losses	138	1330

Additional information table 4.7.

	[R]≤0.15	0.15 <[R] ≤0.30	0.30 <[R] ≤0.50	0.50≤[R
Price ≤€10				
Paper gain	1,262	1,423	1,338	3,264
Realized gain	76	81	57	173
Paper loss	1,227	1,172	1,054	3,190
Realized loss	98	80	73	212
Total observations gains	1,338	1,504	1,395	3,437
Total observations losses	1,325	1,252	1,127	3,402
€10 > Price ≤€25				
Paper gain	79	436	726	5,666
Realized gain	7	26	35	333
Paper loss	93	388	639	7,938
Realized loss	4	17	38	488
Total observations gains	86	462	761	5,999
Total observations losses	97	405	677	8,426
Price > €25				
Paper gain	22	116	300	9,445
Realized gain	0	8	12	427
Paper loss	15	110	296	11,101
Realized loss	0	2	15	499
Total observations gains	22	124	312	9,872
Total observations losses	15	112	311	11,600