The Return of Satisfaction: a Study on the Consequences for Investor Behavior

Master Thesis

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Abstract

In this study I will shed new light on investors' satisfaction levels, risk preferences and trading decisions using stock price development patterns. These patterns significantly influence investor satisfaction and behavior. By using and expanding the experiment done by Grosshans and Zeisberger (2016) I am able to find evidence of investor's preference bias on future trading decisions. These results suggest that investors with a positive bias towards a certain company tend to make lower risk expectations. In accordance, evidence is presented in which the influence of a bias on return expectations becomes more clear. The use of reference points in combination with trading decisions clearly explains and shows presence the disposition effect. Investors not only tend to hold loser stocks for too long, but also, more moderately, if they are satisfied with a stock's performance. Finally, early evidence of a relationship between a preference bias and the disposition effect is presented. These results add to Prospect theory, risk-taking behavior, trading decision theory, and extend the 'traditional' mean-variance trade-off introduced by Markowitz (1952).

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Introduction

"Imagine your favorite soccer team is down at half-time, but recovers in the second half, and the match ends with a draw. You are probably very satisfied with your team turning around the match and getting away with a draw. Now consider the same match with your favorite team being up at half-time, and the final score is again a draw. In this case, you are probably quite dissatisfied with that very same final score", This metaphor is used by Grosshans and Zeisberger (2016, p.1) to simply explain the essence of their research. Because of its simplicity and efficacy I will alter the metaphor and explain the idea behind my follow-up research. Two key differences in my research RE the use of real-world data to research investor satisfaction and risk tolerance and the application of a preference bias. To keep it simple I will stay with a soccer-based example. Imagine you are into betting on soccer matches. You place a bet on a team which will give you a nice return if they win. You are probably very satisfied when it is a tie at half-time, and 'your' team wins at full-time. Now consider the same match, but now 'your' team is down at half-time, and wins at full-time. Would you be more satisfied in the second scenario? What would this result do to your next prediction for the same team? And, what would happen to your satisfaction and future bets if the team you bet on is your favorite team? These fundamental questions are addressed in this research, only not on soccer-based parameters, but on stock market data. In this thesis the effect of price paths on investor satisfaction and investment behavior is analyzed, instead of only the final return as is generally accepted in classical behavioral finance.

This thesis is a follow-up research on a study by Grosshans and Zeisberger and in order to keep the validity and reliability of this research at a sufficient and comparable level, I choose to keep my research parallel to the research of Grosshans and Zeisberger. This includes making some of the same methodological choices and keep an matching structure in order to maintain validity, reliability and comparability. It is shown, by their experimental design, price paths have the potential to influence investor satisfaction and risk tolerance. Therefore, the aim of this research is to verify if the potential of the Grosshans and Zeisberger (2016) holds when the experimental design is slightly altered and artificial data is replaced by actual stock price paths. The question I will answer, and which results will be used to obtain the aim is: "To what extend do actual price paths influence investor satisfaction and risk tolerance"?

Existing 'mean-variance' trade-off literature has predominantly left the way final return is developed out of the satisfactory equation. Therefore, traditional literature also neglected to identify price development effects on trading decisions, and investor's risk tolerance. This study adds to literature on investor satisfaction and risk tolerance by analyzing the 'price path' effect of a stock. Previous literature has taken into account the reputational bias of an investor towards a certain company. But never before has this been combined with the way final return developed itself. By taking the research by Grosshans and Zeisberger a step further, incorporating its assumptions, this thesis pioneers on investor satisfaction and risk tolerance due to price movements. In a logical order this thesis builds upon previous literature by Bernoulli's (1738/1954), Markowitz (1952), Bollen (2007), Glaser (2007), Orr (2007) and Merkle et al. (2015), which are all included in the theoretical framework.

My thesis is not only scientifically relevant because it pioneers in an abstract way to the effect of price movements on investor satisfaction. More interesting, just as in Grosshans and Zeisberger, the satisfaction results for an investor are also related to an analysis in beliefs and preferences. Combined with the 'real data' element of this study this thesis can provide useful insights into the (psychological) drivers for investment decisions. These drivers have early implications on the way the 'disposition effect' has been used in traditional behavioral finance. In addition, this research is partly based upon the concept of order effects, which originates from psychology, as Grosshans and Zeisberger extensively describe in the initial experiment.

Practically, this study contributes to the simplification of finance, by transforming an econometric approach into an accessible experiment. Due to this simplification I hope to breach the intricate atmosphere covering finance and stock market models. Furthermore, my research, as stated before, provides useful insights into the psychological drivers for investment decisions and could even be generalized to psychological order effect theory.

Next, I will discuss some theoretical findings which led to the rise of investor satisfaction. In the same section risk tolerance will be discussed and identified. Both are points of contact with 'happiness economics[1]', as well as the theoretical effect of a bias

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[1] Wilson (1967) first reviews the Subjective Well Being. Diener et al. (1999) state the happiness on the finance domain is mostly determined by financial future perspectives. "The happy person is blessed with positive temperament, tends to look on the bright side, does not excessively ruminate, lives in an economically developed society." These seem to have a connection to risk tolerance.

due to reputational effects. After this the research method is explained, containing methodological choices, survey design and response parameters. In the analysis all results are displayed and discussed. In the following chapter conclusions are made. The conclusions on consequences for investor satisfaction and risk tolerance are followed by a discussion chapter in which I review some methodological choices and make recommendations for future research. I bring the paper to a close with an acknowledgement for my supervisor.

Theoretical Framework

Across literature different views on investor behavior emerged. From 'traditional' Bernoulli's investor utility theory to Modern Portfolio Theory by Markowitz (1952) and Prospect Theory (Kahneman and Tversky, 1972). These views contain different assumptions on what risk is and what determines investor behavior based on their achieved utility. In recent years an increasing supply of literature on investor satisfaction emerged. This study builds upon this recent 'happiness' literature. Firstly, I will take important assumptions about risk into account for this research and define these concepts by looking at traditional Utility Theory and classical Prospect Theory. Secondly, the rise of investor satisfaction theory is reviewed to obtain a profound understanding of this indispensable part.

Risk aversion and -tolerance

In her research Shive (2010) searches for social based determinants of investor behavior. Although economic based determinants are not the essence, these are also taken into account. In the study a strong effect of income (wealth) on investor behavior is observed. Although it is slightly significant the effect is strong. This result could be in line with Bernoulli's (1738/1954) view on investor utility theory. Bernoulli's early version of expected utility theory ascribes relative utility differences to investor wealth, with wealthier investors being willing to take more risk. More recent literature has shown people have varying risk attitudes that occur independently of their degree of wealth (Corter, 2006). In Modern Portfolio Theory, first introduced by Markowitz (1952), utility is based on the trade-off between risk and expected return. This mean-variance trade-off is determined by individual risk aversion characteristics. Whereas risk aversion is the final measure, risk tolerance is what determines the individual risk perception i.e. the two terms are somewhat intertwined but the degree of risk aversion is more of a classification, while risk tolerance is a personalized profile for risk. In recent literature Modern Portfolio Theory is adopted and individual risk aversion and risk tolerance characteristics have been well studied.

Grable (2010) advocates that risk tolerance is a reflection of the mean-variance trade-off and advances determinants of risk tolerance. Age and marital status are both identified as key determinants for risk tolerance by Grable (+ age, + tolerance and + marital status, + tolerance). Furthermore, the combination of education, financial

knowledge, income, and occupation explained the most between-group variability in risk tolerance. So, risk tolerance is primarily based on individual characteristics. For this study risk tolerance is taken into account because individuals form the subjects of the research and it serves the purpose to use reference points. Existing literature in behavioral finance raises the possibility of reference points as an influencer of risk tolerance. Reference points are asset prices which refer to the indifference of an investor to sell or hold an asset. Based on the investors 'zero-utility' point a decision for the asset is made, given the current price of an asset (Adeler et al. (2011); Baucells et al. (2011); Heath et al. (1999); Tversky (1991)). Important to notice is that existing literature has established a connection between risk tolerance and reference points. Traditionally, is has been assumed a reference point is the same as the purchase price of the respective stock (Weber and Camerer, 1998). In contrast, recent literature discovered reference points are sensitive to the past performance of a stock. Using classical Prospect Theory an investor's risk tolerance is sensitive to the price location of the reference point. When an asset price is below a reference point it can turn an investor into risk seeking behavior, considering its individual risk tolerance (Arkes et al., 2008; Odean, 1998). Prospect theory explains this behavior using the disposition effect (Grinblatt and Han, 2002). Weber and Camerer (1998) explain reference point dynamics and their relation to the disposition effect. The disposition effect which is the tendency of investors to hold losing stocks for too long and sell winning stocks too early was first-studied by Kahneman and Tversky (1979). Although, the disposition effect is a well-studied topic, this is mostly on its appearance. Investor preferences are not well-studied in combination with the disposition effect, yet (Barberis and Xiong, 2009; Dhar and Zhu, 2002). This study will make a contribution to this and produces motives to further study preference effects on reference points and the disposition effect.

Glaser et al. (2007) hook up to risk tolerance by studying the main determinants for investors' price forecasts. In opposite to Helm (2007) and Nagy and Obenberger (1994) they find that participants' forecasts are not influenced by the fact that they know or own a particular stock. These participants are not more optimistic in their forecast compared to other participants who do not own the respective stock. Glaser et al. (2007) imply there is no bias among the participants due to affinity with a particular company stock by reputational effects.

Bollen (2007) makes use of a conditional utility function. Hereby Bollen (2007) describes the investment decision is conditional on satisfactory levels of risk and

expected return. Thus, Bollen assumes investor behavior as consequence of the 'mean-variance trade-off'. Also, Fama and MacBeth (1973), Glosten et al. (1993) and Bollerslev et al. (2009) base their studies on the mean-variance trade-off. In addition, the Orr (2007) paper again assumes investors typically prefer portfolio's with both a large mean return and small variance returns. Risk aversion is therefore solemnly based on returns and risk. Now, does the mean-variance trade-off captures the whole of risk tolerance and risk aversion and therefore, utility? Although many individual variables are captured by risk tolerance other factors can influence utility achieved by the mean-variance trade-off.

Investor satisfaction

Literature learns us that risk aversion and risk tolerance are primary determinants for investor behavior and utility. Hence, the question arises, is utility, i.e. investor satisfaction, merely based on risk and expected returns? Balasubramanian et al. (2003) introduces the direct use of price perceptions on investor satisfaction, whereby price perceptions are defined as "the fairness of the level of economic benefits derived from usage in relation to the level of economic costs" (Bolton and Lemon 1999, p. 172). But also in this study customer satisfaction is merely determined by beginning- and ending-values. Helm (2007) takes it a step further in her study. Price perceptions are evolved and captured specifically as 'stock price development'. Although no significant contribution of 'stock price development' on investor satisfaction was found in the sample, a relation might exist because the study also had some limitations caused by the high market volatility and decreasing stock performance most investors had to face during the years prior to the study. In their research Nagy and Obenberger (1994) identify seven relatively homogeneous groups which may explain individual investor behavior. On top of all seven groups expected earnings, i.e. an indirect measure for expected returns, and diversification-needs which is a proxy for risk are considered to be the most important. In this research is also seems the mean-variance trade-off is on top. Except, a great variability of factors is taken into account. Among the results are reputation of firm (which corresponds with the Helm, 2007, paper) and also recent "price movements of firm's stock". The paper only generally states it as a questioned variable, but in theory this variable and its effect on investor satisfaction is fairly under investigated. Recently, the number of studies on investor happiness increased in the literature. For instance, Merkle et al. (2015) investigate the effect of a stock's relative

performance on investor satisfaction and find this to be an important determinant. Grosshans and Zeisberger build upon investor satisfaction by investigating the effect of different price paths on investor satisfaction and risk tolerance. They have conducted an experiment using artificially constructed price paths and have examined these among different groups of respondents. By experimental design, Grosshans and Zeisberger show price paths have the potential to influence investor satisfaction and risk tolerance, also evidence for the presence of a disposition effect, i.e. the tendency to hold losing stocks while selling winning stocks, is found.

Research Method

Stock price paths

This study extends the experiment done by Grosshans and Zeisberger (2016) by using real stock price paths. As in their experiment six different price paths have to be found, these are classified in three groups: "down-up", "straight" and "up-down". The names directly indicate the price path a certain stock follows; "down-up" means the stock first falls in its price, but then recovers, "straight" represents a somewhat monotonic price path which is not characterized by distinctive decreases or increases, and for "up-down" the stock price firstly rises followed by a decline to a certain ending price.

The main and most important difference between this study and the experiment is the realism of the price paths. Mainly, stock prices follow a 'random-walk' and cannot be artificially reconstructed or predicted. Thus the use of real stocks induces several challenges: First, a universal pre-determined return (± 10% in the Grosshans and Zeisberger experiment) for all paths is almost impossible to find. Searching through all historic price paths this can be done, but the use of actual current stock price paths over a specified time horizon limits the search for an universal return of ± 10%. Secondly, stock prices all have different values and are not universal. This not only is coherent with the universal return problem, but it could also induce biased results due to the presentation differences in price paths. Although the return of two price paths could be the same, in absolute terms there could still be a significant difference which might influence the results. This problem is also addressed by Rubaltelli et al. (2005). Furthermore, the amplitude of stock price paths cannot be controlled. In the experiment by Grosshans and Zeisberger the minimum and maximum prices (turning points) are set to be either -30% or +30% measured from the purchase price. It is a utopia to believe these exact minima and maxima can be obtained from current stock price paths. After robustness checks with different minima and maxima (± 20% instead of ± 30%) on their results Grosshans and Zeisberger find the same pattern in their results, only less strong effects, therefore I will not commit myself to the threshold of 30%. Fourth, previously we discussed the value for the minima and maxima, but equally important is the position of these minima and maxima. In the Grosshans and Zeisberger experiment these turning points are initially located after seven months and are the result of a manual change in the deterministic trend of the price series. Again they performed robustness checks using different turning point locations and were able to rule out that

their results are caused by preferences over return distribution skewness rather than the price path.

        All of these four potential problems have to do with a key decision made in the experiment. Namely, in order to construct the price paths "blue chip"[2] characteristics were used. Maintaining this "blue chip" selection significantly complicates the search for appropriate charts. In order to use these particular stock characteristics, the search for appropriate charts is an essential part. I started the search at a 1-year historical time period, as is used in the Grosshans and Zeisberger experiment. To quickly scan for "blue-chips" the main indices to use are: Dow Jones Industrial Average, NASDAQ 100, Euro Stoxx 50 and FTSE 100. Within this time-horizon no representative price paths could be found, due to the nature of stock price movements (Finanzen.net 1-year, 2017). Consequently, the search for appropriate stock price paths concerning a six month historical time period started. This time horizon is also used in research by Glaser et al. (2007) and may therefore also be applicable. Essential to the final results is that all selected stock prices have approximately the same returns and minima/maxima. This could not be found only searching for "blue-chip" stocks. Therefore S&P500, DAX, CAC 40 and the AEX were also included in the search for 6 month price paths. Even after including these indices the variability of those stocks who match the price paths, turned out to be too large with their distributions as displayed in table 1.

Path	Return	Turning Point	Gap
Up-Down winner	8%	30%	22%
Straight winner	15%		15%
Down-up winner	15%	-10%	25%
Up-down Loser	-8%	23.5%	31.5%
Straight Loser	-20%		20%
Down-up loser	-6%	16%	10%

Table 1 The table above shows the distributions for selected stocks over a 6-month period. Return is the return percentage for the stock over 6 months, the turning point is the maximum or minimum amplitude of the price path and the gap represents the maximum width of a price path.

        The stocks matching the return distribution were rather unknown and definitely not labeled "blue-chip" (Finanzen.net 6-month, 2017)[3]. Due to these very distributed price paths three-month historical time period is chosen. Atsalakis and Valvanis (2009) use 60 day historical prices to forecast price movements for the upcoming quarter.

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[2] Blue chip stocks generally experience low volatility, steady returns, steady growth, have a high market capitalization and is considered to be an industry leader (https://www.bluechiplist.com/what-are-blue-chips/)

[3] The time horizon is described by the following period 04-11-2016 till 04-05-2017.

They manage do this with a 68% hit-rate. By using a three-month price path participants are limited to base their decision on only short-term price paths. Due to this use and the lower volatility characteristic of "blue-chip" stocks the searched final return over a three-month horizon is about ±5%. Using a minimum and maximum of ±10-15% (which relatively corresponds to the Grosshans and Zeisberger experiment). An overview is given in table 2.

Path	Company	Return	Turning Point	Gap
Up-Down winner	Bank of America Corp.	5.09%	13.89%	8.8%
Straight winner	Visa Inc.	5.23%		
Down-up winner	Twitter Inc.	5.28%	-18.85%	24.13%
Up-down Loser	Mylan Inc.	-5.20%	13.26%	18.46%
Straight Loser	Chevron Corp.	-5.19%		
Down-up loser	Delta Air Lines Inc.	-5.18%	-13.95%	8.77%

Table 2 The table above shows the distributions for the final selected stocks over a 3-month period. Return is the return percentage for the stock over 6 months, the turning point is the maximum or minimum amplitude of the price path and the gap represents the maximum width of a price path.

Using these search criteria six different price paths are identified, all in American indices (Investing.com 3 month, 2017)[4]. Stock price data is retrieved from Reuters (2017).
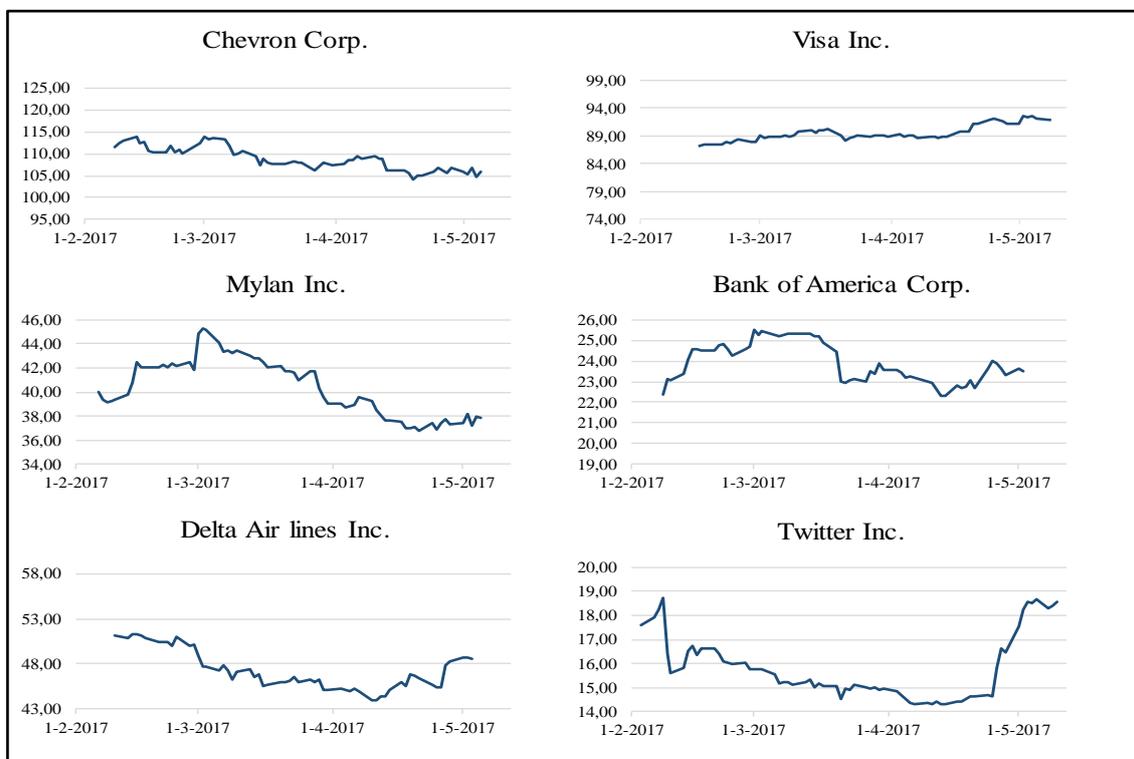

Figure 1 This figure contains a short summary of all selected price paths. Return data is excluded.

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[4] The time horizon is described by the following period: 08-02-2017 till 08-05-2017

Survey

The survey is set up in such a way that participants are asked to act like investors. They continuously have to imagine they bought stocks of the displayed stock price path three-months ago and they are now observing how their investment performed in the past three-months. Presentation of the stocks was done completely random. All participants got to see three price paths from the pool of six. Randomization software of Qualtrics was used to make sure each chart was shown equally[5].

Due to absolute differences in the selected stocks it was chosen to include current return information. Grosshans and Zeisberger (2016) didn't find a significant difference in their results when displaying return information and when not, therefore it is assumed this will not influence the results. The problem with investor satisfaction in combination with absolute values is that higher absolute values tend to have a bigger influence on investor satisfaction, as described by Rubaltelli et al. (2005). Grosshans and Zeisberger used randomized values for the stock prices in order to 'keep things real' and did not encounter this problem. Therefore, I won't further address this.

Satisfaction about the stock's performance is measured using a 9-point Likert scale from "very unsatisfied" to "very satisfied". Next, participants were also asked if they are likely to hold or sell the displayed stock on a 4-point Likert scale ranging from "very likely hold" to "very likely sell", additionally participants had to state what would be their minimum selling price and point estimate the stock price after three more months. To take into account possible biases for actual company names the survey will start with a question about their preferences on the six companies, if subjects 'like' or 'dislike' a certain company they have to tick the box, this allows me to include the effect of possible biases. In order to measure investment behavior on the same level as Grosshans and Zeisberger (2016), the same approach is used in the survey, only now based on short-term price forecasts. The survey can be found in appendix A.

Participants were not allowed to return in the software to change answers to questions they already answered. After the questions, involving charts, participants were asked several socio-demographic and financial literacy related questions. As an incentive participants three vouchers are raffled among participants who left their e-mail address.

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[5] In the analysis $N_1 = N_2 = N_n$ may not hold due to the removal of outliers

Participants

By means of an online survey participants are questioned. In total 121 responses were gathered. Because 18 of these responses were still pending and thus incomplete at the time I started gathering the information these were excluded. At the start of data extraction N=103. 75 Of them are participants which resulted from survey software in which Prof. dr. S.M. Zeisberger assisted me. These participants are from all over the world. After quickly observing the data I deleted 3 observations due to the fact these participants finished their survey in one minute by giving the same answers each time. Of N=100 the average age was 34 years and 65% of the participants is male. On average the participants believe 11.8 months should be a realistic time frame to base stock predictions on, for the comfort I will interpret this as a one-year horizon. Overall the participants rated their mood between "neutral" and "good", and 80% found themselves to at least be on an average level of financial literacy. It took the participants on average 451 seconds to complete the survey, which corresponds to 4:31 minutes.

When conducting the analysis using STATA 14, some minor problems occurred with the dataset. Due to very extreme outliers in the return and risk part of the analysis I decided to remove these outliers in order to create a better representation of the dataset. This resulted in the removal of 7 participants and yielded a total of N=93 without extreme outlier. Due to this, variables were better normally distributed, which favors the analysis. The scatter plots on which the outliers were identified are shown in appendix C.

Results

Investor satisfaction

The results, on investor satisfaction, are discussed below. I observe a relatively small satisfaction gap among winner- and loser stocks, compared to the Grosshans and Zeisberger experiment; namely, 1.46 for the winner stocks and 1.39 for the losers stocks, compared to 2.21 for winner stocks and 2.04 for loser stocks. This implies the variation in satisfaction between price paths is not "strikingly large" (Grosshans and Zeisberger, 2016, p. 7). Several tests are used to see whether the results are paired and therefore not statistically different from each other. This is done by a two-sided Wilcoxon rank-sum test (p-values <0.05), K-sample equality-of-medians test (p-value<0.05) and a Wilcoxon signed-rank test[6] (p-values<0.05). Using these tests no price-path-dependencies were found. Except among the "straight" loser & "up-down" loser (p=0.764 for the K-sample median test and p=0.881 for the signed rank test) and the "up-down" loser & "down-up" loser (p=0.139 for the K-sample median test, although data is significantly paired p=0.025).

The results show clearly that investors are most happy when they experience a gain. Although no price path 'beats' the "straight" winner it is also shown investors are relatively satisfied when the stock recovers itself, i.e. the "down-up" price path. The opposite is true for the "straight" loser and 'downward paths', again the "straight" path produces the most extreme result. While the "up-down" path shows that winner stocks are still relatively more dissatisfied than the other winner paths. These relative differences due to price paths can easily be seen when comparing the "straight" path gap (4.00) with the "up-down" winner & "down-up" (1.15). No significant evidence is found that indicates the variance for "straight" paths is lower than for price paths which include a peak/trough. An overview of all first information is given in appendix B.

	S	U-D	D-U	Gap
Winner stocks	1.84 (1.82)	0.38 (1.66)	1.27 (1.57)	1.46
Loser stocks	-2.16 (1.62)	-1.93 (1.90)	-0.77 (1.27)	1.39

Table 3 Self-stated satisfaction based on the investment opportunities stated in the survey, reported on a 9-point Likert scale from -4 tot +4, and 0 indicating a neutral position. The brackets contain the standard deviations and the gap measures the maximum difference in one domain.

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[6] The Wilcoxon rank-sum test, a K-sample equality-of-medians test and the Wilcoxon signed rank test form the general testing methods in the analysis, except when stated otherwise,

Investor satisfaction, financial literacy

Price paths are the central point of this research, but to avoid biased results due to too much focus on price paths I will control for financial literacy, just as in Grosshans and Zeisberger. In the survey participants are asked about their self-estimated financial literacy on a 5-point Likert scale. For the robustness checks the same analysis as before was done only now including those who self-state themselves at least equal to an average level of financial literacy (results 3 to 5, on the 5-point Likert scale). This robustness check leads to the exclusion of 18.4% of the participants. The results are shown in table 4. Among these results the same patterns are found and no statistically significant differences could be found.

	S	U-D	D-U	Gap
Winner stocks	1.74 (1.92)	0.50 (1.73)	1.38 (1.59)	1.24
Loser stocks	-2.14 (1.67)	-2.00 (2.06)	-0.70 (1.30)	1.44

Table 4 Self-stated satisfaction based on the investment opportunities stated in the survey, reported on a 9-point Likert scale from -4 tot +4, and 0 indicating a neutral position. The brackets contain the standard deviations and the gap measures the maximum difference in one domain. Controlling for financial literacy(1).

But, also noted in the Grosshans and Zeisberger experiment, Gaudecker (2015) found in his research result which imply self-stated financial literacy might not be a good proxy for real financial literacy. Because it is not possible to pool data from a second population, I specify the financial literacy variable from 3-5 to 4-5. So now only participants who self-state themselves with a 'better than average' financial literacy are included. Surprisingly this adjustment does yield different patterns and statistically significant results, as shown in table 5. The satisfaction patterns which occur now seem to be more coherent with satisfaction patterns found by Grosshans and Zeisberger (2016). Suddenly the "down-up" winner price path is the most satisfactory, while the

	S	U-D	D-U	Gap
Winner stocks	2.25 (1.25)	0.86 (1.79)	2.75 (0.97)	1.89
Loser stocks	-1.5 (1.99)	-2.07 (1.90)	-0.92 (1.27)	1.15

Table 5 Self-stated satisfaction based on the investment opportunities stated in the survey, reported on a 9-point Likert scale from -4 tot +4, and 0 indicating a neutral position. The brackets contain the standard deviations and the gap measures the maximum difference in a domain. Controlling for financial literacy(2).

"up-down" loser price path is the most unsatisfactory. So, visually, patterns changed and there is strong evidence that significant differences could be present. Conclusively, the statistical analysis shows the "down-up" winner price path differs significantly from the baseline experiment (p=0.003). Compared to the results from the baseline experiment and the first robustness check for financial literacy participants' satisfactory levels seem more vulnerable to price paths containing a peak/trough. Overall I conclude the results from the baseline results are a robust finding and not prone to participants with a possibly low financial literacy.

Investor satisfaction, preference bias

As stated before an important contribution of this research is to take a possible bias towards certain companies into account. Firstly, this is done by implementing it on the participants' satisfactory levels. Consequently I will apply the effect of a possible bias in all areas of research. Recent literature displayed mixed results, but the main belief is that a bias would extremize the satisfactory levels. In order to control for this bias the two-sided Wilcoxon rank-sum test and the K-sample equality-of-medians test are used. The satisfactory levels of participants who did like one of the companies are compared to the satisfactory levels of participants who didn't like a specific company, not only is important to investigate a 'positive' bias, but the same measures are used to analyze the effect of a 'negative' bias. 24.57% Of the participants do not have a preference for one of the six companies. The distribution is therefore a bit skew, with 75.43% of people who did have a preference for a certain company. In the case of the 'negative' bias, 52.69% of the participants do not dislike a specific company, there is an equal distribution. Results on the mean, standard deviation and satisfaction gap are shown in table 6. The same patterns can be found as with the baseline results, also statistically there are no significant differences between the baseline results and these results, controlling for preference biases. Conclusively, with regard to the satisfactory levels it does not seem the case that a bias (positive or negative) influences satisfaction excessively compared to no bias at all. These results correspond to the study by Glaser et al. (2007), who also do not find sufficient evidence which indicates there is a bias among the participants due to affinity with a particular company stock.

'Positive' bias	S	U-D	D-U	Gap
Winner stocks	1.73 (1.98)	0.21 (1.86)	1.21 (1.66)	1.52
Loser stocks	-2.32 (1.64)	-1.76 (1.95)	-0.71 (1.32)	1.61
'Negative' bias	**S**	**U-D**	**D-U**	**Gap**
Winner stocks	2.00 (1.76)	0.50 (1.77)	1.36 (1.50)	1.50
Loser Stocks	-2.04 (1.73)	-1.81 (2.04)	-0.83 (1.25)	1.21

Table 6 Self-stated satisfaction based on the investment opportunities stated in the survey, reported on a 9-point Likert scale from -4 tot +4, and 0 indicating a neutral position. The brackets contain the standard deviations and the gap measures the maximum difference in one domain. Controlling for biases.

Investor behavior

Return and risk expectations

The participants were asked to fill in their estimates for the stock price in three-months and fill in a most optimistic estimate (given that in 95% of the cases the stock price would be below the estimate) and a most pessimistic estimate (given that in 95% of the cases the stock price would be above the estimate). For the 3-month estimate the average return is 3.22%, while the arithmetic average estimated return (based on the optimistic and pessimistic estimates) is 3.28%. It seems that, overall, participants managed to make semi-rational estimations about future stock prices and shows the participants are on average not really vulnerable to price path risks. Notably, for all estimates it is expected the 3month return transubstantiates the direction of its original path. In contrast to the Grosshans and Zeisberger (2016) the estimates imply the 'price-path' effect for the "up-down" paths does not seem strong. In addition, the "straight" paths seem to achieve more extreme estimates compared to the "up-down" price paths. Therefore, it can be concluded participants have a stronger believe in short-term trend continuation for "straight" price paths. Also for the "down-up" stocks a believe in short-term trend continuation is observed. No significant evidence is found that participants generally seem to expect the stock price will return in direction to the initial purchase price, this might be due to the fact that estimates were based on a three-month horizon. (Grosshans and Zeisberger, 2016; Jegadeesh and Titman, 1993). Table 7 summarizes the estimate statistics. These results clearly show among the winner stocks there is a larger spread in the estimates. After further analysis on the preference of participants an interesting pattern is observed. Namely, in correspondence with Glaser et al. (2007) and in opposition to Helm (2007) and Nagy and Obenberger (1994), no significant

differences are found between participants who do not have a bias and participants with a 'positive or negative' bias towards a certain stock, in general.

Winner stocks	Estimate	Lower	Upper	Width	3-month average
Straight	8.83 (6.79)	-2.13	42.20	44.33	-2.97
Up-Down	7.99 (6.72)	-6.21	27.29	33.5	-6.32
Down-Up	10.07 (17.81)	-26.89	41.96	68.85	11.39
Loser Stocks	Estimate	Lower	Upper	Width	3-month average
Straight	-5.49 (4.06)	-9.48	20.98	30.46	2.52
Up-Down	-0.59 (9.19)	-18.71	37.57	56.28	-0.92
Down-Up	-1.50 (5.52)	-10.10	5.53	15.63	8.30

Table 7 Winner and loser stocks are displayed by the average three-month estimated return, the average lower and upper return of the 95% interval, the width of these bounds and the three-month hypothetical return if the stock price would reach its average three-month price.

In general, I find no differences between three-month estimations due to a preference for a certain company. Both what cannot be overlooked is the possible effect a bias could have on the strength of the estimated direction. Therefore, table 8 displays the relative estimated returns and the difference to the upper and lower limits. Using a Wilcoxon rank sum test all estimated values are tested.

Winner stocks	Estimate	Optimistic return diff.	Pessimistic return diff.
Straight	8.83 (6.79)	3.87 (5.99)	6.60 (5.45)
Up-Down	7.99 (6.72)	12.21 (12.22)	10.90 (10.89)
Down-Up	10.07 (17.81)	18.16 (22.89)	20.66 (22.51)
Loser Stocks	Estimate	Lower	Upper
Straight	-5.49 (4.06)	7.48 (6.60)	3.86 (6.53)
Up-Down	-0.59 (9.19)	13.58 (12.60)	9.49 (11.80)
Down-Up	-1.50 (5.52)	9.39 (8.27)	12.42 (11.26)

Table 8 This table shows the relation between the average three-month estimate and its average difference to the 95% upper bound and the average difference to the 95% lower bound. All numbers are return percentages and the brackets contain the standard deviations.

I find slightly significant results for the "down-up" winner and the "up-down" loser paths, both are estimated more optimistic in the presence of a 'positive' bias (DU-W p=0.094; UD-L p=0.072). Another weak result is the "straight" loser path, which is estimated more optimistically when no 'negative' bias is observed (p=0.098). Surprisingly, one path experiences significant results for the rank sum test and the K-sample median test (p=0.033 and p=0.024). The "straight" winner is estimated more pessimistically if it is associated with a 'negative' bias. The "straight" paths are prone to short-term trend continuation, a negative bias on a 'winner' stock could more strongly influence the estimate, because the participant would believe the stock will fall eventually. Combined with a strong belief in short-term trend continuation this could lead to a more pessimistic estimate. Conclusively, although not expected, little evidence is found that a bias could influence the magnitude of a return estimate.

As explained earlier, the price paths are based on stocks with 'blue-chip' characteristics. It forms an important discrepancy with the Grosshans and Zeisberger experiment. Due to the inability to control and construct price paths volatility differs. Volatility for the loser stocks are between 4.47% for the "down-up" path and 5.26% for the "straight" path, while the winner stocks observe volatilities between 1.96% for the "up-down" path and 2.96% for the "straight" path. Notably is the difference between loser- and winner stock volatilities. Because there is no distinct volatility pattern among the price paths it is harder to generalize this to estimate spreads. These 'real' volatilities could still be used under the assumption the Grosshans and Zeisberger price path volatilities and its patterns might be to artificial. Although it is interesting to observe the size of the gap between the 95% upper and lower bound estimates. A narrower gap proposes participants to estimate a stock as less risky, while a wide gap proposes the opposite. A clear pattern emerges when analyzing these gaps. Both "straight" paths have an estimated return gap of 10.5-11.3%. For the "up-down" winner/loser and the "down-up" loser path the return gap varies between 21.8% - 23.1%. The gap for the "down-up" winner seems to be out of order with a return gap of 38.8%, after correcting for outliers, and using a mean-replacement method of 38.8% the new gap becomes 32.7%. So, surprisingly the "down-up" winner path is perceived as more risky than the other "non-straight" paths. Furthermore, I find no significant differences between these gaps when controlling for a possible bias. Only the outlier, the "down-up" winner path, proves to be significant when taking a bias into account. By using the Wilcoxon rank sum test a p-value of 0.019 is obtained and it can be concluded that participants who have a

'positive' bias towards a certain company make less riskier estimates about this company, with only a 26.9% gap compared to a 44.2% gap. So, no compelling evidence can be found that a relative preference influences the understanding of a risk component. In this way it becomes more accessible to understand reference point dynamics and the effect of a preference bias.

Risk tolerance

Given classical Prospect Theory reference points are an influencer of risk tolerance. Reference points refer to the indifference of an investor to sell or hold an asset. Based on the investors 'zero-utility' point a decision for the asset is made, given the current price of an asset (Adeler et al., 2011; Heath et al., 1999). In general, we saw in the previous section risk was expected to be equally large for both, winner, and loser stocks, with the only exception of the "down-up" path due to the influence of a 'positive' bias. Investor behavior could still be affected by risk tolerance, even under the assumption risk expectations for the two stocks are equal. If a stock price is below the reference point it can turn an investor into risk seeking behavior (Odean, 1998; Weber and Camerer, 1991). I find for the winner stocks the zero utility points are not closely distributed around the current price, while this seems to be the case for the loser stocks. These results are opposite to the results of Grosshans and Zeisberger on reference points. From the results we can imply that reference points are shifted more strongly upward when experiencing a gain. This effect is less strong for the loser stocks, only the results show that the reference point is shifted up for the "up-down" price path. Using real-world data, it is shown investors don't become more risk averse after experiencing a gain, but make them more risk-seeking. The "up-down" winner path seems to be strong evidence for the presence of the disposition effect. This effect describes the tendency of investors to hold loser stocks for too long and selling winner stocks to early (Weber and Camerer, 2011). Although the stock is experiencing a losing trend and participants seem to believe in short-term trend continuation the zero-utility point is far above the current price. This implies the investor could be willing to hold the stock while it has a negative trend. According to the disposition effect, if a stock is a loser but experiencing a positive trend, investors should hold and not sell too early. The reference point of the "down-up" loser implies investors already passed their zero-utility selling point, which implies these investors would indeed sell too early. So, using these

reference point results already evidence is found for the disposition effect. The dynamics of these reference points are shown in table 9.

	S	U-D	D-U	All paths
Winner stocks	3.48 (6.10)	10.02 (20.59)	11.37 (35.87)	8.29
Loser stocks	-1.24 (3.74)	2.86 (9.02)	-0.15 (6.14)	0.49
Difference	4.72	7.16	11.52	7.8
p-value	<0.001	<0.002	<0.001	<0.001

Table 9 The numbers indicate for each path the relative differences between the stated zero-utility prices and the current price of the stock. A positive value means the reference point is above the current price. The p-values are based on a Wilcoxon rank sum test.

Because reference points are closely linked to risk tolerance it isn't unthinkable a relationship with the presence of a bias towards certain stocks can be found. But it could be assumed these preferences are already captured by certain individual characteristics of risk tolerance, through risk and return expectations as shown earlier. In accordance, I could not find a significant difference between relative reference points of participants without a bias and relative reference points for participants with a 'positive or negative' bias. So, it seems a preference bias doesn't have an effect on the position of reference points.

Behavioral consequences

The behavior of an investor is captured by its propensity to hold or sell a certain stock. In my research it is analyzed by transforming the 4-point Likert scale from the survey to a 0 to 1 interval, with 1 being the highest propensity to hold the stock and 0 the highest propensity to sell the stock. The sell/hold statistics of the stocks are shown below in table 10. Generally, all investors prefer to hold a stock, with a minimum holding propensity of 0.56 for the "down-up" winner stock. The "straight" price paths show an interesting pattern, because for the "non-straight" paths the loser stocks are relatively more likely to be held, as on the aggregate level. Which is, in general, compliant with current literature on the disposition effect (Odean, 1998; Weber and Camerer, 1991). It seems the "straight" winner price path is less vulnerable to selling, because of the upward shift in its reference point. Because the absence of mean-reversion points it is hard to analyze the presence of a disposition effect for the "straight" price paths. Although the absence for the "straight" paths doesn't rule out the potential presence of the disposition effect for the "non-straight" price paths. Strong

evidence for the disposition effect can be found when combining the reference point dynamics for the "up-down" paths with the propensities to hold the "up-down" stocks. Although both paths decline and the short term trend continuation should believed to be negative, in both cases the reference points are above the current stock prices and show a preference to hold the stock. Conclusively, this clearly indicates participants tend to hold losing stocks for too long.

	S	U-D	D-U	Non-Straight
Winner stocks	0.75	0.66	0.56	0.61
Loser stocks	0.59	0.64	0.76	0.7
Difference	0.16	0.02	-0.2	-0.09
p-value	<0.02	<0.05[7]	<0.004	<0.05[8]

Table 10 The propensity to hold a certain stocks is reported in means. As explained the 0 to 1 scale is obtained by transforming the 4-point Likert scale. 1 indicates the highest propensity to hold and 0 denoting the lowest propensity to hold.

Important to investigate is what influences an investors decision to hold or sell a certain stock and what could cause a disposition effect. The disposition effect shows the potential influence of individual risk tolerance and therefore one's individual perception. Using a $p<0.05$ Wilcoxon rank sum test I test for the possible effect of a bias towards a certain company and the decision hold or sell a stock. No strong significant differences between groups can be found. So, no compelling evidence is found that biased investors make different hold or sell decisions, results are shown in table 11.

	Positive bias (Wilcoxon rank sum)	Positive Bias (K-sample)	Negative bias (Wilcoxon rank sum)	Negative Bias (K-sample)
Up-Down winner	0.1964	0.670	0.0713	0.148
Up-Down loser	0.8947	0.945	0.2830	0.291

Table 11 For each "up-down" price path p-values are presented based on the direction of the bias towards a certain company. Critical p-value is 0.05, no significant results are found.

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[7] Due to the high probability in the Wilcoxon rank-sum test (p=0.85) a Wilcoxon signed rank test is used to rule out the data paired.

[8] Due to the high probability in the Wilcoxon rank-sum test (p=0.52) a Wilcoxon signed rank test is used to rule out the data paired.

An additional K-sample equality-of-median test also rules out any significant group differences for the "up-down" price paths. As shown in table 11 some results are of very weak significance. These results primarily originate from investors with a negative bias, this bias causes these investors to be more willing to sell the certain stock. Participants' main reasons are the believe that "stocks are likely to produce positive returns" and that "losses are rather the exception; stocks are likely to recover after they have fallen in price. Furthermore, I also ran a check to see whether satisfaction levels influence the sell/hold decision. If a significant relationship between satisfaction and investor behavior could be established this would be a huge leap forward. Using a Wilcoxon rank sum test (p=0.0849) weak evidence is found of the phenomenon that more satisfied investors tend to hold their stock longer. Conclusively, only weak evidence is found that a negative bias towards a certain company causes investors to be more early prepared to sell the certain stock and therefore get round the disposition effect. The same pattern can be observed even weaker for the positive bias. So in general it might be the case that have a bias might reduce the disposition effect. Further research could focus on this, due to the relevance of the disposition effect in modern day behavioral finance.

Conclusion and Discussion

Conclusion

Existing behavioral finance literature has predominantly left the way final return is developed out of the satisfactory equation. Therefore, traditional literature also neglected to identify its effect on trading decisions, and investor's risk tolerance. By applying the Grosshans and Zeisberger experiment to real-world data. As expected, overall, satisfactory levels seem coherent to the research of Grosshans and Zeisberger (2016), although minor differences occurred. For instance, even after controlling for financial literacy no examples could be found where investors are more satisfied with negative returns than with positive ones if the price path developed in their favor. Also the inclusion of the preference bias extends the Grosshans and Zeisberger research. Significant and systematic differences in investor's satisfaction with equal final returns are observed across different stock price paths. In accordance with Glaser et al. (2007) it does not seem the case that a bias influences satisfaction excessively compared to investors without a bias. This implies investors are more rational as psychology on human behavior would suggest. Although results are found in which a bias definitely does influence investment behavior.

Furthermore, my analysis also contains the exploration of risk and return expectations as well as reference point, combined with a preference bias towards a certain company. Although evidence on the belief in short-term trend continuation is not that strong, patterns emerged and it is implied. The absence of 'strong compelling' evidence might be the case due to the chosen time-horizon. Making use of 'blue-chip' stocks makes it hard to distinguish volatility patterns from each other. Despite this obstacle, investors show the same patterns in estimation for future risk as the Grosshans and Zeisberger experiment. Although realized volatility might need seem coherent, observed volatility at first sight can still affect the estimation of future risk. The results do suggest that biased investors could have different risk expectations, these risk expectations could be more optimistic or pessimistic, depending on an investor's bias.

In addition, results show that reference points are shifted strongly upward when investors are experiencing gain. This effect is less strong for loser stock. Using real-word data it is shown investors don't become more risk averse after experiencing a gain but makes them more risk seeking, because their zero-utility point is shifted upward. Opposing the findings in the Grosshans and Zeisberger experiment reference points tend

to be sticky for loser stocks, while these reference points move away from the current price for winner stocks. In correspondence to Grosshans and Zeisberger the findings demonstrate a relative preference for holding loser stocks. Such a distinct pattern emerges due to the change in risk tolerance by the reference points. Due to the inability to find significant results a preference bias doesn't have an effect on the position of reference points and therefore no effect on risk tolerance through reference points. Whereas I find weak evidence that suggests a negative bias towards a certain company causes investors to be more early prepared to sell the certain stock. This finding could have impact on the way the disposition effect has been handled so far in behavioral finance. Some evidence is also found on the presence of a direct relationship between investor satisfaction and the decision to hold/sell an asset. Overall, dissatisfied investors tend to sell their assets more early. All these results contribute to the expanding field of investor satisfaction, risk tolerance and trading decisions. As shown, besides strengthening and confirmation of the Grosshans and Zeisberger findings, this study finds evidence of the influence on a preference bias in different behavioral concepts. The main contribution in this field is that a preference bias may influence the strength of risk estimates and that a preference bias might have an influence in the strength of the disposition effect.

Recommendations

       This study can only be seen as a follow-up on the Grosshans and Zeisberger (2016) experiment. Because also follow-ups should be succeeded I want to make some recommendations for further research. First of all, there is huge potential on researching the effect of a preference bias on the disposition effect. Due to the limitations of my data I could not find strong conclusive effects for this relationship, but the results imply a relationship must be present. Furthermore, it is really insightful if succeeding research could be more of psychological nature when looking at the effect of a preference bias in risk tolerance and risk expectations. Not only this kind of research is needed to obtain a more profound understand of a preference bias, but also on the question: What determines a reference point? As the study by Helm (2007) results might be influenced by the market sentiment at the moment of research. Helm's results were affected by the decreasing stock performance most investors had to face during the years prior to the study, therefore a study of this kind using panel-data could provide useful insights concerning market sentiment. Finally, because my participants came from all over the

world, I think, it is really interesting to conduct control experiments for different regions in the world, by applying macro-level variables to a multivariate dataset.

Limitations

This master thesis also has some limitations which should be taken into account concerning its results. One of the most important methodological choices is the use of a three-month time horizon. This time horizon clearly limits the dataset and therefore the results. Compared to the Grosshans and Zeisberger experiment, short-term trend continuity implications could not be as proved that strongly. Because the price path occurs within three months participants might not believe that strong in short-term continuity. Unfortunately, this lowers the internal validity of the research. Furthermore, the use of 'blue-chip' stocks made it accessible to control for a preference bias, it also caused to make less conclusions on risk expectations due to realized volatility. Although the three-month time horizon could influence the perception of the participant in such a way that the "non-straight" price paths are perceived as more volatile. Price paths could not be constructed, which made it not viable to do exactly the same robustness check as in the Grosshans and Zeisberger experiment, therefore methodological assumptions had to be made. The total population of N=93 makes the research less reliable, also only one dataset could be used, compared to the multiple control datasets in the Grosshans and Zeisberger experiment.

Acknowledgement

I will end with a word of gratitude for the professor who made it able for me to write this thesis and therefore, build upon his research. In the beginning it was no easy for me to find a subject which suited me I came across the experimental research from prof. dr. S.M. Zeisberger. The subject immediately raised my curiosity and fortunately it was possibly for me to write my master thesis on this subject. What I liked most is the way in which the whole topic pioneers and adds to the current literature. I failed to keep myself up to my strict planning due to several circumstances, but my supervisor, prof. dr. S.M. Zeisberger, was there when I needed some assistance. He handed me a framework from which I could write. Therefore I bring a special "thank you", for making this possible, to prof. dr. S.M. Zeisberger

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Appendices

Appendix A – the survey

Survey

Instructions at the beginning of the experiment

Dear Participant,

In the following questionnaire you will be presented with three stock price developments of real companies. Please imagine strongly for each case that you bought the respective stock three-months ago for your own portfolio and now you observe it's performance for the past three-months. Please answer the questions based on the information that is provided in the questionnaire.

For each chart the company name of the stock is stated. Also, each chart includes a small overview of return information on the respective stock.

Please take your time on each stock, really imagine this was your own stock you bought three-months ago and ask yourself how you would feel when observing the respective performance. Overall, this questionnaire will take you 3-5 minutes.

Question 1

Do you like one of the following companies?
- Chevron Corp.
- Visa Inc.
- Bank of America
- Delta Airlines
- Twitter
- Goldman Sachs Group Inc.
- None

Do you dislike one of the following companies?
- Chevron Corp.
- Visa Inc.
- Bank of America
- Delta Airlines
- Twitter
- Goldman Sachs Group Inc.
- None

Question 2-4

Chevron Corp.

| Purchase price: 111.58 | Current price: 105.97 | Return: -5.19% |

How satisfied are you with the performance of your stock

Very unsatisfied   Neutral   Very satisfied
    o   o   o   o   o   o   o   o   o

Would you hold or sell the stock at this current price?

Very likely hold   Very likely sell
    o   o   o   o

At which selling price would you be neither happy nor unhappy?
(Give a numerical response, for example 21.5 or 118)
A reasonable price is:

Chevron Corp.

| Purchase price: 111.58 | Current price: 105.97 | Return: -5.19% |

What is your estimate for the stock price in 3 months?
(Give a numerical response, for example 21.5 or 118)

The estimated price is:

What is your pessimistic estimate for the stock in 3 months?
(Consider that in 95% of the cases the stock price would be above your estimate, give a numerical response, for example 21.5 or 118)

The estimated price is:

What is your optimistic estimate for the stock in 3 months?
(Consider that in 95% of the cases the stock price would be below your estimate, give a numerical response, for example 21.5 or 118)

The estimated price is:

Question 5

How do you assess your knowledge in stock investments compared to the average person?

Much worse	Worse	Average	Better	Much better
o	o	o	o	o

In what mood are you currently?

Very bad	Bad	Normal	Good	Very good
o	o	o	o	o

What would be an appropriate historical time frame for you to base stock predictions on?
… Months

What is your gender?
- Male
- Female

Please enter your age
… years

How did you come up with your price forecasts?
- Losses are rather the exception. Stocks are likely to recover after they have fallen in price.
- If the price chart is downward sloping than prices are probably falling in the future.
- Stocks are very likely to produce positive returns.
- If the current price of a stock is lower than its price three-months ago than this stock is very likely to produce further losses.
- If the current price of a stock is higher than its price three-months ago than this stock is very likely to produce further gains.
- I don't know.
- If the price chart is upward sloping than prices are probable rising in the future.
- None of the statements applies to me

Question 6

You've reached the end of this questionnaire. If you would like to be informed about the findings of this research you can write you e-mail address down below.

Thank you for your participation!
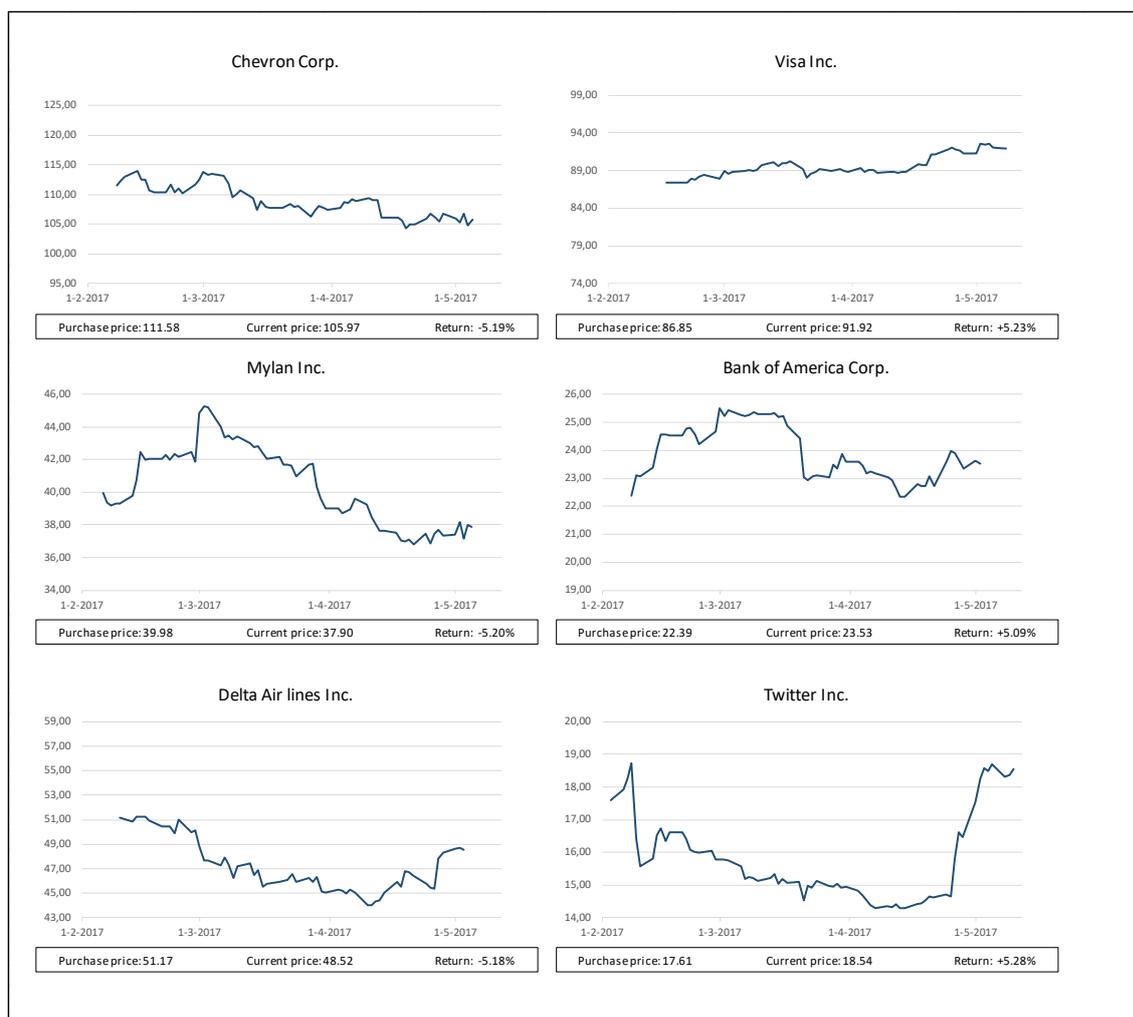
Appendix B – price paths and satisfaction levels

Figure 1 This figure contains a short summary of all selected price paths. Return data is excluded.

Path	Company	Return	Turning Point	Gap
Up-Down winner	Bank of America Corp.	5.09%	13.89%	8.8%
Straight winner	Visa Inc.	5.23%		
Down-up winner	Twitter Inc.	5.28%	-18.85%	24.13%
Up-down Loser	Mylan Inc.	-5.20%	13.26%	18.46%
Straight Loser	Chevron Corp.	-5.19%		
Down-up loser	Delta Air Lines Inc.	-5.18%	-13.95%	8.77%

Table 2 The table above shows the distributions for the final selected stocks over a 3-month period. Return is the return percentage for the stock over 6 months, the turning point is the maximum or minimum amplitude of the price path and the gap represents the maximum width of a price path.

	S	U-D	D-U	Gap
Winner stocks	1.84 (1.82)	0.38 (1.66)	1.27 (1.57)	1.46
Loser stocks	-2.16 (1.62)	-1.93 (1.90)	-0.77 (1.27)	1.39

Table 3 Self-stated satisfaction based on the investment opportunities stated in the survey, reported on a 9-point Likert scale from -4 tot +4, and 0 indicating a neutral position. The brackets contain the standard deviations and the gap measures the maximum difference in one domain.

Appendix C – scatter plots of extreme values