

The Disposition Effect, a Behavioral Bias in the Financial Market

A Survey of the Disposition Effect

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Summary

This paper is a survey of existing papers on the disposition effect, which may be described as a tendency for investors to ride losers too long and sell winners too soon. It provides a comprehensive overview of the existing work done on the disposition effect and further analysis should be done in order to make a theoretical framework that may explain the disposition effect to a larger extent than the current framework.

The objective of this paper has been to compare results from prior analysis, especially regarding how the level of sophistication affects the degree of disposition effect. Results from different studies do not always match, and this paper will investigate this matter and provide possible explanations to this lack of consistency.

The prior returns are normally neglected in analysis of the disposition effect, and the paper claim that prior returns has an explanatory value in understanding the level of disposition effect investors are prone to, both empirically and theoretically.

When news about a security is released, the security prices do not always change as much as the news should imply. Disposition investor will sell securities that are experiencing positive news and create an excess supply, hence making the security prices lower than it should be. If the news is negative the disposition investors will not sell the security, holding the demand higher than it should be related to the news. This is one of the implications of the disposition effect among investors in the financial market.

The disposition effect is reduced when the level of sophistication among investors increases. This is partially because they learn that they are prone to the disposition effect, but also that they have more trades and learn how the financial market works.

Prior work has neglected how the prior returns on the investors' portfolios have been. The paper will discuss how prior returns may affect the level of reluctance to sell losers, hence affecting the disposition effect. Different papers tests for the same effects on similar data, but yield different results and this paper will discuss whether the source of inconsistency in results are prior market movements.

The paper first presents a theoretic framework for explaining the disposition effect. Then a overview of the first major empirical and laboratory experiments proving the disposition effect is given, before it further discuss the implications of the disposition effect.

In conclusion, the paper will look at possible ways to limit the disposition effect by imposing rules, trading solutions where the investor does not have to realize the paper loss/gain, but rather move the invested amount.

Preface

I would like to start by thanking Professor Diderik Lund, the thesis supervisor, for his guidance and helpful advices. My colleagues at Finansco AS deserve my gratitude for their support during the process, especially the general manager, Mr. Pål Tverdal.

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Finally I would like to thank my family and friends for their patience and support during this process.

Any inaccuracies or errors there might be, are mine and only mine.

Martin Moen Vollan

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Contents

| | | |
|-------|--|----|
| 1 | Introduction..... | 1 |
| 2 | The disposition effect | 2 |
| 2.1 | Theoretic framework of the disposition effect..... | 3 |
| 2.2 | A combination of these theories may explain the tendency of riding losers too long and selling winners too soon..... | 9 |
| 2.3 | Major empirical results proving investors are prone to a disposition effect. | 12 |
| 2.3.1 | Methods used to measure the disposition effect. | 14 |
| 2.4 | Experimental analysis of the disposition effect. | 16 |
| 3 | Implications of the disposition effect. | 18 |
| 3.1 | The disposition effect and investor sophistication..... | 19 |
| 3.1.1 | Corporate investment decisions..... | 24 |
| 3.1.2 | The level of investor sophistication affects the disposition effect..... | 25 |
| 3.1.3 | Foreign investors and the disposition effect..... | 33 |
| 3.1.4 | Gender and the disposition effect | 40 |
| 3.2 | Day traders and the disposition effect..... | 43 |
| 3.3 | Market movements and the disposition effect..... | 46 |
| 3.4 | The connection between the disposition effect and security prices..... | 48 |
| 3.4.1 | Under reaction to news..... | 48 |
| 3.4.2 | Equity premium when investors are aware of the disposition effect..... | 50 |
| 3.4.3 | Momentum strategies based on the under reaction to news due to the disposition effect. 52 | |
| 4 | Splitting the tendency to sell losers too late and winners too soon..... | 54 |
| 5 | Critique | 55 |
| 5.1 | Prospect theory as an explanation of the disposition effect only works ex-post the investment is made. | 55 |
| 5.2 | Is prospect theory suitable to explain the disposition effect?..... | 56 |
| 6 | Ways of reducing the disposition effect for an individual investor. | 57 |
| 7 | Conclusion | 59 |
| | References..... | 61 |

List of figures

| | |
|---|----|
| Figure 1: The value function..... | 6 |
| Figure 2: Disposition effect across income | 22 |
| Figure 3: Disposition effect of occupation groups..... | 22 |
| Figure 4: MSCI Broad China Index. | 25 |
| Figure 5: Risk premium as a function of the degree of disposition effect, theta. | 51 |

List of charts

| | |
|--|----|
| Chart 2: Shanghai Stock Exchange Index, 01.01.1999-01.12.2000 | 26 |
| Chart 1: MSCI China Index, 01.01.1999-01.12.2000 | 26 |
| Chart 3: Shenzhen Stock Exchange index, 01.01.1999-01.12.2000..... | 27 |
| Chart 4: Hang Seng Stock Exchange Index, 01.01.1999-01.12.2000..... | 27 |
| Chart 5: Taiwan Stock Exchange Index, 01.01.1994-31.12.1999. | 31 |
| Chart 6: Development at the stock market in Tallinn from 01.01.2004-30.06.2008..... | 34 |
| Chart 7: 5 year of the Tallinn Stock Exchange before the data Talsepp considered. | 34 |
| Chart 8: Australian Stock Market, S&P/ASX 200, 01.01.1995-31.12.2000..... | 37 |
| Chart 9: The two years before the analysis done by Brown et al. | 37 |
| Chart 10: S&P 500, 01.02.1998-31.10.1999 | 44 |
| Chart 11: Lisbon PSI General, 01.01.1999-31.12.2002..... | 47 |

List of tables

| | |
|--|----|
| Table 1 : Comparison between the managed groups' and individuals' roundtrip time | 18 |
| Table 2: Proportion of PGR and PLR by investor type and year..... | 32 |
| Table 3: PGR and PLR for investors in Index Stocks (Partitioned by investor category)..... | 36 |
| Table 4: Comparison between survival and PGR-PLR analysis. | 39 |
| Table 5: Portfolio return and proportion of total assets by investor groups. | 40 |
| Table 6: Genders and the disposition effect. | 41 |

1 Introduction

This paper is a survey about the well documented disposition effect, which may be described as, a tendency for investors to ride losers too long and sell winners too soon, hence creating a behavioral bias in the financial market. Shefrin and Statman (1985) introduced the disposition effect by using prospect theory (Kahneman and Tversky, 1979) and mental accounting (Thaler, 1980) to explain market anomalies. Further work has been done by Odean (1998), where he tested for the disposition effect among 10,000 accounts at a large discount brokerage house. Each account was treated as an individual and Odean tracked their pattern of trade. Until Shapira and Venezia (2000) tested for the disposition effect on the Tel Aviv stock market the disposition effect was closely related to tax-motivated trades, but their evidence showed that the effect was still present in a market without any capital taxation.

In efficient markets an investment should be treated as a sunk cost and only the future probabilities of the return should determine whether or not the investor should stick to their current investment. The disposition effect may still be a part of a market with weak efficiency if the previous prices/fall is a part of the future returns.

If an investor is fronted with the option of selling a losing mutual fund and reinvest the money in another one performing better, the answer will often be that they want to wait until their original investment is back where it started. Investors tend to believe in mean reversion when deciding whether to keep /sell an asset. If the investor knows the first fund has underperformed and he wants to trade, it would be better for him to sell the losing one, get the tax benefit (28% of the loss in Norway) and reinvest in the fund he think will perform better. So why does he not act this way? The psychological “pain” associated with closing the account and make the paper loss a real loss may explain this behavior. The feeling of regret by doing a bad investment makes the investor reluctant to close the account even though he knows he will be better off in pure monetary terms by doing a tax-motivated trade and switch fund manager or stock.

This survey will compare existing knowledge and analyze them according to their respective markets in order to see how the disposition effect is related to previous market returns. Previous studies have not been emphasizing how the disposition effect changes with respect to the previous market return.

2 The disposition effect

Through my work as a financial broker I have discovered reluctance among investors to realize their paper losses and allocate assets differently. The reluctance to reallocate has been reasoned by some as wanting to wait until their investment is back to the amount invested before they are willing to sell and buy other assets. This is consistent with a belief in mean reversion. A rational investor should consider their investment as a sunk cost and then evaluate the future returns of alternative investments in order to decide whether to sell it or not.

The same investors are often willing to invest in a risky asset, which is contrary to their financial plan according to their analysis (MIFID)¹, claiming that they want a medium risk investment. The investors tend to accept an increased risk in order to make a gain large enough to cover the bad investment. Investors that don't want to realize their losses and reinvest, but rather invest in a high risk asset to try to go breakeven after a bad investment are interesting. The link between the disposition effect and increasing willingness to take risk when a loss has incurred is well documented in the literature. Kroll et al. (1988) found that investors do not behave according to the capital asset pricing model² or according to portfolio rebalancing theory. Further the participants in Kroll et al.'s study wanted to know the prior price movement, even though they were told that prices are independent of prior prices. This showed that they are not behaving inside the rational pricing regime. There are studies that seek to explain the documented disposition effect by mean-reversion; the theory that losers turn back to the purchase price. Others have shown that mean reversion does not explain the disposition effect. The participants in a study by Kroll et al. believed in mean reversion or that future prices were a function of prior prices because they wanted to know the prior price movements. Weber and Camerer (1998) have shown that this cannot be the case in their experimental analysis where assets were sold automatically before each period. This reduced the disposition effect substantially, which is contrary to the mean-reversion effect where the

¹ The Market for Financial Instruments Directive (MIFID) is a European Union law regulating the investment services for the countries in the European Economic Area (27 member countries of the European Union and Norway, Iceland and Liechtenstein). The MIFID regulations in addition to "Verdipapirhandelsloven" (The Norwegian law for trading in securities) commit financial brokers to categorize the clients and get relevant information about their current portfolio, personal finance and their purpose of investment (goal and willingness for risk).

² CAPM (Capital Asset Pricing Model) is a model used to price risky securities where the relationship between risk and expected return is used. The risk free rate is used as a part of the model and the model predict how much the investor must be compensated in order to take on additional risk.

individuals would like to buy back the same share in order to wait for them to return to the purchasing price.

Grinblatt and Keloharju (2001) have found evidence for the disposition effect for five investor types: Non-financial corporations, financial and insurance institutions, governmental organizations, non-profit institutions, and households. The evidence from Finland makes us realize that the disposition effect is an important topic concerning investments and behavioral finance.

To some extent, all investors are prone to the disposition effect. This paper will combine the normal prospect theory used to explain the disposition effect with a function of prior returns. The combination of the two functions describe how prior returns affect the level of risk aversion. An investor experiencing a high overall gain, a loss might not hurt much, but with prior losses it may be harder to take a new one.

The literature covering the disposition effect shows different degrees of disposition effect on investor classes. This survey will consider the time before the data in order to see if the investor history is able to explain the differences.

2.1 Theoretic framework of the disposition effect.

In order to explain the disposition effect, numerous papers have been written with different theories used in order to provide a theoretical explanation. Shefrin and Statman (1987) provided a framework that consisted of a combination of prospect theory, mental accounting, regret effects and self control difficulties. Other economists have proposed alternative explanations, but most of these theories have been rejected as explanations of the whole effect. Some of them may have impact on the disposition effect, e.g. tax-motivated³ trades in December in Norway, but do not stand as complete explanatory variables for the disposition

³ In some countries there is a capital taxation of gains/losses on investments. E.g. in Norway the capital taxation is 28% for investments done outside a company, being tied to a person. When an investment that has increased in value is sold, 28% of the return has to be paid as taxed. If the investment sold is sold with a loss, a person is able to subtract 28% of the loss on their tax returns. In many countries there are other rules as well, but for simplicity I only consider this form of taxation. A tax motivated trade is for example to sell a stock that has a lower value, realize the loss, and then reinvest the amount. Let's say the purchase value of a stock holding was 10 000NOK, with 100NOK a stock. That means that the investor would have 100 stocks. If the value decreases to 5 000NOK, the person will still have 100 stocks at a lower value. If the investor sells the stocks he will get a kickback in the tax returns of $5000 \times 28\% = 1400$. By doing this, the investor could now buy the stocks again and have in total 114 stocks. Hence, if the stock goes up, the investor will have a larger gain.

effect. A belief in mean-reversion implies that the stock market will not increase more than the inflation in value over time. If we look at one of the major stock exchange indexes, we clearly see that the stock market does increase in value over time.

Weber and Camerer (1998) found that the disposition effect is reduced significantly when the securities are sold automatically at the end of a period. This cannot be explained by the mean-reversion belief, a belief that prices will return to the original price. E.g. losing stocks will bounce back to their previous price and winning stocks will fall back to their previous lower price.

Shapira and Venezia (2000) have shown that the disposition effect is present in the Israeli stock market even though it is a financial market without any capital taxes. Thus, tax-motivated trades may not be an explanation of the presence of the disposition effect by itself, like Constantinides (1984) claimed in his work.

This survey will focus on the framework provided by Shefrin and Statman (1987), and add recent findings to expand the theory. The framework consists of several behavioral models and a combination of these provides a good explanation of the behavioral bias.

A. Prospect Theory

Kahneman and Tversky developed an important contribution to the choice under uncertainty in their article “Prospect Theory: An Analysis of Decision under Risk” (1979). The prospect theory implies that an individual have two phases that create a personal valuation of the prospect. First the investor has an editing phase where there is a preliminary analysis of the prospects (here: investments), where the investors simplify the probabilities of the outcome, hence creating a personal probability. Second; the investor will have an evaluation phase where the investors choose between the possible investments according to the personal valuation of each prospect. When an investment in a risky asset is made, the investor set their invested amount and purchasing price as a reference point. Relative to the reference point, an investment is considered as a gain or a loss that may have larger differences in utility than pure monetary outcomes. Considering making an investment, where the investor uses personal value function, where the investor applies personal utility of the outcome and their personal belief, to choose the subsequent action.

$$V(x, p; y, q) = \pi(p)v(x) + \pi(q)v(y)$$

, where $\pi(p)$ is the decision weight for probability p , and $v(x)$ is the subjective value of the outcome, x . The second part of the right hand side of the equation is in the same manner for y . This was a new contribution to the theories of decisions under risk. The investor may set their personal valuations and probabilities and act according to this. Kahneman and Tversky claimed that there is evidence that for all $0 < p < 1$, $\pi(p) + \pi(1 - p) < 1$. They call this property sub certainty.

Further, Kahneman and Tversky defined the value function as a deviation from the reference point (initial value of the investment made). An important feature of the value function is that it is convex for losses and concave for gains. Hence, the investors are risk-averse for gains (above the reference point,) and risk-lovers for losses (below the reference point).

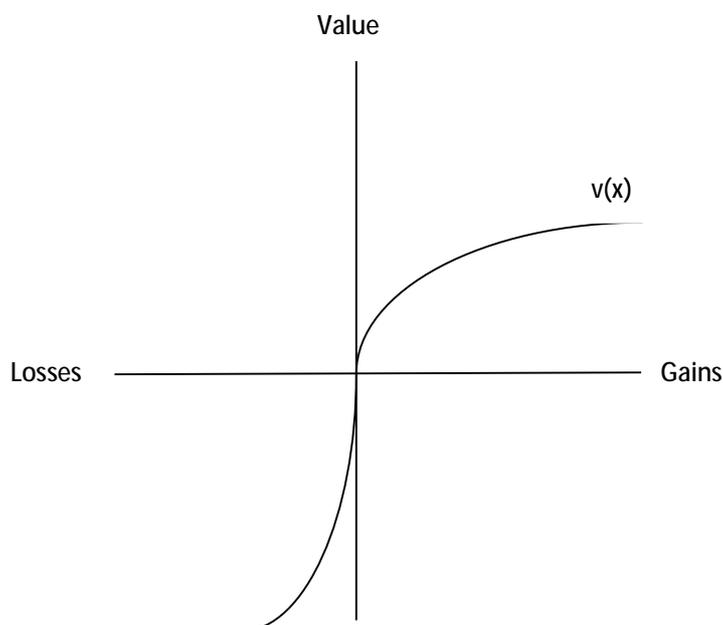
$$\frac{\delta V(x, p; y, q)}{\delta x} < 0 \text{ for } x > 0 \quad \text{and} \quad \frac{\delta V(x, p; y, q)}{\delta x} > 0 \text{ for } x < 0$$

In addition to the convexity of losses, the value function is steeper for losses than proportional gains. Why is the value function steeper for losses than gains in our analysis? The pain associated with a loss and closing the account is larger than the pride and utility of a monetary outcome for a gain. This brings us to the next element of the disposition effect. Work by Kahneman and Tversky (1992) investigated further the properties of the prospect theory.

$$V(x, p; y, q) = \begin{cases} x & \text{for } x \geq 0 \\ \lambda x & \text{for } x < 0 \end{cases}, \text{ with } \lambda > 1.$$

$\lambda = 2.25$ is normally used in the literature, from the empirical work done by Kahneman and Tversky.

Figure 1: The value function



B. *Mental accounting.*

In the article “Mental Accounting Matters”, Thaler (1998), an investor uses mental accounting in the editing phase of the prospect theory. Selling a losing stock is the same as closing an account and opening a new if another investment is made. Prospect theory alone does not explain why investors are reluctant to realize a paper loss, get the tax benefit, and reinvest in a stock with the same expected returns, hence getting a larger amount of shares than prior of the tax swap. If the investor believes that the market will continue to move in a positive direction for his investments, he should want to perform such a tax swap in order to be positioned with a larger amount of capital in motion in the market. The tax swap results in the investor getting a tax advantage from a losing stock, and being able to purchase a larger amount of stocks by reinvesting the “tax gain”; hence having a larger potential gain of an increased value of the stock⁴. Thaler claimed that to close an account with a loss will make the investor experience a psychological pain in addition to the financial loss. This pain will be imposed from the regret

⁴ Most countries have regulations on tax swaps like this. Tax swaps consisting of selling a stock and buying the same one back, but a higher volume will in most countries limit the taxation compensation of the capital loss. It would still be possible to perform a tax swap on stock index funds or other mutual funds without reducing the tax compensation. Performing a tax swap in order to increase the size of the investment makes the risk higher, but it will still be possible to do this again if the investment moves in the wrong direction later on.

effect of the previous bad investment. The paper loss in a bad security does not yield pain to the investor in the same way, cause the prospect theory make the investor willing to take more risk and end up avoiding the pain by returning to the reference point. When the security is sold, the paper loss turns into a real loss and the investor has to admit a prior bad decision. An important part of mental accounting is how the reference point is set. The regret or pride is related to a reference point and the willingness to take risk as well. Kroll et.al (1988) found that subjects wanted to know the past price movement of a security even though they were told that the future returns are independent of past prices. They further examined what happened if all the securities are sold at the end of each period. As expected, the disposition effect is eliminated as a result of the current price as a reference point will make the investor buy the securities that he believe will have the highest risk-adjusted future returns. Weber and Camerer (1998) carried out laboratory experiments with individuals in order to test how different reference points affect the disposition effect. Part 1.4 provides information about their procedure and results. They found that both when the purchase price is set as a reference point and when the previous period price was set as a reference point there was a significant disposition effect. On the other hand, when the current price served as a reference point, induced by all the securities were sold automatically at the start of the period, the disposition effect was reduced substantially. This illustrates the importance of mental accounting and prospect theory related to the disposition effect.

C. Self-control

Experienced investors know they might not always act optimal, and make professionals do their trades and paying for the active allocation in a brokerage firm in order to get a better management of their portfolios. Hence, having a lower disposition effect even without being aware of the disposition effect they would have if they were trading themselves. Being aware of the fact that they are prone to the disposition effect, the investors are able to reduce the effect to some extent, but will not be able to eliminate the behavioral bias. By using professional brokers or fund managers the investors commit themselves to not trading themselves. The investors will only evaluate their own portfolio at certain dates they set, hence still be prone by deciding whether to sell or keep the portfolio. All the sale decisions are replaced with a decision of whether the portfolio should be sold or not.

D. Regret effect

Investors feel pride when a stock is sold with a gain, both relative to the index and from purchase date. The pride makes the investors experience an added personal value which is larger than the pure monetary gain. When the same investors realize a loss, an extra pain in addition to the monetary loss is experienced, resulting in a lower utility. Experiencing one loss, the amount of gains will not matter. Pride effects associated with numerous good investments does not matter compared to the regret experienced with only one bad investment. The regret effect has a larger impact on the investors' utility than the pride effect, and the investors are not able to look positive at the aggregate trades with gain. Even though the pure monetary outcome is positive, the investors' utility may be negative as a result of the regret incurred by the loss. If the investors decide to keep the losing stock with the same gains in other stocks, they will have a positive overall utility. This is a source of the disposition effect and is closely related to mental accounting. Emotionally, paper losses are different than realized losses for investors, explaining why some investors keep their losing stocks longer than their winners.

E. Equity premium

Investors are always able to invest in risky assets, in risk-free assets⁵ or a combination. In order to invest in a risky asset, investors require a certain equity premium, which can be considered as a compensation for the risk. If the investors have options between investing in risky assets with expected returns equal to the risk-free rate, they would certainly deny investing. The equity premium, additional expected return, must be of a certain magnitude (related to the level of risk aversion each investor possesses) if investors will invest in the risky asset. A discussion on how the equity premium is related to the disposition effect is made in section 2.4.

⁵ Bank accounts for most amateur investors. Governmental bonds for investors with larger portfolios.

2.2 A combination of these theories may explain the tendency of riding losers too long and selling winners too soon.

Investors that act according to prospect theory will be risk averse in the area of gains and risk lovers for losses when a stock has a paper gain or paper loss, respectively. Due to these properties, investors have a tendency to sell winners sooner than losers. Intuitively, this may be explained by investors wanting to make sure they get the gain before the stock fall again, and investors are willing to take risk in order to breakeven from a loss. Selling a stock implies that investors have to close a mental account. When investors realize a winner, they will have a pride effect which makes the utility higher than the pure monetary outcome. A loss will create a negative effect in addition to the pure monetary outcome, resulting in the investors keeping their losing stocks in order to avoid the bad experience of a loss. They prefer to wait for the stock to get back to the purchasing price, hence not experience the pain associated with the bad investment done in the past.

Prospect theory represented in the formal way, as Kahneman and Tversky first introduced the theory and later by finding values for the parameters do not fit the empirical evidence of the disposition effect. The theory has explanatory value when explain the patterns of trade. Kaustia (2008) show that the propensity to sell a winning stock does not decrease with the magnitude of gains like prospect theory predicts. In the prospect theory framework, an immediate large gain should make investors less likely to sell the winner because of the concave value function for gains. It has been shown empirically not to be a good description on investors' behavior after a large gain. Most investors tend to lock in a large gain quite fast after the stock price increases substantially. Decreasing risk aversion in the magnitude of gains is not a very good assumption when we are considering investments.

Thaler and Johnson (1990) showed that the willingness to take risk among the participants in their laboratory experiment was dependent on prior loss / gains. The experiment tested when the participants had to choose for themselves and for other persons⁶. Investors that have experienced prior losses will take an additional loss with a higher disutility than investors

⁶ The participants were student for Cornell University, both Undergrads and MBAs. There given three possible outcomes from a situation and were asked to select the one where the person involved was happiest (in one experiment it were two different people, A and B, and in the other type it was themselves). See Thaler and Johnson (1990) for a comprehensive explanation of the experiment.

having aggregated prior gains. In order to get an intuitive explanation of the behavior among investors, we may consider situations from for example a casino. A person that has won thousand Norwegian kroners will not be very bothered if he loses ten kroners before he is going home. If the same person had a prior loss of ten kroners, he would have doubled the loss and hence experience more pain and disutility associated with the same outcome of the gamble. When fronted with possibilities to break even, the investors that have experienced prior losses will have a willingness to take risk that is higher than other gambles when the prior outcomes are different.

The reference point is very important when using prospect theory to analyze how the investors think and act. Many economists use the purchase price as a reference point where investors will consider gains /losses relative to this point. Others use the previous period price as a reference point. Barberis, Huang and Santos (2001) introduced a reference point that combine the risk free rate, the purchase price, prior returns and relative performance to the market as a reference point.

$$X_{t+1} = S_t R_{t+1} - S_t R_{f,t}, \text{ where}$$

$$X_{t+1} \text{ is the gain/loss in time } t + 1, \text{ with } X_{t+1} \begin{cases} < 0 \\ = 0 \\ > 0 \end{cases} \begin{matrix} \text{the investor} \\ \text{lose} \\ \text{breakeven} \\ \text{gain} \end{matrix}$$

S_t is the investors' holdings of the risky asset

R_{t+1} is the return of the risky asset

$R_{f,t}$ is the return of the risk-free rate

Investors will always have the opportunity to invest in a risk free asset at a certain return in any civilized economy. If the return of a stock is 2% and the risk-free rate is 4%, the investors will regret having the investment in the stock and not in the bank. It is relevant to add the risk free rate and possible return when calculating the reference point in order to include the alternative investment in risk free assets.

Introducing a parameter Z_t , which is a benchmark for the amount invested, and combining this with the value of the portfolio, S_t , we are able to make a measure of the prior returns, z_t . Z_t can change by the investor selling or buying stocks, which is placing more assets in the

portfolio or subtracting by selling parts of the portfolio. If the investors change Z_t by making an allocating decision, we assume that S_t will change proportionally and z_t will remain the same. If the market returns changes, the measure z_t will change as well. Explained in a more intuitive way, Z_t is the amount invested and S_t is the current value of these investments, while z_t is the return on the portfolio. When stock prices increase, the measure z_t will increase as well. The amount invested will remain the same and the current value of the portfolio will increase which result in the measure z_t increasing. If the stock prices decrease we see the opposite effects.

Summarized in mathematical form:

$$z_t = S_t / Z_t \quad \text{That we may explained as } z_t = \frac{\text{Current value of the portfolio}}{\text{Amount invested}}$$

Considering how the values of z_t change we get:

$z_t = 1$, the investor has no prior gains/losses.

$z_t > 1$, the investor has accumulated prior gains in the stock market

$z_t < 1$, the investor has accumulated prior losses in the stock market

Expanding Kahneman and Tverskys' value function by making the loss aversion parameter, λ , dependent on prior returns, we get the following equation⁷:

$$v(X_{t+1}, S_t, z_t) = \begin{cases} X_{t+1} & \text{for } X_{t+1} \geq 0 \\ \lambda(z_t)X_{t+1} & \text{for } X_{t+1} < 0 \end{cases} \quad \text{where, } \lambda(z_t) = \lambda + k(1 - z_t), k > 0$$

Including the measure of prior returns in the degree of loss aversion, let us model how the previous losses make a loss more painful and how prior gains are able to cushion the new loss.

How prior returns affect investors behavior in trading has not been discussed to a large extent in the existing literature. Analysis done in a bull market will make the investor have a lower degree of loss aversion, hence a propensity to sell losers at a higher level than investors being in a bear market. The results from the work done on a bear market will make the disposition

⁷ For an analysis of the different values of the measure z_t , see Barberis, Huang and Santos (2001)

effect higher as a result of the prior losses amplifying the current situation. This paper discusses how the expansion of the prospect theory may explain some of the inconsistent results in different markets and papers. To the authors knowledge there are not done extensive analysis on how prior returns affect the prospect theory. Leal et al. (2008) do examine the Portuguese stock market in a bull and bear market, but Leal et al. do not consider how prior returns affect the level of disposition effect but how a bull/bear- market change the current degree of disposition effect.

2.3 Major empirical results proving investors are prone to a disposition effect.

“The Disposition to Sell Winners Too Early and Ride Losers Too Long: Theory and Evidence”, Shefrin and Statman (1985) provided the first empirical evidence for the disposition effect among investors. The analysis was based on one dataset with transaction costs (from Schlarbaum et al. 79) and another that contained aggregate data of mutual funds trades, where the cost was very low.

Shefrin and Statman made one of the first important contributions to the empirical analysis regarding the disposition effect. They concluded that tax considerations cannot explain the pattern of loss and gain realization by itself. They discussed whether taxes may invoke self-control frameworks that reduce the disposition effect temporary, and correctly predicted that in December, the end of the fiscal year in USA, the investors had a lower disposition effect. The article further proved that the tendency to ride losers too long and winners too short was present in real world markets and not only in laboratory experiments. Shefrin and Statman did not conclude or proved the disposition effect in their article, but the motivated others to continue working on the disposition effect. Following their important contribution, numerous articles and papers has proven the disposition effect in different financial markets.

Ferris, Haugen and Makhija (1987) chose the 30 smallest stocks (by equity value at the start of the data sample) from the Center for Research in Security Prices in an interval between December 1981 and January 1985 to test for the disposition effect. The analysis had a weakness in form of the small stocks not being traded every day. They made a linear assumption from the last traded price to the next one in order to be able to analyze the data. Small cap companies are not as liquid as large cap ones, hence the average holding time may

be longer than holding time in large cap ones. The results from the analysis are valuable, but the fact that the data consists of small cap companies must be kept in mind when using the results.

They had two competing hypotheses, with three implications:

“Hypothesis 1:

According to the tax-loss-selling hypothesis, the volume of trading in stocks with capital losses will exceed the volume of stocks with capital gains in December for stocks purchased within the past calendar year. In contrast, the disposition effect predicts that the volume of trading in stocks with capital gains will exceed the volume in stocks with capital losses.

Hypothesis 2:

The tax-loss-selling hypothesis predicts that stocks with capital gains will exhibit greater trading volume in January as compared to stocks with capital losses. The disposition effect predicts the same trading pattern as the tax-loss-selling hypothesis.

Hypothesis 3:

The disposition effect predicts that the volume of trading in stocks with capital gains will exceed the volume in stocks with capital losses in all months of the year.”

The results favored hypothesis 3, and supported the disposition effect. Hypothesis 1, hence tax considerations to explain the trading pattern was not valid.

The rejection of the tax-considerations as explanatory factor for the disposition effect was further investigated by Shapira and Venezia (2000). They tested the pattern of the trade made by clients in a large brokerage house in Israel. Gains/losses incurred from stocks are not subject to taxation in Israel, so by testing on the Tel Aviv Exchange they were able to exclude the tax effect. The results showed that the disposition effect was still present without the tax-considerations like Shefrin and Statman (1985) claimed.

2.3.1 Methods used to measure the disposition effect.

Ratio analysis.

Odean (1998) introduced two ratios to measure the disposition effect:

$$\text{Proportion of Gains Realized (PGR)} = \frac{\text{Realized Gains}}{\text{Realized Gains} + \text{Paper Gains}}$$

$$\text{Proportion of Losses Realized (PLR)} = \frac{\text{Realized Losses}}{\text{Realized Losses} + \text{Paper Losses}}$$

Large differences in these proportions indicate that the investors are reluctant to realize losses and eager to realize gains (if $PGR > PLR$), hence prone to the disposition effect. Odean found that the PLR was higher for all months of the year except December, when the beneficiary tax system may work as a self-control scheme. Ratio analysis is a good measure when testing on the average level for the disposition effect.

Survival analysis with a hazard function.

When data is containing individual and demographic variables and we want to analyze how the degree of sophistication affect the disposition effect it is relevant to consider the holding time. The degree of sophistication will change over time as the investors learn and get more sophisticated. Ratio analysis does not let us incorporate the time element in the analysis resulting in another measure named survival analysis being used on certain data. Using survival analysis⁸ we are able to measure how the demographic variables impact the disposition effect and change it over time.

Feng and Seasholes (2005) analyzed the disposition effect by using a Weibull hazard function to measure the non-constant change in the survival function. Normally a Cox proportional hazard model is used in the survival analysis where there is a constant change and probability of the survival function. Testing for the disposition effect does not have a constant element or probability of holding time; hence the Cox proportional hazard model is not a very good model when testing the disposition effect. Using a Weibull distribution in the survival analysis, we are able to do a regression with a non-constant change. The measure considers

⁸ Survival analysis is used to measure the holding time of a stock. The analysis considers the time until a stock is sold. It does not include repeating patterns or multiple similar actions by investors.

each day a stock is sold or it survives to the next period. By using a hazard function the element of time is added in the measure of the disposition effect. For example an investor who buys two stocks and sell the winner after one day and keep the loser for 1 year will, according to Feng and Seasholes (2005), have a different disposition effect by using their measure rather than ratio analysis.

The hazard function is of the form: $h(t, p, X, Z_t) = p\lambda t^{p-1} \exp(X\beta + Z_t\gamma + \varepsilon_t)$, with X as a fixed covariate and time varying covariate Z_t .

Using the Weibull function with the following equations:

$$f(t) = p\lambda t^{p-1} \exp(-\lambda t^p) , \text{ Duration density}$$

$$S(t) = \exp(-\lambda t^p) , \quad \text{Distribution of survival times.}$$

$$h(t) = p\lambda t^{p-1} , \quad \text{Hazard rate}$$

Where t is time, p is probability and λ is the constant of integration.

The hazard ratio is a measure of coefficient change when the hazard rate changes a unit in the associated covariate:

$$\text{hazard ratio}(\gamma) = \frac{h(t, p, X, Z_t=1)}{h(t, p, X, Z_t=0)} = \mathbf{\exp}(\gamma).$$

To estimate parameters γ 's and β 's, Feng and Seasholes (2005) used maximum likelihood.

In the data Feng and Seasholes (2005) used, there were only 10% of all stocks that were held more than 50 days. Brown et al. (2002) concluded that after holding a stock 200 days, investors are not prone to the disposition effect. Feng and Seasholes (2005) did not consider decreasing disposition effect in their analysis, but rather emphasized the holding time of the stock as crucial to investigate the change in the level of disposition effect.

2.4 Experimental analysis of the disposition effect.

Weber and Camerer (1998) tested different ways of setting the reference point in their experimental analysis of the disposition effect. They found that a reference point consisting of the current price make the disposition effect disappear completely. In order to set the reference point equal to the current price, all stocks were sold and the individuals were able to buy back the stocks they wanted or invest in other stocks. When the individuals were able to buy without considering past investments, they behaved without a disposition effect and selected a better bundle of securities than they would if the stocks were kept in their portfolios, with respect to the following returns.

Weber and Camerer(1998) tested the magnitude of the disposition effect with purchase price reference point, last period reference point, automatically sold assets and the effects of higher trading volumes in four hypotheses.

Subjects in their laboratory experiment made portfolio decisions before each of the 14 periods the experiment lasted. They had to decide whether to buy or sell six risky assets at announced prices. Money not invested in stocks were held in cash and paid not interest. In order to make the participants act as they would in a real situation they were endowed with 10 000 DM at the beginning of the experiment. After the experiment they got 0.1% (in session 1) and 0.2% (in session 2) of the final valuation of the portfolio. They were not allowed to short sell or to borrow money for investments. Subjects knew the probability of a rise and fall for the six different assets, but they did not know the corresponding stock to each probability.

Participants were given a questionnaire to report their selections.

In order to test how the degrees of disposition effect change with different reference points, the two sessions had a different framework. In session 1, the participants kept the holdings from the last period in the beginning of the next one. In session 2, all stocks were sold automatically before the new period started; hence all decisions had to be made all over again. The reference point in session 1 was the purchase price, while the reference point in session 2 was the current price of the stock.

The article showed that automatic selling at the start of each period reduced the disposition effect substantially, which cannot be explained by mean-reversion. If mean reversion could explain the disposition effect, the investor would buy back the same stocks. With the previous

period price as a reference point, the disposition effect was observed, but to a lower extent than with the purchase price as a reference point. The closer the reference point was to the current price, the less likely were the individuals prone to the disposition effect. The analysis showed that a higher trading volume was positively correlated with the magnitude of the price changes of the assets. Explained intuitively, when the individuals' traded frequently, they were able to adjust their reference point closer to the current price in the market.

3 Implications of the disposition effect.

Shapira and Venezia (2000) tested for the disposition effects in the Israeli stock market by using ratio analysis. They evaluated the duration of the roundtrips for both losing and winning stocks. Their article showed that the disposition effect was present in a market without any taxation on capital gains or losses. Hence rejecting the hypothesis that tax-related trading is able to explain the disposition effect stated by for example Constantinides (1984).

A roundtrip is the time from a security is bought until it is sold (and the investor having zero left of the specific security). In their article, Shapira and Venezia measured the disposition effect among both individual investors and managed groups (with a broker). They discovered that the disposition effect was still present, but to a larger extent among the individual investors than the professionally managed investors.

Table 1 : Comparison between the managed groups' and individuals' roundtrip time

| All Deals | | | | | |
|---------------|---------------|----------------|-------------------|---------------|----------------|
| Managed Group | | | Independent Group | | |
| | Losing Stocks | Winning Stocks | | Losing Stocks | Winning Stocks |
| N | 29662 | 21670 | N | 6640 | 3884 |
| Average | 55,42 | 24,84 | Average | 63,27 | 20,24 |
| Std.Dev | 58,8 | 34,44 | Std.Dev | 72,78 | 29,3 |
| | Difference | | | Difference | |
| | 30,58 | | | 43,03 | |

Source: Shapira and Venezia (2000)

The difference between the mean duration of the losing roundtrips and winning roundtrips was significant at a level of 0,001 in Shapira and Venezias' paper. The disposition effect was defined as the mean difference between the roundtrip time of losing stocks and winning stocks. Comparisons of the level of disposition effect between independent and professional investors were made. The professionally managed investors exhibited a disposition effect as well, but to a much lower extent than the independent group.

3.1 The disposition effect and investor sophistication.

Shapira and Venezia claimed that professional training and experience may reduce the judgmental bias toward sticking to the losing stocks. According to their article professionals exhibit a lower disposition effect. Samuelson and Zeckhauser (1988) introduced the phenomenon “status quo bias” that relate to mental accounting and the disposition effect. The status quo bias is that individuals prefer to maintain their current situation. Implying that they don’t want to sell nor buy stocks at a specific time, because their present wellbeing is good. Samuelson and Zeckhauser proved that subject act differently if they were put in a current situation as opposed to a hypothetical situation where they might choose differently. The comforts of having things the way they are, and the fear of making a bad decision, create a bias towards staying put. A professional will not be affected by the status quo bias when administrating a client’s portfolio like individuals are. Professionals managing client accounts make decisions without an endowment effect⁹, and status quo bias towards the existing portfolio, because the portfolios are simply not their assets.

“Churning” the client accounts may be another possible explanation to why managed groups have a lower level of disposition effect than individuals. “Churning” is an activity where the professionals create many (unnecessary) transactions in order to receive a percentage or a fixed fee for each order; hence getting a higher personal salary. Stock brokers in Norway normally get paid between 0.02% and 0.05% in the retail market for each transaction. They earn the same regardless of whether this transaction is a sale or a buy and if the client makes a profit or not. The shorter roundtrips might stem from the professionals incentives to increase their own salaries by performing many trades. The conclusion that professionals were not as exposed to the disposition effect as amateurs in Shapira and Venezias’ article is not conclusive and needs to be examined in markets with a different cost structure. For example when there is only a positive result bonus.

Dhar and Zhu (2006) examined how heterogeneous investors were prone to the disposition effect at different levels. They identified differences between individuals and tried to explain

⁹ Endowment effect is a result of a person getting a higher personal valuation for a good after the good is bought. In the financial setting it is closely related to the staus quo bias because the personal valuation of the stocks is higher than the real value, and because of this the investor may prefer to stay put even though there might be better to trade.

them by investor characteristics such as demographic differences, level of education, level of wealth and occupation. Dhar and Zhus' analysis contributed with important results to explain how heterogeneous investors' characteristics affect the level of disposition effect. 19.7% of the investors in the sample did not have any disposition effect or the opposite of the disposition effect even though the disposition effect was significant on average. Self imposed rules like stop loss functions or other trading schemes may explain why a fraction of the investors in the data was not prone to the disposition effect or having a reverse disposition effect. Individuals working in professional occupations and individuals with high wealth had significantly lower disposition effect than their counterparts. Investors trading frequently had a lower disposition effect because they were able to "trade themselves out" of the status quo bias and hence the disposition bias, supporting Weber and Camerer (1998). A high amount of trades made the investors have less emotional relationship toward each stock; making it easier to sell their stocks and reducing their level of disposition effect.

Professional traders have more information about the behavioral biases in the financial market than independent amateurs resulting in a different level of disposition effect between the two groups. If individuals understand their tendency to stick with losing stocks too long, they may be able to adjust their behavior in order to reduce the disposition effect and get a higher return on their portfolios. The information about behavioral biases and the disposition effect is available for all investors. Increasing their knowledge should increase the probability of a high return on their portfolios, so it seems strange that all investors don't enlighten themselves.

There is normally a relationship between the amount invested and the income/wealth of the investors. A large portfolio make the investor have more at stake than investors with a low value portfolio. Wealthier investors afford the cost related to others to administrate their portfolio or to give them trading advices. These combinations make wealthy investors more likely to educate themselves about the disposition effect. Directly by reading about it or indirectly by letting someone manage their portfolios.

Dhar and Zhu tested two hypotheses regarding the disposition effect and how it was changed by the trading frequency, education level¹⁰ and income level:

Hypothesis 1: Trading frequency is negatively related to the magnitude of the disposition effect.

Hypothesis 2a: Individual investors in the “high-income” bracket will display smaller disposition effect than individual investors in “low-income” bracket.

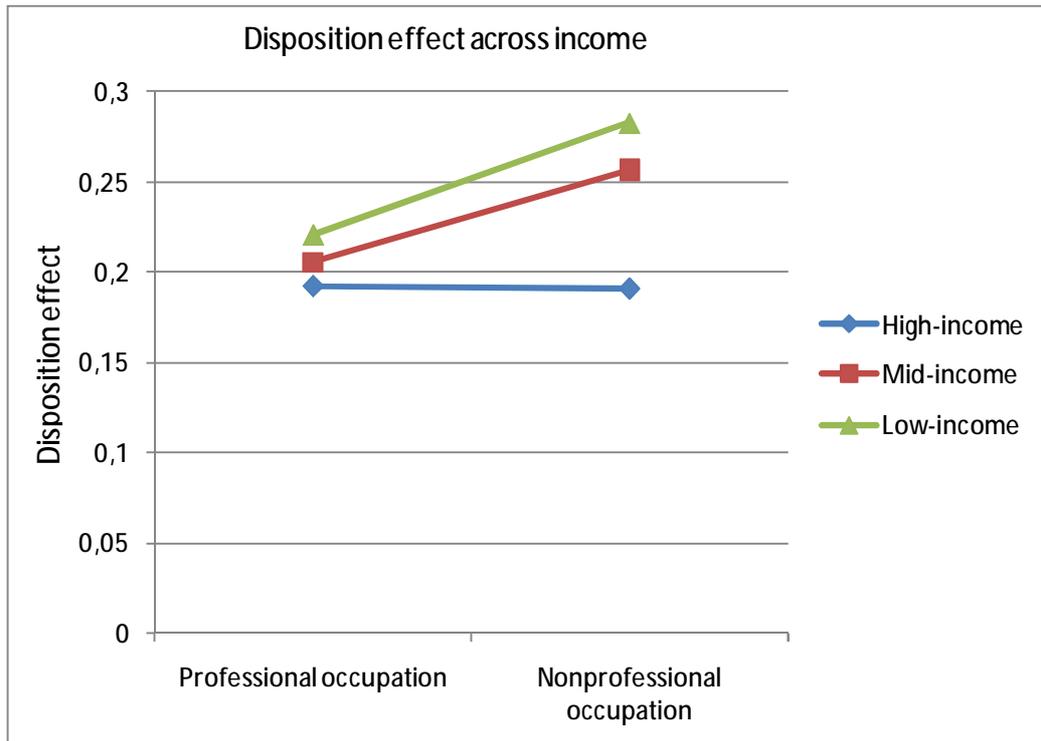
Hypothesis 2b: Individual investors who work in “professional” occupations will display smaller disposition effect than investors in “nonprofessional” occupations.

The 20% not having any disposition effect had a much higher trading frequency than the others in the data Dhar and Zhu investigated. In addition to the trading frequency they had a higher level of income and a higher percentage of professional occupation than the remaining 80%. This supported hypothesis 1, stated above. In part 4, a discussion is made on how investors are able to reduce their disposition effect to a certain extent related to the work done by Dhar and Zhu (2006).

The two different categories of occupation in the high-income group did not make a significant difference on the level of disposition effect. Measured in the low-income category, the professionals had a significantly lower disposition effect than the nonprofessionals. This supported the claim that the high-income investors were more likely to use brokers and/or educate themselves and by doing this adapting/learning the professionalism; hence reducing their personal disposition effect. Income and occupation had separate effects on the level of disposition effect on each individual. Low-income investors did not use brokers or advisors to the same extent as wealthy investors, making them more dependent on their own knowledge, which were inferior to the wealthy investors.

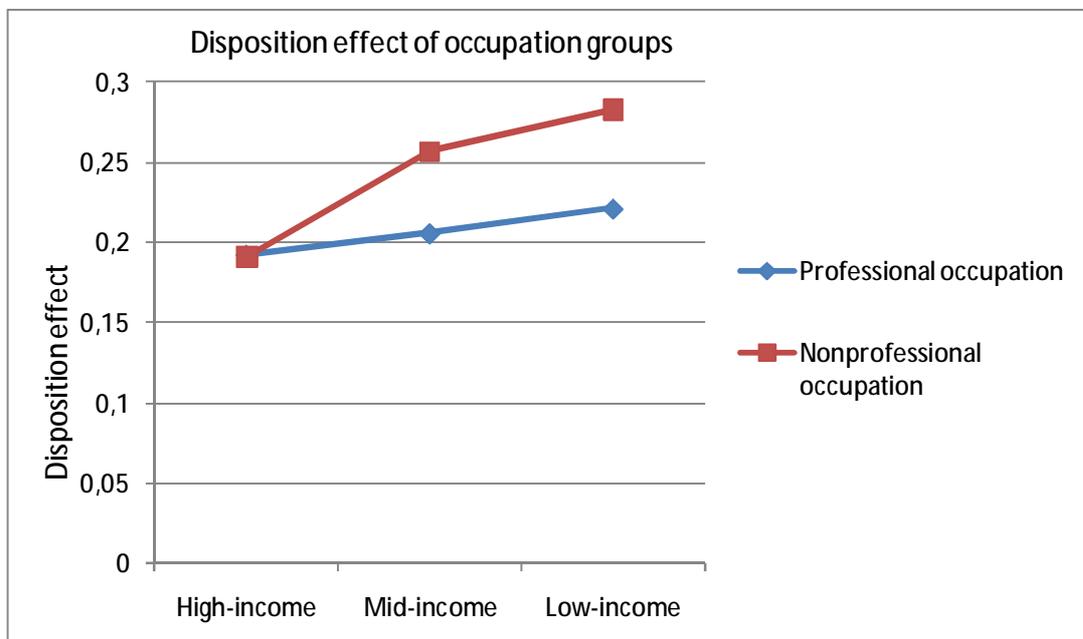
¹⁰ The data does not provide information about the investors' level of education, so the occupations non-professional and professional are used as a measure for the level of education.

Figure 2: Disposition effect across income



Source: Dhar and Zhu (2006)

Figure 3: Disposition effect of occupation groups



Source: Dhar and Zhu (2006)

Dhar and Zhu ran a regression analysis on the data in order to check the hypothesis stated above. Ratio analysis was used by Dhar and Zhu when they tested for the disposition effect.

$$\frac{\text{Realized Gain}}{\text{Realised Gain} + \text{Paper Gain}} - \frac{\text{Realized Loss}}{\text{Realized Loss} + \text{Paper Loss}} = PGR - PLR = DE = \gamma D + \beta X + \varepsilon,$$

Where D is a matrix containing the demographic variables of each individual, X is the individual trading pattern and portfolio characteristics, and ε is the error term.

They found that if the amount of trades was increased with ten, the degree of disposition effect declined by 0.06. That's 30% from the mean disposition effect. The result was highly significant and strongly supported hypothesis 1. The reduction of the disposition effect reflects that investors are more willing to sell their losers when their trades are numerous. A large number of stocks in a portfolio and a high turnover rate make the endowment effect lower for the investors. Their preference for staying with the stocks they have, the status quo bias, is reduced by not having an endowment effect. The regression analysis also showed that the high-income investors had 10% lower disposition effect than the low-income ones. Further; that the professionals had 20% lower disposition effect than the nonprofessionals. This strongly supported hypothesis 2a and 2b.

In addition to finding significant results to their hypothesis, the regression analysis showed that age was an important factor on the disposition effect. Older investors have more experience and using this experience make them understand the market better. Previous observations of bear markets make older investors lean that not every fall in the market is a bull market correction. Younger traders might not have the same experience and think that every decline in a market is a bull market correction. Older experienced investors know that the stock market does not increase at all times; hence selling their assets faster than young investors and being less prone to the disposition effect. Young investors may also be overconfident and believe that they are able to beat the market as a result of prior successful trades after entering the market.

The possibility of a co linearity problem when testing for the effects of income and professional occupations is quite clear in Dhar and Zhus regression analysis. In order to test the robustness of their results they adopted three different measures for the disposition effect.

The first one was $\frac{RG}{RL} - \frac{PG}{PL}$, which is the proportion realized gains to realized losses minus the

proportion of paper gain to paper losses. The second measure, $\frac{PGR}{PLR}$, was introduced by Odean (1998). The last one is from Weber and Camerer (1998) that define the number of winners and losers to measure the disposition effect $(S_+ - S_-) / (S_+ + S_-)$.

The differences between the measures are that Odean (1998) considered frequent traders contra infrequent traders while Weber and Camerer (1998) considered the number of trades with winners and losers, not portfolio size or frequency of trades. The different measures yielded important results on how variables affect the level of disposition effect. High-income was significantly negative for all three measures, age was significantly negative for the three measures as well and nonprofessionals were significantly positive for the three measures. This proved that the results were consistent if other measures than ratio analysis was used as well. Using a survival analysis might yield different results. The three measures here do not consider the holding time of the stocks, which is relevant for the variables that may change over time.

3.1.1 Corporate investment decisions.

Crane and Hartzell (2008) tested the disposition effect on Real Estate Investment Trusts (REITs)¹¹. By examining the data from REITs they were able to investigate whether management of corporations were prone to the disposition effect or not. Crane and Hartzell collected property-specific data for the public-traded REITs from 1996 to 2006 in the SNL DataSource Real Estate Property database. SNL provided data about each property; date bought and sold, purchase and sale price, location, property type, age and more variables. The data made it possible to examine whether the corporate managers had a disposition effect, hence selling the properties that had increased in value faster than the decreasing ones.

In the REITs the managers were significantly more likely to sell a property that had a gain than a property that had a loss in value in the data. The results were both economically and statistically significant.

Crane and Hartzell found that firms that were prone to the disposition effect to a larger extent, received a lower return per square foot sold, on average. The result was consistent with the

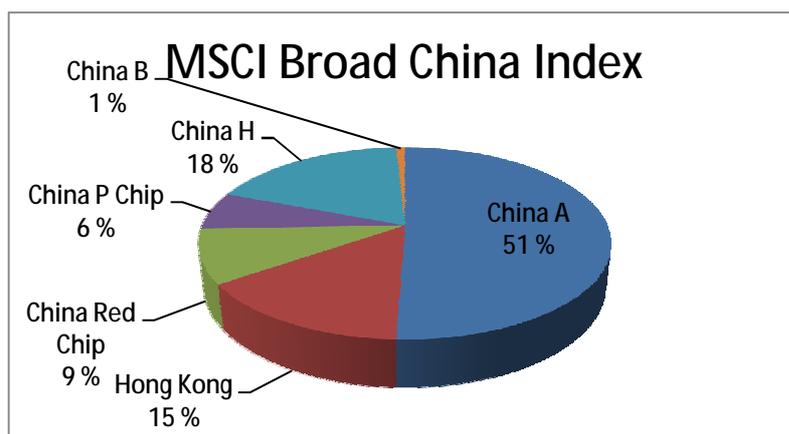
¹¹ REITs are real estate companies that offer shares to the public. The shares work as in other companies, but the REITs invest in yielding properties and the profits are paid out as dividends to the shareholders.

theory of selling profitable properties too fast and being stuck in decreasing valuating properties; hence reducing the overall return of the REITs. Selling a property in a REIT does not trigger a tax; thus tax explanations of the behavior did not have any explanatory value.

3.1.2 The level of investor sophistication affects the disposition effect.

Feng and Seasholes (2005) tested for the disposition effect on data from a brokerage house in the Peoples Republic of China (PRC). Testing in PRC had many advantages. There was no capital gain taxation, investors were only allowed to have one account and the market was quite “new”. Feng and Seasholes claimed that the Chinese market did not have a prominent trend in the data period: “Finally, the MSCI China Index¹² does not have a prominent trend over our sample period. The average monthly return is -0,34% from January 1999 to December 2000“. The stock exchanges in China exhibited a prominent trend in the period as chart 2-4 display. Feng and Seasholes used the MSCI China Index, and this index did not have a prominent trend in the data period, which Feng and Seasholes correctly claimed. The MSCI China Index was not the best index to measure if the market had a prominent trend. This index is a sector-weighted index that may be different from the stock exchange indexes. The author claims there was an increasing market trend in the data sample. The results were still valuable, but should be treated as a bull market dataset.

Figure 4: MSCI Broad China Index.



Source: MSCI Barra, China Index as of Oct.22, 2009.

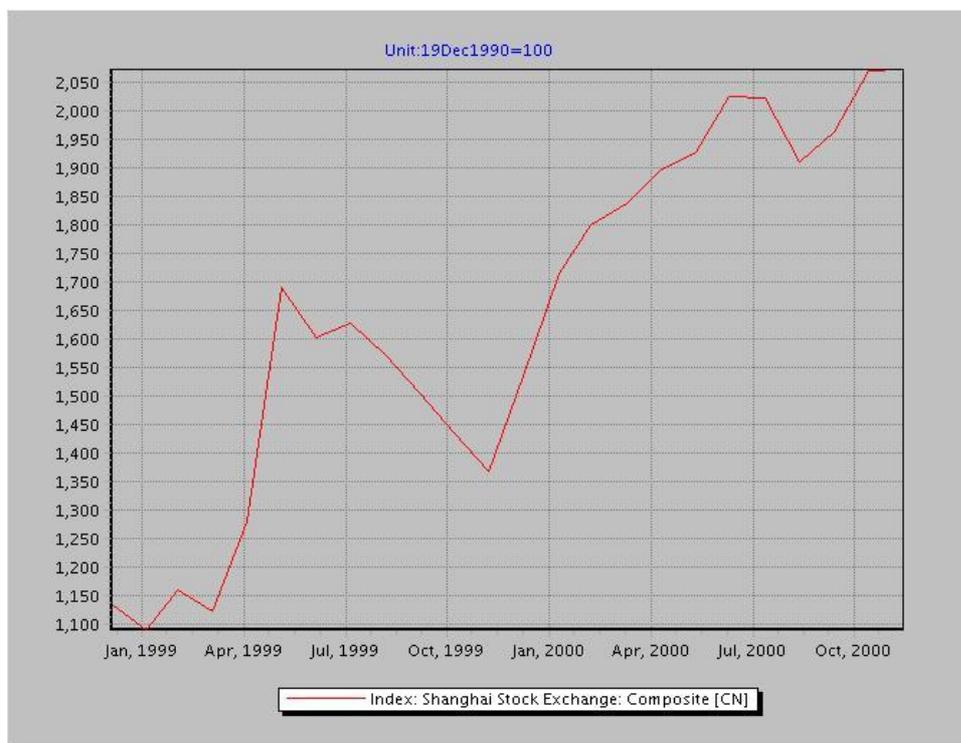
¹² The MSCI China Index is an index combining the three Chinese stock exchanges in Shanghai, Shenzhen and Hong Kong. The MSCI China Index is made using the Global Industry Classification Standard (GISC) which consists of different sectors, industry groups, industries and sub-industries. GISC classification is used as a tool for portfolio management and investment analysis.

Chart 1: MSCI China Index, 01.01.1999-01.12.2000



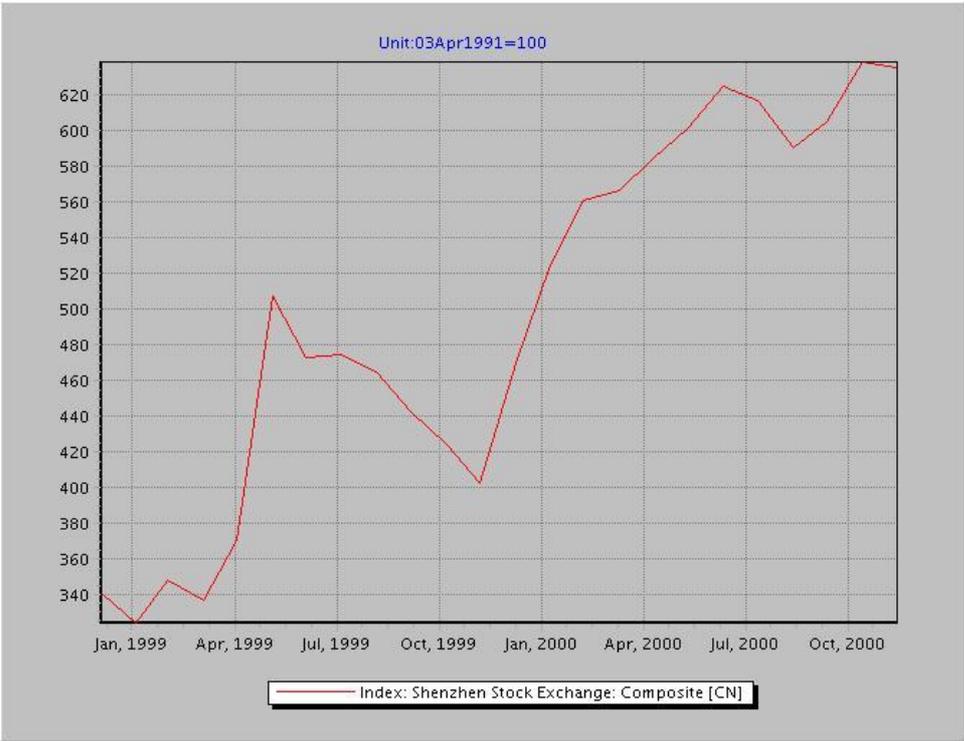
Source: Reuters EcoWin

Chart 2: Shanghai Stock Exchange Index, 01.01.1999-01.12.2000



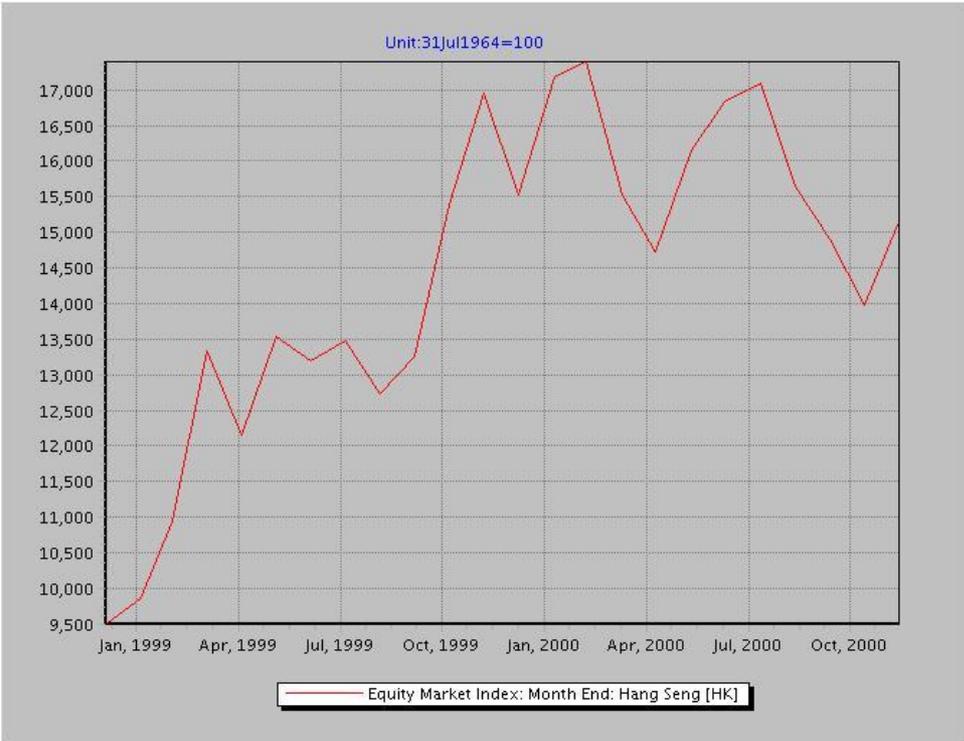
Source: CEIC Macroeconomic Databases for Emerging and Developed Markets.

Chart 3: Shenzhen Stock Exchange index, 01.01.1999-01.12.2000



Source: CEIC Macroeconomic Databases for Emerging and Developed Markets.

Chart 4: Hang Seng Stock Exchange Index, 01.01.1999-01.12.2000



Source: CEIC Macroeconomic Databases for Emerging and Developed Markets.

The account regulation made the analysis on the link between disposition effect, investor sophistication and trading experience possible. Feng and Seasholes tracked the trading experience and sophistication evolution on the data and analyzed how it affected the level of disposition effect. Feng and Seasholes were able to test both on the aggregate level and the individual level in the Chinese market.

Feng and Seasholes used a Weibull hazard function in combination with survival analysis in order to test for the disposition effect. Consistent with prior work, they found evidence for the disposition effect on the individual level as prior studies had found on the aggregate level. The connection between sophistication and the disposition effect on the individual level was an important contribution to the literature on the disposition effect. They showed that the level of disposition effect and the level of sophistication are correlated. When the level of sophistication increased, the disposition effect was dampened.

Several parameters were used in order to measure the level of sophistication. In China each investor had to apply for trading rights. The rights concerned how an order can be placed, for example paper tickets, telephone, internet links, etc. They hypothesized that a sophisticated investors had more trading rights related to their accounts. The diversification at the start of period was used as a measure for the level of sophistication at the start of the sample; where highly diversified investors were more sophisticated. Age was also an important measure when modeling the level sophistication. In the study, young investors were more sophisticated than the older investors because of the quite young liberalized capital market in China, contrary to Dhar and Zhu (2006) where the market was experienced.

The results from the regression analysis were striking. Sophisticated investors were 67% less prone to the disposition effect than amateurs. In prior work, all investors were reluctant to realize losers, but this study concluded that sophisticated investors did not have the same sensitivity to losses. Further they found that the partial effect related to gains and losses were always close in magnitude and with opposite signs, but the effect regarding losses was always stronger. Mental accounting in combination with prospect theory was able to explain the asymmetry. According to theory, the losses should be considered as one unit, while gains should be separated. A sophisticated investor had to determine whether to realize a loss or not, hence; realizing all his losses. In the case of gains, each gain had to be considered separately, thus the tendency to close the accounts and realize the gains with sophisticated investors could not be eliminated.

According to the regression analysis made on the Chinese sample, the trading experience did not eliminate the disposition effect, but attenuated it. In combination with the level of sophistication, the reluctance toward realizing losses was totally eliminated. Feng and Seasholes used the regression coefficients to check the degree of loss aversion among investors. A thirty year old male, with five trading rights and more than two stocks in his initial portfolio when he passes his 16th trade was used as the most sophisticated type of investor.

If $experience \times trading\ rights \times diversification \times gender \times age = 1$, the investor is not sensitive towards losses.

Inserting the regression coefficients from Feng and Seasholes (2005)¹³ they got:

$$0,5513 \times 1,0362^5 \times 1,1473 \times 1,2997 \times 1,0495 = 1,00306 \geq 1,0000$$

This result showed that the most sophisticated investor type was not sensitive to losses at all. The level of sophistication made the investor eliminate the tendency to stay with losers.

If a similar setup was done with respect to the sensitivity towards gains they got¹⁴:

$$6,1314 \times 0,9651^5 \times 0,8474 \times 0,7620 \times 0,9430 = 3,1259 \gg 1,0000$$

The hazard ratio was between the sample average of 4,3842 and 1,0000 which was the value of no sensitivity towards gains.

Hence; sophistication and experience totally eliminated the reluctance to sell at a loss, but only reduced the tendency to realize winners too soon.

While the reluctance to sell was completely eliminated, investor sophistication and experience only reduced the sensitivity towards gains by 36%. Feng and Seasholes did not provide explanation on why investors kept their eagerness to realize gains in the paper. The bias toward selling to soon need to be examined further and might be explained in other ways than the disposition effect. Kaustia (2008) showed that prospect theory was not suitable in

¹³ The data is from table 5a in Feng and Seasholes (2005) where the Trading Loss Indicator take as a value of one every day a stock is trading below its purchase price, and zero otherwise.

¹⁴ The data is from table 5b in Feng and Seasholes (2005) where they use the Trading Gain Indicator which take a value of one every day the stock is trading below its purchase price, and zero otherwise.

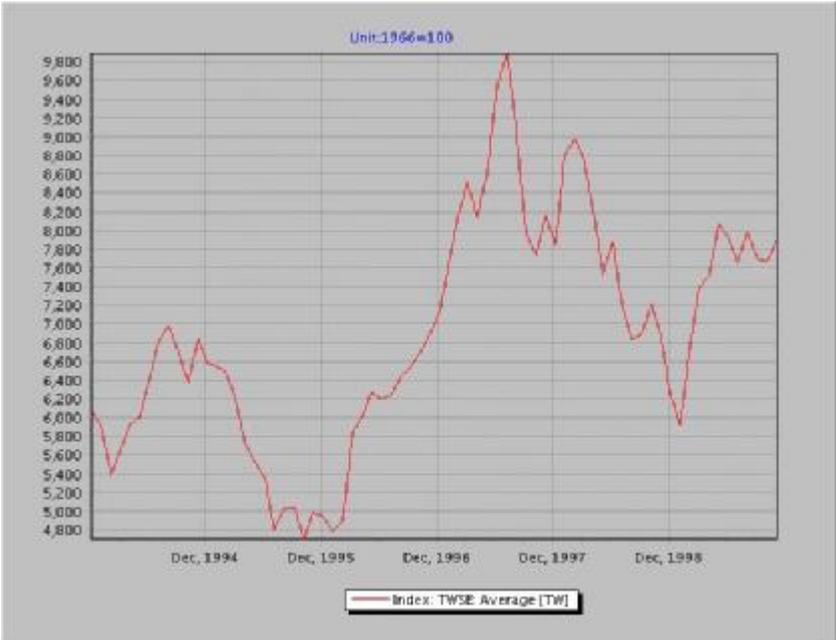
explaining behavior for gains by itself. A further discussion on the topic is made in section 4.2.

Mental accounting could explain why the reluctance to realize losses could be eliminated while the propensity to sell winners too soon was only dampened. Losses were treated like one large transaction and the investor had to decide whether to take a loss or not. Gains were treated separately and could not be treated in the same manner.

An article published by Barber et al. (2007) examined trades at the Taiwan Stock Exchange (TSE) in a five years period. The dataset contained a total of more than one billion trades. The stock market in Taiwan had many similarities with the Chinese stock market examined by Feng and Seasholes. Each trader had his own code, which made the identifying and following an investor over time process possible. Barber et al. categorized traders into groups of individuals, corporations, dealers, foreign investors and mutual funds. Individuals were by far the largest group both by value and number, while foreign investors and mutual funds only counted for 5% of all trades by value. During the years of the dataset the TSE experienced a bear market (The Asian financial crisis in 97) and bull market¹⁵. Hence, the analysis of the disposition effect in all kinds of market and not only one specific market trend could be made.

¹⁵ A bull market is a market that increases over time. A bear market is a market that decreases over time. The reason why the market movement have these names is that the bull attack from below and upward while the bear attack by hitting from above and downwards.

Chart 5: Taiwan Stock Exchange Index, 01.01.1994-31.12.1999.



Source: CEIC Macroeconomic Databases for Emerging and Developed Markets.

Barber et al. found, on the aggregate level, that investors were about twice as likely to sell a winner to a loser, supporting prior studies and providing additional evidence regarding the reluctance to realize losses for investors. Further, the work showed that, on average, the investors realized a gain 84% faster than a loss.

Table 2: Proportion of PGR and PLR by investor type and year.

Daily proportion of gains realized (PGR) and proportion of losses realized (PLR) by investor type and year

| | Individual Investors | Corporations | Foreigners | Dealers | Mutual funds | All investors |
|--|-------------------------|------------------|-------------------|------------------|-------------------|------------------|
| <i>Panel A: Mean of daily PGR</i> | | | | | | |
| 1995 | 8,94 | 1,67 | 0,59 | 8,96 | 0,88 | 6,46 |
| 1996 | 4,67 | 0,77 | 0,48 | 4,65 | 1,01 | 2,95 |
| 1997 | 4,4 | 0,8 | 0,6 | 5,21 | 1,27 | 3,01 |
| 1998 | 4,06 | 0,69 | 0,5 | 4,65 | 1,26 | 2,67 |
| 1999 | 3,64 | 0,9 | 0,39 | 3,83 | 1,57 | 2,51 |
| 1995-99 | 5,06 | 0,95 | 0,51 | 5,39 | 1,2 | 3,45 |
| <i>Panel B: Mean of daily PLR</i> | | | | | | |
| 1995 | 1,92 | 0,4 | 0,47 | 2,08 | 0,88 | 1,65 |
| 1996 | 1,89 | 0,33 | 0,61 | 1,68 | 1,01 | 1,61 |
| 1997 | 2,8 | 0,64 | 0,95 | 3,33 | 1,27 | 2,52 |
| 1998 | 1,4 | 0,32 | 0,68 | 1,49 | 1,26 | 1,22 |
| 1999 | 1,42 | 0,23 | 0,67 | 1,51 | 1,57 | 1,19 |
| 1995-99 | 1,9 | 0,39 | 0,68 | 2,03 | 1,2 | 1,65 |
| <i>Panel C: Mean of difference (PGR-PLR)</i> | | | | | | |
| 1995 | 7,02** (0,83) | 1,27** (0,13) | 0,11 (0,07) | 6,88** (1,33) | 0,12 (0,10) | 4,81** (0,57) |
| 1996 | 2,78** (0,48) | 0,44** (0,08) | -0,13** (0,04) | 2,98** (0,40) | -0,14* (0,06) | 1,34** (0,29) |
| 1997 | 1,60** (0,36) | 0,15** (0,07) | -0,35** (0,06) | 1,88** (0,62) | -0,91** (0,19) | 0,49** (0,30) |
| 1998 | 2,66** (0,25) | 0,37** (0,06) | -0,19** (0,03) | 3,16** (0,25) | -0,43** (0,09) | 1,45** (0,19) |
| 1999 | 2,23** (0,34) | 0,67** (0,08) | -0,28** (0,02) | 2,32** (0,48) | -0,85** (0,15) | 1,32** (0,24) |
| 1995-99 | 3,17** (0,36) | 0,56** (0,07) | -0,17** (0,03) | 3,36** (0,40) | -0,45** (0,08) | 1,81** (0,26) |

** : Reliably different from zero at the 1% significance level

* : Reliable different from zero at the 5% significance level

Source: Barber et al. 2007

3.1.3 Foreign investors and the disposition effect

An interesting element in table 2 was that both mutual fund and foreign investors displayed a reverse disposition effect. The results showed that market changes affect the level of disposition effect.

Different works have concluded differently when it comes to investor groups and to which extent they were prone to the disposition effect. Talsepp (2009) and Brown et al. (2002) came up with different results regarding how foreign investors are prone to the disposition effect.

Talsepp (2009) examined how foreign investors traded on the Tallinn Stock Exchange using data from Nasdaq OMX Tallinn Stock Exchange. Talsepp found evidence that experience and investor sophistication decreased the level disposition effect consistent with other articles.

Talsepp found that foreign investors displayed a reverse disposition effect in the data sample. This was the tendency to sell losers faster than winners, hence doing very well in the market. In Barber et al. they showed that foreign investors in Taiwan did not display a disposition effect, but did not get a reverse disposition effect like Talsepp did. The magnitude of the reverse disposition effect Talsepp found was very low and may be considered as no disposition effect

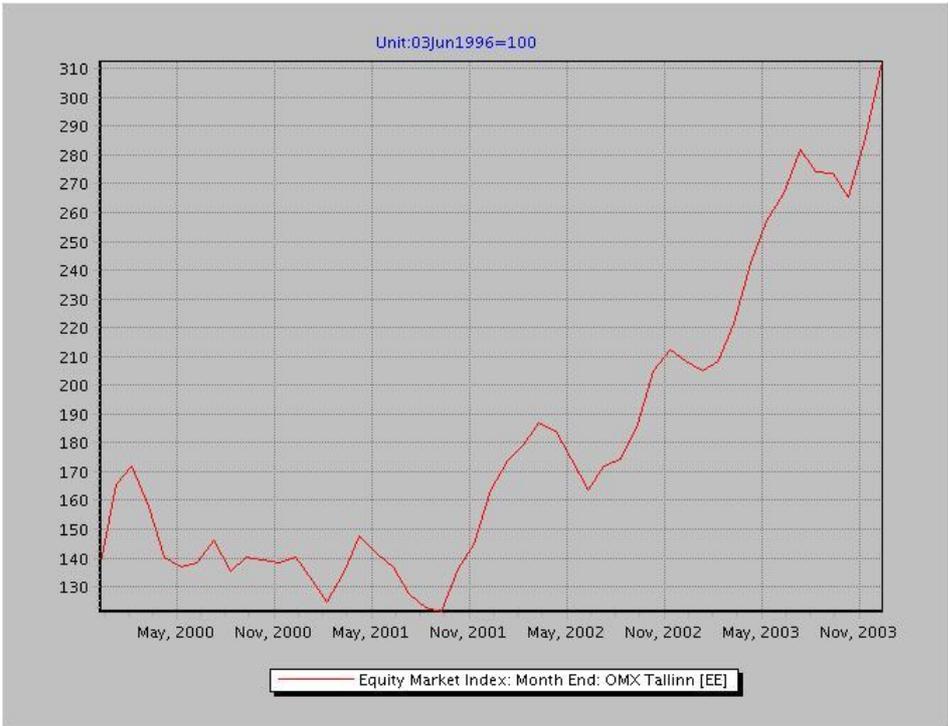
Talsepp concluded that foreign investors exhibited a reverse disposition effect in the data period. Compared to the analysis in Barber et al. (2007), the results fit in a bull market. The result is not consistent with the data from Leal et al (2008) that showed that investors were prone to a stronger disposition effect in a bull market than a bear market. The level of disposition effect among foreign investors in a bear market was not examined in Talsepp's paper. The market returns before the data sample should be implemented when analyzing the disposition effect. The stock market in Estonia exhibited a prominent trend both in the five years prior to the data and in the data period. Prior market returns affect the current investor behavior and should not be neglected. Section 3 discuss this relationship.

Chart 6: Development at the stock market in Tallinn from 01.01.2004-30.06.2008



Source: CEIC Macroeconomic Databases for Emerging and Developed Markets.

Chart 7: 5 year of the Tallinn Stock Exchange before the data Talsepp considered.



Source: CEIC Macroeconomic Databases for Emerging and Developed Markets.

The 5 years before the data set Talsepp used had a clear increasing trend and was a bull market. It was likely investors that had been in the market the prior years were less prone to the disposition effect compared to a falling market. Losses after significant gains are not associated with the same level of pain and regret as losses after having prior losses on the portfolio. Talsepp found that foreign investors displayed a reverse disposition effect. The results might be the investors locking in previous gains and not being affected by the losses because they were small in magnitude compared to the overall gains.

Brown et al. tested the Australian market for index stocks¹⁶ and IPOs¹⁷ and found that foreign investors are significantly subject to the disposition effect. The investor categories which exhibited the lowest degree of disposition effect in their data were insurance companies, nominee companies and trusts. The only category that had a reverse disposition effect was governmental. The data Brown et al. used has a prominent trend and is a bull market similar to the data Talsepp used. Like chart 9 display, the 2 years prior to the data set did not have the same trend and this may explain that the authors concluded differently.

By including the prior period, an explanation of the different result may be provided. The 5 years prior to the data they examined may have impact on the data analyzed and be the source of the different results.

¹⁶ Investors investing in index stocks are trading with stocks that are included by the All-Ordinaries Index in Australia. The stocks are liquid and because of this the investors are able to buy/sell the stocks when they want to (not considering price impact on decisions to buy/sell).

¹⁷ Initial Public Offering (IPO) is when a company (issuer) issues common stocks to the public for the first time. The investment is regarded risky because the investor does not have any historical data to know whether the price is correct. The day of listing, the price of the stocks may differ compared to the IPO price.

Table 3: PGR and PLR for investors in Index Stocks (Partitioned by investor category)

Aggregated for each category of investors who purchased index stocks in the period 1995-2000 from a previous zero shareholding. For the entire year there are 988,944 realized gains, 149,098,090 paper gains, 413,217 realized losses and 124,170,401 paper losses. For the month of June there are 35,308 realized gains, 7,128,248 paper gains, 39,216 realized losses and 9,722,799 paper losses. The *t*-statistics test the null hypothesis that the difference in PGR and PLR are equal to zero, assuming that all realized gains, paper gains, realized losses and paper losses result from independent decisions.

| Period | Banks | Nominee Comp. | Insurance | Superannuation | Trusts | Government | Incorp. Comp. | Individuals | Foreign | All investors |
|-------------------|-------|---------------|-----------|----------------|--------|------------|---------------|-------------|---------|---------------|
| <i>All months</i> | | | | | | | | | | |
| PGR | 0.55% | 3.68% | 2.70% | 0.47% | 2.34% | 4.49% | 0.83% | 0.51% | 0.65% | 0.66% |
| PLR | 0.28% | 2.61% | 2.47% | 0.19% | 2.05% | 4.83% | 0.48% | 0.23 | 0.30% | 0.33% |
| PGR-PLR | 0.28% | 1.07% | 0.23% | 0.28% | 0.29% | -0.34% | 0.35% | 0.28% | 0.35% | 0.33% |
| PGR/PLR | 1.99 | 1.41 | 1.09 | 2.47 | 1.14 | 0.93 | 1.73 | 2.22 | 2.17 | 1.99 |
| <i>t</i> -stat. | 0.48 | 29.96 | 1.20 | 18.98 | 5.56 | -0.88 | 31.37 | 58.03 | 8.30 | 75.53 |
| <i>June</i> | | | | | | | | | | |
| PGR | 0.58% | 3.49% | 3.00% | 0.50% | 2.61% | 4.31% | 0.93% | 0.60% | 0.63% | 0.73% |
| PLR | 0.13% | 2.56% | 2.58% | 0.26% | 2.52% | 5.10% | 0.63% | 0.35 | 0.32% | 0.45% |
| PGR-PLR | 0.45% | 0.92% | 0.42% | 0.24% | 0.09% | -0.80% | 0.30% | 0.25 | 0.31% | 0.29% |
| PGR/PLR | 4.31 | 1.36 | 1.16 | 1.91 | 1.04 | 0.84 | 1.47 | 1.73 | 1.96 | 1.65 |
| <i>t</i> -stat. | 0.26 | 7.46 | 0.60 | 4.69 | 0.49 | -0.60 | 7.35 | 13.84 | 2.13 | 18.13 |
| <i>July-May</i> | | | | | | | | | | |
| PGR | 0.55% | 3.70% | 2.67% | 0.47% | 2.32% | 4.51% | 0.82% | 0.50% | 0.65% | 0.65% |
| PLR | 0.29% | 2.61% | 2.46% | 0.18% | 2.00% | 4.80% | 0.46% | 0.22% | 0.30% | 0.32% |
| PGR-PLR | 0.26% | 1.08% | 0.21% | 0.29% | 0.31% | -0.29% | 0.36% | 0.28% | 0.35% | 0.33% |
| PGR/PLR | 1.87 | 1.41 | 1.09 | 2.56 | 1.16 | 0.94 | 1.78 | 2.32 | 2.19 | 2.05 |
| <i>t</i> -stat. | 0.41 | 29.03 | 1.08 | 18.51 | 5.75 | -0.73 | 30.82 | 57.01 | 8.04 | 74.00 |

Source: Brown et al. (2002)

Chart 8: Australian Stock Market, S&P/ASX 200, 01.01.1995-31.12.2000



Source: CEIC Macroeconomic Databases for Emerging and Developed Markets.

Chart 9: The two years before the analysis done by Brown et al.



Source: CEIC Macroeconomic Databases for Emerging and Developed Markets.

The two works used different measures of the disposition effect. While Brown et al. used ratio analysis; Talsepp used Cox proportional hazard model along with ratio analysis to measure the level of disposition effect. Talsepp argued that the use of survival analysis included an important element in the analysis, the holding time, while PGR/PLR analysis only considered the amount of sales. Brown et al. performed analysis on how the holding time influenced the degree of disposition effect and found that the disposition effect diminished with time. When a stock was held 200 days, the investor was indifferent between realizing a gain or a loss. Consistent with Odeans' (1999) work; that investors were more prone to the disposition effect the first half of the fiscal year¹⁸. Talsepp (2009) did not state how long the average holding times for the different classes of investors were.

Talsepp broke down the number of different accounts and found that the data of the foreign investors were 3.7% for individual investors and 3.4% of the institutional investors of the total amount of investors respectively. Further, Talsepp compared the difference between survival analysis and PGR-PLR analysis in table 4.

¹⁸ In the analysis of the disposition effect a fiscal year is the tax year. December is, for example, the end of both the fiscal year and the calendar year in Norway. In Australia, June is the last month of the fiscal year. In the end of a fiscal year investors are more likely to consider tax effects on their investments. Tax considerations may affect the degree of disposition displayed by investors in the different months of the year. The end of the fiscal year normally shows that the investors are not prone to the disposition. Some investors may use the end of the fiscal year as a self-control scheme in order to force themselves to realize losses from the beneficiary tax system for losses.

Table 4: Comparison between survival and PGR-PLR analysis.

| Investor type | Survival analysis | | PGR-PLR ratio analysis | | | | | |
|---------------------------------|----------------------|----------------------|------------------------|-------|---------|--------|-----|---------|
| | Hazard ratio for TIL | Hazard ratio for TGI | PGR | PLR | PGR-PLR | T-stat | | PGR/PLR |
| All investors | 0.774*** | 1.270*** | 0.314 | 0.289 | 0.025 | 13.476 | *** | 1.087 |
| Institutions | 0.724*** | 1.368*** | 0.213 | 0.202 | 0.011 | -5.026 | *** | 1.055 |
| Individual investors | 0.807*** | 1.214*** | 0.419 | 0.372 | 0.047 | 17.061 | *** | 1.126 |
| Foreign investors | 1.334*** | 0.741*** | 0.175 | 0.192 | -0.017 | 5.566 | *** | 0.912 |
| Local investors | 0.735*** | 1.337*** | 0.355 | 0.321 | 0.034 | 15.583 | *** | 1.106 |
| Local private investors | 0.781*** | 1.256*** | 0.420 | 0.371 | 0.049 | 17.113 | *** | 1.132 |
| Foreign private investors | 1.372*** | 0.707*** | 0.406 | 0.384 | 0.022 | 2.210 | ** | 1.057 |
| Local institutional investors | 0.627*** | 1.575*** | 0.261 | 0.237 | 0.023 | 7.449 | *** | 1.101 |
| Foreign institutional investors | 1.568*** | 0.636*** | 0.135 | 0.153 | -0.017 | 5.557 | *** | 0.882 |

***significant at 1% level; **significant at 5% level; *significant at 10% level

Survival analysis presents hazard ratios for the Trading loss indicator(TIL) and the Trading gain indicator(TGI) used as the only covariate in filtered subsample regressions. PGR-PLR analysis presents the Proportion of gains realized(PGR)minus the Proportion of losses realized(PLR) for filtered subsamples. In this paper I add PGR/PLR to compare with results from other papers.

Source:
Talsepp(2009)

Foreign investors staying with the stock they bought prior to the data sample and were going to sell when the market decreased might be the source of the reversed disposition effect. Consistent with the portfolio return for the different investor groups. Chart 6 shows how the index moved and that the overall investor had positive returns in the period Talsepp used when the index was used as an indicator for the portfolios return.

Table 5: Portfolio return and proportion of total assets by investor groups.

Portfolio return and proportion of total assets by investor group

| Portfolio return | Investor type | Proportion of total asset |
|------------------|---------------------------------|---------------------------|
| 17.63% | Institutions | 83.14% |
| 16.65% | Private investors | 16.86% |
| 21.06% | Foreign investors | 45.00% |
| 14.56% | Local investors | 55.00% |
| 15.26% | Local private investors | 15.20% |
| 31.61% | Foreign private investors | 1.66% |
| 14.22% | Local institutional investors | 39.80% |
| 20.65% | Foreign institutional investors | 43.35% |
| 0.00% | Government related | 0.06% |
| 16.30% | Funds | 1.59% |
| 29.43% | Nominee accounts | 29.76% |
| -0.41% | Client accounts | 6.83% |

Source: Talsepp(2009)

Foreign investors, both private and institutional outperformed the portfolio return of the respective locals. The locals, private and institutional investors, had quite similar portfolio returns in Talsepps paper. The results from the analysis showed that a low disposition effect and high returns on a portfolio was negatively correlated; the investors that displayed a low degree of disposition effect had higher returns.

3.1.4 Gender and the disposition effect

Da Costa, Mineto and Da Silva (2007) performed a laboratory experimental analysis with the same framework used by Weber and Camerer (1998) to analyze the disposition effect. The new element brought to the experiment was that the female participant received a pale-pink paper while the male participants received a white paper. Byrnes et al. (1999) showed that, in general, women were more risk-averse than men. The goal of the experiment was to check whether the differences between the genders were true for the level of disposition effect as well.

The participants in the experiment were asked to make portfolio decisions prior to 14 periods by choosing to buy or sell six stocks. No short selling or borrowing was allowed. Prices of the

stocks were determined randomly and the different stocks could rise or fall with different probabilities. Two separate experiments were made. One of the experiments had deliberate selling and the other one had automatic selling in each period. The participants in the experiment with deliberate selling used their purchase price as a reference point, while the participants of the experiment with automatic sales used the previous period price as a reference point.

Da Costa et al. showed that the genders behaved equally with the purchase price as reference point, consistent with the data from Feng and Seasholes (2005). When the previous period price was used as a reference point, the disposition effect differed for the genders, according to Da Costa et al. The female participants were not prone to the disposition effect, while the male participants still exhibited a tendency to ride losers.

Table 6: Genders and the disposition effect.

Table 6a

Female sales using the purchasing price as a reference point

| Stock | A | B | C | D | E | F | Overall* |
|-----------------|---------|---------|---------|---------|---------|---------|----------|
| | Total % |
| Sales with gain | 141 71 | 76 44 | 97 78 | 78 39 | 51 38 | 82 61 | 525 55 |
| Even | | 23 13 | | | | | 23 2 |
| Sales with loss | 57 29 | 73 42 | 27 22 | 120 61 | 83 62 | 53 39 | 413 43 |
| Total | 198 | 172 | 124 | 198 | 134 | 135 | 961 |

*Z=3.69, p-value<0.01 for the test of gains(525) versus losses(413)

Table 6b

Male sales using the purchasing price as a reference point

| Stock | A | B | C | D | E | F | Overall* |
|-----------------|---------|---------|---------|---------|---------|---------|----------|
| | Total % |
| Sales with gain | 173 92 | 134 62 | 156 93 | 89 54 | 76 50 | 137 75 | 765 71 |
| Even | | 27 13 | | | | | 27 13 |
| Sales with loss | 15 8 | 55 25 | 12 7 | 77 46 | 76 50 | 45 25 | 280 26 |
| Total | 188 | 216 | 168 | 166 | 152 | 182 | 1072 |

*Z=14.97, p-value<0.01 for the test of gains(765) versus losses(283)

Table 6c

Female sales at t using previous prices at t-2 and t-1 as reference points

| stock | | A | B | C | D | E | F | Overall* | % |
|-------------|-----|-----|----|----|----|----|----|----------|----|
| Price trend | | A | B | C | D | E | F | Overall* | % |
| t-2 | t-1 | | | | | | | | |
| G | G | 34 | 16 | 19 | 24 | 21 | 7 | 121 | |
| L | G | | | 8 | 19 | | 3 | 30 | |
| - | G | 39 | 31 | 33 | 43 | 30 | 22 | 198 | |
| Total | | 73 | 47 | 60 | 86 | 51 | 32 | 349 | 44 |
| G | L | 20 | 11 | 3 | | 8 | 17 | 59 | |
| L | L | 37 | 21 | 14 | 18 | 24 | 19 | 133 | |
| - | L | 57 | 46 | 27 | 48 | 32 | 43 | 253 | |
| Total | | 114 | 78 | 44 | 66 | 64 | 79 | 445 | 56 |

Z*=-3.44, p-value<0.01

The null (sales with gain9 of less then or equal to 50 percent cannot be rejected

Table 6d

Male sales at t using previous prices at $t-2$ and $t-1$ as reference points

| stock | | A | B | C | D | E | F | Overall* | % |
|-------------|-----|-----|-----|-----|-----|----|----|----------|----|
| Price trend | | | | | | | | | |
| t-2 | t-1 | | | | | | | | |
| G | G | 50 | 49 | 38 | 37 | 44 | 23 | 241 | |
| L | G | | | 12 | 23 | | 13 | 48 | |
| - | G | 68 | 70 | 69 | 60 | 52 | 52 | 371 | |
| Total | | 118 | 119 | 119 | 120 | 96 | 88 | 660 | 75 |
| G | L | 5 | 13 | 3 | | 3 | 11 | 35 | |
| L | L | 10 | 16 | 3 | 8 | 15 | 15 | 67 | |
| - | L | 15 | 31 | 12 | 17 | 18 | 29 | 122 | |
| Total | | 30 | 60 | 18 | 25 | 36 | 55 | 224 | 25 |

$Z^*=14.63$, $p\text{-value}<0.01$

Source: *Da Costa, Mineto and Da Silva (2007)*

Table 6c and 6d showed that men are much more prone to the disposition effect with a reference point set in the last period than females.

3.2 Day traders and the disposition effect.

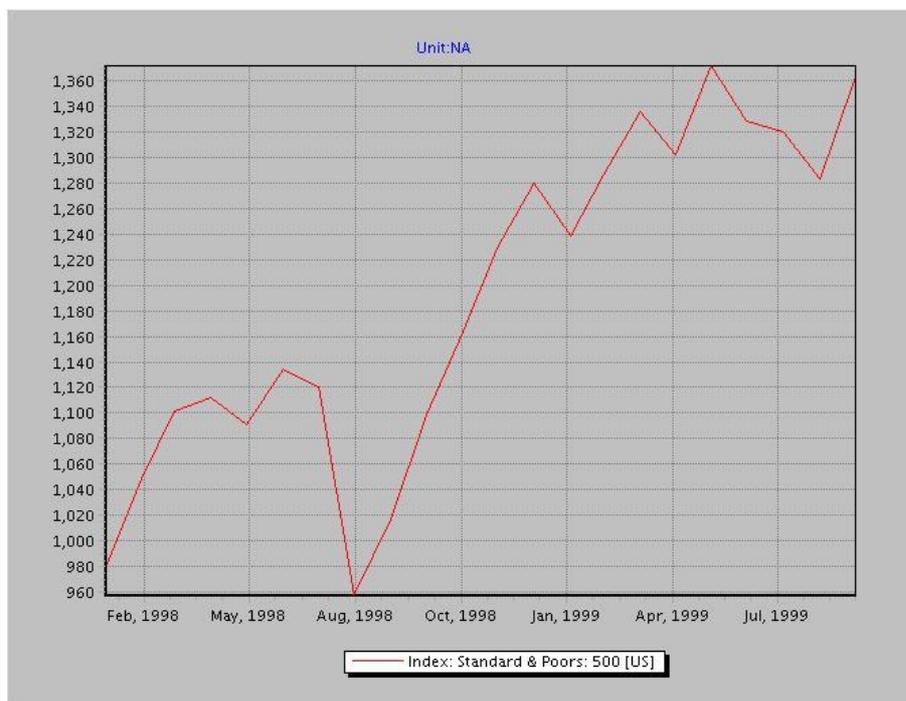
Prior articles showed the importance of the disposition as a behavioral bias in the financial market when it came to holding assets on a longer basis. The North American Securities Administrations Association (NASAA) (1999) found that 70% of all day traders tend to lose everything they invest. Day traders buy stocks (excluding short selling¹⁹ in the first analysis for simplicity) and stay with the stocks or sell for a very short time horizon. Most stocks do not have very high intraday volatility, which means that it is crucial for a day trader to realize a larger number of gains than losses intraday. In order to lose what they invest, their total losses must be of a larger magnitude than gains in their portfolios. The loss may come from having larger losses than gains with the same holding time, or that the holding time for a losses are longer than the holding time for gains, given that the return is equal (proportional negative and positive for losses and gains, respectively). In order to do well as a day trader

¹⁹ Short selling a stock is selling a stock you don't actually own. Performing this sort of investments is suitable if an investor think the market will decrease. The investor will make a bet that he is able to buy the security at a lower price when the stock is "delivered". If the price decreases, the investor will have positive return and the other way around if the price of the stock increases.

investors have to be able to cut losses and keep winners all the time. Day traders are particularly interesting to look at when studying the disposition effect because day traders do not consider portfolio rebalancing, tax reasons and transaction costs. The irrelevance of the other considerations, like other investments are prone to, make only two possible explanations for holding a losing stock longer than a winning one relevant; the disposition effect and the mean reversion belief. Do day traders have a tendency to ride losers too long as well and are they prone to the disposition effect and this is a source of the overall loss among the 70% losing their investments?

Jordan and Diltz (2004) examined data on trades performed by day traders in seven different branch offices of a national securities firm that specializes in day trading. The data period they used was from February 1998 until October 1999.

Chart 10: S&P 500, 01.02.1998-31.10.1999



Source: CEIC Macroeconomic Databases for Emerging and Developed Markets.

As chart 10 displays there was a prominent trend for the data period.

Jordan and Diltz (2004) showed that the inverse relationship between time and profitability is statistically significant and hence the disposition effect was a better explanation than the mean reversion belief for the behavior. Their dataset contained 100 032 trades, where there were 51 881 profitable trades, 41 183 losing trades and 6 968 break-even trades. From these trades

361 day traders had profitable trades while the 359 others had losing trades. According to these numbers the majority of day traders had an overall profit which contradicted the NASAA data. The day traders examined could still be prone to a disposition effect if the holding time of the losers were longer than the winners. Jordan and Diltz found that 38% percent of the traders held profitable trades longer than losing ones, and 62% were prone to the disposition effect. Numerous day traders use technical analysis²⁰ and follow special schemes in order avoid holding losers and discover the winners in an early phase. Investors that used technical analysis may be the part that did not exhibit a disposition effect.

Jordan and Diltz performed a sign test to examine whether the aggregate traders were prone to the disposition effect by a statistically significant margin. At the 1% level, the majority of the traders held a loser longer than a winner, supporting the disposition effect as an explanation of the dynamics of the day trading.

Short sales are a form of transactions used by many day traders. The first analysis provided by Jordan and Diltz was long positions. They investigated whether short sellers were prone to the disposition effect and found that short sellers were not prone to the disposition effect and in fact tend to ride winners longer than losers, hence a reverse disposition effect. A possible explanation to why short sellers were not prone to the disposition effect is that they were more sophisticated on average than the ones only going long in the stocks.

Further; Jordan and Diltz concluded that it was the transaction itself of a short sale rather than the trader characteristics that did not show a disposition effect.

²⁰ Technical analysis is a way of recognizing price patterns and the investors using this sort of analysis believe that patterns tend to repeat themselves. Using trend channels and deciding to buy/sell a stock when it breaks out of the trend line. Investors' using technical analysis use different measures but the common feature is that they use prior information to try to predict the market in the short-run.

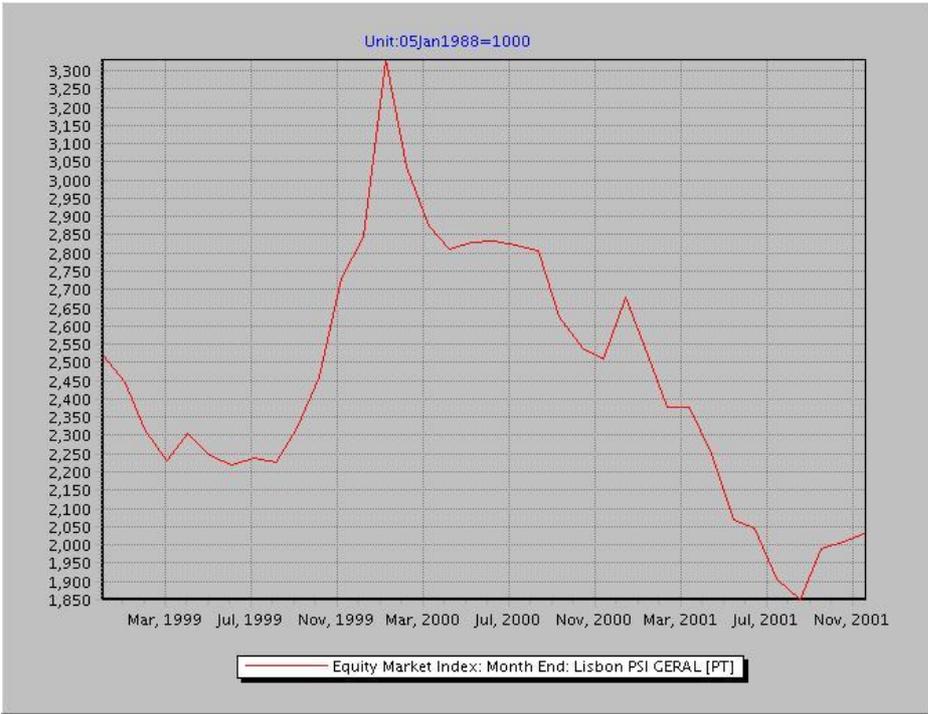
3.3 Market movements and the disposition effect.

Leal et al. (2008) investigated data on 1496 individual Portuguese investors over four years. During the four years time, the Portuguese stock market had one bull market and one bear market, using Leal et al. definitions. The paper contributed with an analysis on how investors reacted to bull and bear markets and if their level of disposition effect were the same in the two periods.

In the bull market, the majority of the stocks had increased in value, meaning that the total gains in a portfolio increased and the number of losses decreased, if their portfolios followed the index. We could predict an indifferent investor (not prone to the disposition effect) to sell more winners than losers because the number of winners were higher in the bull market. In a bear market, we would expect the investor to sell more losers because the proportion of the portfolio of losers should be larger than the proportions of winners, given that the investors' portfolio resembled the market. Leal et al. found strong evidence for the disposition effect in both a bull and a bear market, but a stronger effect in the bull market. The difference between the markets was statistically significant. It was natural to expect the opposite results; that investors would have used momentum strategies in a bull market and was prone to the disposition effect at a larger extent than in a bear market, but Leal et al. showed the opposite.

A possible explanation of the somewhat surprising result may be that the investors had decreasing utility of gains according to the value function. This property made the investor realize their winners and hold on to their losers, even in a bull market. The investors hoped that their losers would bounce back to the purchase price. Even though the overall portfolio returns were positive, the investors did not want one loss to wipe out all the experienced pride from the good investments.

Chart 11: Lisbon PSI General, 01.01.1999-31.12.2002



Source: CEIC Macroeconomic Databases for Emerging and Developed Markets.

3.4 The connection between the disposition effect and security prices.

In the literature, the disposition effect has been well documented. The behavioral bias affects how investors have been trading in the financial market and it would be natural to assume that the investors' behavior have affected the pricing for securities in the market.

3.4.1 Under reaction to news.

Andrea Frazzini (2006) examined the relationship between the disposition effect and reaction to news. In the standard efficient markets theory it has been showed that the disposition effect should not be present. When an asset is bought it should be considered a sunk cost. The only considerations from the investors should be to analyze the current and probable future returns in order to decide whether to buy or sell a stock. With the disposition effect, most investors set the reference point as the price paid and this price has been a part of the decision whether to sell or not later on. Such behavior make the investors act suboptimal according to expected utility theory and may incur larger losses than necessary on their portfolios. Rational investors might use the previous prices as an indicator about the future price development; thus still acting rational if they believe that previous prices have influence on the future prices. But acting in such a manner contradicts the weak market efficiency hypothesis because the past prices do not provide any information about the future prices.

Mean reversion is the belief that prices will return to their initial price, either by a positive or negative drift. Using prior information about a stock to decide whether to buy or sell departs from the mean reversion. With a mean reversion belief the investor assume the stock price is fixed and the prices will only fluctuate around this price. Investors that use technical analysis use prior prices on stocks in order to discover for repeating patterns on stock values and making investment decisions based on these patterns.

According to the efficient market hypothesis, news should be priced in securities and give them a new price dependent on the information given instantly. This theory has been challenged through the last years.

Frazzini claimed that news will not be implemented in the stock prices instantly because of the disposition effect. Investors sold stocks experiencing positive news in order to realize

winner like all disposition effect investors behave. The supply of the stocks was at a higher level than the fundamental price predicted, affecting the price of the stock. Investors were selling their winners, and made the purchase price lower because of the increased supply from prior stockowners. When negative news regarding a stock was published, the investors did not sell the stock, according to the theory in this paper, and did not create excess supply and a steep reduction in the price. The disposition effect kept the price higher than “perfect market pricing” would. In both cases a price drift followed. With the negative news, the price drift was negative and pushed the stock price to the price it should have according to the importance of the news. With positive news, the price drift was positive. The magnitude of the price drift and under reaction depended on the difference between the price at the time of the news and the reference price (normally price paid for the security).

Frazzini tested the hypothesis: *“When most of the current holders are facing a capital loss, stock prices under react to negative news and in turn generate a negative post-announcement price drift. When most of the current holders are facing a capital gain, stock prices under react to positive news and in turn generate a positive post-announcement drift. Moreover, holding the news constant, the capital gains overhang forecasts post-event returns”*.

Frazzini’s analysis supported the hypothesis regarding under reaction to news. As a result investors were able to have a strategy consisting of having long positions in stocks that presented good news and short positions in stocks that presented bad news. This strategy let the investors use an investment rule based on post-earnings announcement drifts. The degree of under reaction and hence the consequent profits were amplified by the magnitude of the disposition effect. Movements as a result of news returns on stocks had a better fit when with positive news than negative news. This might come from the fact that investors prone to the disposition effect were likely to hold on to their losers, and kept on selling the winners after in the consequent periods.

In addition to the under reaction to news, Frazzini documented the disposition effect among fund managers. The analysis confirmed the intuition from Wermers (2003) that underperforming managers were reluctant to realize their losses and report negative results.

3.4.2 Equity premium when investors are aware of the disposition effect.

In order to invest in a risky asset, investors will expect higher return than the risk-free rate depositing the money in a bank account will yield. All investors require an equity premium of a certain magnitude to invest in a risky asset.

Roger (2009) investigated whether the size of the equity premium was increased in order for disposition investors to invest in risky assets. Disposition investors displayed a welfare loss that was increasing in the intensity of disposition effect and the evaluation frequency of the portfolio. Further; investors that decided to invest in a stock in period 1, chose to invest in period 2 as well, even though the investors knew they were prone to the disposition effect. Investors that were conscious about their disposition effect required a higher equity premium. When the investors evaluated their portfolios daily instead on monthly, the expected return decreased substantially. This linked the evaluation period and the disposition effect together. Roger showed that the critical value (loss aversion parameter) for the investors to be indifferent between a risky asset and a risk free asset was:

$\lambda^* = \frac{p}{1-p} \frac{u-r}{r-d}$ where u and d is defined by $x_2 = uS_0$ and $x_1 = dS_1$, where p is the probability of price going up and r is the risk-free rate.

λ^* is derived from the equation $v(x) = (x - x^*)_+ - \lambda(x^* - x)_+$,

where $v(x)$ is the value function, x the final wealth, x^* , the reference wealth level and

λ is the loss aversion coefficient. Intuitively, the equation display how the final valuation of the outcome is based on prior wealth and the loss aversion.

The value function: $E[v(W_2, \lambda', \theta)] = 0.25((1 - \theta)(\pi + \sigma)^2 + 2r(\pi + \sigma) + (2 - \theta)(\pi^2 - \sigma^2 + 2r\pi) + \lambda'[(\pi - \sigma)^2 + 2r(\pi - \sigma)])$ was used by Roger in order to evaluate the influence the disposition effect had on the equity premium.

The critical value was calculated using data from Barberis et al(2001) on the New York Stock Exchange and Treasury Bills from 1926-1995:

$r = 1.0058$; $\pi = 5.45\%$; $\sigma = 20.02\%$.

The values are risk free rate, risk premium and the standard deviation of stock returns, respectively. Considering a simple case where $p = 0.5$; $u = r + \pi + \sigma$ and $d = r + \pi - \sigma$, the critical value is: $\lambda' = \frac{4\pi^2 - (\sigma - \pi)^2 + 2r(3\pi + \sigma)}{(\sigma - \pi)(2r + \pi - \sigma)}$ if $ud - r^2 > 0$. Inserting the results from Barberis we get: $\lambda' = 2.657$. This is different from the critical value to loss aversion used by Kahneman and Tversky (1979), which used $\lambda' = 2.25$, but only slightly smaller than Benartzi and Thaler (1995) $\lambda' = 2.77$.

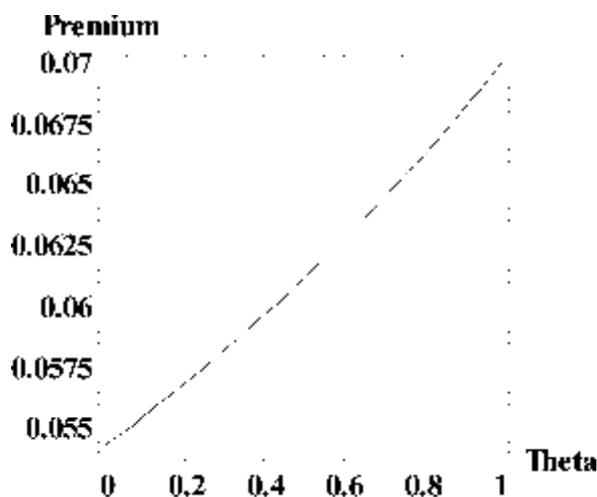
To evaluate how the equity premium changed with respect to the disposition effect θ , Roger derived the derivative of the premium equity:

$$\frac{d\pi}{d\theta} = \frac{\pi(\pi + \sigma + r)}{r + (1 - \theta)(\pi + \sigma) + (2 - \theta)(r + \pi) + \lambda'(r + \pi - \sigma)} > 0.$$

Intuitively, the equity premium was increasing in the degree of disposition effect. Even though it was true, the magnitude of the effect was not very large.

If $\theta = 1$, the premium increased by 7%, and with $\theta = 0$, the premium was 5.45%. Hence; the disposition effect did not affect the equity premium to a large extent. Further, Roger showed that monthly evaluations of the portfolios made investors less prone to the disposition effect daily evaluation. Thus; the equity premium required by investors that knew they were prone to the disposition effect was decreasing in the evaluation time. Roger concluded that investors that were consciousness about the disposition effect required a higher equity premium in order to invest in stocks.

Figure 5: Risk premium as a function of the degree of disposition effect, theta.



Source: Roger (2009)

3.4.3 Momentum strategies based on the under reaction to news due to the disposition effect.

Frazzini (2006) showed how the disposition effect make the market under react to both positive and negative news. Grinblatt and Han (2005) investigated if it is possible to use a momentum strategy based on the arbitrage opportunities arising from the spread between the equilibrium price and the fundamental value of the stock. As Frazzini showed it was a price drift after the news until the pricing merge to point where the price reflected all the available information. The spread emerged from the situation where investors did not have perfectly elastic demand for a stock. The demand perturbation caused by disposition investors generated an under reaction to news by not incorporating the information into the stock price. Past winners were undervalued because the positive news was not reflected in the prices and the past losers were kept at an artificial high price because of the reluctance to sell.

The individual reference points differ as a result of the different periods the stocks were bought. The dynamics in the stock market made the price converge to the fundamental price as a result of the stocks bought by new investors that had a reference point closer to the fundamental price. Hence the winning stocks had a tendency to increase in value the next period and the losing stocks contained a negative price movement that followed the next period. This was the source for arbitrageurs to use momentum strategies. Grinblatt and Han (2005) found that the equilibrium market price was a weighted average of the reference price and the fundamental value of the stock i .

$$P_t = wF_t + (1 - w)R_t \text{ where } w = \frac{1}{1 + \mu\theta}.$$

P_t : Price in t

F_t : Fundamental price in t

R_t : Reference price in t

μ : Proportion of investors prone to the disposition effect.

θ : Relative intensity of the disposition effect.

The market price under reacted to news when $0 < w < 1$. The size of w depends on the amount of disposition investors, measured by the proportion μ and the relative intensity of the disposition effect, θ . The transparency of the stock market let investors know the current price a stock is traded at. In combination with their reference point price, investors use the current price in order to form an updated reference point price in the next period.

$$R_{t+1} = V_t P_t + (1 - V_t) R_t \text{ where } V_t \text{ is the updating weight in period } t + 1.$$

Over time, the reference point prices investors use tends to converge to the fundamental price. The dynamics of the market when w is constant is

$$P_{t+1} - P_t = w(F_{t+1} - F_t) + (1 - w)(R_{t+1} - R_t).$$

By definition the expected change in the fundamental price is zero, hence the difference between the market price and the reference price is the informational part of the equation.

Aggregating over investors, Grinblatt and Han found that the reference prices converged to the market price. Note that the market price was a weighted average of the reference prices and the fundamental price. The expected price increase was formed by the two prior equations in order to evaluate possible momentum strategies:

$$E_t \left[\frac{P_{t+1} - P_t}{P_t} \right] = (1 - w) V_t \frac{P_t - R_t}{P_t}$$

Expected stock return was a monotonically increasing function of the unrealized capital gain. The theoretical result was difficult to use by arbitrageurs. The price converged to the price containing the new information fast and arbitrageurs could not know the price drift duration. The equation showed that momentum strategies and arbitrage opportunities were possible, but because of the timing difficulties it was very risky. At the purchasing date, the market price may be equal to the fundamental price and hence the arbitrage opportunity was gone.

4 Splitting the tendency to sell losers too late and winners too soon.

The tendency to ride losers too long and sell winners too soon has been treated as a symmetrical behavioral bias in most of the literature. Investors may be more reluctant to realize their losses than they are eager to realize their winners. The experienced pain associated with the regret effect will differ among investors. Some investors will be determined not to realize a loss because of the emotional pain in addition to the monetary loss is large; hence have a high tendency to ride losers. The same investors might not realize their winners as soon as others, so the disposition effect is not necessarily symmetrical.

Feng and Seasholes (2005) found that some investors eliminated the tendency to ride losers too long but did not eliminate the tendency to sell winners too soon. Prior market movements affect the return on the investors' portfolio and may be another source than level of sophistication to why the disposition effect is not always symmetrical.

A bad investment might not affect investors with prior gains too large because of the large overall gain. Losses that are small in magnitude compared to the overall returns will not invoke a regret effect, because the overall value is positive. A new loss in addition to large prior losses may amplify the regret effect; hence making the investors more averse in realizing losers. The value function with the prior returns from section 2.2 show this relationship:

$$v(X_{t+1}, S_t, z_t) = \begin{cases} X_{t+1} & \text{for } X_{t+1} \geq 0 \\ \lambda(z_t)X_{t+1} & \text{for } X_{t+1} < 0 \end{cases} \quad \text{where, } \lambda(z_t) = \lambda + k(1 - z_t), k > 0$$

The value function shows that prior returns will affect the subsequent actions investors make. A high prior gain (high z_t) results in an additional pain in losses that is lower than investors that enter the market and get a loss.

By including prior returns we are able to explain some of the inconsistency in work done on the disposition effect, as the discussion in section 2.1.3. Past market movements are of importance to evaluate the level of disposition effect among investors in a data sample. Prior returns will also have implications for the asymmetrical relationship in the disposition effect

5 Critique

5.1 Prospect theory as an explanation of the disposition effect only works ex-post the investment is made.

The disposition effect has been well documented through extensive analytical work. There are not many economists that deny the disposition in financial markets. The analysis done on the disposition effect is based on the way investors act when they own a stock and given options between stocks (experimental studies).

Hens and Vleck (2005) investigated how investors act according to prospect theory and investment by looking at a binomial tree of stock investments in 3 periods. In the first period investors had to decide to buy a risky or risk-free asset. The second period they had to decide to keep /sell / buy a risky asset. The third period gave the final outcome of the investments. Hens and Vleck claimed that disposition investors will not invest at all, because of the prospect theory properties; the investor preferred a risk-free asset to a risky investment when the investor is risk averse for gains and risk lover for losses.

This was based on investors knowing they were prone to the disposition effect. Investors tend to believe they are more sophisticated and rational than they really are. Analyzing the disposition effect, Hens and Vleck claimed that prospect theory only was a suitable explanation ex-post the investment is made. If the investor had the degree of loss aversion as prospect theory predict, they would not invest at all; hence, prospect theory could not be used as an explanation of the disposition effect.

If investors knew they were prone to the disposition effect they would require a higher equity premium in order to invest in the risky asset. Hens and Vleck further made the assumption of all parameters was constant over time degree of risk aversion and coefficient of loss aversion, respectively. At time $t=1$, the period after the investment was made, investors could have changed their attitudes towards risk. The adjusted behavior could have implications for the equity premium demanded or the choice of selling the whole portfolio and exit the market.

The work done by Hens and Vleck is interesting and showed that prospect theory was not a perfect explanation of the disposition effect. The author disagrees with the claim that investors that know they are prone to the disposition effect will not invest at all. Self-conscious investors will rather adjust the equity premium in order to invest than not entering the market at all.

The equity premium will necessarily be higher when the investor knows he is prone to a disposition effect because of the decisions that will be made later on are not optimal in order to maximize profits.

5.2 Is prospect theory suitable to explain the disposition effect?

Kaustia (2008) claimed that prospect theory was unlikely to explain the disposition effect. According to Kaustia, prospect theory had preference based value in explaining the disposition effect, but not behavioral explanatory value. Psychological explanations like mental accounting, regret aversion and self-control were better at explaining the disposition effect.

Kaustia rejected the hypothesis that prospect theory was able to explain the disposition effect as a result of the propensity to sell a stock did not change with respect to return like the value function predicted. According to prospect theory, investors would have a smaller propensity to sell after a large gain, but the results from the data show that the investors had the same propensity to sell for large gains as small ones. The prospect theory predicts that investors are risk lovers for losses (convex value function) and risk averse for gains (concave value function), relative to the reference point, see figure 1. This implies that the investors should have a larger propensity to sell after a small gain compared to a larger one. Kaustia found the contrary; that the propensity to sell a stock with gain was increasing in the magnitude of gains.

Alternative explanations for the disposition effect like mean-reversion, target pricing and tax considerations did not have a large explanatory value according to Kaustias' results, consistent with other empirical work.

6 Ways of reducing the disposition effect for an individual investor.

Given the behavioral bias of the disposition effect in the financial market, there are ways to reduce the disposition effect for individual non-professional investors.

Knowledge is the most obvious way of reducing the disposition effect. The possibility of a high return normally motivates investors to read information and learn about the financial market. The importance of investor behavior in the financial market has been neglected by a large proportion of investors and professionals for many years. Educating investors should be in both investors and professionals' interest in order to get better returns which are monetarily profitable for both parts. If the investors know that they are prone to the disposition effect they will naturally be able to adjust their behavior to some extent.

Imposing self control schemes is another way of reducing the disposition effect. Some investors have a stop-loss rule that implies that they have to sell the stocks when they fall below a specific value. This ensures that the investors will not be stuck with a loser when it substantially over time. A stock being sold when the price decreases by 5% is an example of a possible stop-loss function. Numerous investors consider their portfolios as one investment; hence only considers a stop-loss on the whole portfolio. This behavior will not reduce the disposition effect, but only the magnitude of the losses.

There is a product named Unit-Link in the Norwegian retail market. This is an insurance product with specific qualities for individual investors. The element of insurance is that 101% of the holding is paid to the favored person in the insurance policy. First off, the Unit-Links have been criticized for being high priced in the retail market. After paying an establishment cost, the investors are able to choose different funds, including bond funds, mutual funds and combined funds. There are no transaction costs after the establishment cost. When investors switch funds in the policy there is no taxation. The taxation will incur when the investors withdraws amounts from the policy or terminates the policy. No transaction costs and treating the portfolio of funds as one investment (only one mental account) make the investors likely to have a lower disposition effect. Mental accounting will not limit the trading of funds, because the mental account is related to selling the whole portfolio or not. Some financial institutions offering this product have different strategies where the professionals switch the

funds for the investor, such that the investors are able to choose whether they want to trade funds themselves or let professionals take control. The cost structure removes the risk of “churning, so the amateur investors should make professionals allocate their portfolios in order to attenuate the disposition effect.

Consider a situation where an investor buys one mutual fund. The investor will be prone to the disposition effect in the same way as a single stock. If the same investor has made a decision about creating a Unit-Link policy and have the same mutual fund in the policy, he would have a lower threshold in order to switch the bad performing fund to other funds, because the policy is treated as one mental account.

Limitations in using Unit-Link policies to reduce the disposition effect for individual investors are the time horizon²¹, the establishment cost and no shielding deduction like other investments have.

The tax system in Norway²², related to investments, contributes to reducing the disposition effect (tax system for individuals). Investors are able to deduct tax for losses and have to pay tax for gains in each fiscal year (ending in December as the calendar year in Norway). The positive tax effect on reducing the disposition effect may be dampened as a result of investors waiting until December to realize their losses and get a tax deduction, even though it may be optimal to realize the loser in for example May.

²¹ Because of the startup costs, the investor should have a longer time horizon than when a single stock is bought.

²² Simplified, the capital tax system in Norway on individuals is that capital gains are taxed by 28%, while capital losses let the investor subtract 28% of the loss of their tax report. In addition to this investors are able to subtract a shielding deduction, which is a deduction of the risk-free rate each year.

7 Conclusion

The main contribution from this thesis has been a comprehensive survey on the different implications the disposition effect has on the financial market and how the level of disposition effect varies with investor characteristics.

The disposition effect is a well documented behavioral bias in the financial market. To various extents, work done on the disposition effect all concludes that investors have a tendency to ride losers too long and ride winners too short. The behavioral bias makes investors reduce their return compared with investors that are not prone to the disposition effect.

The disposition effect is a source of under reaction to news in the financial market. When bad news is released, the stock prices do not decrease as much as it should, because the disposition investors hold on to the losing stocks. There will not be excess supply of stocks and the prices will not decrease like they would if investors were not prone to the disposition effect. The opposite is true for positive news.

It has been shown that sophisticated investors tend to have a lower degree of disposition effect. This survey considers the different aspects of the disposition effect and how it relates to different demographic variables and level of sophistication. Feng and Seasholes (2005) showed that investors were able to eliminate the tendency to ride losers too long, but the tendency to sell winners too soon was still present. Trading rules in order to reduce the tendency to ride losers too long are easier to form and use for investors.

Investors that are conscious that they are prone to the disposition effect require a higher equity premium in order to invest in risky assets. These investors are likely to perform poorly compared to more sophisticated investors or other investors that are prone to a lower extent; hence requiring a higher equity premium. When the equity premium is not sufficiently large some investors might stay out the market and limit the demand for stocks.

Prior work has not considered how prior returns affect the level of disposition effect. This survey provides a framework for measuring the level of disposition effect and how it relates to past returns.

The portfolio return in previous periods is, to the authors understanding, an important feature of the disposition effect. Using the framework developed by Barberis, Huang and Santos (2001) combined with prospect theory, the paper make a new reference point consisting of risk free rate, purchasing price, prior return and relative performance. In combination with the value function from prospect theory the paper provide a framework for analyzing how prior returns affect the level of disposition effect.

There are critique regarding how the disposition effect is explained in the literature, but the fact that investors are prone to the disposition effect to various extents is proven empirically and experimentally and not disputed. The critique is towards the theoretical framework, not the empirical results.

The thesis shows that the disposition effect has many implications in the financial market and that the level of disposition effect varies with investor characteristics.

The author encourages further work on the relationship between prior returns and the level of disposition effect on different investor classes.

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