

VU Research Portal

Psychological Aspects of the Disposition Effect: An Experimental Investigation

Lee, K.M.C.

2011

document version

Publisher's PDF, also known as Version of record

[Link to publication in VU Research Portal](#)

citation for published version (APA)

Lee, K. M. C. (2011). *Psychological Aspects of the Disposition Effect: An Experimental Investigation*. Tinbergen Institute/Thela Thesis.

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal ?

Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

E-mail address:

vuresearchportal.ub@vu.nl

PSYCHOLOGICAL ASPECTS OF THE DISPOSITION EFFECT:
AN EXPERIMENTAL INVESTIGATION

ISBN 978 90 3610 235 3

Cover design: Crasborn Graphic Designers bno, Valkenburg a.d. Geul

This book is no. **498** of the Tinbergen Institute Research Series, established through cooperation between Thela Thesis and the Tinbergen Institute. A list of books which already appeared in the series can be found in the back.

VRIJE UNIVERSITEIT

Psychological Aspects of the Disposition Effect:
An Experimental Investigation

ACADEMISCH PROEFSCHRIFT

ter verkrijging van de graad Doctor aan
de Vrije Universiteit Amsterdam,
op gezag van de rector magnificus
prof.dr. L.M. Bouter,
in het openbaar te verdedigen
ten overstaan van de promotiecommissie
van de faculteit der Economische Wetenschappen en Bedrijfskunde
op vrijdag 10 juni 2011 om 11.45 uur
in de aula van de universiteit,
De Boelelaan 1105

door

Ka Man Carmen Lee

geboren te Hong Kong, Hong Kong

promotor: prof. dr. A. Lucas
copromotoren: dr. R.G.W. Kräussl
dr. L.J. Paas

PhD committee: prof. dr. G. Antonides
 prof. dr. R. T. Frambach
 dr. F. S. Peters
 prof. dr. P. P. Wakker
 prof. dr. M. Zeelenberg

Acknowledgements

This dissertation is the result of four challenging yet rewarding years. Now I am at the end of this journey and I owe this to many people. First of all, I would like to express my gratitude to my supervisors Andre Lucas, Roman Kraeussl and Leo Paas, who gave me the opportunity to do a PhD in Marketing/Finance. This Marketing/ Finance/ Psychology mix was all new to us back in 2006, and it turned out to be a great success. We have different academic background and it is very inspiring to work with you, you have all provided very useful feedback from different perspectives that helped me to finish this thesis. Thank you for your confidence in my ability to conduct experimental research, also for your advice and support, without you this thesis would never been accomplished.

I also benefited from the interaction with my colleagues from the marketing department. I owe many thanks to Ruud, Mirella, Feray, Corine, Jaap, Erik, Hester, Remco, Maria, Kobe, and other colleagues for all the feedbacks that they have given me. Your comments have certainly improved my work. I greatly appreciate the help I received from Sandra and Niels to deal with all the incomprehensible bureaucratic matters that just seem to follow me around. You really make my life easier. Anita, thanks for all the nice coffee breaks and conversations. Saima, thanks for being a great roommate and a friend, you helped me so much you don't even know. Work life gets more fun when I can share the ups and downs on Basket Tuesdays with fellow PhD students, Suzi, Inda, Roel, Linn, Juan, Yuval, Suzanne, Chen, Carolin and many others. And a special thank goes to Wes for the many cappuccinos and laughs we shared in the past four years.

I am very grateful to the Social Psychology group, especially Wilco and Carla, who organized such an incredible class. Thank you my fellow students, I would not have done a PhD if I have not studied in such an inspirational group. Thank you Kaska and Liga, for the

many nice conversations and drinks that we shared, it is so nice to have someone who really understands, I'm so glad to have you around since day one.

I want to thank my family for their love and support; I would not be able to finish this thesis if it was not for the motivation that they have given me, 謝謝! Finally I want to thank Rickard for supporting me. Not only you have listened to all the little minor details of my work and my frustrations, but most importantly you have been here for me all this time. Thanks for being awesome, jag älskar dig.

Table of Content

Acknowledgements	vii
Table of Content	ix
CHAPTER 1: INTRODUCTION	1
1.1 General Motivation	1
1.2 Dissertation Themes.....	4
1.2.1 <i>Theme I: Adaptation of Reference Points</i>	4
1.2.2 <i>Theme II: Anticipated and Experienced Emotions</i>	6
1.3 Outline.....	8
CHAPTER 2: WHY DO INVESTORS EVENTUALLY SELL LOSERS? HOW ADAPTATION TO LOSSES AFFECTS FUTURE CAPITULATION DECISIONS	9
2.1 Abstract	9
2.2 Introduction.....	10
2.3 Theoretical Framework	13
2.3.1 <i>Expectation and Capitulation</i>	13
2.3.2 <i>Prospect Theory and Reference Point Adaptation</i>	15
2.3.3 <i>Value Function for Multistage Decisions</i>	19
2.3.4 <i>Reference Point Adaptation and the Capitulation Decision</i>	22
2.4 Methodology	25
2.4.1 <i>Participants and Procedure</i>	25
2.4.2 <i>Investment Goals as Measures of Adaptation</i>	29
2.4.3 <i>Questionnaire</i>	32
2.5 Results.....	33
2.5.1 <i>Preliminary Results</i>	33
2.5.2 <i>Complete Model Results</i>	36
2.6 General Discussion	40
2.7 Conclusion	44
Appendix 2A: Robustness Check	46
Appendix 2B: Questionnaire.....	48
CHAPTER 3: PERSONALITY AND INVESTMENT: PERSONALITY DIFFERENCES AFFECT INVESTORS' ADAPTATION TO LOSSE	49
3.1 Abstract	49

3.2	Introduction.....	50
3.3	Theoretical Framework.....	53
3.3.1	<i>Acceptance and Adaptation of Reference Point</i>	53
3.3.2	<i>Big Five Personality Traits and Adaptation</i>	56
3.4	Empirical Study.....	61
3.4.1	<i>Subjects</i>	61
3.4.2	<i>Personality Measures</i>	61
3.4.3	<i>Adaptation Measures</i>	62
3.5	Results.....	64
3.6	Conclusion and Discussion.....	66
	Appendix 3A: The 50-Item Set of IPIP Big-Five Factor Markers.....	68
	CHAPTER 4: THE EFFECT OF ANTICIPATED AND EXPERIENCED REGRET AND PRIDE ON INVESTORS' FUTURE SELLING DECISIONS	73
4.1	Abstract.....	73
4.2	Introduction.....	74
4.3	Conceptual framework.....	77
4.3.1	<i>Valence-Based versus Specific Emotions Approach</i>	77
4.3.2	<i>Anticipated Regret, Anticipated Pride, and Selling Investments</i>	78
4.3.3	<i>Experienced Regret, Experienced Pride, and Selling Investments</i>	82
4.4	Experiment 1: Anticipated and Experienced Emotions in the Loss Domain.....	85
4.4.1	<i>Participants and Procedure</i>	85
4.4.2	<i>Measures</i>	86
4.4.3	<i>Results</i>	88
4.5	Experiment 2: Anticipated and Experienced Emotions in the Gain Domain.....	91
4.5.1	<i>Participants and Procedure</i>	91
4.5.2	<i>Measures</i>	91
4.5.3	<i>Results</i>	92
4.6	Discussion.....	93
4.7	Conclusion.....	94
4.7.1	<i>General Discussion</i>	94
4.7.2	<i>Limitations and Further Research</i>	98
	CHAPTER 5: CONCLUSION	101
5.1	Summary of the Main Research Findings.....	101
5.2	Theoretical Contribution.....	105

5.2.1	<i>Adaptation of Reference Point</i>	105
5.2.2	<i>Personality and Coping</i>	106
5.2.3	<i>Emotions</i>	107
5.3	Suggestions for Further Research	108
	NEDERLANDSE SAMENVATTING	111
	REFERENCES	115

CHAPTER 1:

INTRODUCTION

1.1 General Motivation

In traditional finance and within the traditional economic paradigm, economic agents are assumed to be perfectly rational, such that agents keep their knowledge and beliefs updated according to the Bayesian updating rule, and make optimal decisions based on the subjective expected utility framework (Barberis and Thaler 2005). However, over the last three decades, a growing body of behavioral finance literature has demonstrated that people in reality behave far from completely rational (Barberis and Thaler 2005).

This dissertation focuses on the so-called disposition effect, one of the most intriguing phenomena in decision making under risk, particularly in financial markets. The disposition effect describes the investors' tendency to hold their losing investments too long and sell their winning investments too early. The disposition effect is not only found in experimental studies, (Weber and Camerer 1998; Lee, Park, Lee and Wyer 2008), but also in real data obtained from the stock and property markets (Odean 1998; Garvery and Murphy 2004; Genesove and Mayer 2001). Empirical findings show that investors in the stock market hold their losers 1.6 times longer than they hold their winners, and this trading pattern cannot be explained by attempts to rebalance portfolios or to avoid transaction costs (Odean 1998). DeBondt and Thaler (1985) find that portfolios of prior losing stocks outperform the portfolios of prior winning stocks over the next three years, which is known as the winner-loser effect. However, Odean (1998) finds that the disposition effect is not justified by subsequent investment performance, because the sold winners on average outperform the unsold losers. This phenomenon is important because it leads to suboptimal financial decision-

making, and influences households' current and future wealth (Dhar and Zhu 2006; Odean 1998).

According to Shefrin and Statman (1985), the disposition effect can be explained by prospect theory, mental accounting, anticipated emotions, and self-control. Among these explanations, prospect theory (Kahneman and Tversky 1979) is the most prominent. Based on the s-shaped value function in the prospect theory framework, individuals tend to be risk averse in the gain domain and risk-taking in the loss domain. Therefore, when facing a paper gain, individuals tend to take the risk-free option (i.e. sell) as opposed to the risky option (i.e. hold). When facing a paper loss, individuals tend to take the risky option instead and hold on to their losing investment. Dhar and Zhu (2006) investigate the disposition effect at the individual level. They find that individual differences in terms of socio-economic variables, such as wealth and occupations, among retail investors (i.e. individual who trade securities for their personal account) can also explain their propensity to sell winners and hold losers. In addition, Lee, Park, Lee and Wyer (2008) suggest that the disposition effect can be explained by subjective values that investors attach to possible gains and losses, rather than their expectation for future increase or decrease in stock price.

Previous studies regarding the disposition effect primarily focus on comparing the propensity of selling in the gain versus the loss domain by means of cross-sectional analysis (Dhar and Zhu 2006; Odean 1998), but little is known about the investors' decision-making process in a more realistic dynamic setting with multiple decision moments. A key question remains unanswered: what are the determinants of investors' decisions to sell their winning or losing investments in a dynamic setting? In the loss domain, although investors are less inclined to sell losers, many of them eventually sell if losses accumulate further. Combining the empirical evidence that investors tend to avoid the realization of losses relative to gains, with the phenomenon that many investors eventually do sell their losing investments, leads to

the seminal question of this dissertation: what are the precise determinants of this capitulation decision? In the gain domain, investors are presented with evidence that their investments are bringing in positive return. Why would they choose to sell these winning investments with a good track record, instead of selling those with negative performance?

This dissertation adds to the existing literature by providing the first effort to investigate the disposition effect in a dynamic setting. Since investment involves in practice multiple decision moments, understanding individuals' trading behavior requires further evidence regarding their decision-making process in a dynamic setting. In this dissertation, we make use of experimental methods to investigate individuals' decision-making process. We propose and empirically test two novel explanations of investors' selling decisions, namely (1) adaptation of reference point, and (2) anticipated and experienced emotions. Both of these explanations are linked to bounded rationality. Correspondingly, the dissertation is divided into two themes. We believe that these two explanations are promising, because both prospect theory and emotions have been suggested as explanations for the disposition effect in the literature. Although we have a dynamic perspective, we expect these explanations also apply to our studies. Since prospect theory and reference points are used to explain why investors tend to hold losers, we believe they can also explain why people eventually sell losers. And since Shefrin and Statman (1985) suggest emotions can explain the investors' propensity to hold losers and sell winners, we follow up on this idea and expect that emotions can also explain why investors eventually sell losers.

In this dissertation we concentrate on selling decisions in the loss domain, because empirical evidence has shown that people are not inclined to sell losing investments. What determinants would eventually motivate the capitulation decisions remains unclear in the literature. By focusing on the loss domain, we aim to provide more insights to the question of

what are the main determinants of investors' capitulation decisions. Nevertheless, we have also included the gain domain in Chapters 3 and 4 to provide comparisons.

1.2 Dissertation Themes

1.2.1 Theme I: Adaptation of Reference Points

The first theme of the dissertation is devoted to the examination of how individuals' adaptation to losses over time links to their capitulation decisions. Adaptation to a financial loss, or (reference point) adaptation, means that an individual's reference point is adjusted to the decreased value of the losing investment. Thus, the individual perceives the loss to be smaller/less painful. We refer to investors' decisions to stop losses by selling the losing investment as capitulation decisions. To the best of our knowledge, the analysis here is the first effort to examine investors' capitulation decisions in a dynamic setting with multiple decision moments.

The first theme of the dissertation is divided into two chapters. In Chapter 2 we investigate our novel explanation for the disposition effect: adaptation of the reference point. The reference point is here not specified as static, instead, it adapts in the direction of a prior outcome, upwards for gains and downwards for losses (Arkes, Hirshleifer, Jiang and Lim 2008). In the loss (gain) domain, a downward (upwards) adjustment of the reference point implies that the perceived size of the incurred loss (gain) becomes smaller. Any subsequent price of the investment is evaluated relative to this adapted reference point. We integrate prospect theory (Kahneman and Tversky 1979), adaptation level theory (Helson 1964), expected utility theory (e.g. von Neumann and Morgenstern 1944; Harless and Camerer 1994) and evidence on reference point adaptation (Arkes et al. 2008), in order to specify a dynamic model to predict how investors' adaptation affects their capitulation decisions in a setting with multiple decision moments. The standard expected utility model implies that

investors' expected utility of an outcome is a function of (1) their subjective expectation of future value changes of the investment, and (2) the subjective values attached to these objective value changes (Lee et al. 2008). We propose that subjective values attached to future expected increases or decreases in the price of an investment depend on the investor's adapted reference point. Therefore, we expect that the interaction between (1) subjective expectation and (2) subjective value affects the investor's expected utility of future outcomes, and his/her probability to sell a losing investment. Consistent with our theoretical framework, we find empirical evidence supporting the relevance of the interaction between expectation and adaptation as a key determinant of an investor's capitulation decision on his/her financial investment. Chapter 2 is based on Lee, Kraeussl, Lucas and Paas (2008).

Chapter 3 is the second chapter of the first theme of this dissertation. The findings reported in Chapter 2 suggest a link between the investor's level of adaptation of the reference point and his/her capitulation decision. Chapter 3 builds upon this insight and aims to further enhance the understanding of reference point adaptation at the individual level. The coping literature has demonstrated that differences in personality affect how individuals adapt to various stressful events, such as physical pain and traumatic experiences (Morgan, Matthews and Winton 1995; Miro and Raich 1992). The objective here is to apply these findings to another type of stressful events, namely financial losses. Many studies in the coping literature are based on the Big Five model of personality (Bishop et al. 2001; David and Suls 1999). We expect that this model provides a useful context for assessing individual differences in adaptation to financial losses. The Big Five personality traits are: (1) extraversion; (2) agreeableness; (3) conscientiousness; (4) emotional stability (versus neuroticism); and (5) intellect (Goldberg 1992). A recent meta-analysis study by Connor-Smith and Flachsbart (2007) indicates that the Big Five personality traits are linked to individuals' ability to adapt to/cope with various stressful situations. Although most

individuals are capable of adapting to ups and downs in life satisfaction (Brickman, Coates and Janoff-Bulman 1978; Kahneman 1999), their extents of adaptation vary (Lucas, Clark, Georgellis and Diener 2003). Our goal is to test the proposed link between the Big Five personality traits and adaptation of reference point in the context of financial/investment decisions. We show that individuals scoring higher on agreeableness and intellect, and lower on conscientiousness adapt to prior losses to a larger extent. This implies that these more adapted investors are more likely to attach higher subjective positive value for future gain and lower negative value for future loss, as compared to those individuals who have adapted less to prior losses. This chapter is based on Lee, Kraeussl and Paas (2010).

1.2.2 Theme II: Anticipated and Experienced Emotions

The second theme of this dissertation deals with the examination of the effects of anticipated and experienced emotions on selling decisions and consists of one chapter. In Chapter 4 we test our second novel explanation for the disposition effect, namely the role of emotions within financial decision-making. In particular, we examine how anticipated and experienced emotions simultaneously affect investors' decisions to hold on to or to sell an investment in the more realistic dynamic setting of multiple decision moments. Within the consumer behavior literature, experienced emotions are found to have a significant impact on consumers' switching, complaining, and word-of-mouth intentions (Tsiros and Mittal 2000; Zeelenberg and Pieters 2004). Anticipated emotions can affect consumers' likelihood to discontinue a service relationship as well (Lemon, White, and Winer 2002). We argue that switching decisions in the marketing domain are very similar to capitulation decisions in the finance domain, as both of these decisions involve the discontinuation of a relationship between an individual and a product/service with negative performance. Therefore, we expect both anticipated and experienced emotions to predict investors' selling decisions. We refer

experienced emotions as the emotions that one is feeling at the moment, and anticipated emotions as the emotions that one expects to feel in the future. Anticipated regret and anticipated pride have been suggested as explanations for the disposition effect (Shefrin and Statman 1985), but this proposition has not been empirically tested. Moreover, the investment process in practice consists of a chain of decisions. These dynamics have not been motivated by Shefrin and Statman (1985). In addition to anticipated emotions that individuals expect to feel after future decisions, investors may experience emotional feedback from previous decisions as well. Since both anticipated and experienced emotions may affect investors' subsequent behavior, we argue that these two effects should be examined simultaneously in a dynamic setting.

We focus on two specific emotions: (1) regret for the loss domain and (2) pride for the gain domain. In the loss domain, regret results from counterfactual thinking, that is, a comparison between the obtained outcome and what might have been (Bell 1982; Loomes and Sugden 1982). In the gain domain, pride is a positive emotion resulting from achievement, attributed to effort or abilities (Tangney 1999; Tracy and Robins 2007). We build our hypotheses upon the appraisal theory of emotions (Bagozzi, Gopinath, and Nyer 1999) and regret regulation theory (Pieters and Zeelenberg 2007). According to the appraisal theory of emotions (Bagozzi, Gopinath, and Nyer 1999), cognitive appraisals of situations play an essential role in the elicitation and differentiation of emotions and affect individuals' subsequent decision. Regret regulation theory (Pieters and Zeelenberg 2007) suggests that regret has implications for individuals' behavior. For example, people are more likely to choose an option that involves less anticipated regret. Our experimental findings indicate that in the loss domain high experienced and low anticipated regret predict a greater probability of selling a losing investment. In the gain domain, only experienced pride, not anticipated pride,

predicts a greater probability of selling a winning investment. This chapter is based on Lee, Kraeussl and Paas (2009).

1.3 Outline

This dissertation critically reviews the literature in the fields of marketing, finance and psychology, in order to understand the psychological aspects of the disposition effect. There are three empirical studies presented in Chapters 2, 3 and 4. Chapter 2 tests a dynamic model of how investors' adaptation to losses is linked to their capitulation decision. Chapter 3 investigates whether individual differences in personality traits affect people's adaptation to gains and losses. Chapter 4 tests how anticipated and experienced emotions affect investors' decisions to hold on to or to sell an investment. Chapter 5 summarizes the main results and implications from the previous chapters, and discusses ideas for future research.

CHAPTER 2:

Why do investors eventually sell losers?

How adaptation to losses affects future capitulation decisions

2.1 Abstract

According to disposition effect theory, people hold losing investments too long. However, many investors eventually sell at a loss, and little is known about which psychological factors contribute to these capitulation decisions. This study integrates prospect theory, utility maximization theory, and theory on reference point adaptation to argue that the combination of a negative expectation about an investment's future performance and a low level of adaptation to previous losses leads to a greater capitulation probability. The test of this hypothesis in a dynamic experimental setting reveals that a larger total loss and longer time spent in a losing position lead to downward adaptations of the reference point. Negative expectations about future investment performance lead to a greater capitulation probability. Consistent with the theoretical framework, empirical evidence supports the relevance of the interaction between adaptation and expectation as a determinant of capitulation decisions.

2.2 Introduction

One of the most intriguing phenomena related to decision making under uncertainty, particularly in financial markets, is the disposition effect. Shefrin and Statman (1985) propose that investors tend to hold their losing investments too long and sell their winning investments too early. This claim received empirical support in a laboratory setting (Weber and Camerer 1998), an online setting (Lee, Park, Lee, and Wyer 2008), in the stock market (Odean 1998), and in property markets (Genesove and Mayer 2001). The widespread attention to the disposition effect reflects its potentially harmful effect on current and future wealth through suboptimal financial decision making. A timely sale of losing investments can substantially improve a household's financial position (Dhar and Zhu 2006; Odean 1998). Therefore, it is important to answer the key remaining question: Why do many investors eventually capitulate to their losing investment? Current theory only provides insight into why investors hold on to losers too long. Current theory does not explain why investors eventually do sell losers. Next to theoretical relevance, our study has societal implications. Determining the factors that stimulate or impede a timely capitulation is important from a welfare perspective and may be useful for financial advisory work and the enhancement of financial literacy.

Empirical results reported by Lee et al. (2008) attribute the disposition effect to differences in the values that investors attach to possible gains and losses, rather than to any differences in their perceived likelihood of occurrence. This reasoning is also reflected in prospect theory (Kahneman and Tversky 1979). Prospect theory claims that investors do not perceive a gain or a loss in absolute terms. Instead, investors measure the perceived value of each outcome according to its distance from the investor's reference point. Any value above (below) that reference point is perceived as a gain (loss) by the investor. However,

asymmetry in the value function causes losses to exert approximately twice the psychological effect of equally sized gains.

Although prospect theory attempts to explain investors' overall tendency to sell winning investments too soon and hold losing investments too long, it cannot explain how investors eventually reach their capitulation decisions. Prospect theory usually assumes the reference point is static and equal to the initial value of the investment. Yet investors might engage in reference point adaptations, adjusting their reference point in the direction of a prior outcome: upward for gains and downward for losses (Arkes, Hirshleifer, Jiang, and Lim 2008). In the domain of losses, which is the topic of interest for this study, a downward adjustment of the reference point implies a smaller perceived loss. Arkes et al. (2008) do not study the antecedents of reference point adaptation, but we argue that both the size of the loss and the time spent in a losing position might affect the extent of this adaptation.

For this study, we therefore combine reference point adaptation with prospect theory and the expected utility model to pose an explanation of why many investors eventually capitulate to their losing investments. Standard expected utility theory implies that investors' expected utility of an outcome is a function of (1) their subjective expectation of the (objective) future value changes of the investment, and (2) the subjective values they attach to the objective value changes (Lee et al. 2008). Although the expected utility of an outcome clearly depends on many factors, studies of the disposition effect generally focus on these two (e.g., Lee et al. 2008). Because the investor's objective in the expected utility model is determined by the interaction of his or her subjective expectations and subjective values attached to the possible outcomes, we hypothesize that their interaction also affects decisions to hold or sell a losing investment. Investors with negative expectations about the investment's future performance should be more likely to capitulate to a losing investment if they have adapted less to previous losses. With this hypothesis, we depart from prior research

by Weber and Camerer (1998), who assume that investors hold on to losers if they have barely adapted. In addition to developing and testing our alternative hypotheses, we apply the expected utility model with reference point adaptation in a dynamic rather than a static setting. Therefore, unlike prior research, we test how dynamically changing expectations and reference point adaptation levels affect financial decision-making.

Accordingly, our empirical analysis relies on this conceptual framework and the results of two recently published empirical papers. Lee et al. (2008) show that the disposition effect is mostly due to the different subjective values that investors attach to gains and losses. However, they compare subjective values in the gain and loss domains only in a single-decision setting. Arkes et al. (2008) also show that an investor's reference point shifts after a change in the value of an investment. By focusing on a single value change, these authors do not link the adaptation of reference point levels directly to financial decision-making. In contrast, we conduct a dynamic experiment to determine how reference point adaptation occurs in a dynamic setting with multiple decision moments, as well as how it influences the decision to hold or sell losing investments. Our experiment thus provides insight into the antecedents of reference point adaptation. Furthermore, by allowing for multiple decision moments, we can observe the variation in expectations and reference point adaptations over time, which we exploit in turn to study their interaction. Our combination of adaptation-level theory and the expected utility model provides insight into why investors eventually sell losing investments. Our experimental approach also approximates real-life investment decision-making better than static experimental procedures. In reality, investors operate in a dynamic, multiperiod setting. Therefore, the experimental framework we use to study multiple consecutive investor decisions offers better external validity.

2.3 Theoretical Framework

The expected utility model predicts that the expected utility of each possible outcome affects choice behavior. For example, if the expected utility of holding on to a losing investment is low, we should observe fewer investors holding on to a losing stock. The expected utility of an outcome is the product of (1) its subjective probability of occurrence and (2) its subjectively perceived value. Thus, both a higher perceived likelihood of negative outcomes and lower subjective values attached to those outcomes produce lower expected utilities, which in turn lead to higher capitulation probabilities.

Lee et al. (2008) suggest that subjective probabilities and values have interactive effects on investors' decisions, though without formally testing this prediction. We provide a test of these interaction effects and study their impact on the decision to capitulate to a losing investment. Accordingly, we discuss the notions of expectations and probabilities, the concept of subjective value as determined by adaptation levels, and our hypothesis regarding how the interaction between probabilities and perceived values might be linked to the capitulation decision.

2.3.1 Expectation and Capitulation

According to the expected utility framework, decision makers determine the value of an outcome by multiplying its subjective probabilities and their subjectively perceived values. Probabilities thus have linear effects. Prospect theory (Kahneman and Tversky 1979) instead suggests nonlinear influences, such that people overweight low probability events and underweight medium and high probability events. We adopt a standard finance perspective: It is rational for an investor to sell a losing investment only if he or she does not expect its price to increase sufficiently to offset its risk. We do not demand a clear choice between linear versus nonlinear probability weighting functions, because we are only interested in the

interaction between the subjective value and subjective expectation. Therefore, in our experimental setting, participants formulate subjective expectations of whether the investment will increase or decrease. This requires less cognitive effort than formulating a subjective probability (and weighting) of each individual possible outcome (Lee et al. 2008). The expectation of the direction of future performance may be the only cognitive statement the decision maker can formulate, or it may be a summary statement of a more fine-grained set of beliefs. Either way, we expect this expectation to affect the investor's decision to sell a losing investment, either due to changes in perceived probabilities or to changes in probability weights. In particular, negative expectations about future price development should lead to a greater tendency to capitulate.

Lee et al. (2008) test the relation between past performance and expected future performance. They find that on average, people believe that the future price of a current loser is more likely to increase, whereas the price of a currently held winner is more likely to decrease. Our approach differs from Lee et al.'s (2008) in two main ways. First, we focus on the effect of subjective beliefs about the likelihood of future price increases or decreases on actual financial decision-making, not the link between past performance and future expectations. Second, we concentrate solely on the loss domain, which provides a clearer, more direct view of the capitulation phenomenon.

Investors may have positive expectations of stocks that previously incurred losses, especially if they think the losing stock has bottomed out and will regain some of its losses in future investment periods (Andreassen 1988). This negative recency effect (i.e., tendency to predict the opposite of the last event) is known as the gambler's fallacy (Ayton and Fischer 2004). In contrast, when investors adopt the hot hand fallacy, they expect a positive recency effect and the recurrence of an event (Ayton and Fischer 2004). Concretely, they develop negative expectations about future performance after a loss. Both phenomena appear in actual

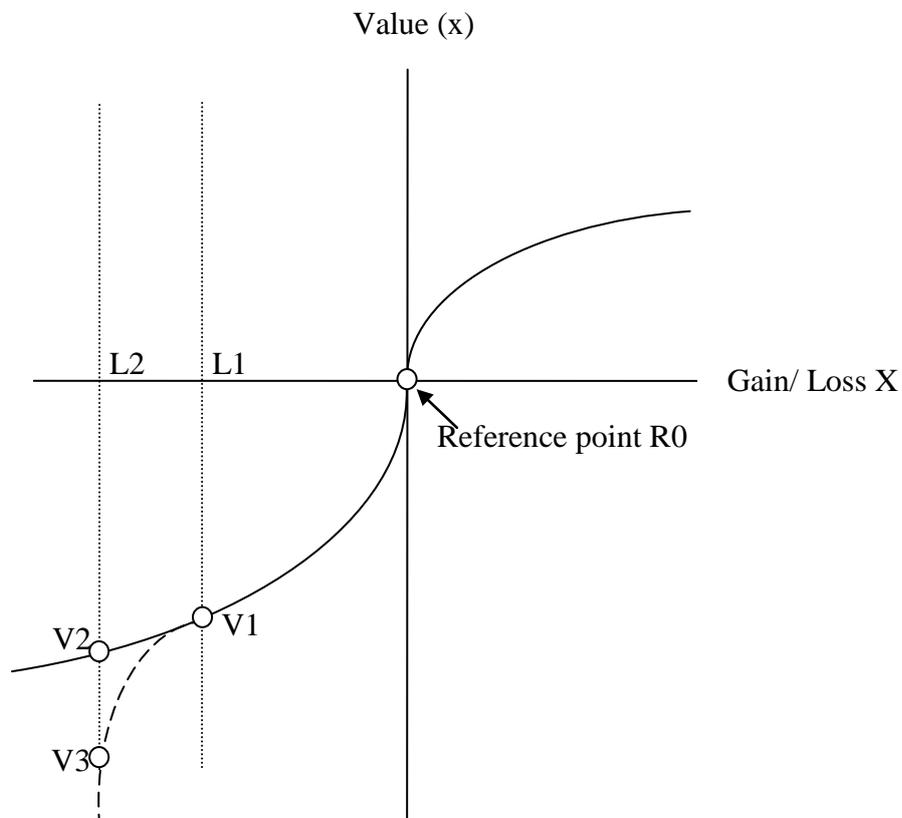
investment strategies, referred to as momentum (positive recency) and contrarian (negative recency) strategies, respectively (Morrin, Jacoby, Johar, He, Kuss, and Mazursky 2002). Therefore, we do not predict that either of these two single fallacies is dominant in our framework. Rather, we only infer that subjective negative expectations should relate to a greater probability to capitulate.

2.3.2. Prospect Theory and Reference Point Adaptation

Prospect theory postulates that investors evaluate outcomes according to a reference point. If the outcome is above (below) this point, it represents a gain (loss) (Kahneman and Tversky 1979). Moreover, investors experience loss aversion, in that the concavity of the value function above the reference point and its convexity below this point (see Figure 2.1) causes investors to be risk averse in the gain domain and risk seeking in the loss domain. Although selling a losing investment can prevent additional losses, actually realizing the loss has more value only if the perceived probability of incurring additional losses is very high. Consider for example an investment that has dropped from its initial neutral value, as represented by the reference point R_0 in Figure 1, to the low value L_1 . The perceived value of the investment now equals V_1 . A subsequent drop in the price of the asset to L_2 implies a smaller change in perceived value compared with the first drop, because of the convexity of the value function in the loss domain (Weber and Camerer 1998). Conversely, an increase from L_1 implies a comparatively larger difference in perceived value. Therefore, investors tend to favor the risky option (holding on to the losing investment and incurring only a “paper loss”) over the safe option (realizing the loss and avoiding further pain).

Figure 2.1

S-shaped value functions and the disposition effect



Notes: The solid line represents the S-shaped value function proposed by Kahneman and Tversky (1979) in a one-stage setting. For larger losses in a two-stage setting, the quasi-hedonic editing rule (Thaler and Johnson 1990) suggests a concave region (dashed line) in the value function of the loss domain.

Determining the appropriate reference point is a fundamental issue. Kahneman and Tversky (1979) suggest it might be the status quo or the expectation or aspiration level. It is unclear though where the reference point actually lies. In financial decision-making, there is no consensus about which price determines the reference point: the initial purchase price (Odean 1998; Weber and Camerer 1998), the historical peak of a stock price (Gneezy 2005), or the expected value of future outcomes (Kőszegi and Rabin 2006; Yogo 2008).

This controversy is further complicated if we consider that the reference point may be dynamic. Kahneman and Tversky (1979) propose that the current level of perceived wealth depends on a person's adaptation to past and present stimuli, just as the adaptation level is affected by prior stimuli (Helson 1964). Reference point adaptation, also referred to as a shift

of the reference point or an updated reference point, implies that in a dynamic setting, the reference point adapts upward (downward) as gains (losses) accumulate. Subsequent prices then get evaluated relative to the adapted reference point. The adaptation process also may be asymmetric, such that people adapt more to gains than to losses of the same magnitude (see Arkes et al. 2008; Chen and Rao 2002).

Although adaptation to economic gains and losses is demonstrated by prior literature, the extent of adaptation over time has not been analyzed. Adaptation-level theory suggests that the perceived magnitude of a stimulus depends on its relation to an adapted level or reference point, determined by preceding stimuli. According to Helson's (1964) formula, the reference point (R_t) is the average of past stimuli levels,

$$R_t = t^{-1} \cdot \sum_{\tau=0}^t X_{\tau}, \quad (1)$$

where X_t represents the current stimulus level, and t represents time. It is unlikely that investors adapt to losses exactly as suggested in Equation (1) though, and Helson's theory has been criticized on several grounds. Sarris (1967) argues that extreme stimuli do not affect the adaptation level as much as Helson (1964) claims, and Parducci (1968) suggests that the effect of a stimulus is influenced by the rank of the stimulus in a group of other stimuli. Moreover, Equation (1) cannot differentiate how a loss experienced, say two years ago, and a recent one, experienced two days ago, affect adaptation levels differently. To account for this temporal component, Hardie, Johnson, and Fader (1993) propose modeling the adaptation level as

$$R_t = \alpha X_{t-1} + (1 - \alpha)R_{t-1}, \quad (2)$$

for a scalar $0 \leq \alpha \leq 1$. Although the parameter α grants recent stimuli more weight than past stimuli, it still cannot provide for a full separation of time and stimuli levels.

To achieve more flexibility in capturing reference point adaptation, we propose examining the unique effects of time and past stimuli on the adaptation level separately.

Equation (1) implies that the adapted reference point emerges as a recursive average of all preceding stimuli. Therefore, in a loss domain, we expect the adapted reference point to relate positively to the sum of all previous losses (i.e., size of total loss), but negatively to the number of time points elapsed. The sum of past stimuli in our setting thus collapses to the size of the total loss since $t = 0$, or $(p_0 - p_t)$. As the stock price continues to decline, the total loss increases, and we expect the adapted reference point to decrease. A lower adapted reference point actually indicates a greater extent of reference point adaptation if the investment is in a losing position. We do not expect the adaptation process to follow the precise dynamics of Equation (1), but we anticipate a significant relationship of both the total sum of past stimuli and the elapsed time to the final adapted reference point. We thus hypothesize that in a loss domain:

H1a: *A larger total loss leads to a lower adapted reference point (R_t) and a higher adaptation level ($AL_t = p_t - R_t$).*

H1b: *A longer time spent in a losing position leads a lower adapted reference point (R_t) and a higher adaptation level ($AL_t = p_t - R_t$).*

We model the effect of total loss and time on the adaptation level as

$$AL_t = p_t - R_t = \alpha + \beta_1 \cdot t + \beta_2 \cdot TL_t + \beta_{int} \cdot t \cdot TL_t + \varepsilon_t, \quad (3)$$

where AL_t denotes the adapted reference point, p_t is the current price of an investment, t is time in a losing position, and TL_t is the size of the total loss. Because it takes time for a loss to accumulate, there must be some correlation between time spent in a losing position and size of total loss; therefore, we also include an interaction term. As seen in hypotheses H1a and H1b, we define the “adaptation level” as the extent to which one has adapted to prior losses. The adaptation level has a negative relation to the adapted reference point and also directly relates to the current price level p_t . In our experimental design, the current definition of the adaptation level is important because different subjects are exposed to different price

shocks at different stages of the experiment. The inclusion of the current price level in the measure for the adaptation level corrects for this. For example, consider subjects A and B who both start at a price $p_0 = 100$, but are hit by different losses and end up at $p_t^A = 80$ and $p_t^B = 50$, respectively. If both subjects have an adapted reference point level of $R_t^A = R_t^B = 80$, it is clear that subject A has fully adapted, whereas subject B has not. This corresponds with the value of the adaptation level, which is 0 for subject A and -30 for subject B. Full adaptation is achieved if the adaptation level is 0.

We integrate our use of adaptation-level theory with prospect theory in a dynamic context. When an investor experiences a loss, the reference point in the prospect theory framework adapts downward, which influences his or her subsequent capitulation decisions. The use of adaptation theory is thus indispensable for a realistic understanding of the capitulation decision in a dynamic investment experiment.

2.3.3. Value Function for Multistage Decisions

According to the S-shaped value function from prospect theory, if the reference price equals the current price (full adaptation), no disposition effect occurs (Dhar and Zhu 2006; Weber and Camerer 1998). In the absence of adaptation though, the S-shaped value function implies a maximum disposition effect (Weber and Camerer 1998). The convexity of the value function in the loss domain implies that further losses have a smaller impact on value if the reference point does not change (see Figure 2.1). The comparison of the extremes of full versus no adaptation implies that more adaptation leads to a relatively smaller tendency to hold on to losing investments. Thus, more adaptation should partly offset the disposition effect. Holding expectations constant, investors who have adapted more to their losses should be more likely to capitulate.

This proposition differs from Weber and Camerer's (1998) claims. We argue that in a dynamic setting, an alternative value function is more applicable than the original S-shaped value function from prospect theory. Thaler and Johnson (1990) consider the S-shaped value function useful for describing risk aversion in a gain domain and loss aversion in a loss domain for *one-stage decisions* without prior outcomes. Examples of such decisions include decisions about which university to attend or which particular house to buy. However, other decisions involve repeated choices, which require a dynamic, multistage perspective. Examples include consumers who decide, for example, whether to repurchase a product, or investors who decide whether to hold or to sell investments at different points in time. Previous literature provides many examples of how prior outcomes and sunk costs affect subsequent investment decisions (e.g., Arkes and Blumer 1985; Laughhunn and Payne 1984). However, Weber and Camerer (1998) assume that prior gains or losses do not influence subsequent decisions, beyond the magnitude effects that occur for larger single-stage gains or losses. For example, after incurring a \$30 loss, an additional \$10 loss has the same negative utility as a \$40 single-stage loss (Weber and Camerer 1998). Our experimental design allows for an ongoing effect of prior losses on subsequent decisions.

Thaler and Johnson (1990) report empirical evidence that prior gains induce risk-seeking behavior in subsequent choices and thus propose a quasi-hedonic editing rule: in a two-stage gamble with a prior loss, a subsequent loss is not automatically integrated with the initial loss. Their findings suggest people may be risk averse if they have experienced a prior loss, such that the value function in a loss domain may contain a concave region, in addition to a convex region. Several other studies confirm that the value function in the loss domain is not always convex but rather is convexo-concave for increasing absolute loss sizes. Markowitz (1952) was the first to propose a utility function with convex and concave regions in both the gain and loss domains. Kahneman and Tversky (1979) have been cited mainly for

their S-shaped value function, but they also consider special circumstances and alternative specifications. For example, they suggest that because large losses often lead to lifestyle changes, concave regions are likely in the value function for losses. Using horse race betting data, Jullien and Salanié (2000) find that bettors appear risk averse for large losses.

Moreover, several experimental studies reveal evidence of concave utility functions for losses when respondents must choose among options with different risk levels, such as a lottery choice between a low payoff/low-risk versus a large payoff/high-risk profile (Abdellaoui, Bleichrodt, and L'Haridon 2008; Laughhunn, Payne, and Crum 1980; Laury and Holt 2008; Loehman 1998; Sullivan and Kida 1995; Zeelenberg and van Dijk 1997). Outside the laboratory setting, analyses based on health insurance plans further suggest the utility function for losses is convex at first but becomes concave for large losses (Marquis and Holmer 1996). Using this evidence, De Giorgi, Hens, and Post (2005) propose a formal modification of the S-shaped value function, namely, a piecewise exponential value function, which contains a concave region of the value function in the loss domain. Finally, explicitly allowing for different behavior in the value function for small versus larger losses is particularly important in our case, because we study dynamic capitulation decisions when losses accumulate over time. Despite the growing evidence of a concave region in the value function for large losses, prior studies consider only stand-alone decisions that do not relate dynamically, unlike the multistage decision setting we employ here.

In Figure 2.1, we illustrate the value function that we use in our theoretical framework for investors who do not adapt to losses. The function is based on the piecewise exponential value function (De Giorgi et al. 2005) and is consistent with the quasi-hedonic editing rule (Thaler and Johnson 1990). Close to the reference point R_0 , the value function is kinked and convexo-concave in the realized value, as proposed by Kahneman and Tversky (1979). But for large losses, the piecewise exponential value function is concave in the loss domain and

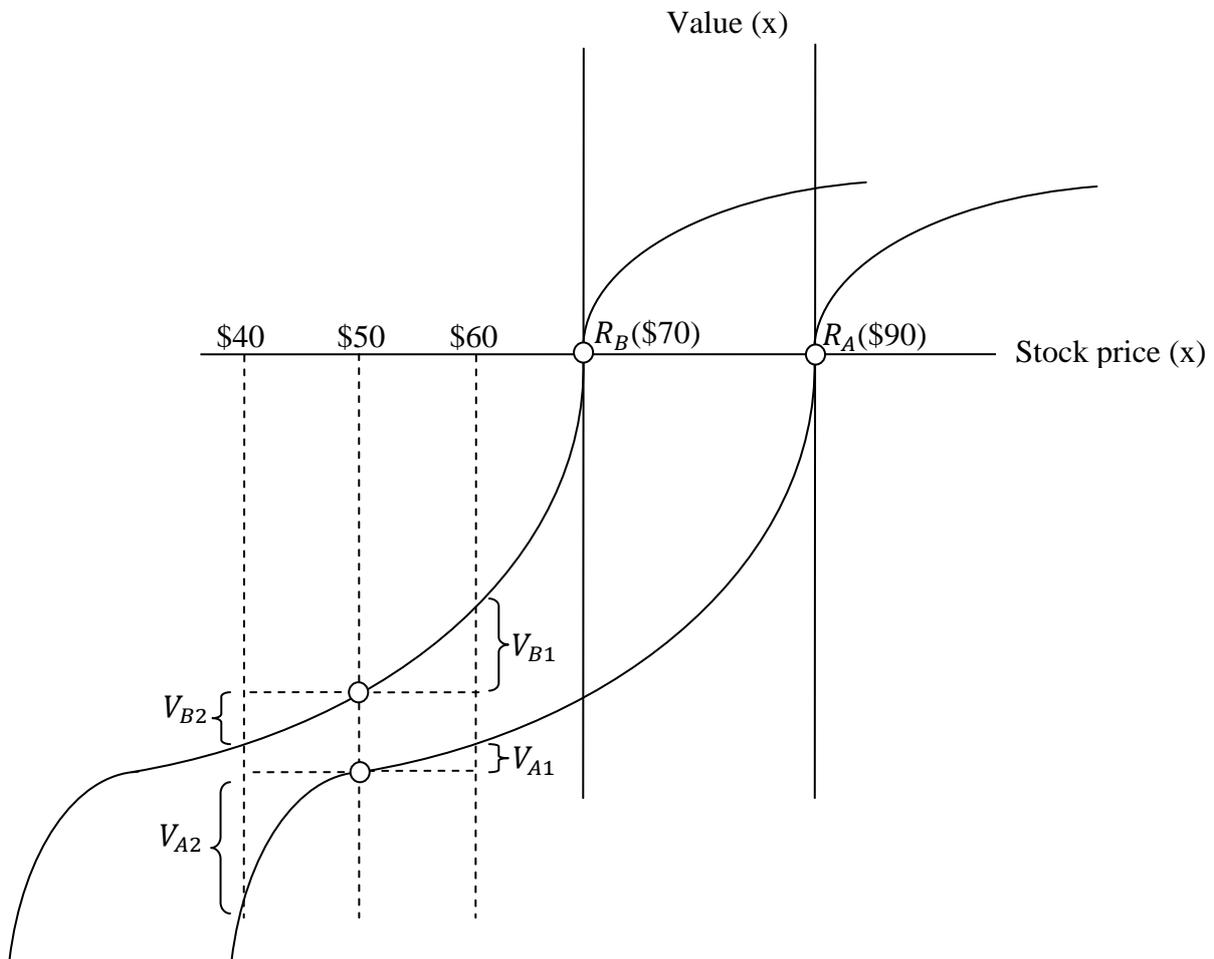
discourages extreme risk taking. For example, consider a stock price decline from its initial price R_0 to L_1 at time 1, and then a further decline to L_2 at time 2. According to this value function with a second kink in the loss domain, the perceived value would be V_3 rather than V_2 .

2.3.4. Reference Point Adaptation and the Capitulation Decision

We expect investors who have adapted to prior losses to be less likely to sell losing investments. Consider the example in Figure 2.2, in which we illustrate the reference points of both investors in a horizontal manner. Investor A and investor B both start investing in a stock at t_0 . They buy the stock at the same initial price of \$100, which we assume is equal to their initial reference point. For the sake of simplicity, we also assume that the value functions of investors A and B are exactly the same. However, the extent to which each investor adapts to gains or losses differs. At t_1 , the stock price drops from \$100 to \$50, after which investor A's reference point (R_A) decreases to \$90, whereas that of investor B (R_B) shifts to \$70. Thus, investor B adapts more to the loss than investor A. We further assume that the stock price at t_2 is equally likely to drop further to \$40 or bounce back to \$60.

Figure 2.2

Interaction between expectation and reference point adaptation



Notes: Investor A and investor B both start investing in stock X at t_0 with \$100 per share. At t_1 , the stock price drops from \$100 to \$50. Investor A's reference point (R_A) moves to \$90, while that of investor B (R_B) moves to \$70. Assume at t_2 there is an equal chance that the price drops further to \$40 or bounces back to \$60. If the stock price decreases to \$40, it results in a more negative value for investor A than for investor B ($V_{A2} > V_{B2}$). If the stock price increases to \$60, it leads to a more positive value V_{B1} for investor B than for investor A ($V_{B1} > V_{A1}$). Using the expected value function, investor A sells the stock, but investor B holds it. This effect is strengthened if both investors hold similarly negative views on the future performance of the stock due to concavity of the value function of the non-adapted investor A for stock prices below the current price.

For simplicity, we assume that the shape of the value function remains the same and only its horizontal position changes. As Figure 2.2 shows, the less adapted investor A is in the concavo-convex area of the value function, whereas investor B is clearly in the convex region for the two possible outcomes. Investor A thus is more likely to sell the asset, but investor B is more likely to hold it. If both investors predict negative future performance, the

effect gets reinforced, such that investor A's expected value function decreases much faster than that of investor B, due to the concavity for large losses. We then would expect more pronounced differences in capitulation decisions between less adapted and more adapted investors who hold similar negative views on the stock's future performance. This interaction between adaptation and expectation represents an innovative feature in our model.

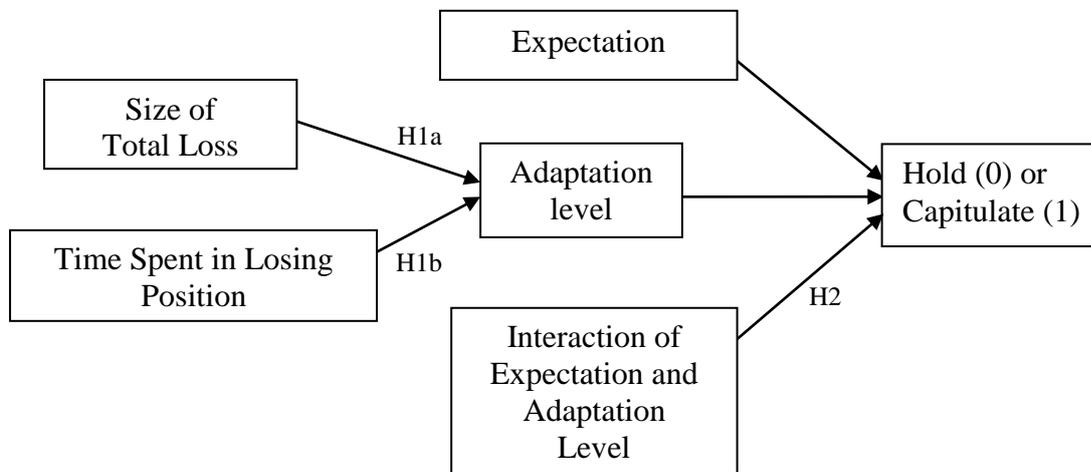
The value functions without (Figure 2.1) and with a second kink (Figure 2.2) have different implications on selling probabilities. Based on Figure 2.1, generally individuals in a losing position do not sell for fair bets due to the convexity of the value function in the loss domain. And for individuals who hold negative expectations, more adaptation to prior losses leads to a more negative (steeper) expected value, which motivates selling. Therefore, more adaptation relates to a stronger probability to sell. As for Figure 2.2, we expect the same effects as discussed based on Figure 2.1. However, in addition, for the extreme non-adaptors who hold negative expectations, they are facing with a very steep negative expected value (with 2 kinks), which motivates selling. Therefore, here non-adaptation relates to a stronger probability to sell. In Figure 2.1, due to the flatness of the value function in the loss domain for extreme non-adaptors, the prediction would be opposite.

Given the set-up of the experiment (multiple stages of significant losses, insignificant gains), a value function with a second kink is more appropriate to use than a single kink one (see Section 2.3.3), thus we expect the effect based on Figure 2.2 play a more dominant role in this study. Therefore, we summarize our complete dynamic model of an investor's financial decision-making in Figure 2.3, with the following expectations:

H2: *A negative expectation about an investment's future performance combined with a low adaptation level ($AL_t = p_t - R_t$) leads to a larger capitulation probability.*

Figure 2.3

Proposed model of decision-making for a losing investment



2.4 Methodology

2.4.1 Participants and Procedure

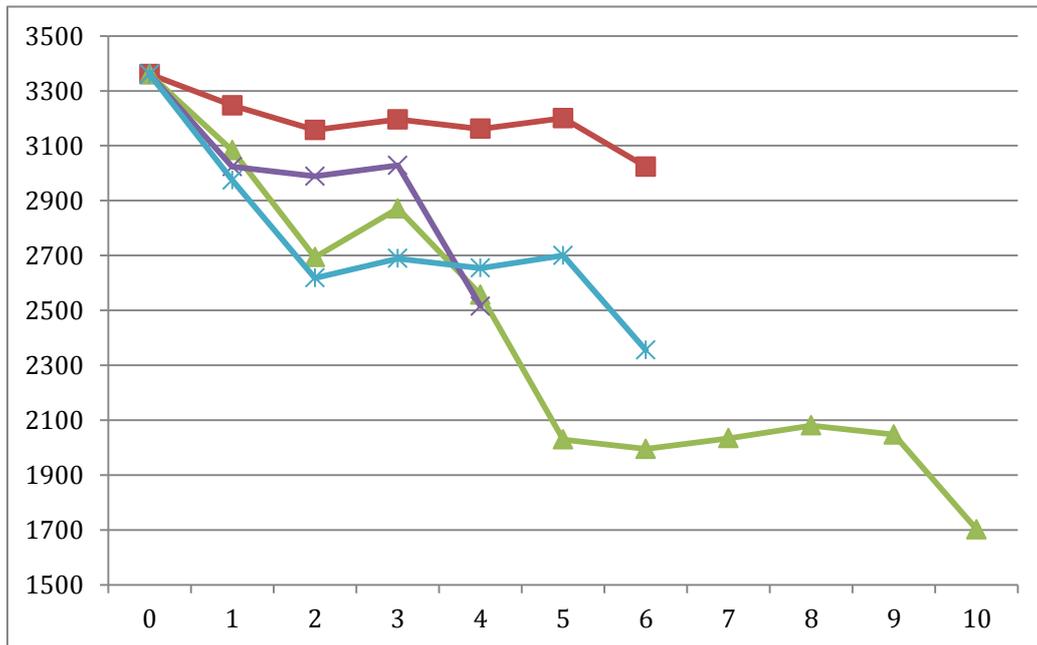
Respondents considered a single stock, about which they had to make multiple decisions to hold or sell. The amounts and timing of losses varied across respondents. In our experiment, 111 students at a Dutch university (72 male, 39 female) participated, with a chance to win a cash prize by enrolling in a lottery. To motivate participants to perform well, they were informed that they have a chance to win a lottery prize of €50, if the winner's investment performance is at or above the top 30%, the prize would be doubled to €100. We in fact distributed a prize of €100, regardless of the actual investment performance of the winner. Participants arrived at the lab and were assigned to individual cubicles. They reviewed a scenario in which they recently started investing in a single stock, stock X. The amount invested in stock X was predetermined and equal for every participant. We specified up to 10 investment periods for the experiment. After each period, participants received information on the stock's performance and were asked whether they wanted to hold or sell the stock. They could only choose to sell or hold the entire invested amount. Before each

decision, respondents answered a short questionnaire that elicited their expectation of the stock's future performance and their reference point adaptation level. After participants chose to sell the investment, or when the randomly predetermined number of investment period had been reached, the experiment ended. Participants were debriefed about the purpose of the study.

Previous studies of the disposition effect have employed a limited number of predetermined price patterns (Lee et al. 2008; Weber and Camerer 1998). To increase the generalizability of our findings though, we generated a wide range of intermediate price dynamics over the ten investment periods. All participants incurred losses in their investment, but to make the price patterns realistic and avoid long runs of losses, we included some mild upward movements in the intermediate stages. To avoid overly frequent upward movements, we divided the (up to) ten investment periods into three unequally sized blocks. Participants were randomly assigned a first loss of 5%, 10%, 20%, or 40%, roughly evenly spread out over the initial 1, 3, or 5 periods in block 1. Then in block 2, prices stayed relatively stable (upward or downward stock price movements of around 1%) for either 2 or 4 periods. A second major loss of 5%, 10%, or 15% took place in block 3 within 1 period. Then the experiment ended. Therefore, participants considered various combinations of price patterns, based on randomly assigned sizes and durations of losses (see Table 2.1). A visualization of the different price paths is given in Figure 2.4.

Figure 2.4

Four sample price patterns presented to participants in the experiment



Notes: Participants considered various combinations of price patterns, based on randomly assigned sizes and durations of losses (see Table 2.1 for details) and there are some mild upward movements in the intermediate stages.

Table 2.1

Price changes presented in the experiment

a. Block 1 (Start wealth level \$3361)

	First major loss			
	$\approx -5\%$	$\approx -10\%$	$\approx -20\%$	$\approx -40\%$
Number of periods	Price change at each period (in \$)			
1	-165.06	-337.38	-674.76	-1331.36
3	-113.95	-193.24	-386.48	-834.24
	-89.56	-178.23	-356.46	-698.46
	38.45	35.36	70.72	201.34
5	-38.27	-99.21	-198.42	-277.33
	-55.68	-89.43	-178.86	-390.12
	40.36	40.32	80.64	177.45
	-61.49	-109.31	-218.62	-314.05
	-49.98	-78.47	-156.94	-527.31

b. Block 2

	Stable prices
	$\approx 1\%$
Number of periods	Price change at each period (in \$)
2	-34.78
	39.32
4	-34.78
	39.32
	46.18
	-33.20

c. Block 3

	Second major loss		
	$\approx -5\%$	$\approx -10\%$	$\approx -15\%$
Number of period	Price change at each period (in \$)		
1	-177.23	-345.31	-512.89

Notes: We divide the prices presented to participants into three blocks. The initial value of stock X starts at \$3361 ($\33.61×100 shares). Participants were randomly assigned to incur approximately a 5%, 10%, 20%, or 40% first major loss in block 1 (over 1, 3, or 5 periods). In block 2, participants experienced price changes of approximately 1% (2 or 4 periods). In block 3, participants incur a second major loss of approximately 5%, 10%, or 15% in 1 period. The order of price presentations in blocks 1 and 2 were random.

2.4.2 *Investment Goals as Measures of Adaptation*

Several measures of adaptation levels have been proposed in previous studies. For example, Baucells, Weber, and Welfens (2007) ask subjects to report the selling price at which they would feel “neither happy nor unhappy.” However, these participants must understand the concept of indifference and be able to express that psychological state in terms of stock prices. Another limitation of former studies (Baucells et al. 2007; Chen and Rao 2002) stems from their presentation of a series of outcomes, after which participants report their reference point. This type of retrospective evaluation can be highly biased (Freedman, Thorton, Camburn, Alwin, and Young-DeMarco 1988). Moreover, this methodological approach does not allow researchers to observe how reference points change over the course of the study.

Arkes et al. (2008) instead ask participants to report how much an investment must appreciate (depreciate) further to make them feel as happy (sad) as they were when they learned about a previous gain (loss). However, people may have difficulty imagining how they would feel about future gains and losses, and comparing these imagined feelings with recollections of recently experienced feelings. Affective forecasting studies demonstrate that people’s predictions of their own hedonic reactions to future events are susceptible to errors and biases (Wilson and Gilbert 2005). Although people often predict the valence of their emotional reaction (good vs. bad) or even specific emotions (e.g. joy, sadness) correctly, they also overestimate the intensity and duration of their emotional reactions. Wilson and Gilbert (2005) suggest that in the case of negative events, people underestimate how quickly they will cope with the pain or loss.

If the prospect value function in Figures 2.1 and 2.2 is constant over time, it does not matter which measure of reference prices we use. Most reference points generally refer to current wealth, though aspiration levels also can serve as anchoring values (Kahneman and

Tversky 1979). Heath, Larrick, and Wu (1999) further argue that goals can serve as reference points, such that outcomes have a smaller marginal impact when they are more distant from a postulated goal, and failing to reach the goal is more psychologically harmful than overshooting it (i.e., loss aversion). Their findings also suggest that goals influence people's performance, effort, and persistence in non-risky situations, as well as their choices in risky settings. When presented with a single decision task, people are more risk seeking when they have not attained their goal, consistent with the S-shaped value function in prospect theory. Therefore, we use investors' goals as an indicator of an adapted reference point. This choice receives support from the psychological notion that goals energize and direct human behavior (Austin and Vancouver 1996; Elliott and Dweck 1988). Moreover, previous management studies show that the aspiration level is adaptive and affected by performance feedback (Lant 1992; Mezas, Chen, and Murphy 2002). Rasmussen, Wrosch, Scheier, and Carver (2006) also find that goals serve as reference values for feedback. If a goal is perceived as unattainable, people disengage from this goal and then reengage with new goals which benefit their well-being (Wrosch, Miller, Scheier, and Brun de Pontet 2007). Accordingly, we consider goal changes an appropriate measure of reference point adaptations in our setting.

Specifically, when investors adapt their reference points, the adaptation is reflected in their goals. To measure investors' goals, we asked the participants, after each new price realization, to report at what price level they would feel satisfied and at what price level they would be willing to sell their invested security. We use these selling prices as measures of reference point adaptation, similar to Arkes et al. (2008), though we do not adopt their use of the BDM procedure (Becker, DeGroot, and Marschak 1964). The BDM procedure, which specifies two future prices with equal probabilities, cannot distinguish the reference point from the selling decision. That is, participants in a BDM study indicate a minimum selling price prior to the random selection of one of the two future prices. They must sell at the

random price if it equals or is higher than their minimum selling price. Therefore, the decision is inherently determined by the minimum selling price. In our experiment, investment goals did not lead to any hold/sell obligation; rather, participants could hold or capitulate, regardless of their previously postulated investment goals. Our measure of reference point adaptation also is more intuitive and requires less cognitive effort than measures used in previous studies (e.g., Baucells et al. 2007), so participants can manage to provide answers about their adapted reference points for multiple points in time.

However, our calculation of the adapted reference point requires some additional discussion. We use the investment goal measures to estimate the adapted reference points, as in Arkes et al. (2008). If the adapted reference point at time t_0 is R_0 and the satisfactory price is S_0 , the difference between R_0 and S_0 should be the same as the difference between R_1 and S_1 at t_1 , with the assumption that the shape of the prospect theory value function remains unchanged:

$$S_0 - R_0 = S_1 - R_1 \rightarrow \Delta R_t = R_t - R_{t-1} = S_t - S_{t-1} \cdot (4)$$

If one participant reports a satisfactory price of \$37 at t_0 and \$35 at t_1 , the adapted reference point has adjusted \$2 downward. Although neither the satisfactory price nor the selling price is the reference point per se, by holding the prospect theory value function constant, we can determine any reference point adaptation over time according to the adaptations in the satisfactory price and selling price over time. By tracking the differences in the satisfactory and selling prices over the course of the experiment, we also capture the movement of the adapted reference point. The adaptation level is then defined by the difference between the current price the computed reference point, $AL_t = p_t - R_t$.

Investors who set high investment goals also may have a more optimistic expectation of the investment's performance, which would imply a positive correlation between the reference point and expected performance. Nonetheless Heath et al. (1999) find that the effect

of goals on persistence, effort, and task performance is independent of expectations or likelihood. To account for any potential correlation between expectation and goal, in our analysis we made use of partial least squares regression, which supposes that all the variables in the model are correlated. Thus any possible statistical correlation between goals (adapted reference point) and expectation is controlled for in our analysis.

2.4.3 Questionnaire

We borrowed four measures from Arkes et al. (2008) and Ayton and Fischer (2004). For the investment goal, we use two items, pertaining to the satisfactory price of investors—“In the next month, what is the price of stock X that would make you feel satisfied?” (M = \$32.75, SD = \$5.35)—and estimates of the selling price—“In the next month, if the stock price increases, what is the price you would sell at?” (M = \$35.64, SD = \$6.26). The initial price of the stock was \$33.61. We also measure expectations of the rational system by asking, “How do you think the price of stock X will change in the next month?” The responses used a nine-point scale (1 = “surely decrease,” 9 = “surely increase,” M = 5.68, SD = 1.66). We only asked participants to report their subjective expectation for the near future (next period). We did not administer measures of their expectations about the more distant future. Therefore, our expectation measure is myopic and could prompt myopic decision-making. Finally, we measure whether participants chose to hold on to or capitulate their losing investment by asking: “Do you want to hold or sell stock X now?”

We also administered several control questions to assess individual differences related to age, gender, risk aversion, motivation to perform well, perception of the riskiness of the stock, and investment experience in any kind of financial products and in equity. Risk aversion was measured through asset allocation tasks. Participants’ motivation to perform

well and their perception of the riskiness of the stock were measured on nine-point scales on which larger numbers indicated higher motivation and risk perceptions.

We prefer to test all hypothesized relations simultaneously, to control for the correlation among the variables. Structural equation modeling (SEM) seems appropriate in this situation, but covariance-based techniques do not allow for dichotomous dependent variables, such as the hold/sell decision in our framework. We therefore apply partial least squares (PLS) regression analysis, which is a distribution-free technique with fewer constraints. In particular, it allows for the simultaneous testing of hypotheses, single- and multi-item measurement, the use of both reflective and formative scales, and the use of dichotomous dependent variables. Our use of PLS thus is not related to measuring latent variables but rather reflects our goal to analyze the complete model at once. We tested our three hypotheses using SmartPLS 2.0 (Ringle, Wende, and Will 2005). The adapted reference point has two measures. The remaining variables all have one measure each, which means reliability and validity tests are not applicable for these single-measure variables. We pooled a total of 552 decisions for analysis. A limitation of PLS due to its complexity and iterative nature of the estimation process is that no exact statistical theory is available for inference. Standard errors for the PLS parameter estimates are usually computed based on the bootstrap, see Ringle, Wende and Will (2005). We follow this line and use a bootstrap procedure with 500 replications to assess parameter significance.

2.5 Results

2.5.1 Preliminary Results

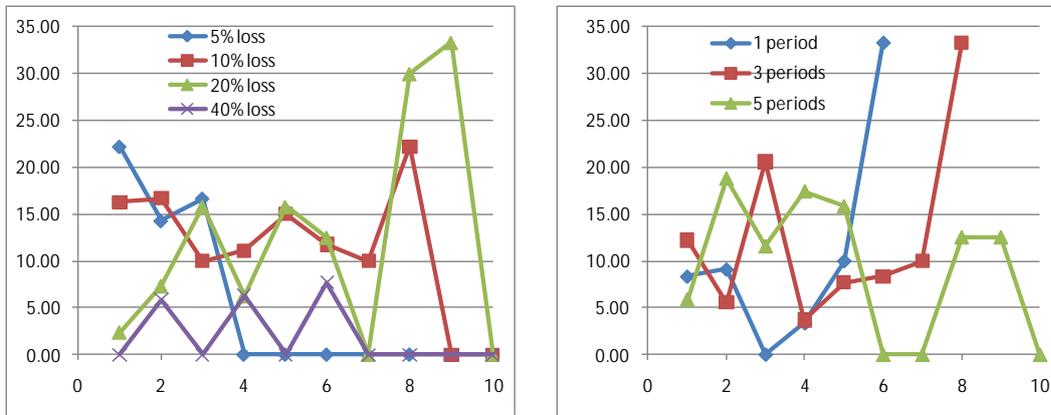
Before we estimate our structural model, we present some descriptive statistics in Figure 2.5. The left-hand panel in Figure 2.5 plots the empirical capitulation frequencies of the 111 participants over the (maximum) 10 stages of the experiment, disaggregated over the

size of the loss in the first stage of the experiment. The frequencies are computed per first-stage loss size by dividing the number of capitulators over the period by the number of subjects that still participated at the start of the period. The frequencies can thus be interpreted as discrete time hazard rates. The figure shows that the participants with the 5% loss size only left the experiment early, or not at all. This is probably due to the small size of the loss, which remains comparable to the small up and down random price movement during the second stage of the experiment. The 40% loss subjects show less systematic behavior. A few capitulate in the first 5 periods, but most subjects participate till the end. The subjects with the 10% and particularly the 20% loss rates show more variation over time. The 20% loss subjects appear to capitulate somewhat later in the experiment, suggesting that the loss size influences the capitulation decision. Note, however, that these descriptive statistics do not control for all the other hypothesized effects.

The right-hand panel in Figure 2.5 shows the capitulation frequencies disaggregated over the duration of the first-stage loss. The pattern there is much clearer. A number of individuals cannot suffer the first-stage loss and capitulate early on. Subsequently, there are flatter segments where most subjects remain in the experiment and do not capitulate. Finally, a second big shock is administered and many subjects leave the experiment directly. Interestingly, the subjects whose first-stage loss was spread out over 5 periods do not react as fiercely as the other groups to the final (third-stage) large loss. We now turn from the descriptive statistics to the actual model estimation.

Figure 2.5

Descriptive statistics: empirical capitulation frequencies over time



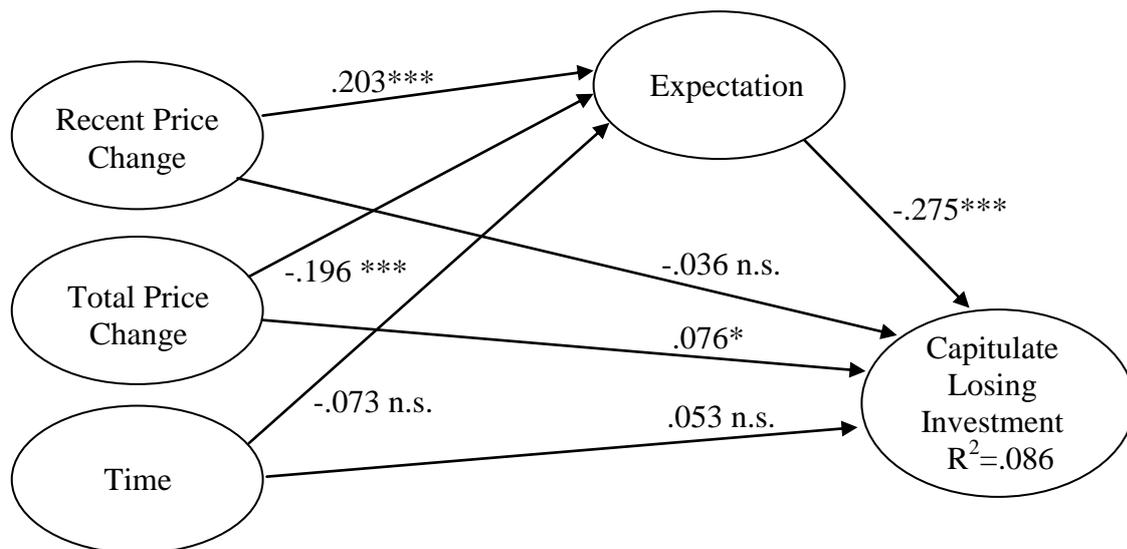
Notes: The left-hand panel shows the empirical capitulation frequencies over the 10 stages of the experiment, disaggregated with respect to the size of the first-stage loss. For example, for the 10% loss curve in period 2, we divide the number of subjects that were administrated a 10% first-stage loss and capitulated in the second period, by the number of 10% first-stage loss subjects still participating at the start of period 2. The right-hand panel holds similar empirical capitulation frequencies, but disaggregated over the duration of the first-stage loss (see also Table 2.1).

Before testing the full model, we estimated a preliminary model with time spent in a losing position, total price change since the initial period (such that a more negative price change indicated a larger total loss), and the most recent price change since the previous period (such that a more negative price change indicated a larger recent loss). These explanatory variables refer to the expectation and probability of capitulation (see Figure 2.6). The results show that the size of the total price change relates negatively to expectations ($\beta = -.196, t = 4.447, p < .001$), such that participants expect a bounce back (negative recency) in prices as losses accumulate. However, the size of the most recent price change relates positively to expectations ($\beta = .203, t = 4.226, p < .001$), so participants expect a momentum (positive recency) effect and positively correlated price movements in the short run. These results are consistent with our expectation that both positive and negative recency effects occur simultaneously. We also find a positive relation between the size of the total price change and the capitulation probability ($\beta = .076, t = 2.387, p = .017$). This finding indicates

that a larger loss relates to a larger probability to hold on to the losing investment, consistent with the notion that people avoid realizing losses. As the total price change becomes more negative, the probability to capitulate decreases, and a negative expectation relates to a greater probability of capitulation. This effect is significant ($\beta = -.275, t = 6.808, p < .001$). However, the size of recent losses and time spent in a losing position do not significantly influence the capitulation probability ($\beta = -.036, t = 1.088, p = .277$; $\beta = .053, t = 1.128, p = .260$), nor does time spent in a losing position affect expectations ($\beta = -.073, t = 1.356, p = .176$). The explanatory power of this preliminary model is limited ($R^2 = .086$), because we excluded some important interaction terms. Our complete model addresses this gap.

Figure 2.6

Results of preliminary model (no adaptation level or interaction with expectation)



* $p < .05$.

*** $p < .001$.

n.s. = not significant, results based on two-tailed t -test.

2.5.2 Complete Model Results

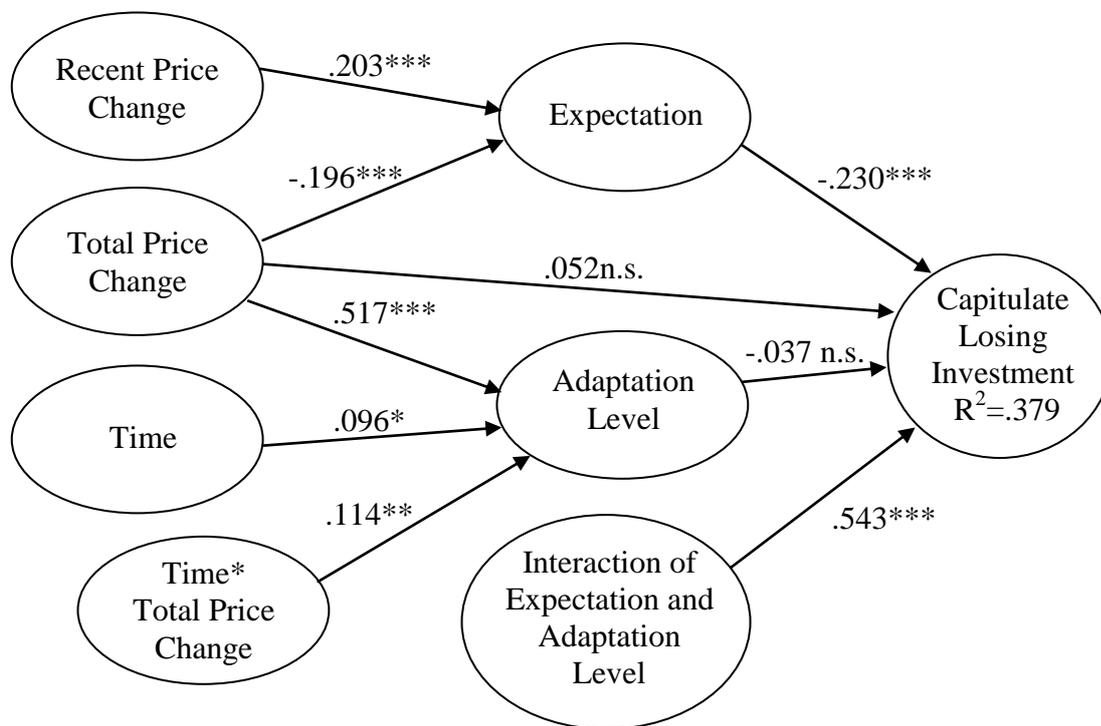
We provide the results for the complete model in Figure 2.7, which shows that the findings are consistent with the preliminary model, in that more negative expectations about

the stock's future performance predict a stronger likelihood to capitulate ($\beta = -.230, t = 7.202, p < .001$). Higher values for our expectations measure imply more positive expectations about the investment's future values. Thus, a negative effect implies that people with lower expectations are more likely to sell.

Figure 2.7

Results of the complete proposed model

(including adaptation level and interaction with expectation)



* $p < .05$.

** $p < .01$.

*** $p < .001$.

n.s. = not significant, results based on two-tailed t -test.

Notes: The insignificant effects of recent price change and time on capitulation probability and effect of time on expectation remain insignificant in this analysis. For simplicity, we do not show these relations this figure.

The time spent in a losing position (measured by the time index of the hold/sell decision, $\text{Time} = 1, \dots, 10$) and the size of the total loss have a significant impact on reference point adaptation. Participants are more adapted if the total loss they experienced (i.e., their negative total price change) is larger ($\beta = .517, t = 14.761, p < .001$) and if the time spent in the losing position is longer ($\beta = .096, t = 2.554, p = .011$). In our experimental setting, it

generally takes time for losses to accumulate, so losses correlate with longer times in a losing position. To ensure that the effects of the size of the total price change and time are unique, and to disentangle their effects on the adaptation level, we include an interaction term between time and the total price change. This interaction term significantly affects the adaptation level ($\beta = .114, t = 2.465, p = .014$). We conclude that there is strong empirical support for Hypotheses 1a and 1b. Larger total losses and a longer time spent in a losing position induce greater adaptation level. We find no direct effect of the adaptation level on capitulation ($\beta = -.037, t = 1.034, p = .302$).

Finally, we test whether the interaction between the adaptation level and expectations affects the tendency to capitulate. We find a significant interaction effect ($\beta = .543, t = 9.320, p < .001$). We examine the interaction effect more closely by splitting the sample. On the nine-point measurement scale for expectations, we designate those equal to 6 or greater as positive expectations, and the rest as negative. In Table 2.2, we provide the means of the capitulation probability for positive versus negative expectations and high versus low adaptation level. For positive expectations, the capitulation probability is small for both high and low adaptation level groups. However when the expectation is negative, the capitulation probability is greater for the low than for the high adaptation level group, which is in line with the proposition as in Hypothesis 2.

Table 2.2

Probability of capitulation with respect to expectation (high vs. low)
and adaptation level (high vs. low)

Capitulation Probability			
		Adaptation level	
		High	Low
Expectation	Negative	.155	.255
	Positive	.037	.036

Notes: A median split was performed on all adaptation levels obtained in the experiment. To distinguish between positive and negative expectations, expectations of 6 to 9 were labeled as positive, and of 1 to 5 as negative expectations. The capitulation probability is small when the expectation is positive, regardless of the adaptation level. When the expectation is negative though, the capitulation probability is greater when the adaptation level is low than when it is high.

Our findings in Figure 2.7 indicate that the effect of the total price change on the selling decision becomes insignificant ($\beta = .052$, $t = 1.264$, $p = .207$) when we include the adaptation level and its interaction term with expectation in the model. Thus, when we control for the extent to which subjects have adapted, the relation between the size of the total loss and the capitulation probability becomes irrelevant. To predict investors' capitulation decisions, the actual size of the total loss is not an important factor, because investors adapt to losses. Instead, it is more important to know how much the investors have adapted to the loss.

To mitigate concerns about the robustness of the results, we incorporate the individual characteristics of respondents as controls in our analysis for the expectation, the adaptation level, and the capitulate decision. The results remain robust. Investment experience has no direct effect on expectation, adaptation level, or capitulation. Higher risk aversion induces more positive expectations ($\beta = .218$, $t = 4.061$, $p < .001$). Also, if the stock is perceived as riskier ($\beta = .068$, $t = 1.997$, $p = .046$) or the subject reports a higher motivation to perform

well in the experiment ($\beta = .093$, $t = 2.211$, $p = .028$), the capitulation probability is significantly higher.

In summary, we find (empirical) support for Hypotheses 1a, 1b, and 2. Furthermore, the variance in the capitulation probability can be substantially better explained by the complete model ($R^2 = .379$) than by the preliminary model ($R^2 = .086$). The interaction between expectation and adaptation thus offers a powerful explanation of investors' capitulation decisions in a dynamic setting: pessimistic expectations about future stock performance matter most if one has not adapted to prior losses. We confirm this claim with a simple exercise: dropping only the interaction term from the full model in Figure 2.7 reduces the R^2 to a meager .086 again.

2.6 General Discussion

We investigate how investors eventually come to the decision to sell their losing investments. Our conceptual model integrates prospect theory and adaptation-level theory, and we test that model with a laboratory experiment. Previous literature has tested subjective expectations and subjective value as two separate determinants of investors' hold/sell decisions. To the best of our knowledge, this study is the first investigation of their interaction effect on capitulation probability. In addition, we have proposed a novel way to model investors' subjective values of losses by measuring their adaptation to losses.

Our study confirms previously reported empirical findings and adds to existing knowledge about reference point adaptation. In particular, our finding that negative expectations lead to larger selling probabilities is consistent with standard economic theories, such as Lee et al.'s (2008) finding that a participant's subjective expectation cannot explain the disposition effect. Our empirical results also are consistent with Arkes et al.'s (2008) claim that investors adapt to losses. We provide additional insight into the separate effects of

time spent in a losing position and the size of losses, because we disentangle their unique influences. In line with Hardie et al. (1993), we find that the temporal component plays a critical role in (financial) decision-making, but we also note that the adaptation level depends on the time spent in a losing position. That is, it takes time for investors to adapt to a financial loss. Lee et al. (2008) also find that investors' subjective values attached to gains and losses affect their hold/sell decisions. We extend these findings by proposing a dynamic model for predicting subjective value, based on investors' expectations and adaptation to prior losses.

The opposite effects of the size of a recent loss and total losses on expectations warrant some attention as well. When the size of total losses increases, participants report significantly more optimistic expectations ($\beta = -.196, t = 4.395, p < .001$), a reflection of the bounce-back effect, according to which participants expect a depreciated stock to appreciate again in the future. When the recent loss is larger though, participants report negative expectations ($\beta = .203, t = 4.214, p < .001$), implying that they expect momentum in future stock market prices. These results simultaneously support both the gambler's fallacy and the hot hand fallacy. They also highlight the importance of studying the role of time and the differential impact of recent and total losses on investors' expectations and decision-making. Through this link, we can explain why many investors eventually capitulate to their losing investments.

Furthermore, unlike Weber and Camerer (1998), we aim to determine how reference points adapt in a multiple-period setting and its relation to decision-making. As our main contribution, we bring several concepts together in a dynamic model to predict investors' decisions. The concept of reference point adaptation is relatively recent (Arkes et al. 2008) and has not been linked clearly to investment decisions. Therefore, we exploited Kahneman and Tversky's (1979) prospect theory to discuss the concept of reference point adaptation but also needed to take into account the quasi-hedonic editing rule (e.g., Thaler and Johnson

1990). Prospect theory, the quasi-hedonic editing hypothesis, as well as the piecewise quadratic utility function all suggest a “tipping point” in the loss domain, after which concavity (and thus risk aversion) sets in for large or subsequent losses. The importance of this point for our experimental setting and empirical model design is evident. As losses accumulate over time, the values of future prospects by an individual investor depend on his or her level of adaptation.

We provide key insights into reference point adaptation in a dynamic context. Over time, both the size of the loss and the time spent in a losing position lead to more downward adjustments of the reference point and increases in the level of adaptation. Moreover, we find that individuals’ adaptation level to prior losses interacts with expectations to affect capitulation. If expectations are negative, ill-adapted subjects (i.e., with lower adaptation levels) have on average a higher tendency to capitulate. These findings imply a link between reference point adaptation and (financial) decision-making, and are particularly relevant to decision-making research in a multi-period or longitudinal setting. Such a dynamic setting closely resembles decision-making in reality, because people face repeated decisions daily. Our findings are also relevant for investment markets such as pension funds, which are designed to be held over prolonged periods. The related buying and selling decisions are less frequent, and the role of time may be even more important. Our model may also apply to other situations that involve price changes and continuous decision-making. For example, Lewis (2006) attempts to explain the negative effect of promotions on brand equity using adaptation theory (Blattberg, Briesch, and Fox 1995; Neslin 2002), such that deeply discounted prices lead to the formation of lower reference prices. Adaptation also might be relevant for nonfinancial consumer behavior elements, such as when consumers stay with service providers that offer declining levels of service quality. If the decline is gradual, adaptation may explain inertia, together with an avoidance of switching costs (De Ruyter,

Wetzels, and Bloemer 1998). Further research should adjust our dynamic experiment to test the relevance of adaptation in such non-financial settings.

In addition, several limitations in our study suggest further directions for research. We acknowledge that an investor's adapted reference point (inferred from the investment goal) and expectation about the stock's future performance may be correlated. Lant (1992) shows that models applied to expectation formation are useful for describing aspiration formation. Thus, adaptation to losses could induce more negative expectations about future price performance. A more negative forecast about stock prices also may increase willingness to sell the stock at a lower price, in line with models proposed by Köszegi and Rabin (2006) and Yogo (2008) who define the reference point as an expectation about future outcomes. To estimate the expected value of the future outcome, individuals must be aware of their own perceived current state (i.e., adapted reference point), so it should not be surprising that investors' expectations about the stock's future performance relates to their adapted reference point. However, we measured both variables, instead of manipulating them in our experimental setting and thus cannot conclude any causal relationship. Additional research should investigate these possible relations.

In addition, we conducted this experiment within a short time frame, whereas in reality, investors have more time between various decision moments. Future studies should try to replicate our findings using larger samples in more natural settings. Another potential follow-up study could test if our model also works in the domain of gains. Our participants were undergraduates, and many of them lacked any actual investment experience, which may raise questions about the generalizability of our results. However, we do not find a significant difference in the capitulation tendency between those who have and do not have prior investment experience.

The dynamic methodology we used is novel; therefore, the results should be validated in follow-up experiments. For example, additional experiments might provide money to participants to invest prior to the start of the investment task, which would increase realism and force participants to invest their own money. To minimize the “house money” effect, the prior task for which participants get paid should appear unrelated to the investment study. Other studies could make use of other price patterns, such as periods of insignificant price changes prior to a shock of loss. Finally, further research might administer additional measures of expectations in the long term.

2.7 Conclusion

Prospect theory (Kahneman and Tversky 1979) proposes that values of financial gains or losses are not perceived in absolute terms but rather depend on a comparison against a reference point. Arkes et al. (2008) find that such a reference point is not static, and people adapt to gains and losses. The value of a second gain or loss partly depends on the adaptation of reference points to the first gain or loss. We therefore investigate the antecedents of reference point adaptation and the role that it plays in the decision to capitulate to a losing investment.

By using a dynamic experiment, we can conclude that a larger prior loss and a longer time spent in a losing position predict greater reference point adaptation. Consistent with standard finance theory, negative expectations lead to a stronger tendency to capitulate. Moreover, the effect of negative expectations is stronger when investors have adapted less to their prior loss. Thus, in the presence of negative expectations, investors who adapted more to prior losses are less likely to capitulate to their losing investment, compared with those who have adapted little.

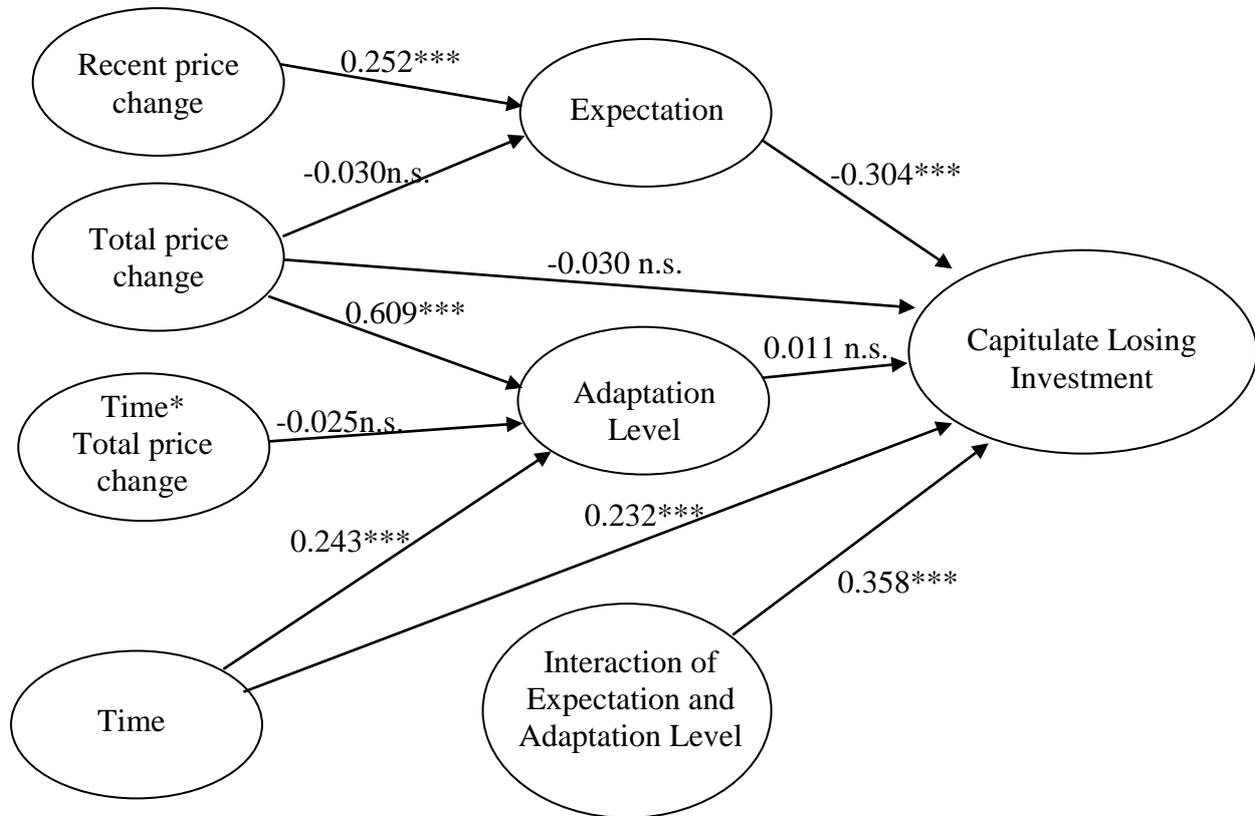
We relate our finding to the disposition effect (Shefrin and Statman 1985) and suggest that the adaptation of reference points influences investors' probability to capitulate to their losing investment. Our findings may also apply in other multistage decision-making settings, such as those related to consumers' repurchase or switching choices for product or service suppliers.

Appendix 2A: Robustness Check

To tackle unobserved characteristics of the individuals that may be correlated with the measures of expectations or adapted reference point, we performed an additional analysis in the following way. Including the individual effects directly as individual level dummies into the PLS analysis does not work in the SmartPLS software package; the programme protests to such a large number of individual effects. We therefore opted for a more ad hoc approach to address this issue. We demeaned all (dependent and explanatory) variables per individual and did our baseline PLS analysis on the transformed variables. There are three main changes with respect to our baseline analysis. (i) The total loss no longer significantly influences the expectation. (ii) Also the interaction between time in a losing position and the total loss loses significance. (iii) Finally, the time in a losing position more strongly impacts the adaptation level (so longer time, more adaptation), and in addition now also influences the selling decision directly (positively). The remaining coefficients are stable and their statistical significance remains unaffected. In particular, the interaction between expectation and adaptation level remains a key variable to explain the variation in selling behavior.

Figure 2.A1

Robustness check (fixed effect)



Note: All variables in the analysis have their means centered to zero.

*** $p < .001$.

n.s. = not significant, results based on two-tailed t -test.

Appendix 2B: Questionnaire

In each investment period of the experiment, the following questions were asked in this exact order:

1. How do you think the price of stock X will change in the next month?

Surely decrease 1 2 3 4 5 6 7 8 9 Surely increase

2. In the next month, what is the price of stock X that would make you feel satisfied?

I will be happy with: _____

3. In the next month, if the stock price increases, what is the price you would sell at?

Would sell at : \$ _____

4. Do you want to hold or sell stock X now?

Hold

Sell & convert to savings

CHAPTER 3:

Personality and Investment:

Personality Differences Affect Investors' Adaptation to Losses

3.1 Abstract

The coping literature has demonstrated that differences in personality affect how individuals adapt to various stressful events, such as physical pain and traumatic experiences. This chapter extends these findings into a stressful event in the financial domain, investment losses. We hypothesize that differences in the Big Five personality traits can explain variance in individuals' extent of adaptation to financial losses. The reported findings show that individuals scoring higher on *agreeableness* and *intellect*, and lower on *conscientiousness* adapt more to losses. It will be argued that these findings suggest that adaptation requires willingness and ability to process new information.

3.2 Introduction

When facing stress, people react differently. While the performance of some people would be negatively affected, some people seem to be able to remain calm and not to be influenced by the stressor. Individuals may deal with stressful events in life using various coping strategies, including their effort to cope with the stressor or to regulate their emotions. The coping strategies can affect the final outcome of the stressful event (Lazarus and Folkman 1984). The stressful events investigated in the extant literature are diverse, including divorce of parents (Lengua and Sandler 1996), traumatic events such as flooding (Morgan, Matthews, and Winton 1995), and physical pain (Miro and Raich 1992). The current chapter applies the findings from the coping literature to another type of stressful events, financial losses. This extension not only provides a first insight into the relevance of coping for financial decision making, but also enhances our knowledge of a recently investigated topic in behavioral finance, i.e., reference point adaptation (Arkes, Hirshleifer, Jiang, and Lim 2008; Lee, Kraeussl, Lucas, and Paas 2009).

Adaptation to a financial loss, or (reference point) adaptation, implies that an individual's reference point is adjusted to the decreased value of the losing investment. Consider an investment with an initial value of \$100. The initial reference point for the investment is represented by its initial value of \$100. This is the neutral value, in which neither losses nor gains are perceived to have occurred by the investor. Now assume that the value of this investment decreases to \$70. Some individuals may not adapt to this change, their reference point remains at \$100. Others may fully adapt and have an adapted reference point of \$70. Furthermore, those individuals who partially adapted to the financial will have an adjusted reference point between \$70 and \$100. Adaptation has consequences for the manner in which the investor will interpret future changes in the value of the investment. For example, those who have not adapted to the first \$30 value decrease will not feel positive

about the investment when its value changes from \$70 to \$90, while those who have adapted fully will be positive about the investment after this increase. For the latter group the increase to \$90 implies an increase to a level that is above their current reference point.

Reference point adaptation is a salient topic for research, as it is related to the occurrence of the disposition effect. The disposition effect concerns the investors' tendency to hold losing investments (losers) too long and sell winning investments (winners) too soon (Shefrin and Statman 1985; Stracca 2004; Van der Sar 2004). Evidence of the disposition effect has been found in experiments (Weber and Camerer 1998; Lee, Park, Lee, and Wyer 2008) and in trading records among retail and professional investors (Odean 1998; Garvey and Murphy 2004). The disposition effect has high societal relevance as it leads to suboptimal financial decisions, which may have strong effects on household welfare and company profits. Prospect theory (Kahneman and Tversky 1979) is the most prominent explanation for the disposition effect. Apart from prospect theory, Shefrin and Statman (1985) suggest that mental accounting, anticipated regret and pride and self control can explain the disposition effect. Recently other explanations for the occurrence of the disposition effect have also received attention (e.g., Dhar and Zhu 2006; L'Haridon 2009). Most relevant for the current chapter, Lee et al. (2009) find that adaptation to prior financial losses affect individuals' probability to sell losing investments, which is highly relevant in explaining the disposition effect. Lee et al. (2009) find that when holding expectations of the investments future gains or losses constant, larger adaptation to prior loss is linked to a smaller probability to sell losers.

Current knowledge on reference point adaptation, however, is limited, particularly into the occurrence of individual differences in reference point adaptation (Arkes et al. 2008; Lee et al. 2009). Arkes et al. (2007, 2008) find that individuals adapt to gains faster than to losses and they report cross-cultural differences in reference point adaptation. However, no

previous research assessed how reference point adaptation varies across individuals. Thus, there is uncertainty as to how individual heterogeneity, such as personality, affects how much individual adapt to gains and losses. Empirical findings reported in the economics literature show that personality influences individuals' earnings (Bowles, Gintis, and Osborne 2001; Groves 2005; Nyhus and Pons 2005; Semykina and Linz 2007) consumption patterns (Brandstätter and Güth 2000), and the degree of cooperative behaviors (Boone, De Brabander, and van Witteloostuijn 1999). However, since adaptation to financial gains and losses is a relatively novel area of research (Arkes et al. 2008), there is a gap in literature regarding the link between personality and adaptation of reference point.

Based on a large body of literature on how people cope with stressful events (e.g., Lazarus and Folkman 1984; Connor-Smith and Flachsbart 2007), it is clear that individual differences in personality affect individuals' decision making, behavior, and coping strategies. Acceptance, one of many possible coping strategies, closely resembles adaptation, see Section 3.3. Furthermore, previous research shows personality traits are linked to the use of various coping strategies and also to acceptance in particular (see summary by Connor-Smith and Flachsbart 2007). Therefore, we will derive hypotheses from the coping literature concerning how individual personality differences affect adaptation to financial losses, see Section 3.3. Sections 3.4 and 3.5 present the conducted empirical study and its results. Section 3.6 concludes and discusses the findings and provides implications for future research on the adaptation of reference points, personality and financial decision making.

This chapter contributes to knowledge in various literature streams. Research examining the link between personality differences and coping with financial losses has not been reported previously. Thus, we contribute to the coping literature by investigating a new stressor, namely financial losses. Next to this, insight into the affects of individual personality

differences on adaptation to financial losses will enhance knowledge of this particular adaptation process, see discussion in Section 3.6.

3.3 Theoretical Framework

According to Lazarus and Folkman (1984), coping is commonly defined as attempts to adapt to pain, or manage one's own negative responses to pain or other stressors. Research in coping has shown that individuals cope with various stressful life events using diverse strategies (Lazarus and Folkman 1984). In a review Skinner, Edge, Altman and Sherwood (2003) find that there are more than a hundred coping categorization schemes. Commonly used coping strategies include, problem-solving, wishful thinking, withdrawal, denial and cognitive restructuring. Connor-Smith and Flachsbart (2007) conduct a meta-analysis in the coping literature and find that the Big Five personality traits predict the use of specific coping strategies. For example, extraversion and conscientiousness predict the use of strategies such as problem-solving and cognitive restructuring.

The coping strategy of most interest here is *acceptance*, meaning that one comes to terms with the stressor/environment that cannot be changed, learning how to live with it, and develops a sense of understanding (Connor-Smith and Flachsbart 2007). In a way, the person accepts the current environment to be the new status quo. Section 3.3.1 discusses similarities between acceptance and adaptation. Section 3.3.2 discusses the relations between acceptance, reference point adaptation and personality. Section 3.3.2 also presents the hypotheses to be tested in the empirical study.

3.3.1 *Acceptance and Adaptation of Reference Point*

Acceptance is a particularly important coping strategy in situations where the stressor is something to be accommodated to, as opposed to situations where the stressor can be

changed easily (Carver, Scheier, and Weintraub 1989). David and Suls (1999) find that lower perceived control over events was associated with greater reliance on coping strategies such as distraction, acceptance, seeking emotional social support, but less use of direct action. When facing paper losses, retail investors can hardly change the situation. The only two actions they can engage in are: hold on to the losing investment or sell it and realize the loss. None of these actions give investors control over the financial loss that they already incurred. Thus, we expect that acceptance is a potential important coping strategy for financial losses.

We propose that the coping strategy *acceptance* closely resembles *reference point adaptation* in the prospect theory framework (Kahneman and Tversky 1979). Before discussing this resemblance, we first briefly discuss reference point adaptation from the perspective of prospect theory. Prospect theory postulates that investors evaluate outcomes with regard to a reference point. This is the salient neutral point on the evaluation scale, if the outcome is above (below) this point, it is considered as a gain (loss). Furthermore, prospect theory suggests investors experience loss aversion, because losses impose approximately double the psychological effect of equally sized gains. In addition, investors are risk averse in the gain domain, and risk seeking in the loss domain. This is reflected in concavity of the value function above the reference point and convexity below, see Figure 3.1. This results in the disposition effect (Shefrin and Statman 1985; Stracca 2004; Van der Sar 2004). Although selling a losing investment can prevent one from incurring additional losses, actually realizing the loss is psychologically painful. Therefore, investors tend to choose the risky option (holding on to the losing investment, i.e. keeping just “paper losses”) in order to retain the possibility of avoiding pain. In the gain domain, investors are likely to sell winners to realize/capture the paper gain due to their risk aversion.

Figure 3.1

Utility function in prospect theory

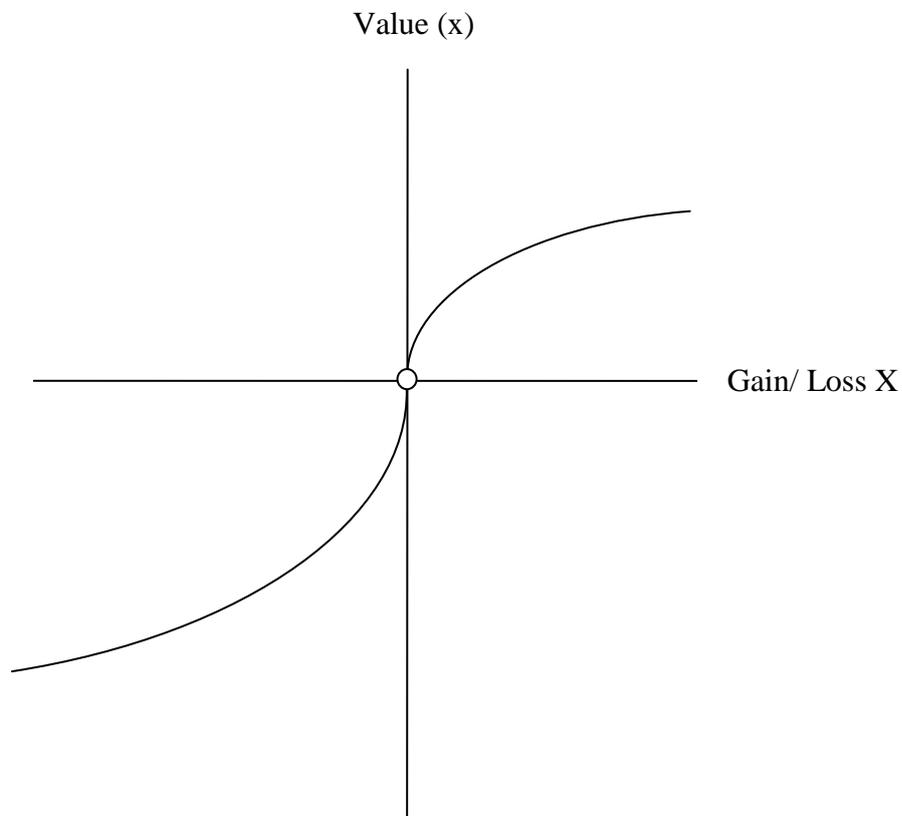


Figure 3.1 depicts the conventional prospect theory value function (Kahneman and Tversky 1979) that is used in the theoretical framework of this chapter. Here we do not employ the value function with concave region in the loss domain as shown in Figures 2.1 and 2.2 in Chapter 2. It is because in this chapter we conduct a single-stage experiment to investigate how personality affect adaptation, therefore it is not appropriate to use the double kink value function for multi-stage setting illustrated in Chapter 2.

The reference point of an individual in prospect theory may not be static. Recent studies (Arkes et al. 2008; Lee et al. 2009) have demonstrated occurrence of reference point adaptation, after the values of investments have changed. The shift of the reference point is in the direction of a prior outcome. After incurring a loss the reference point of many investors will shift downwards and upward adjustments may occur after gains. Arkes et al. (2008) find

that individuals can adapt to both gains and losses in the financial domain, meaning that through time, prior gains (losses) would generate less positive (negative) value. Individuals update their reference point based on prior financial gains or losses, and partly if they do not fully accept their prior gain and loss as their status quo. Furthermore, individuals adapt to gains at a faster pace as compared to losses (Arkes et al. 2008). Lee et al. (2009) also found that investors adapt to gains and losses, and they report an experiment that shows investors are more likely to let go of their losing investments if they have adapted less to the losing investment, holding expectations constant.

The notion of acceptance in the coping literature and adaptation of reference point both concern reactions of individuals to a new stressor or loss. When people engage in acceptance, they learn to live with the loss and the resulting limitations. Thus, the situation with a stressor becomes the status quo. When investors adapt to paper losses, their reference point moves downward and towards the paper loss, that is, they have a new status quo. As such, both acceptance and adaptation of reference point are dealing with individuals' perception of the updated status quo/neutral reference. In both of these concepts, the stressor/paper loss influences the location of the updated status quo/reference point.

Adaptation is a relatively novel topic in the behavioral finance literature and has not received much attention. However, acceptance as a coping strategy, has been examined to a wide extent in the psychology and personality literature. In the following, we review the literature on the Big Five personality dimensions and propose links between personality and adaptation in the financial domain, based on the coping literature.

3.3.2 Big Five Personality Traits and Adaptation

Changes in life circumstances can create ups and downs in life satisfaction. Most individuals will be capable of adapting to such changes (Brickman, Coates, and Janoff-

Bulman 1978; Kahneman 1999). Nonetheless, Lucas, Clark, Georgellis and Diener (2003) report evidence showing that there are significant individual differences in the extent to which individuals adapt back to their baseline level (or reference point). They find that years after a loss or a traumatic event, some people do not rebound to how satisfied they felt about their life, prior to the event. That is, they do not accept the occurrence of the event and its consequences over time. Adaptation to financial losses resembles acceptance. Since there are individual differences in terms of accepting events in life, it is not surprising that in the financial domain some investors adapt more/faster to financial gains and losses than the others (Arkes et al. 2008; Lee et al. 2009). However, the specific individual differences that are related to reference point adaptation have not been researched previously.

In terms of how individual differences affect other aspects of financial decision-making, several antecedents have been tested previously. For instance, Dhar and Zhu (2006) find that investors with higher educational levels and professional occupations are less likely to exhibit the disposition effect. Grinblatt, Keloharju and Linnainmaa (2009) suggest that investors with a high IQ outperform those with a below average IQ. While individual differences such as age, gender, income, intelligence, etc have been tested or controlled for in these prior studies, the effects of personality on investment have not been examined. We propose that the Big Five model of personality provides a useful context for assessing individual differences in adaptation to financial losses. Many studies in the coping literature are based on this model (for example, Bishop et al. 2001; David and Suls 1999). Since we build our hypotheses upon the findings in the coping literature, we also make use of the Big Five model of to hypothesize individual differences in adaptation to financial losses.

The Big Five traits are commonly labeled as: (1) Extraversion (or Surgency); (2) Agreeableness; (3) Conscientiousness (or Dependability); (4) Emotional Stability (vs.

Neuroticism); and (5) Intellect or Openness to Experience, Culture (Goldberg 1992)¹. These traits are rooted in biological structure and processes (McCrae et al. 2000). The Big Five traits are the five main dimensions of personality. In each dimension various characteristics are included, as will be discussed below. A recent meta-analysis study by Connor-Smith and Flachsbart (2007) indicates that the Big Five personality traits predict the use of different coping strategies by individuals. As there seem to be strong similarities between the coping strategy acceptance and adaptation to financial gains/losses, we focus our discussion on the literature of the Big Five personality traits and acceptance, and propose hypotheses.

Extraversion includes positive affectivity, sociability, assertiveness and sensitivity to reward (McCrae and John 1992; Rothbart and Bates 1998). Individuals scoring high on extraversion tend to be energetic, cheerful, and optimistic, and they tend to view stressful situations as challenges (Gallagher 1990). Being energetic and optimistic should facilitate the use of engagement strategies such as cognitive restructuring, problem solving, seeking support, etc. David and Suls (1999) also suggest that those who score higher on extraversion should rely more on active, problem-focused coping strategies because of their tendency to see problems as challenges. As an exception, Bishop et al. (2001) have found that extraversion to be positively related to acceptance, which is not an active coping strategy (Connor-Smith and Flachsbart 2007). In sum, most of the reported empirical research suggests extraversion primarily affects the likelihood to engage in coping strategies other than acceptance. Thus, we expect no relation between extraversion and reference point adaptation/acceptance, i.e.:

H1: Extraversion does not affect adaptation to financial losses.

¹ There are two dominant labels of the Factor V in five-factor models of personality: Openness to Experience versus Intellect. Goldberg (1994) suggests that in the Five Factor Model of genotypic personality dispositions, Factor V can be interpreted as Openness to Experience. However, in the Big Five model of phenotypic personality-trait, Factor V is better labeled as Intellect or Imagination.

Agreeableness includes characteristics such as trust, altruism, and compliance (McCrae and John 1992). This dimension largely reflects interpersonal tendencies. Individuals scoring high on agreeableness tend to have a more extensive social support network from which they can seek support when stressors are encountered. Since agreeableness relates to compliance, individuals scoring higher on agreeableness are more likely to accept the current situation (Costa, Somerfield, and McCrae 1996). Bishop et al. (2001) find that agreeableness is positively related to the use of acceptance as a coping strategy. In the financial domain, we expect that if the price of the investment has decreased, people who score high on agreeableness are more likely to accept the current situation, i.e.:

H2: Agreeableness has a positive relation with adaptation to financial losses.

Conscientiousness includes characteristics such as high levels of self-regulation, persistence, impulse control, achievement orientation, and self-discipline (McCrae and John 1992). Conscientiousness represents the general tendency to be strong-willed, and determined. Conscientious individuals are careful planners and engage in active coping strategies when a stressor is encountered. Individuals scoring high on conscientiousness have strong control over their own attention; they are able to stay focused on tasks, regardless whether the tasks are enjoyable or not. This high attention span and persistence enables individuals to engage in various coping strategies, which leads to a smaller probability that acceptance is chosen above other coping strategies. Moreover, individuals scoring high on conscientiousness have high levels of persistence and achievement orientation, they may hold on to their expectations and previously set goals and refuse to accept anything less (McCrae and John 1992). This may lead to a negative relation between conscientiousness and adaptation to financial losses.

H3: Conscientiousness has a negative relation with adaptation to financial losses.

Neuroticism (vs. emotional stability) reflects one's general tendency to experience negative affective states. *Neuroticism* includes characteristics such as negative affectivity, self-consciousness, physiological reactivity, and behavioral inhibition (McCrae and John 1992; Miles and Hempel 2003; Rothbart and Bates 1998). *Neuroticism* includes intense emotions and strong responses to stress. Individuals scoring high on *neuroticism* experience a high level of unpleasant arousal, when facing stressful events. To avoid feeling unpleasant, they are likely to use coping strategies that help disengaging themselves from the stressful events, such as avoidance, withdrawal, venting emotions, etc (Connor-Smith and Flachsbart 2007). As these means of coping are more likely to be used by individuals scoring high on *neuroticism*, acceptance becomes a strategy that is less likely to be chosen. Thus, we expect a negative relation between *neuroticism* and reference point adaptation. Since *neuroticism* is opposite to *emotional stability*, we expect a positive relation between *emotional stability* and reference point adaptation:

H4: Emotions Stability has a positive relation with adaptation to financial losses.

*Intellect, also often referred as Openness to experience*¹, represents the tendency to be creative and to engage in divergent thinking. *Openness to experience/ intellect* includes creativity, curiosity, flexibility, imagination, and intellectual interests (McCrae and John 1992). Since individuals scoring high on *intellect* are more flexible and creative, they may try a number of coping strategies until they find one that suits the demands of the stressful situation. Furthermore, Bishop et al. (2001) find that *openness to experience* is positively related to positive reinterpretation and acceptance. People who score high on *openness to experience* are more likely to take new perspectives and look into new events from various angles. They may be more likely to perceive a paper loss as expectable or less surprising when other external factors, such as market turbulence, economics and political factors, etc, are under consideration. Thus, they are expected to be more likely to accept the new financial

situations and the updated price of an investment, that is, they are more likely to accept their paper losses. Therefore, we expect a positive relation between openness to experience and reference point adaptation.

H5: Intellect has a positive relation with adaptation to financial losses.

3.4 Empirical Study

3.4.1 Subjects

A total of 229 undergraduate students (132 male, 93 female, 4 non-responses) from a university in The Netherlands participated in this study. Questionnaires were filled in during a class that is part of an undergraduate course in marketing for the Business Program. The average age of participants is 21.67 years (SD=2.38). Each participant voluntarily filled out the questionnaire to enter a lottery of cash rewards, a total of 500 EUR was paid.

3.4.2 Personality Measures

There are various measures for the Big Five factors. The more commonly used ones are: the Eysenck Personality Questionnaire (EPQ-R) (Eysenck, Eysenck, and Barrett 1985) and the NEO Five-Factor Inventory (NEO-FFI) (Costa and McCrae 1992). Among these Big Five personality traits, openness (also referred to as openness to experience, intellect, culture) is least consistent across measures (John and Srivastava 1999). Several authors have criticized the reliability of the scores of openness in NEO scales across studies (Caruso 2000), and the validity of openness as a personality trait (Goldberg 1994). To overcome problematic measurement of openness within the NEO scales, we use another relatively new personality inventory the International Personality Item Pool - IPIP (Goldberg 1992) to measure personality (Theakston et al. 2004; Heaven and Bucci 2001). Gow, Whiteman, Pattie, and Deary (2005) find that Emotional Stability, Extraversion and Conscientiousness

scales of the IPIP were highly correlated with those of the NEO-FFI, while Agreeableness and Intellect/Openness scales correlated less strongly. They conclude that the IPIP scales have good internal consistency and relate strongly to major dimensions of personality assessed by NEO Five Factor Inventory (NEO-FFI) developed by Costa and McCrae (1992) and Eysenck Personality Questionnaire-Revised Short Form (EPQ-R) developed by Eysenck, Eysenck and Barrett (1985).

We used the 50-Item set of IPIP Big Five factor markers (Goldberg 1992); each of the five domains was measured by 10 items rated on a 5-point scale (1=very inaccurate, 5= very accurate). About half of the items in each domain are negatively scored. Examples of the items include: am the life of the party (measuring *Extraversion*), am interested in people (measuring *Agreeableness*), am always prepared (measuring *Conscientiousness*), get stressed out easily (measuring *Emotional Stability*), have a rich vocabulary (measuring *Intellect*). We calculate the mean score for each of the five traits. The IPIP scale has good internal consistency. The Cronbach's alphas of the Big Five personality traits obtained in our study are: Extraversion = .86, Agreeableness = .72, Conscientiousness = .75, Emotional Stability = .79, Intellect = .74. Reliability of the IPIP items for each of the five traits obtained in this study is consistent with previous studies².

3.4.3 Adaptation Measures

We adopt the reference point adaptation measures used in study 1 in the paper of Arkes et al. (2008). While our focus is on adaptation in the domain of loss, we also included the domain of gain for comparison purposes. By random assignment, participants were presented either with a gain (N=118) or a loss (N=111) scenario. In both scenarios participants were told that they had bought a stock for \$30 per share two months ago. The

² For example, the Cronbach's alpha obtained in the student sample of Gow et al. (2005) for Extraversion, Agreeableness, Conscientiousness, Emotional Stability, Intellect are .87, .72, .80, .85, and .77 respectively.

price of the stock decreased (increased) to \$24 (\$36) last month. Participants were asked to fill out what stock price today would make them feel equally sad (happy) as the previous loss (gain). With this question, participants were in fact asked to report what the stock price has to be today to generate the same utility as the previous gain or loss. In the loss domain, if one does not adapt to the previous loss at all, then the stock price at \$24 per share today would generate the same negative utility. If one does adapt to the loss, then we expect the equally sad price to be under \$24. For the gain domain not adapting implies one would be equally happy if the price of the stock remains to be \$36. To calculate the adaptation of reference point, Arkes et al. (2008) proposed an equality, which we also used to calculate adaptation in this study. Assume that the previous reference point is R_0 and the previous stock price is defined as P_1 . Furthermore, the shape of the prospect theory value function is held constant and the difference between R_0 and P_1 is the same as the difference between the equally happy/sad price (P^*) and the adapted reference point (R^*).

$$P^* - R^* = P_1 - R_0 \rightarrow \Delta R = R^* - R_0 = P^* - P_1 \quad (1)$$

For the loss domain in our study, participants on average think that a second loss to \$21.26 would make them feel as sad as the previous loss from \$30 to \$24. For the gain domain in our study, participants on average believe that a second gain to \$40.14 would make them feel equally happy as the first gain from \$30 to \$36. These answers are extremely close to those obtained in study 1 of Arkes et al. (2008) (\$40.24 for winning investments and 21.49 for loser). Equation (1) implies that the value obtained from the second gain ($\$40.14 - R^*$) is the same as the value of the first gain ($\$36 - R_0$). Thus, on average participants in the gain domain have adapted \$4.14 upwards ($\$40.14 - R^* = 36 - R_0 \rightarrow \Delta R = R^* - R_0 = \$40.14 - \$36$) after the first gain. In the loss domain, on average participants have adapted \$2.74 downwards ($\$21.26 - \24). Participants have adapted to a greater extent in the gain domain than in the loss domain, which is also consistent with Arkes et al. (2008).

3.5 Results

We calculated the participants' scores on the Big Five personality traits, by taking the means of the item-scores for each trait, as the Cronbach's Alpha in each scale was sufficiently high, see Section 3.4.2. Multivariate linear regression analysis was conducted to assess the effects of these mean scores on the extent of adaptation in the loss and gain domains. Results indicate that in the loss domain, higher scores on agreeableness ($\beta = .245$, $t(109) = 2.73$, $p = .007$) and intellect ($\beta = .318$, $t(109) = 3.26$, $p = .001$), and lower score on conscientiousness ($\beta = -.210$, $t(109) = -2.22$, $p = .028$) are related to a greater extent of adaptation to loss. The effect of extraversion ($\beta = -.173$, $t(109) = 1.79$, $p = .076$) on adaptation is marginally insignificant and emotional stability does not affect adaptation to financial losses ($\beta = -.040$, $t(109) = -.436$, $p = .664$). In this analysis, R-square equals .16, $F(5, 105) = 4.010$, $p = .002$.

We ran a similar multivariate linear regression of personality on adaptation in the gain domain to provide a comparison. In the gain domain, none of the scores are significantly related to the extent of adaptation to gains, for agreeableness $\beta = -.075$ ($t(115) = -.786$, $p = .434$), for intellect $\beta = -.093$ ($t(115) = -.957$, $p = .341$), for extraversion $\beta = -.018$ ($t(115) = -.186$, $p = .853$), for conscientiousness $\beta = -.131$ ($t(115) = -1.38$, $p = .170$), and for emotional stability $\beta = -.045$, ($t(115) = -.471$, $p = .639$). In this analysis, R-square equals .04, $F(5, 111) = .937$, $p = .460$. These results are summarized in Table 3.1.

Table 3.1

Effects of Big Five personality traits on adaptation to losses and gains

	Extent of Adaptation (Beta)			
	Domain of	Domain of	Domain of	Domain of
	Loss	Gain	Loss	Gain
Big Five				
personality traits				
Extraversion	-0.173	-0.018	-0.168	-0.004
Agreeableness	0.245**	-0.075	0.230*	-0.049
Conscientiousness	-0.210*	-0.131	-0.216*	-0.113
Emotional Stability	-0.040	-0.045	-0.042	-0.061
Intellect	0.318**	-0.093	0.310**	-0.106
Controls				
Sex			-0.005	-0.071
Age			0.042	-0.027
R²	0.160	0.040	0.160	0.039

Notes: * $p < .05$. ** $p < .01$.

As hypothesized, higher scores on agreeableness and intellect, and lower scores on conscientiousness lead to more adaptation to losses. Furthermore, extraversion does not significantly affect adaptation to financial losses. Thus, hypotheses 1, 2, 3 and 5 received support respectively. Emotional stability is not linked to adaptation to loss, so hypothesis 4 was not supported. Another finding is that personality is only relevant for adaptation to financial losses and not for adaptation to gains. Our results remain robust after controlling for individual differences such as sex and age.

3.6 Conclusion and Discussion

The behavioral finance literature has demonstrated that risk aversion, loss aversion, mental accounting (Kahneman and Tversky 1979; Shefrin and Staman 1985; Thaler 1985; Thaler and Johnson 1990), education level, professional occupations (Dhar and Zhu 2006) and IQ (Grinblatt, Keloharju, and Linnainmaa 2009) can all affect individuals' decisions. Our results support previous studies (Dhar and Zhu 2006; Grinblatt, Keloharju, and Linnainmaa 2009) that heterogeneity among individuals can explain the variance in their financial decisions. We extend the literature by researching beyond the conventional socio-economical, demographical factors and cognitive capabilities, and test how personality traits relate to adaptation to losses. While our results confirm previous findings that individuals adapt faster to gains than to losses (Arkes et al. 2008), we also show that there is a link between personality and adaptation. With the use of a questionnaire, we find that individuals who score higher on *agreeableness* and *intellect*, and lower on *conscientiousness* adapt to losses to a larger extent. The Big Five personality traits, on the contrary, do not have significant impact on adaptation to gains. Thus, personality is influential when one is adapting to negative events, for example, financial losses, but not when one is facing positive events. The latter is a topic that can be investigated in other domains.

The results of this study, together with the results of previous studies that investigated investor heterogeneity (Dhar and Zhu 2006; Grinblatt, Keloharju, and Linnainmaa 2009), may have implications for the design of investment education programs that frequently focused on cognitive skills, such as understanding risks and returns. If personality traits affect adaptation to financial losses, investment education programs may teach investors about how their disposition traits in personality may affect their trading decisions.

In this study, we have focused on personality and have excluded other potentially relevant individual differences. Further investigation is needed to increase our understanding

of the explanatory power of heterogeneity among individuals on adaptation to financial losses and subsequent effects on financial decisions. Future research should explore other potential variables that may explain the variance in adaptation of the reference point, such as self-esteem, type-A personality. Our results may also link to the study of subjective well-being. Our results suggest that personality may affect how individuals adapt to the economic environment and how they perceive their subjective well-being. Greater knowledge of how variables measuring individual differences are related to adaptation to financial losses can increase our understanding of retail investors' decision-making processes.

Our results also lead to a more general suggestion for further research. Adaptation to gains and losses is important for gaining understanding into investment decisions in a dynamic setting. It has been found that adaptation to prior gains or losses affect subjective value of attached to subsequent trading options, which eventually affect investors' investment decisions. More specifically, Lee et al. (2009) found that adapted reference point interacts with expectation and affects investors' decisions to hold or to sell a losing investment. In this chapter, we find that individuals' personality traits affect their extent of adaptation, implying that personality traits should be taken into account in economic models as well.

Appendix 3A: The 50-Item Set of IPIP Big-Five Factor Markers

How Accurately Can You Describe Yourself?

Describe yourself as you generally are now, not as you wish to be in the future. Describe yourself as you honestly see yourself, in relation to other people you know of the same sex as you are, and roughly your same age. So that you can describe yourself in an honest manner, your responses will be kept in absolute confidence. Indicate for each statement whether it is 1. Very Inaccurate, 2. Moderately Inaccurate, 3. Neither Accurate Nor Inaccurate, 4. Moderately Accurate, or 5. Very Accurate as a description of you.

	Very Inaccurate	Moderately Inaccurate	Neither Accurate Nor Inaccurate	Moderately Accurate	Very Accurate	
1. Am the life of the party.	O	O	O	O	O	(1+)
2. Feel little concern for others.	O	O	O	O	O	(2-)
3. Am always prepared.	O	O	O	O	O	(3+)
4. Get stressed out easily.	O	O	O	O	O	(4-)
5. Have a rich vocabulary.	O	O	O	O	O	(5+)
6. Don't talk a lot.	O	O	O	O	O	(1-)
7. Am interested in people.	O	O	O	O	O	(2+)
8. Leave my belongings around.	O	O	O	O	O	(3-)
9. Am relaxed most of the time.	O	O	O	O	O	(4+)

10. Have difficulty understanding abstract ideas.	0	0	0	0	0	(5-)
11. Feel comfortable around people.	0	0	0	0	0	(1+)
12. Insult people.	0	0	0	0	0	(2-)
13. Pay attention to details.	0	0	0	0	0	(3+)
14. Worry about things.	0	0	0	0	0	(4-)
15. Have a vivid imagination.	0	0	0	0	0	(5+)
16. Keep in the background.	0	0	0	0	0	(1-)
17. Sympathize with others' feelings.	0	0	0	0	0	(2+)
18. Make a mess of things.	0	0	0	0	0	(3-)
19. Seldom feel blue.	0	0	0	0	0	(4+)
20. Am not interested in abstract ideas.	0	0	0	0	0	(5-)
21. Start conversations.	0	0	0	0	0	(1+)
22. Am not interested in other people's problems.	0	0	0	0	0	(2-)
23. Get chores done right away.	0	0	0	0	0	(3+)
24. Am easily disturbed.	0	0	0	0	0	(4-)
25. Have excellent ideas.	0	0	0	0	0	(5+)
26. Have little to say.	0	0	0	0	0	(1-)
27. Have a soft heart.	0	0	0	0	0	(2+)

28. Often forget to put things back in their proper place.	O	O	O	O	O	(3-)
29. Get upset easily.	O	O	O	O	O	(4-)
30. Do not have a good imagination.	O	O	O	O	O	(5-)
31. Talk to a lot of different people at parties.	O	O	O	O	O	(1+)
32. Am not really interested in others.	O	O	O	O	O	(2-)
33. Like order.	O	O	O	O	O	(3+)
34. Change my mood a lot.	O	O	O	O	O	(4-)
35. Am quick to understand things.	O	O	O	O	O	(5+)
36. Don't like to draw attention to myself.	O	O	O	O	O	(1-)
37. Take time out for others.	O	O	O	O	O	(2+)
38. Shirk my duties.	O	O	O	O	O	(3-)
39. Have frequent mood swings.	O	O	O	O	O	(4-)
40. Use difficult words.	O	O	O	O	O	(5+)
41. Don't mind being the center of attention.	O	O	O	O	O	(1+)
42. Feel others' emotions.	O	O	O	O	O	(2+)
43. Follow a schedule.	O	O	O	O	O	(3+)
44. Get irritated easily.	O	O	O	O	O	(4-)

45. Spend time reflecting on things.	<input type="radio"/>	(5+)				
46. Am quiet around strangers.	<input type="radio"/>	(1-)				
47. Make people feel at ease.	<input type="radio"/>	(2+)				
48. Am exacting in my work.	<input type="radio"/>	(3+)				
49. Often feel blue.	<input type="radio"/>	(4-)				
50. Am full of ideas.	<input type="radio"/>	(5+)				

Notes. The numbers in parentheses after each item indicate the scale on which that item is scored (i.e., of the five factors: (1) Extraversion, (2) Agreeableness, (3) Conscientiousness, (4) Emotional Stability, or (5) Intellect/Imagination) and its direction of scoring (+ or -). These numbers should not be included in the actual survey questionnaire.

Source: http://ipip.ori.org/New_IPIP-50-item-scale.htm

CHAPTER 4:

The Effect of Anticipated and Experienced Regret and Pride on Investors' Future Selling Decisions

4.1 Abstract

This chapter investigates the effect of two emotions, regret and pride, on individual investors' decisions to hold or sell a winning or losing investment, in the form of the disposition effect. The results suggest that regret and pride can predict hold/sell decisions, beyond the effect of general valence. In the loss domain, high experienced and low anticipated regret predict a greater probability of selling a losing investment. In the gain domain, only experienced pride, not anticipated pride, indicates a greater probability of selling a winning investment. The authors discuss the implications of these findings and possible avenues for further research.

4.2 Introduction

Individual investors' decisions to hold or sell an investment may depend on their emotions. For example, regret and pride may explain the occurrence of the disposition effect, by which people tend to hold losing investments (losers) too long and sell winning investments (winners) too early (Shefrin and Statman 1985). Evidence of the disposition effect has been reported in a number of studies employing various methodologies. It has been confirmed by laboratory and online experiments (Weber and Camerer 1998; Lee et al. 2008), and by the trading records of individual investors and professional traders (Odean 1998; Garvey and Murphy 2004). It often leads to inappropriate financial decision making, resulting in losses for both individual investors and firms (Dhar and Zhu 2006). To explain the disposition effect, Dhar and Zhu (2006) assess the effects of individual differences, and Muermann and Volkman (2007) develop a theoretical portfolio choice model that incorporates anticipated regret and pride. Their model reflects Shefrin and Statman's (1985) proposal that investors may take pride in their ability to make profits through their investments, which implies they would be likely to sell winners. However, when selling a loser, their ex-post knowledge suggests that a forgone alternative decision would have resulted in more desirable outcomes, so to avoid this form of regret, investors hold on to their losers (Shefrin and Statman 1985). Although the roles of anticipated regret and pride were proposed, the roles of experienced regret and pride are neglected.

Empirical evidence shows that investors must feel responsible for their buying or selling decisions to feel regret or pride in their decisions, which ultimately leads to the disposition effect. However the roles of regret and pride were theoretically asserted instead of directly tested (Summers and Duxbury 2007). Furthermore, although previous investment decisions and thoughts of counterfactual alternatives influence people's subsequently

experienced satisfaction/regret, there is a missing link between experienced emotions and future investment decisions (O'Curry Fogel and Berry 2006).

Despite the recent research efforts, three issues thus remain unaddressed. First, the effects of anticipated regret and pride on investors' hold/sell decisions have not been tested directly. Second, though Shefrin and Statman (1985) propose the disposition effect results from anticipated regret and pride, the investment process actually consists of a chain of decisions. In addition to anticipating emotions that they may feel after future decisions, investors may experience emotional feedback from previous decisions. We therefore address, for the first time, the relevance of emotional feedback for the disposition effect. This investigation complements previous studies of other consumer consequences, such as switching behavior, complaints, repurchase intentions, loyalty, word of mouth, and customer satisfaction, which show that emotions experienced as a result of previous decisions affect subsequent attitudes and behavior (Chitturi, Raghunathan, and Mahajan 2008; Hennig-Thurau et al. 2006; Zeelenberg and Pieters 2004).

Third, recent developments in emotions research highlight the importance of specific emotions (e.g., regret, pride) compared with overall valence-based emotions (e.g., good/bad, satisfaction/dissatisfaction) (DeSteno et al. 2000; Lerner and Keltner 2000). Whereas general valence is an overall judgment of (dis)satisfaction that results from all negative and positive emotions, the specific emotions approach focuses on the idiosyncratic element of each emotion, which might be negative or positive, including its antecedents, appraisal, and behaviorally induced responses (DeSteno et al. 2000). Because Shefrin and Statman (1985) do not specify why they choose specific emotions rather than general valence, it remains unclear which approach will be relevant for the decision to sell losing/winning investments. This issue is also relevant for a more general discussion, in that general valence is still widely used. For example, Hennig-Thurau et al. (2006) test the role of positive affect, and

(dis)satisfaction commonly appears as a predictor of consumer intentions and behavior (see Chitturi, Raghunathan, and Mahajan 2008; Oliver 1980). Most importantly, previous studies only focused on testing either the effect of anticipated emotions or experienced emotions on consumers' decisions; we contribute to the literature by providing the first test of how anticipated and experienced emotions simultaneously affect subsequent decisions in a dynamic setting.

The reason for focusing our investigation on two specific emotions, regret and pride, is that they share one important element: *sense of responsibility*. One can only experience regret if one feels responsible for a bad decision that cannot be justified (Pieters and Zeelenberg 2007). Other negative emotions, such as anger and disappointment, can be experienced without the feeling of responsibility, but regret cannot. Pride arises from achievements that can be attributed to one's abilities or efforts (Williams and DeSteno 2008). Thus, pride differs from other positive emotions, such as joy, that pride is also linked to a sense of responsibility for the outcome. Summers and Duxbury (2007) find that the mere experience of gains or losses, without being responsible for the outcome, was not sufficient to generate the disposition effect. In financial modelling, Muermann and Volkman (2007) include preferences of anticipated regret and pride in their choice model to predict the disposition effect. It appears that the sense of responsibility is a prerequisite to predict individuals' subsequent decision. Thus, in order to predict holding or selling decisions in dynamic setting, we identify regret and pride to be important candidates of emotions to investigate, due to their associations with responsibility.

Nevertheless, consumers may experience other emotions apart from pride and regret following financial gains or losses, for example, anger or sadness (Westbrook and Oliver 1991). However, these are secondary emotions that come after primary emotions such as regret (Levine 1996). Since our choice of focusing on regret and pride is based in their

association with one's sense of responsibility, other secondary emotions that do not carry this characteristic are not in the scope of this chapter.

In Section 4.3 we present the conceptual framework. Then in Sections 4.4 and 4.5 we report two experiments. Experiment 1 investigates the effects of anticipated and experienced regret on investors' hold/sell decisions in a loss domain; Experiment 2 tests the effects of anticipated and experienced pride on these decisions in a gain domain. We conclude with an overall discussion of the results, their implications, and possible avenues for further research, in Sections 4.6 and 4.7.

4.3 Conceptual framework

4.3.1 Valence-Based versus Specific Emotions Approach

Psychology and consumer behavior literature provide ample evidence that emotions can influence behavior (for a review, see Bagozzi et al. 2000). Two primary approaches model the effects of emotions on behavior: general valence and specific emotions. The first approach, the valence-based approach, consists of a summation of the positivity and negativity of all the emotions that individuals experience and results in an overall level of (dis)satisfaction. In this approach, negative emotions result in more dissatisfaction, while positive emotions result in more satisfaction. The main merit of the valence-based approach is its parsimony (Zeelenberg and Pieters 2004), that it allows all emotions to be summarized into one variable: (dis)satisfaction. The disadvantage of the valence-based approach is that it does not allow for investigating the specific characteristic of each emotion.

The appraisal theory of emotions (Bagozzi, Gopinath, and Nyer 1999) instead implies that cognitive appraisals of situations play an essential role in the elicitation and differentiation of emotions and resulting behavior. For example, both regret and disappointment are associated with disconfirmed expectations. However, disappointment

implies agency related to circumstances (i.e., undesirable outcome caused by circumstances outside the person's control), whereas regret relates to self-agency (i.e., undesirable outcome caused by the self). Each emotion may result in different action tendencies or readiness (Frijda, Kuipers, and ter Schure 1989). Because regret entails a tendency to blame oneself and attempt to correct previous mistakes, it may result in attempts to undo bad decisions. Disappointment instead involves the tendency to attribute a disconfirmed expectation to circumstances and thus reluctance to make decisions. General valence fails to capture such detailed differences.

There has been research in marketing pointing to the effect of both general valence and specific emotions on the decision to hold or sell losing and winning investments. The reported findings imply specific emotions have idiosyncratic elements, relevant for consumer behavior, which are not always captured by a measure of general valence. Zeelenberg and Pieters (2004) find that regret and disappointment directly affect switching, complaining, and word-of-mouth intentions, after they control for general valence. Tsiras and Mittal (2000) also show that general valence directly influences repurchase and complaint intentions, but regret directly influences repurchase intentions only. In the context of financial decision making, no empirical study has yet tested whether specific emotions, such as regret and pride, are relevant for explaining the sale of losing/winning investments. Prior findings thus lead us to the following hypothesis:

H₁: The effects of specific emotions on hold/sell decisions are distinct from that of valence-based emotion, in domains for which specific emotions are relevant.

4.3.2 Anticipated Regret, Anticipated Pride, and Selling Investments

Anticipated regret. Regret results from counterfactual thinking, that is, a comparison between the obtained outcome and what might have been (Bell 1982; Loomes and Sugden

1982). Regret is found to be a primary negative emotion (Tsiros and Mittal 2000) that it is the second most frequently expressed emotion in daily conversations (Shimanoff 1984). Regret is an important emotion to investigate, not only because it is commonly experienced, but also because it has strong behavioral implications. Various studies in marketing have identified regret as a relevant emotion in consumer decision making (e.g., Simonson 1992; Tsiros and Mittal 2000; Zeelenberg and Pieters 2004). Pieters and Zeelenberg (2007) propose that anticipated regret has a prospective element that signals when decisions may be regrettable; it also contains a retrospective element that looks in the past to guide current decisions.

Shefrin and Statman (1985) propose that investors resist realizing losses, which would imply that ex-post knowledge indicates the forgone alternative decisions would have led to better outcomes. For example, if investors sell an investment at a loss, they not only realize the loss but also experience a feeling of regret associated with their previous non-optimal decision. To avoid this experience of regret, investors tend to postpone selling at a loss. According to Reb's (2008) empirical findings about the role of regret aversion in decision making, the salience of regret increases the length and depth of information search and the amount of time before a decision. Lemon, White, and Winer (2002) reveal that consumers who anticipate regret, in the context of dropping an ongoing service provider, are less likely to discontinue the service relationship. Because this type of decision strongly resembles investors' sale decisions, we expect that anticipated regret also affects investors' hold/sell decisions.

In addition, action can lead to more regret than inaction, according to the action effect (Gilovich and Medvec 1995), and from the moment investors initially invest in the product, holding their investment is a decision not to act, or inaction. Selling requires the decision to change the status quo, that is, action. Therefore, selling (action) should produce more regret

compared with holding (inaction), given a constant outcome³. In order to avoid anticipated regret; investors tend to hold losing investment.

H_{2a}: In the loss domain, greater anticipated regret leads to a lesser selling probability.

Anticipated pride. Pride is a positive emotion resulting from achievement, attributed to one's effort or abilities, and it is intrinsically linked to self esteem (Tracy and Robin 2007). Anticipated pride is found to be related to task preference (Trope 1980), self control/ impulse control (MacInnis and Patrick 2006; Patrick, Chun and MacInnis 2009) and brand choices (Simonson 1989) in non-risky settings. In addition, anticipated pride is suggested to be a determinant on consumers' ethical purchasing behavior (Angus-Leppan and Owen 2005). In risky domains, however, there is a gap in the literature regarding a relation between anticipated pride and decisions. While pride has received increasing research efforts in the psychology literature recently (Fredrickson 2001; Tracy and Robins 2007; Williams and DeSteno 2008), anticipated pride is an understudied topic, especially in terms of how it may affect risky or financial decisions. There are, nevertheless, evidences demonstrating the effects of general anticipated feelings on risky decisions. In a non-financial risk domain, anticipated feelings are found to reduce the practice of unsafe sex (Richard, van der Pligt and de Vries 1996). Anticipated feelings also affect individuals' gambling choices in the framework of subjective expected pleasure theory (Mellers and McGraw 2001). The subjective expected pleasure theory proposes that individuals anticipate pleasure for future outcomes of each decision option. Then they weigh each anticipated pleasure by the

³ This interpretation of action and inaction is novel in financial decision making literature. Weber and Camerer (1998) reverse the "selling equals action, holding equals inaction" associations by using an "automatic selling" procedure in their experiment: After each investment period, the stock would be sold automatically. With this procedure, the regret associated with action (sell) declines; participants in their study faced a different set of options: to repurchase or not to repurchase the investment. In this case, repurchase (hold) is the "action" option, and not to repurchase (sell) is the "inaction" option. Their reversal also may have diminished the anticipated regret associated with selling a losing investment, hence their finding that the disposition effect was greatly reduced.

corresponding subjective expectation that an outcome will occur. Finally, the decision option with the highest anticipated pleasure is chosen. This framework deals with anticipated pleasure, which is more of a valence-based than a specific emotion approach. Nonetheless, the arguments underlying this framework may also apply to anticipated pride, that the decision option associated with the highest anticipated pride is expected to be chosen.

Pride was suggested to be the counterpart of regret, in explaining the disposition effect (Shefrin and Statman 1985). Investors are expected to take pride in their sale of a winning investment, because they regard the realized gain as proof they have made good decisions. In order to obtain this sense of anticipated pride, investors have to sell the winners. Thus, anticipated pride is proposed to result in a desire to sell winning investments too soon (Shefrin and Statman 1985). However, this proposition has not been tested directly. Summers and Duxbury (2007) have manipulated the presence of responsibility in their study, but anticipated emotions were not measured explicitly. Although feeling responsible for a decision is a prerequisite for feeling regret or pride, it may not automatically lead to these emotions, thus their study did not provide direct support for the proposed effect of anticipated pride on selling tendency. In the preference model by Muermann and Volkman (2006), they provide mathematical proof that by incorporating anticipated pride and regret in individuals' preferences, investors exhibit trading behavior consistent with the disposition effect. However, the support from this paper is theoretical instead of empirical.

We aim to provide the first empirical testing on the proposition by Shefrin and Statman (1985). Since the feeling of pride is linked to self esteem, when investors sell winning investment, they would feel good about their prior purchase/ holding decision and have a boost in their self esteem. As such, anticipated pride is expected to motivate investors to sell winning investment:

H_{2b}: In the gain domain, greater anticipated pride leads to a greater selling probability.

4.3.3 Experienced Regret, Experienced Pride, and Selling Investments

Experienced regret. Regret regulation theory suggests regret is based on past decisions (experienced) and possible future decisions (anticipated). Furthermore, Pieters and Zeelenberg (2007) propose experienced regret has a retrospective element that informs decision makers about the level of their goal achievement. It strongly depends on prior outcomes (Bagozzi et al. 2000), and it contains a prospective element that shapes subsequent behavior. For instance, marketing literature has shown that experienced regret affects consumers' subsequent repurchase intention, word-of-mouth, switching decisions (Chitturi, Raghunathan, and Mahajan 2008; Zeelenberg and Pieters 2004).

Investing generally involves a chain of decisions, such that regret could be experienced after each decision. We argue that in such dynamic conditions, the probability of holding losing investments decreases as the level of experienced regret increases. Hart and Mas-Colell (2000) propose an adaptive procedure, known as regret matching, such that in a repeated game, players change their current strategy, at probabilities proportional to the regret experienced by not using other strategies previously. Their formulation focuses on how experienced regret that results from a known outcome in the past can predict subsequent choices. In each period, players either persist in using the same strategy or change their strategy. The probabilities of changes are proportional to how much higher the accumulated payoff would have been if the participants had previously changed their strategy. To adapt this finding to decisions involving losing investments, we let U_h be the total payoff resulting from a previous decision h (i.e., hold the investment) and U_s be the forgone payoff of the decision s (i.e., sell the investment). Then, $U_h - U_s$ indicates the level of experienced regret of

having chosen h instead of s , given $U_h > U_s$. Larger differences imply higher levels of experienced regret. Empirical findings support this regret-matching proposition: Consumers who experience more regret tend to change their behavior, such as switching products or service providers (Ratner and Herbst 2005; Zeelenberg and Pieters 2004), or express lower repurchase intentions (Tsiros and Mittal 2000). We argue that switching suppliers or eliminating repurchase intentions resembles selling an investment and hypothesize:

H_{3a}: In the loss domain, greater experienced regret leads to a greater selling probability.

Experienced pride. Shefrin and Statman (1985) also propose that pride motivates investors; specifically, anticipated pride pushes investors to sell winners, because they know they will experience pride when they do so. Because investing involves a chain of decisions, we assume investors not only anticipate pride before selling but may already have experienced pride resulting from previous decisions about a winner.

Despite increasing research into pride in the past few years (Fredrickson 2001; Tracy and Robins 2007; Williams and DeSteno 2008), we still know little about its effects on financial decision making. Fredrickson (2001) suggests pride increases people's scope of attention and broadens their action repertoires, enabling them to obtain greater achievements. Thus, consumers may be more likely to search for alternatives and less likely to continue their relationship with their current product or service providers. Pride also is linked to a sense of autonomy/self-agency, that people attribute positive outcomes to their own abilities and efforts (Williams and DeSteno 2008). They believe the positive outcome is independent of the chosen product/service provider, so their repurchase likelihood declines. Therefore, contrary to the common assumption that positive emotions (e.g. satisfaction) are linked to stronger repurchase intention, feeling of pride can decrease consumers' repurchase intention

(Louro, Pieters, and Zeelenberg 2005). In a financial setting, repurchase intention is similar to intention to hold winning investment. Therefore, in an investment context, we hypothesize:

H_{3b}: In the gain domain, greater experienced pride leads to a greater selling probability.

Together H_{3a} and H_{3b} imply that extreme level of emotions (either regret or pride) in the experience dimension would motivate individuals to opt out and sell the investments. While the experience of regret motivates individuals to “make things right”, the experience of pride motivates individuals to search for alternatives. Both experiences of these emotions lead to a stronger tendency to change the status quo from hold to sell.

Up till this point we have proposed that regret is relevant for predicting selling probabilities in the loss domain, while pride is relevant for predicting those in the gain domain. However, it is conceivable that regret (pride) may also be relevant for the gain (loss) domain in certain scenarios. For example, one can engage in the following mental exercise: in the loss domain, if one chooses to sell a losing investment now and its price drops further in the next time period, then the decision to sell would prove to be a good judgment as it has prevented further losses. Therefore, one may anticipate pride for this scenario. In the gain domain, it is possible to imagine that if one chooses to sell a winning investment now and the stock price increases further in the future, then the decision to sell would be considered too soon as some gain has been forgone, and one may anticipate regret in this scenario. However, these scenarios are not the main focus of this chapter. As this is the first empirical test of how regret and pride affect selling probabilities, we first focus on testing the effects of these emotions in their most relevant domain (regret for loss, pride for gain). We do, however, include a test of the effect of anticipated pride in the loss domain and anticipated regret in the gain domain in our robustness test. We conducted Experiment 1, focused on the loss domain,

to test H_1 , H_{2a} , and H_{3a} , whereas Experiment 2 focused on the gain domain, tested H_1 , H_{2b} , and H_{3b} .

4.4 Experiment 1: Anticipated and Experienced Emotions in the Loss Domain

4.4.1 *Participants and Procedure*

A total of 66 undergraduate students (40 men, 26 women) from a university in The Netherlands, with an average age of 22.79 years, participated. Their reward for participating depended on the final value of their investment. On average, they received about EUR 4. Participants were assigned to individual cubicles and presented with the study scenario: They recently had started investing in a single stock X. The amount initially invested was predetermined and equal for all participants. We specified up to ten investment periods, in which the stock price declined. To enhance the realism of the price patterns, we eliminated the possibility of long runs of losses. After each period, participants received information about the stock's performance and were asked whether they wanted to hold or sell the whole invested amount. Before each decision, they answered a short questionnaire about their experienced emotions. The experiment ended after participants decided to sell the stock; for those who never chose to sell, the experiment ended after 10 periods.

Previous studies of the disposition effect usually employed a limited number of predetermined price patterns (Lee et al. 2008; Weber and Camerer 1998). We randomly generated a wider range of gains or losses and intermediate price dynamics over the (up to) 10 investment periods to enhance the generalizability of the results. We divided the ten investment periods into three phases; this setting was previously used in Lee et al. (2009). In phase 1, with a random assignment of 5%, 10%, 20%, or 40% losses, participants considered a first decrease in the stock price, which was roughly evenly spread out over the initial 1, 3, or 5 periods. In phase 2, the prices remained relatively stable (up or down stock price

movements of around 1%) for either 2 or 4 periods. In phase 3, participants were exposed to a second negative shock in the stock price of 5%, 10%, or 15%, which took place in 1 period. The experiment then ended. In total then, we used 72 possible general price patterns: 4 (first loss: 5%, 10%, 20%, 40%) \times 3 (first losing period: 1, 3, 5 periods) \times 2 (stable prices: 2, 4 periods) \times 3 (second loss: 5%, 10%, 15%). On average, participants held the losing stock for 5.32 (SD = 2.84) periods. When participants sold the losers, they had incurred an average loss of 18.58% (SD = 13.60).

4.4.2 Measures

The dependent variable in the model was the hold/sell decision; anticipated and experienced regret, as well as (dis)satisfaction, served to predict participants' values for this dichotomous variable. We also included several control variables. We derived the measures of experienced regret from Zeelenberg and Pieters (2004), with two questions: (1) "How good or bad do you judge your decision to hold stock X in the last month?" (1 = "very good," 9 = "very bad") and (2) "How much regret do you feel about holding stock X in the last month?" (1 = "none," 9 = "very much"). We averaged their answers to form an index of regret ($\alpha = .74$). We used a single-item measure for anticipated regret, participants imagined that they had sold the investment and indicated on a nine-point scale (1 = "not at all," 9 = "very much") how much regret they anticipated they would feel as a result. To control for the effect of general valence, we derived measures of (dis)satisfaction from Zeelenberg and Pieters (2004). Using a nine-point scale (1 = "not at all," 9 = "very much"), after each investment period, participants indicated how *bad* and *dissatisfied* they felt; as positive opposites of these items, participants also indicated how *good* and *satisfied* they felt. The

averaged answers to these four items formed an index of (dis)satisfaction, for which larger numbers indicated more dissatisfaction ($\alpha = .91$)⁴.

For the control measures, we adopted the two-item measures of disappointment from Zeelenberg and Pieters (2004): (1) “How much disappointment did you feel about the performance of stock X?” (1 = “none,” 9 = “very much”) and (2) “To what extent was the performance of stock X better or worse than you expected beforehand?” (1 = “much better,” 9 = “much worse”) ($\alpha = .60$). We include disappointment as control because previous literature has identified the major difference between regret and disappointment is that disappointment does not entail a sense of responsibility. With this control measure, we can test our assumption that only specific emotions that are linked to responsibility are relevant in a dynamic investment decision setting. We employed a single-item measure of expectations of future price changes, based on Ayton and Fischer (2004): “How do you think the price of stock X will change in the next period?” (1 = “surely decrease,” 9 = “surely increase”). Finally, after answering all questions for emotions and expectation, participants indicate whether they want to hold or sell the stock at the end of each investment period. To control for individual differences, we included age, sex, field of university studies, risk aversion, and investment experience in financial markets, particularly stocks. We adopted the measure of risk aversion from Holt and Laury (2002), who propose a 10-pair lottery choice decision task. By observing when a respondent switches between paired options, Holt and Laury (2002) suggest they can determine how risk averse the person is.

⁴ The measures of (dis)satisfaction, regret, and disappoint are adapted from Zeelenberg and Pieters (2004), who obtained Cronbach’s alphas of these measures of .908, .937, and .882, respectively, consistent with the alphas of these scales in our data.

4.4.3 Results

We collected 351 decisions (frequency of hold = 308, frequency of sale = 43), in which 65% of the participants sold the losing investment (43 of 66). In order to test whether the relevant specific negative emotions (regret and disappointment) affect the general valence ((dis)satisfaction), we followed Zeelenberg and Pieters's (2004) procedure. We first regressed disappointment and regret on (dis)satisfaction. Disappointment ($\beta = .585, p < .001$) and regret ($\beta = .331, p < .001$) both explained the variance in general valence ($R^2 = .663$). These results are consistent with Zeelenberg and Pieters's (2004).

We also conducted multivariate logistic regression analyses to test the hypotheses. Specifically, we regressed the 351 hold/sell decisions on experienced regret, (dis)satisfaction, disappointment, anticipated regret, and expectation of future performance simultaneously. The inclusion of (dis)satisfaction, anticipated regret and experienced regret is to test H_1 , H_{2a} , and H_{3a} respectively, disappointment and expectation were included in the analysis as control. The parameter estimates, included in Table 4.1 (see Model 1), indicated that higher experienced regret induced a greater sale probability ($B = .398, p = .037$) and higher anticipated regret led to a smaller sale probability ($B = -.204, p = .040$). Higher (dis)satisfaction predicted a smaller probability of selling a loser ($B = -.446, p = .010$), whereas more negative expectation led to a higher selling probability ($B = -.494, p < .001$). Disappointment did not significantly affect the hold/sell decision ($B = .020, p = .916$). The insignificant role of disappointment on probability to sell confirms our expectation that only specific emotions that are associated with a sense of responsibility seem to be relevant for dynamic investment decisions. As expected, we find opposite effects of anticipated and experienced regret on probability to sell losing investment.

Table 4.1

Results of experiment 1 and 2 (Loss and gain domain)

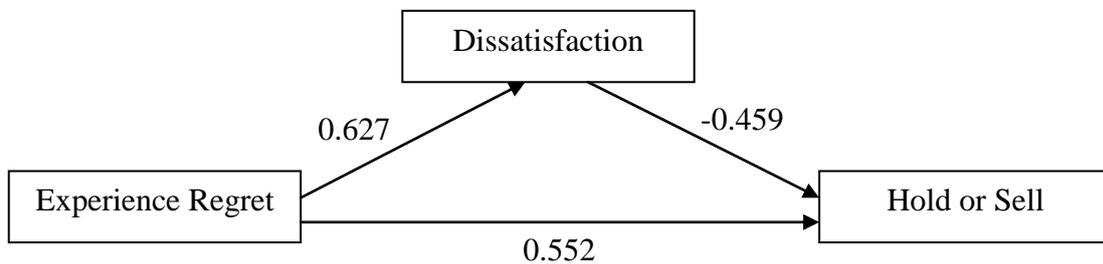
Domain	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
	Loss	Gain	Loss	Gain	Loss	Gain	Loss	Gain
Selling Probabilities (B)								
(Dis)satisfaction	-0.446*	0.174	-0.436*	0.174	-0.440*	0.261	-0.440*	0.231
Experienced regret	0.398*		0.407*		0.403*		0.423*	
Anticipated regret	-0.204*		-0.290**	-0.319**	-0.200*		-0.281*	-0.293**
Experienced pride		0.539***		0.513**		0.606***		0.575***
Anticipated pride		0.014		0.153		0.067		0.192
Disappointment	0.020		0.003		0.047		0.312*	0.027
Expectation	-0.494***	-0.644***	-0.561***	-0.561***	-0.491***	-0.848***	-0.554***	-0.736***
Controls								
Sex					-0.078	1.238*	0.009	1.062*
Age					-0.110	0.110	-0.118	0.135
Risk aversion					0.136	0.110	0.108	0.156
Investment experience (General)					0.577	-0.389	0.635	-0.732
Investment experience (Equity)					-0.683	-1.379	-0.815	-0.990
Business administration studies					0.405	0.087	0.286	-0.331
Cox & Snell R²	0.129	0.202	0.148	0.244	0.139	0.257	0.157	0.285

Notes: * $p < .05$. ** $p < .01$. *** $p < .001$. Risk aversion was measured based on Holt and Laury (2002). Regarding investment experience, participants indicated with a yes/no answer. Although we have participants coming from at least eight fields of studies, they predominantly study within the business administration faculty (108 out of 130). Nevertheless we include a dummy variable to control any possible effect of studying business administration as compared to studying other subjects.

To assess whether the effect of experienced regret is mediated by dissatisfaction, a Sobel test was conducted. Since our dependent variable is dichotomous (hold or sell), we first followed the procedure of MacKinnon and Dwyer (1993) to make the coefficients comparable across equations. Results of the Sobel test indicate that the effect of experienced regret on probability to sell is mediated by dissatisfaction ($z = -3.360, p < .001$).

Figure 4.1

Mediation analysis of experiment 1(loss domain)



In summary, lower anticipated regret and higher experienced regret predicted a higher probability that the participant would sell losing investments. These findings support H_{2a} and H_{3a}, respectively. The effects of anticipated and experienced regret remained significant even after we controlled for the effect of (dis)satisfaction, in support of H₁. Thus, specific emotions, instead of general valence, should be used to predict financial decision making. Although regret explained variance in (dis)satisfaction, the effects of experienced regret and dissatisfaction on the probability of selling losers were opposite: Higher experienced regret motivated investors to sell; higher dissatisfaction motivated them to hold. Therefore, regret should be investigated as a specific emotion, not incorporated into a general valence measure.

4.5 Experiment 2: Anticipated and Experienced Emotions in the Gain Domain

4.5.1 Participants and Procedure

The procedure for Experiment 2 was the same as that for Experiment 1, except that we tested the hypotheses relevant to the gain instead of the loss domain. A total of 64 undergraduate students (40 men, 24 women) from a university in The Netherlands, with an average age of 23.16 years, participated. Their rewards again depended on the final value of their investment; on average, they received about EUR 6.

The price patterns for Experiment 2 were generated with the same random method as in Experiment 1 but represented mirror patterns (i.e., gains instead of losses). On average, participants held the winning stock for 3.34 periods ($SD = 2.18$). When participants sold the winner, they had incurred an average gain of 19.03% ($SD = 14.90$). The large standard deviation reflected the variety of price patterns.

4.5.2 Measures

We used three measures of experienced pride, from Williams and DeSteno (2008). On a nine-point scale (1 = “not at all,” 9 = “very much”), participants indicated how *fulfilled*, *confident*, and *proud* they felt after each investment period. The averaged answers to the three items formed an index of pride ($\alpha = .86$)⁵. As a manipulation check (Williams and DeSteno 2008), participants also answered how well they thought they performed compared with others on the investment task (1 = “much worse,” 9 = “much better”). We used a single-item measure of anticipated pride, in which participants thought about whether they would sell the investment and indicated on a nine-point scale (1 = “not at all,” 9 = “very much”) how much pride they would feel after selling it. We also administered the measures of (dis)satisfaction

⁵ The Cronbach’s alpha of the measure of experienced pride, from Williams and DeSteno (2008), was .81. Of the four items in their measure, we did not adopt *satisfied*, because it overlaps with the valence-based emotion measure.

and the other controls, as in Experiment 1. In the loss domain we include disappointment as a control emotion for regret, in order to establish that the sense of responsibility is important in predicting hold/ sell decisions. The difference of responsibility between disappointment and regret is well supported in the literature. However, such a consensus is not presented for the identification of one single specific emotion that is very similar to pride, but without the sense of responsibility. Therefore we do not include a control emotion for pride.

4.5.3 Results

We collected 214 decisions in the gain domain (frequency of hold = 155, frequency of sale = 59), and 92% of participants eventually sold the winning investment (59 of 64). To discover whether the relevant specific positive emotion (i.e., pride) was a determinant of general valence ((dis)satisfaction), we again followed Zeelenberg and Pieters (2004). The linear regression analysis results showed that pride ($\beta = -.632, p < .001$) explained variance in (dis)satisfaction ($R^2 = .424$).

In the multivariate logistic regression analysis, we regressed the 214 hold/sell decisions on experienced pride, (dis)satisfaction, anticipated pride, and expectation of future performance simultaneously. The inclusion of (dis)satisfaction, anticipated pride and experienced pride is to test H_1 , H_{2b} , and H_{3b} respectively, expectation was included in the analysis as control. The resulting parameter estimates, which we provide in Table 4.1 (see Model 2), indicate that higher experienced pride ($B = .539, p < .001$) entailed a greater sale probability. The effect of (dis)satisfaction on hold/sell decisions about a losing investment proved statistically insignificant ($B = .174, p = .239$). Contrary to our expectations higher anticipated pride did not predict the sale probability ($B = .014, p = .874$), but a more negative expectation related to a higher probability ($B = -.644, p < .001$).

4.6 Discussion

We first compare the overall results in Experiment 1 and 2. As we expected, participants reported more regret and (dis)satisfaction in the loss condition than in the gain condition. The average experienced regret in the loss domain ($M = 5.02$) differed significantly from that in the gain domain ($M = 3.08$, $p < .001$). (Dis)satisfaction in the loss domain ($M = 6.06$) also differed significantly from that in the gain domain ($M = 3.69$, $p < .001$). Participants experienced significantly more pride in the gain domain ($M = 5.07$) than in the loss domain ($M = 3.77$, $p < .001$). With regard to anticipated emotions, participants reported more anticipated regret in the loss domain than in the gain domain and more anticipated pride in the gain domain than in the loss domain. For anticipated regret, $M = 6.48$ in the loss domain, and $M = 5.73$ in the gain domain ($p < .001$), whereas for anticipated pride, $M = 5.15$ in the loss domain, and $M = 5.50$ in the gain domain ($p = .057$). Since the set up of Experiments 1 and 2 are the same except for their domain (losses vs. gains), our results support that regret and pride were the relevant emotions for the loss and gain domains, respectively, consistent with Shefrin and Statman's (1985) propositions. Second, according to our manipulation check, participants in the gain condition believed their performance was better than others' in the investment task. The score on the manipulation check was significantly lower in the loss domain ($M = 4.31$) than in the gain domain ($M = 5.45$, $p < .001$). Third, the findings were consistent with the disposition effect. In Experiment 2, 92% of the participants eventually sold the winning investment, and in Experiment 1, 65% of the participants sold the losing investment.

To validate the logistic regression analyses, we performed six additional multivariate logistic regressions (see Models 3 to 8 in Table 4.1). Models 1 and 2 are based on our theoretical framework, that experienced and anticipated regret (pride) were tested as explanatory variables for selling probabilities in the loss (gain) domain. Models 5 and 6 are

similar to Models 1 and 2 except that control variables were included in these analyses as well. Our results remain robust. In the loss domain, none of the control variables significantly affected the probability of sale. However, we observed a gender effect in the gain domain: Male participants had a stronger tendency to sell winners on average. None of the other controls altered the results significantly.

Models 3 and 4 differ from Models 1 and 2 that they control for the possible effects of anticipated regret in the gain domain and anticipated pride in the loss domain. Our results remain robust that both anticipated and experienced regret are linked to the selling probabilities in the loss domain, and experienced pride has an impact on selling probabilities in the gain domain. And indeed we find evidence that anticipated pride (regret) can be relevant for the loss (gain) domain. Models 7 and 8 are similar to Models 3 and 4, apart from that control variables were included. Again, besides the gender effect in the gain domain, none of the other controls affect our results significantly.

4.7 Conclusion

4.7.1 General Discussion

Previous research considered the roles of anticipated and experienced emotions in decision models (see Anderson 2003), however anticipated and experienced regret/ pride were not measured and tested in the same study. We conducted two experiments to investigate the role of anticipated and experienced specific emotions (i.e., regret and pride) with regard to investors' hold/sell decisions. In Experiment 1, we found that higher experienced regret led to a greater probability of selling a losing investment; in Experiment 2, our results indicated that higher experienced pride predicted a larger probability of selling a winning investment, in support of H_{3a} and H_{3b} . As for anticipated emotions, our results showed that higher anticipated regret led to a lesser probability of selling a losing investment,

but anticipated pride did not significantly affect the sale probability for a winning investment, in support of H_{2a} but not H_{2b} . Thus, with regard to Shefrin and Statman's (1985) propositions that anticipated regret and pride explain the disposition effect, we found support for the former but not the latter claim.

In the loss domain, we hypothesized opposite effects of anticipated and experience regret on selling probabilities in the loss domain, and same direction effect of anticipated and experience pride in the gain domain. We only find support for the former but not the latter because we do not find significant effect of anticipated pride on selling probabilities. Perhaps for pride experience is more important than anticipation, which is not the case for regret. Since it is human nature to avoid pain and seek pleasure, the trade-off between anticipated regret and experienced regret in terms of avoiding pain is very important. It is because when experienced regret becomes sufficiently high, individuals no longer need to avoid pain by holding on loser because they are already experiencing a high level of regret. As such, both anticipated and experienced regret are influential on selling probabilities since they offer the values to make the trade-off. However, in the gain domain both anticipated and experienced pride are related to pleasure seeking. Since the effects of anticipated and experienced pride are not opposite as those of anticipated regret and experienced regret, there is no trade-off effect between anticipated and experienced pride. When facing constant positive outcome, individuals prefer to obtain it soon than later due to time discounting. Thus, what can be experienced now is more important than what is anticipated at a later time point. This may be why experienced pride affects probability to sell winners but anticipated pride does not. Nonetheless, this is an issue for further investigation. Pride is an understudied topic, let alone the anticipation of pride. More research is needed to investigate the relation between anticipated and experienced pride, and how they affect individuals' risky decisions.

In our analysis, (dis)satisfaction did not significantly affect participants' hold/sell decisions in the gain domain, and the effects of both anticipated and experienced regret in the loss domain remained significant when we controlled for (dis)satisfaction. These findings provide support for H₁, because the effects of specific emotions were not completely captured by the valence-based measure. Overall we provide the initial evidence that both anticipated and experienced emotions (anticipated regret, experienced regret, experienced pride and (dis)satisfaction) are influential on investors' decision to hold or to sell in a dynamic setting.

An important issue for future research concerns the conditions under which a valence-based or a specific emotion is more useful in understanding consumer behavior (Bagozzi et al. 2000; Zeelenberg and Pieters 2004). Our results highlight the importance of this issue. In the loss domain, while valence-based emotion (dissatisfaction) leads to less probability to sell, a specific emotion (experienced regret) predicts a larger probability to sell. These opposite effects have not been identified in previous consumer research (Zeelenberg and Pieters 2004). A possible reason for these results is that our results are obtained on a risky and dynamic decision setting. In a riskless setting, when consumers' expectation of a service or products is not met, the poor performance of the product/ service was determined. Consumers then feel regretful and dissatisfied with prior purchase decision, which results in a higher probability to switch provider. However, in the financial market, a losing investment may bounce back in the future. The investment return is not determined until the point where the investment is sold. In such a risky setting, the effects of general valence and specific emotions seem to be different as compared to those in a riskless setting. Further investigation is needed regarding this issue.

The reported results also have several theoretical implications. First, we have provided partial empirical support for the propositions offered by Shefrin and Statman (1985): Anticipated regret causes people to hold on to losers, but anticipated pride does not

seem to cause them to sell winners. In addition, we contribute to the literature by initially testing how anticipated and experienced emotions affect consumers' decision simultaneously. We demonstrate that experienced emotions can explain the disposition effect, together with anticipated emotions. We also acknowledge that investing requires a chain of decisions, so the emotions experienced as a result of prior outcomes should affect investors' decisions. Zeelenberg and colleagues (2002) point out that whereas previous studies have established a relation between specific emotions and corresponding thoughts, action tendencies, and goals (Frijda, Kuipers, and ter Schure 1989), it remains unclear how experienced regret may cause behavior. Studies that attempt to establish this link are rare (Tsiros and Mittal 2000; Zeelenberg and Pieters 2004), but we contribute to current understanding. Our findings show that even before an account is closed at a loss, investors already experience regret, which leads to a larger selling probability. Our empirical evidence has revealed that when experienced regret is high, investors become much more likely to change their investment decision from hold to sell, in support of the theoretical regret-matching procedure (Hart and Mas-Colell 2000).

Our findings are consistent with previous studies; specific emotions have unique effects over and beyond that of general valence in predicting consumer behavior. Yet whereas prior marketing studies on specific emotions versus general valence focus on riskless environments (e.g., Zeelenberg and Pieters 2004), we provide research evidence from a financial investment domain, which inherently includes risky decisions. Finally, we show that emotions play an important role in investment decision making. According to Mellers and McGraw (2001), anticipated emotion improves the predictability of choice, over and beyond that of subjective expected utility theory. We suggest that the predictive power of a financial decision-making model can be improved by the addition of both anticipated and experienced emotions.

Our findings show that experienced emotions can explain the disposition effect. Emotions research reveals that emotions provide feedback based on prior actions and shape subsequent decisions. We thus posit a link between value creation/perception and emotions. Perhaps emotions, whether anticipated or experienced, provide input regarding the value of subsequent options that investors face. Further research should investigate how the implications derived from emotions research can be incorporated into economic theories and models to provide better predictions of investors' financial decisions.

4.7.2 Limitations and Further Research

We note several limitations. First, we conducted our experiments within a short time frame, but in reality, investors often have more time between their receipts of various information about changes in the stock's value. Further research should try to replicate our findings in a (more) natural setting. Second, the generalizability of our study can be questioned, because the participants in our experiments were students who may not represent the general population of investors in terms of their trading experience, income, wealth, risk aversion, and so on. Additional research would benefit from using a larger and more representative sample.

We also researched two specific emotions, regret and pride. Other specific emotions could be considered in the sale of winning or losing investments too; for example, shame and guilt may affect such decisions. Shame and regret are both negative emotions. However, whereas regret relates to counterfactual thoughts about previous decisions/behavior, shame arises when the social self is threatened, in the form of social esteem, status, or acceptance (Dickerson, Gruenewald, and Kemeny 2004). The participants in our experiments knew that their (individual) results would be kept confidential, so the level of social self-threat was relatively low. In practice though, investment performance may be more transparent. For

example, investors may discuss their performance with others and feel reluctant to realize a loss because they would experience shame. They also could experience guilt if their investment decision led to negative outcomes for others (e.g., loss of children's college fund in the stock market). To gain insight into the roles of specific emotions in investment decision making, a broader set of emotions should be investigated in the future.

CHAPTER 5: CONCLUSION

In this dissertation we examine the individual investor's disposition effect from a dynamic perspective, with a focus on investigating the key determinants of investors' capitulation decisions. We propose and experimentally test two explanations for investors' capitulation decision, namely (1) adaptation of the reference point, and (2) anticipated and experienced emotions. Both of these explanations are linked to bounded rationality and they have been suggested as explanations for the disposition effect in the literature. We expect that they may also explain investors' capitulation decisions. In the first part, Chapters 2 and 3, we study how adaptation of the reference point links to investors' capitulation decisions, and how differences in personality affect individuals' adaptation to financial losses. In the second part, Chapter 4, we analyze how anticipated and experienced emotions predict individual investor's selling decisions. In this final chapter we highlight the most important results and implications of each of the previous chapters and discuss how they relate to each other. We conclude with directions for future research.

5.1 Summary of the Main Research Findings

In Chapter 2 we study how individuals eventually come to the decision to capitulate their losing investments. We formulate a conceptual model that integrates prospect theory (Kahneman and Tversky 1979), adaptation level theory (Helson 1964) and expected utility model (e.g. von Neumann and Morgenstern 1944; Harless and Camerer 1994). This dynamic model predicts how the adaptation of reference point affects individuals' subjective values assigned to subsequent price change, which interact with their subjective expectations for future price movements, and eventually affect the individuals' subsequent investment decisions. We contribute to the literature by studying investors' capitulation decision in a

realistic dynamic setting. In accordance with the adaptation level theory by Helson (1964), we show that the larger the size of prior losses and the longer the time spent in a losing position predict a lower adapted reference point. Consistent with standard finance theory, our results indicate that negative expectations lead to a stronger tendency to capitulate a losing investment. More importantly, we find that the level of reference point adaptation and expectation for future price movements have an interaction effect on capitulation probabilities. This means that investors may be reluctant to sell their losing investment at the beginning. However, they adapt to the loss over time, and the extent of adaptation depends on the size of the loss and the time in a losing position. After controlling for the effect of subjective expectation, those investors who adapt little to prior losses are more likely to capitulate the losing investment than those who have adapted more to the prior losses.

Chapter 3 builds upon Chapter 2 and further examines adaptation of the reference point. We explore how personality might explain the differences in individuals' adaptation to losses. With the use of a questionnaire, we measure personality differences with the Big Five model of personality (Bishop et al. 2001; David and Suls 1999). Our findings indicate that individuals who score higher on agreeableness and intellect, and lower on conscientiousness adapt to losses to a larger extent. However, the Big Five personality traits do not have significant impact on adaptation to gains. Our results imply that the relation between personality traits and adaptation is domain-dependent: personality traits only predict adaptation to losses, but not to gains.

In Chapter 4 we test our second proposed explanation for the disposition effect: individual investor's anticipated and experienced emotions. Although anticipated regret and pride have been suggested as explanation for the disposition effect by Shefrin and Statman already in 1985, these emotions have not been tested empirically. Moreover, an individual's investment decision consists of a chain of decisions. Apart from anticipated emotions,

investors also experience emotional feedback from previous decisions. Therefore, to model the effects of emotions on investor's selling decisions in a dynamic setting, it is necessary to take both anticipated and experienced emotions into account. We find that higher experienced regret (pride) leads to a greater probability of selling a losing (winning) investment. As for anticipated emotions, our results indicate that higher anticipated regret leads to a smaller probability to sell a losing investment, but anticipated pride does not affect the probability to sell a winning investment. Thus, with regard to Shefrin and Statman's (1985) proposition that anticipated regret and pride explain the disposition effect, we find empirical support for the former but not the latter. Overall, our results show that emotions, whether experienced or anticipated, are influential on individuals' probabilities to sell their investments. Investors and practitioners should be aware that emotions are relevant factors in their decision-making process. See Table 5.1 for an overview.

Table 5.1
Overview of empirical studies in this thesis

Chapter 2	
<hr/>	
<i>Focus</i>	Adaptation and Capitulation decisions
<i>Objectives</i>	To test how interaction between adaptation of reference point and expectation leads to capitulation decisions in the loss domain
<i>Theories</i>	Prospect theory, Adaptation level theory, expected utility model
<i>Key findings</i>	<ul style="list-style-type: none"> • The larger the size of prior losses and the longer the time spent in a losing position predict a lower adapted reference point • Negative expectations lead to a stronger tendency to capitulate a losing investment • After controlling for the effect of subjective expectation, those investors who adapt little to prior losses are more likely to capitulate the losing investment than those who have adapted more to the prior losses
<hr/>	
Chapter 3	
<hr/>	
<i>Focus</i>	Personality and Adaptation
<i>Objectives</i>	To examine the influence of the Big Five personality traits on individuals' adaptation of reference point
<i>Theories</i>	Big Five Personality Model, Prospect theory
<i>Key findings</i>	<ul style="list-style-type: none"> • Individuals with higher scores on <i>agreeableness</i> and <i>intellect</i>, and lower score on <i>conscientiousness</i> adapt to losses to a larger extent • The Big Five personality traits do not have significant impact on adaptation to gains
<hr/>	

Chapter 4

<i>Focus</i>	Anticipated/ Experienced Emotions and Capitulation decisions
<i>Objectives</i>	To test how anticipated and experienced emotions (focus on regret and pride) affect individuals' probabilities to sell winning or losing investment
<i>Theories</i>	Appraisal theory of emotions, Regret regulation theory
<i>Key findings</i>	<ul style="list-style-type: none">• Higher experienced regret (pride) leads to a greater probability of selling a losing (winning) investment• Higher anticipated regret leads to a smaller probability to sell a losing investment, but anticipated pride does not affect the probability to sell a winning investment

5.2 Theoretical Contribution

In this dissertation, we have conducted three empirical studies related to investors' selling decisions. Therefore, we have grouped the discussion of the findings of this dissertation into three themes: adaptation of reference point, personality and coping, and emotions. In the following, we provide a discussion of the theoretical implications of this dissertation regarding these three themes.

5.2.1 Adaptation of Reference Point

In Chapter 2 we investigate how investors eventually come to the decision to sell their losing investments. Our study confirms previous findings and adds to knowledge about reference point adaptation. In particular, our empirical results are consistent with Arkes et al. (2008) that individuals adapt to losses. We provide additional insight into the separate effects of time spent in a losing position and the size of losses on reference point adaptation, by disentangling their unique influences. Consistent with Hardie et al. (1993), we find that the

temporal component is important in (financial) decision making, but we also find that the adapted reference point depends on the time spent in a losing position. That is, it takes time for investors to adapt, as much as is possible, to a financial loss.

Previous literature has tested subjective expectations and subjective value as two separate determinants of investors' hold/sell decisions. For instance, Lee et al. (2008) find that investors' subjective values attached to gains and losses affect their hold/sell decisions. We extend these findings by conducting the first investigation of the interaction effect between subjective expectations and subjective value on capitulation probability in a dynamic setting. In addition, we have proposed a novel way to model investors' subjective values of losses, by measuring their adaptation to losses.

DeBondt and Thaler (1985) find that portfolios of prior losing stocks outperform the portfolios of prior winning stocks over the next three years, which is known as the winner-loser effect. If prior losers on average outperform prior winners, then holding on to losing investments seem to be a good trading strategy. This would imply that those individuals who adapt more to their losses are better off than those who adapt less, because the more adapted investors are more likely to hold on to the losing investment till the price bounces back. However, this implication should be interpreted with some care. Our tests in this chapter are based on experimental data, therefore the decisions may differ from actual trading decisions in practice.

5.2.2 Personality and Coping

The behavioral finance literature has demonstrated that risk aversion, loss aversion, mental accounting (Kahneman and Tversky 1979; Shefrin and Statman 1985; Thaler 1985; Thaler and Johnson 1990), education level, professional occupations (Dhar and Zhu 2006) and IQ (Grinblatt, Keloharju, and Linnainmaa 2009) can all affect individuals' decisions. Our

results from Chapter 3 support previous studies (Dhar and Zhu 2006; Grinblatt, Keloharju, and Linnainmaa 2009) that heterogeneity among individuals can explain the variance in their financial decisions. We contribute to the literature by researching beyond socio-economical, demographical factors and cognitive capabilities, and test how personality traits relate to adaptation to losses. While our results confirm previous findings that individuals adapt faster to gains than to losses (Arkes et al. 2008). We also demonstrate the link between personality and adaptation. In particular, we find that differences in personality have significant impact on adaptation to losses, but not to gains.

Weber and Welfens (2008) propose that investors' probabilities to sell winning or losing investments seem to be stable personality traits, specifically, those investors who hold losers too long may not be the same investors who sell their winners too soon. Our experimental findings in this chapter are consistent with the proposition of Weber and Welfens (2008), but we provide empirical evidence that personality differences can also play a role in adaptation to financial losses.

5.2.3 *Emotions*

Emotions, either anticipated or experienced, play an important role in consumers' decision-making processes. In line with the findings in the field of marketing, Chapter 4 adds to the literature that anticipated and experienced emotions are also influential in the financial investment domain. First, regarding anticipated emotions, the results in Chapter 4 provide partial empirical support for the propositions offered by Shefrin and Statman (1985): anticipated regret causes people to hold on to losers, but anticipated pride does not seem to cause them to sell winners. Second, regarding experienced emotions, we acknowledge that investing requires a chain of decisions, so the emotions experienced as a result of prior outcomes should affect investors' decisions. However, studies that attempt to establish this

link are rare (Tsiros and Mittal 2000; Zeelenberg and Pieters 2004). We contribute to the literature by initially testing how anticipated and experienced emotions affect investors' decision simultaneously. Our findings show that even before an account is closed at a loss, investors already experience regret, which leads to a larger probability to sell the losing investment. These results are in support of the theoretical regret-matching procedure (Hart and Mas-Colell 2000). In addition, our findings are consistent with previous studies, that specific emotions have unique effects over and beyond the effect of general valence in predicting consumer behavior. While prior marketing studies on specific emotions versus general valence focus on riskless environments (e.g., Zeelenberg and Pieters 2004), we add to the literature by providing research evidence from a financial investment domain, which inherently consists of risky decisions.

5.3 Suggestions for Further Research

This dissertation contributes to the existing knowledge on the disposition effect by examining the dynamic process in which selling decisions are reached. We find that both (1) adaptation of reference point and (2) anticipated and experienced emotions affect individuals' probabilities to sell their investments. Nevertheless, our experimental findings raise new questions and highlights areas in which more research is needed.

One of the major new challenges for future research is to link the results in Chapter 2 with research and analysis of real trading data. In Chapter 2, we use an experimental setting to obtain our data on individual investment decisions; thus, future research is needed to test the generalizability of our model with real trading data. Combining the findings of the winner-loser effect (DeBondt and Thaler 1985) and our results in Chapter 2, it appears that holding on to a losing investment by adapting to the losses may be a favorable trading

strategy. Examining whether adapting to losses is a useful trading strategy in financial markets is the next logical step in this line of behavioral finance literature.

The process of adaptation might also have relevance for more non-financial aspects of consumer behavior. Adaptation may explain why consumers stay with service providers with declining levels of service quality, as this behavior resembles holding on to losing investments. If the decline of service quality is gradual, adaptation may partially explain inertia, next to avoidance of incurring switching costs (De Ruyter, Wetzels and Bloemer 1998). In future research, the dynamic experiments reported in this dissertation can be adjusted for assessing the suggested relevance of adaptation in a marketing setting.

In Chapter 3 we focused on personality and exclude other potential variables regarding individual differences. A next logical step for future research would be to explore other potential variables that may explain the variance in individual's adaptation levels of their reference point, such as self-esteem or aggressiveness. Future research should analyze how these variables regarding individual differences interact with each other and investigate their relative explanatory power over adaptation to financial losses and gains. Greater knowledge of how individual differences are related to adaptation of reference point can also increase our understanding of retail investors' decision-making processes, and help to explain the variances in retail investors' investment return.

Our experimental findings in Chapter 4 show that emotions, whether anticipated or experienced, affect individuals' selling probabilities. Future research should investigate how the implications derived from emotions research (e.g. regret avoidance) can be incorporated into economic models to provide better predictions of investors' financial decisions. Research on the emotion pride is relatively recent (Fredrickson 2001; Tracy and Robins 2007; Williams and DeSteno 2008), and far more research is needed to shed light on the roles that experienced pride and anticipated pride play in investors' decision-making processes.

Another important issue for future research in emotions concerns the conditions under which a valence-based or a specific emotion is more useful in understanding consumer behavior (Bagozzi et al. 2000; Zeelenberg and Pieters 2004). Our results on investment decision processes highlight the importance of this issue. In the loss domain, while valence-based emotion (dissatisfaction) leads to a smaller probability to sell, a specific emotion (regret) predicts a greater probability to sell. These opposite effects have not been identified in previous consumer research. A possible reason for these findings is that previous research has focused on a riskless non-dynamic setting. By contrast, our results are obtained in a risky and dynamic setting with multiple decision moments. In financial markets, a losing investment may bounce back in the future. The investment return is not determined until the point where the investment is sold. In such a dynamic risky setting, the directions of the effects of general valence and specific emotions seem to be different as compared to those in a riskless setting. Further investigation is needed regarding the effects of emotions in static versus dynamic and riskless versus risky settings.

Finally, we tested the effects of two specific emotions, regret and pride, on investors' selling decisions in Chapter 4. Other specific emotions could be considered in the sale of winning or losing investments as well; for example, shame and guilt. To gain insight into the roles of specific emotions in investment decision making, a broader set of emotions should be investigated in the future. We are confident that our current results provide a first step to the understanding of the disposition effect in a dynamic perspective.

Nederlandse Samenvatting

Deze dissertatie bespreekt het zogenaamde *disposition-effect*, een van de meest intrigerende fenomenen in besluitvorming bij risico's, met name op financiële markten. Het disposition-effect beschrijft de neiging van beleggers om hun verliesgevende beleggingen te lang aan te houden en hun winstgevende beleggingen te vroeg te verkopen (Shefrin en Statman 1985). Eerdere onderzoeken naar het disposition-effect richten zich vooral op het vergelijken van verkopen bij winst versus verlies aan de hand van cross-sectioneel onderzoek (Dhar en Zhu 2006; Odean 1998). Er is echter maar weinig bekend over het besluitvormingsproces van beleggers onder meer realistische, dynamische omstandigheden met meerdere beslismomenten. Een belangrijke vraag blijft onbeantwoord: wat zijn de bepalende factoren bij de beslissing van beleggers om hun winstgevende of verliesgevende beleggingen te verkopen onder dynamische omstandigheden? Bij verlies zijn beleggers niet snel geneigd om tot verkoop over te gaan, maar uiteindelijk verkopen veel beleggers toch als de verliezen blijven oplopen. Het empirisch bewijs dat beleggers het nemen van verlies eerder proberen te vermijden dan het nemen van winst en het fenomeen dat veel beleggers uiteindelijk toch hun verliesgevende beleggingen verkopen, leidt tot de kernvraag van deze dissertatie: wat zijn de precieze determinanten die tot de beslissing tot capitulatie leiden? Deze dissertatie is een aanvulling op de bestaande literatuur en geeft een eerste aanzet tot onderzoek naar het disposition-effect onder dynamische omstandigheden. We maken hierbij gebruik van experimentele methoden om het besluitvormingsproces van individuen te onderzoeken. We onderzoeken de volgende twee nieuwe verklaringen voor de beslissing van beleggers om te verkopen, namelijk (1) adaptatie van het referentiepunt en (2) verwachte en ervaren emoties.

In Hoofdstuk 2 onderzoeken we onze eerste verklaring voor het disposition-effect: adaptatie van het referentiepunt. Het referentiepunt wordt hier niet als statisch gegeven

gezien, maar als een gegeven dat zich in de richting van een eerdere uitkomst beweegt, naar boven voor winsten en naar beneden voor verliezen (Arkes, Hirshleifer, Jiang en Lim 2008). Bij verlies (winst) duidt een aanpassing van het referentiepunt naar beneden (naar boven) erop dat de ervaren omvang van de opgelopen verliezen (winst) kleiner wordt. Elke volgende waarde van de belegging wordt gewaardeerd ten opzichte van dit aangepaste referentiepunt. We formuleren een conceptueel model dat de theorie over inschatting van kansen en risico's (prospect theory: Kahneman en Tversky 1979), de theorie over adaptatieniveau (adaptation level theory: Helson 1964) en het model over de verwachte waarde (expected utility model: bijv. von Neumann en Morgenstern 1944; Harless en Camerer 1994) combineert. Dit dynamische model voorspelt hoe een aanpassing van het referentiepunt van invloed is op de subjectieve waarde die een individu aan een volgende prijsaanpassing toekent, waarbij een wisselwerking bestaat met de subjectieve verwachtingen over toekomstige prijsschommelingen, en uiteindelijk van invloed is op volgende beleggingsbeslissingen van individuen. In overeenstemming met de adaptatieniveaustheorie van Helson (1964), tonen we aan dat hoe groter de omvang van eerdere verliezen is en hoe langer de verliespositie aanhoudt, hoe lager het aangepaste referentiepunt zal zijn. Overeenkomstig de gangbare beleggingstheorie laten onze resultaten zien dat negatieve verwachtingen leiden tot een sterkere neiging tot capitulatie van een verliesgevende belegging. Bovendien vinden we, overeenkomstig ons theoretische raamwerk, dat het adaptatieniveau van het referentiepunt en de verwachting over toekomstige prijsschommelingen van invloed zijn op de capitulatiewaarschijnlijkheid. Afgezien van het effect van subjectieve verwachtingen, zijn beleggers met een geringe adaptatie aan eerdere verliezen eerder geneigd hun verliesgevende beleggingen te verkopen dan beleggers met een grotere adaptatie aan eerdere verliezen.

Hoofdstuk 3 bouwt voort op het in Hoofdstuk 2 verkregen inzicht en gaat dieper in op aanpassing van het referentiepunt op individueel niveau. We onderzoeken hoe

persoonlijkheid de verschillen in verliesadaptatie tussen individuen kan verklaren. Uit de literatuur hierover blijkt dat verschillen in persoonlijkheid van invloed zijn op hoe individuen zich aanpassen aan stressvolle situaties, zoals fysieke pijn en traumatische ervaringen (Morgan, Matthews en Winton 1995; Miro en Raich 1992). Het doel van Hoofdstuk 3 is om deze bevindingen toe te passen op andere typen stressvolle gebeurtenissen, zoals financiële verliezen. Veel eerdere onderzoeken zijn gebaseerd op het 'Big Five'-persoonlijkheidsmodel (Bishop et al. 2001; David en Suls 1999). Onze verwachting is dat dit model een bruikbare context biedt voor het beoordelen van individuele verschillen in de adaptatie bij financiële verliezen. Met behulp van een vragenlijst meten we persoonlijkheidsverschillen aan de hand van het Big Five-model (Bishop et al. 2001; David en Suls 1999). Onze bevindingen wijzen erop dat individuen die hoger scoren op inschikkelijkheid en intellect, en lager op zorgvuldigheid in grotere mate adaptatie tot verliezen vertonen. Dit impliceert dat beleggers die zich meer aan verliezen hebben aangepast eerder geneigd zijn een subjectief hogere positieve waarde aan toekomstige winsten en lagere negatieve waarde aan toekomstige verliezen toe te kennen vergeleken met diegenen die minder aanpassing aan eerdere verliezen vertonen. De karaktertrekken uit het Big Five-model blijken echter geen significante invloed te hebben op aanpassing aan winsten. Onze resultaten impliceren dat de relatie tussen persoonlijkheidskenmerken en adaptatie afhankelijk is van het betreffende domein: persoonlijkheidskenmerken voorspellen alleen aanpassing bij verliezen, niet bij winst.

In Hoofdstuk 4 onderzoeken we onze tweede voorgestelde verklaring voor het disposition-effect: de verwachte en ervaren emoties van de belegger. We onderzoeken met name hoe verwachte en ervaren emoties de besluitvorming bij het aanhouden of verkopen van een belegging beïnvloeden onder meer realistische, dynamische omstandigheden met meerdere beslismomenten. We richten ons op twee specifieke emoties: (1) spijt bij verlies en (2) trots bij winst. Hoewel verwachte spijt en trots al in 1985 door Shefrin en Statman als

verklaring voor het disposition-effect zijn aangedragen, zijn deze emoties nooit empirisch onderzocht. Bovendien bestaat de besluitvorming van een individu over een belegging uit een reeks beslismomenten. Naast verwachte emoties ervaren beleggers ook emotionele feedback van eerdere beslissingen. Uit de literatuur over consumentengedrag blijken ervaren emoties een belangrijke invloed te hebben op het voornemen van consumenten om over te stappen, te klagen of anderen over hun ervaringen te vertellen (Tsiros en Mittal 2000; Zeelenberg en Pieters 2004). We stellen dat overstapbeslissingen op marketinggebied niet veel verschillen van verkoopbeslissingen op financieel gebied, aangezien beide beslissingen het afbreken van een relatie tussen het individu en een tegenvallend product/dienst inhouden. Daarom verwachten we dat zowel verwachte als ervaren emoties de verkoopbeslissingen van beleggers beïnvloeden. In twee experimentele onderzoeken vonden we dat een grotere ervaren spijt (trots) tot een grotere kans op verkoop van een verliesgevende (winstgevende) belegging leidt. Wat betreft verwachte emoties blijkt uit onze resultaten dat grotere verwachte spijtgevoelens leiden tot een kleinere waarschijnlijkheid dat een verliesgevende belegging wordt verkocht, maar dat verwachte trots niet van invloed is op de waarschijnlijkheid dat een winstgevende belegging van de hand wordt gedaan. Voor de bewering van Shefrin en Statman (1985) dat verwachte spijt en verwachte trots een verklaring voor het disposition-effect leveren, vinden we in ons empirisch onderzoek alleen steun voor het eerste geval, maar niet voor het laatste. In het algemeen laten onze resultaten zien dat zowel verwachte als ervaren emoties van invloed zijn op de waarschijnlijkheid dat iemand zijn beleggingen verkoopt.

References

- Abdellaoui, M., Bleichrodt, H., and L'Haridon, O. (2008), "A Tractable Method to Measure Utility and Loss Aversion Under Prospect Theory," *Journal of Risk and Uncertainty*, 36, 245-66.
- Anderson, C. J. (2003), "The Psychology of Doing Nothing: Forms of Decision Avoidance Result From Reason and Emotion," *Psychological Bulletin*, 129, 139-67.
- Andreassen, P. B. (1988), "Explaining the Price-Volume Relationship: The Difference Between Price Changes and Changing Prices," *Organization Behavior and Human Decision Processes*, 41, 371-89.
- Angus-Leppan, T., and Owen, K. (2005), "A Conceptual Model of Ethical Purchasing," *Proceedings of the ANZMAC 2005 Conference*, 1-9.
- Arkes, H. R., and Blumer, C (1985), "The Psychology of Sunk Cost," *Organization Behavior and Human Decision Processes*, 35, 124-40.
- Arkes, H. R., Hirshleifer, D., Jiang, D., and Lim, S. (2007), "A Cross-cultural Study of Reference Point Adaptation: Evidence from China, Korea, and the US," Munich Personal RePEc Archive Paper No. 9863, available at <<http://mpra.ub.uni-muenchen.de/9863/>>.
- Arkes, H. R., Hirshleifer, D., Jiang, D., and Lim, S. (2008), "Reference Point Adaptation: Tests in the Domain of Security Trading," *Organization Behavior and Human Decision Processes*, 105, 67-81.
- Austin, J. T., and Vancouver, J. B. (1996), "Goal Constructs in Psychology: Structure, Process, and Content," *Psychological Bulletin*, 120, 338-75.
- Ayton, P., and Fischer, I. (2004), "The Hot Hand Fallacy and the Gamble's Fallacy: Two Faces of Subjective Randomness?" *Memory and Cognition*, 32, 1369-78.

- Bagozzi, R. P., Baumgartner, H., Pieters, R., and Zeelenberg, M. (2000), "The Role of Emotions in Goal-Directed Behavior," in *The Why of Consumption*, S. Ratneshwar, David Glen Mick, and Cynthia Huffman, eds. London: Routledge, 36-58.
- Bagozzi, R. P., Gopinath, M., and Nyer, P. U. (1999), "The Role of Emotions in Marketing," *Journal of the Academy of Marketing Science*, 27, 184-206.
- Barberis, N. and Thaler, R. H. (2005), "A Survey of Behavioral Finance," in R. H. Thaler (Ed.), *Advances in Behavioral Finance Vol. II* (pp. 1-75), New York: Russell Sage Foundation.
- Baucells, M., Weber, M., and Welfens, F. (2007), "Reference Point Formation Over Time: A Weighting Function Approach," Working paper, University of Mannheim, available at < <http://ideas.repec.org/p/xrs/sfbmaa/07-43.html>>.
- Becker, G. M., DeGroot, M. H., and Marschak, J. (1964), "Measuring Utility by a Single-response Sequential Method," *Behavioral Science*, 9, 226-36.
- Bell, D. E. (1982), "Regret in Decision Making Under Uncertainty," *Operations Research*, 30, 961-81.
- Blattberg, R. C., Briesch, R., and Fox, E. J. (1995), "How Promotions Work," *Marketing Science*, 14, 122-32.
- Bishop, G. D., Tong, E. M. W., Diong, S. M., Enkelmann, H. C., Why, Y. P., Khader, M., and Ang, J. C. H. (2001), "The Relationship Between Coping and Personality Among Police Officers in Singapore," *Journal of Research in Personality*, 35, 353-74.
- Boone, C., De Brabander, B., and van Witteloostuijn, A. (1999), "The Impact of Personality on Behavior in Five Prisoner's Dilemma Games," *Journal of Economic Psychology*, 20, 343-77.
- Bowles, S., Gintis, H., and Osborne, M. O. (2001), "Incentive-enhancing Preferences: Personality, Behavior, and Earnings," *American Economic Review*, 91, 155-58.

- Brandstätter, H., and GÜth, W. (2000), "A Psychological Approach to Individual Differences in Intertemporal Consumption Patterns," *Journal of Economic Psychology*, 21, 465-79.
- Brickman, P., Coates, D., and Janoff-Bulman, R. (1978), "Lottery Winners and Accident Victims: Is Happiness Relative?" *Journal of Personality and Social Psychology*, 36, 917-27.
- Caruso, J. C. (2000), "Reliability Generalization of the NEO Personality Scales," *Educational and Psychological Measurement*, 60, 236-54.
- Carver, C. S., Scheier, M. F., and Weintraub, J. K. (1989), "Assessing Coping Strategies: A Theoretically Based Approach," *Journal of Personality and Social Psychology*, 56, 267-83.
- Chen, H., and Rao, A. (2002), "Close Encounters of Two Kinds: False Alarms and Dashed Hopes," *Marketing Science*, 21, 178-96.
- Chitturi, R., Raghunathan, R., and Mahajan, V. (2008), "Delight by Design: The Role of Hedonic Versus Utilitarian Benefits," *Journal of Marketing*, 72, 48-63.
- Connor-Smith, J. K., and Flachsbart, C (2007), "Relations Between Personality and Coping: A Meta-analysis," *Journal of Personality and Social Psychology*, 93, 1080-1107.
- Costa, P. T., and McCrae, R. R. (1992), *Revised NEO Personality Inventory (NEO PI-R) and NEO Five-factor Inventory (NEO-FFI) Professional Manual*. Odessa, FL: Psychological Assessment Resources.
- Costa, P. T., Somerfield, M. R., and McCrae, R. R. (1996), "Personality and Coping: A Reconceptualization," in M. Zeidner and N. S. Endler (Eds.), *Handbook of coping: Theory, research, applications* (pp. 44-61), New York: Wiley.
- David, J. P., and Suls, J. (1999), "Coping Efforts in Daily Life: Role of Big Five Traits and Problem Appraisals," *Journal of Personality*, 67, 265-94.

- De Giorgi, E., Hens, T., and Post, T. (2005), "Prospect Theory and the Size and Value Premium Puzzles," Working paper, available at <http://ideas.repec.org/p/hhs/nhhfms/2005_020.html>.
- De Ruyter, K., Wetzels, M., and Bloemer, J. (1998), "On the Relationship Between Perceived Service Quality, Service Loyalty and Switching Costs," *International Journal of Service Industry Management*, 9, 436-53.
- DeSteno, D., Petty, R. E., Wegener, D. T., and Derek D. Rucker (2000), "Beyond Valence in the Perception of Likelihood: The Role of Emotion Specificity," *Journal of Personality and Social Psychology*, 78, 397-416.
- Dhar, R., and Zhu, N. (2006), "Up Close and Personal: An Individual Level Analysis of the Disposition Effect," *Management Science*, 52, 726-40.
- Dickerson, S. S., Gruenewald, T. L., and Kemeny, M. E. (2004), "When the Social Self Is Threatened: Shame, Physiology, and Health," *Journal of Personality*, 72, 1191-16.
- Elliott, E. S., and Dweck, C. S. (1988), "Goals: An Approach to Motivation and Achievement," *Journal of Personality and Social Psychology*, 54, 5-12.
- Eysenck, S. B. G., Eysenck, H. J., and Barrett, P. (1985), "A Revised Version of the Psychoticism Scale," *Personality and Individual Differences*, 6, 21-29.
- Fredrickson, B. L. (2001), "The Role of Positive Emotions in Positive Psychology: The Broaden-and-Build Theory of Positive Emotions," *American Psychologist*, 56, 218-26.
- Freedman, D., Thornton, A., Camburn, D., Alwin, D., and Young-DeMarco, L. (1988), "The Life-history Calendar: A Technique for Collecting Retrospective data," *Sociological Methodology*, 18, 37-68.
- Frijda, N. H., Kuipers, P., and ter Schure, E. (1989), "Relations Among Emotion Appraisal and Emotional Action Readiness," *Journal of Personality and Social Psychology*, 57,

212-28.

- Gallagher, D. J. (1990), "Extraversion, Neuroticism and Appraisal of Stressful Academic Events," *Personality and Individual Differences*, *11*, 1053-57.
- Garvey, R., and Murphy, A. (2004), "Commissions Matters: The Trading Behavior of Institutional and Individual Active Traders," *Journal of Behavioral Finance*, *5*, 214-21.
- Garvey, R., and Murphy, A. (2004), "Are Professional Traders Too Slow to Realize Their Losses?" *Financial Analysts Journal*, *60*, 35-43.
- Genesove, D., and Mayer, C. (2001), "Loss Aversion and Seller Behavior: Evidence from the Housing Market," *The Quarterly Journal of Economics*, *116*, 1233-60.
- Gilovich, T., and Medvec, V. H. (1995), "The Experience of Regret: What, When, and Why," *Psychological Review*, *102*, 379-95.
- Gneezy, U. (2005), "Updating the Reference Point: Experimental evidence," in R. Zwick, and A. Rapoport (Eds.), *Experiential business research*, vol. III (pp. 263-284), Massachusetts: Kluwer Academic Publishers.
- Goldberg, L. R. (1992), "The Development of Markers for the Big-Five Factor Structure," *Psychological Assessment*, *4*, 26-42.
- Goldberg, L. R. (1994), "Resolving a Scientific Embarrassment: A Comment on the Articles in this Special Issue," *European Journal of Personality*, *8*, 351-56.
- Gow, A. J., Whiteman, M.C., Pattie, A., and Deary, I. J. (2005), "Goldberg's IPIP Big-Five Factor Markers: Internal Consistency and Concurrent Validation in Scotland," *Personality and Individual Differences*, *39*, 317-29.
- Grinblatt, M., Keloharju, M., and Linnainmaa, J. T. (2009), "Do Smart Investors Outperform Dumb Investors?" Chicago Booth Research Paper No. 09-33; AFA 2010 Atlanta

Meetings Paper; CRSP Working Paper, available at < <http://ssrn.com/abstract=1364014>>.

- Groves, M. O. (2005), "How Important is Your Personality? Labor Market Returns to Personality for Women in the US and UK," *Journal of Economic Psychology*, 26, 827-41.
- Hardie, B. G. S., Johnson, E. J., and Fader, P. S. (1993), "Modeling Loss Aversion and Reference Dependence Effect on Brand Choice," *Marketing Science*, 12, 378-94.
- Harless, D. and Camerer, C. (1994), "The Predictive Utility of Generalized Expected Utility Theories," *Econometrica*, 62, 1251-89.
- Hart, S., and Mas-Colell, A. (2000), "A Simple Adaptive Procedure Leading to Correlated Equilibrium," *Econometrica*, 68, 1127-50.
- Heath, C., Larrick, R. P., and Wu, G. (1999), "Goals as Reference Points," *Cognitive Psychology*, 38, 79-109.
- Heaven P.C.L., and Bucci S. (2001), "Right-wing Authoritarianism, Social Dominance Orientation and Personality: An Analysis Using the IPIP Measure," *European Journal of Personality*, 15, 49-56.
- Helson, H. (1964), *Adaptation Level Theory*. New York: Harper and Row.
- Hennig-Thurau, T., Groth, M., Paul, M., and Gremler, D. D. (2006), "Are All Smiles Created Equal? How Emotional Contagion and Emotional Labor Affect Service Relationships," *Journal of Marketing*, 70, 58-73.
- Holt, C. A., and Laury, S. K. (2002), "Risk Aversion and Incentive Effects," *American Economic Review*, 92, 1644-55.
- John, O. P., and Srivastava, S. (1999), "The Big Five Trait Taxonomy: History, Measurement, and Theoretical Perspectives," in L. A. Pervin and O. P. John (Eds.),

- Handbook of Personality: Theory and Research* (2nd ed.; pp. 102-38), New York: Guilford Press.
- Jullien, B., and Salanié, B. (2000), "Estimating Preferences Under Risk: The Case of Racetrack Bettors," *The Journal of Political Economy*, 108, 503-30.
- Kahneman, D., and Tversky, A. (1979), "Prospect Theory: An Analysis of Decision Under Risk," *Econometrica*, 47, 263-92.
- Kahneman, D. (1999), "Objective Happiness," in D. Kahneman, E. Diener, and N. Schwarz (Eds.), *Well-being: The Foundations of Hedonic Psychology* (pp. 3-25), New York: Sage.
- Köszegi, B., and Rabin, M. (2006), "A Model of Reference-dependent Preferences," *Quarterly Journal of Economics*, 121, 1133-65.
- Lant, T. K. (1992), "Aspiration Level Adaptation: An Empirical Exploration," *Management Science*, 38, 623-44.
- Laughhunn, D. J., and Payne, J.W. (1984), "The Impact of Sunk Outcomes on Risky Choice Behavior," *Canadian Journal of Operational Research and Information Processing*, 22, 151-81.
- Laughhunn, D. J., and Payne, J.W., and Crum, R. (1980), "Managerial Risk Preferences for Below-target Returns," *Management Science*, 26, 1238-49.
- Laury, S. K., and Holt, C. A. (2008), "Further Reflections on the Reflection Effect," *Risk Aversion in Experiments Research in Experimental Economics*, 12, 405-40.
- Lazarus, R. S., and Folkman, S. (1984), *Stress, Appraisal, and Coping*. New York: Springer.
- Lee, C., Kraeussl, R., Lucas, A., and Paas, L. (2008), "A Dynamic Model of Investor Decision-Making: How Adaptation to Losses Affects Future Selling Decisions," Discussion Paper no. 112, Tinbergen Institute.

- Lee, C., Kraeussl, R., and Paas, L. (2010), "Personality and Investment: Personality Differences Affect investors' Adaptation to Losses," Research Memorandum 2010-7, VU University Amsterdam.
- Lee, C., Kraeussl, R., and Paas, L. (2009), "The Effect of Anticipated and Experienced Regret and Pride on Investors' Future Selling Decisions," Research Memorandum 2009-57, VU University Amsterdam.
- Lee, H.-J., Park, J., Lee, J.-Y., and Wyer Jr., R. S. (2008), "Disposition Effects and Underlying Mechanisms in E-trading of Stocks," *Journal of Marketing Research*, 45, 362-78.
- Lemon, K. N., White, T. B., and Winer, R. S. (2002), "Dynamic Customer Relationship Management: Incorporating Future Considerations into the Service Retention Decision," *Journal of Marketing*, 66, 1-14.
- Lengua, L. J., and Sandler, I. N. (1996), "Self-regulation as a Moderator of the Relation Between Coping and Symptomatology in Children of Divorce," *Journal of Abnormal Child Psychology*, 24, 681-701.
- Lerner, J. S., and Keltner, D. (2000), "Beyond Valence: Toward a Model of Emotion-Specific Influences on Judgement and Choice," *Cognition and Emotions*, 14, 473-93.
- Levine, L. J. (1996), "The Anatomy of Disappointment: A Naturalistic Test of Appraisal Models of Sadness, Anger, and Hope," *Cognition and Emotion*, 10, 337-60.
- Lewis, M. (2006), "Customer Acquisition Promotions and Customer Asset Value," *Journal of Marketing Research*, 43, 195-203.
- L'Haridon, O. (2009), "Behavior in the Loss Domain: An Experiment Using the Probability Trade-off Consistency Condition," *Journal of Economic Psychology*, 30, 540-51.
- Loehman, E. (1998), "Testing Risk Aversion and Nonexpected Utility Theories," *Journal of Economic Behavior and Organization*, 33, 285-302.

- Loomes, G., and Sugden, R. (1982), "Regret Theory: An Alternative Theory of Rational Choice under Uncertainty," *Economic Journal*, 92, 805-24.
- Louro, M. J., Pieters, R., and Zeelenberg, M. (2005), "Negative Returns on Positive Emotions: The Influence of Pride and Self-Regulatory Goals on Repurchase Decisions," *Journal of Consumer Research*, 31, 833-40.
- Lucas, R. E., Clark, A. E., Georgellis, Y., and Diener, E. (2003), "Reexamining adaptation and the set point model of happiness: Reactions to changes in marital status," *Journal of Personality and Social Psychology*, 84, 527-39.
- MacInnis, D. J., and Patrick, V. M. (2006), "Spotlighting on Affect: Affect and Affective Forecasting in Impulse Control," *Journal of Consumer Psychology*, 16, 224-31.
- MacKinnon, D. P., and Dwyer, J. H. (1993), "Estimating Mediated Effects in Prevention Studies," *Evaluation Review*, 17, 144-58.
- Markowitz, H. (1952), "Portfolio Selection," *The Journal of Finance*, 7, 77-91.
- Marquis, M. S., and Holmer, M. R. (1996), "Alternative Models of Choice under Uncertainty and Demand for Health Insurance," *Review of Economics and Statistics*, 78, 421-27.
- McCrae, R. R., Costa, P. T., Jr., Ostendorf, F., Angleitner, A., Hrebickova, M., Avia, M. D., et al. (2000), "Nature Over Nurture: Temperament, Personality, and Life Span Development," *Journal of Personality and Social Psychology*, 78, 173-86.
- McCrae, R. R., and John, O. P. (1992), "Introduction to the Five-factor Model and Its Applications," *Journal of Personality*, 60, 175-215.
- Mellers, B. A., and McGraw, A. P. (2001), "Anticipated Emotions as Guides to Choice," *Current Directions in Psychological Science*, 10, 210-14.
- Mezias, S., Chen, Y.-R., and Murphy, P. R. (2002), "Aspiration-level Adaptation in an American Finance Services Organization," *Management Science*, 48, 1285-1300.
- Miles, J. N. V., and Hempel, S. (2003), "The Eysenck Personality Scales," in M. Hersen, M.

- Hilsenroth, and D. Segal (Eds.), *The comprehensive handbook of psychological assessment: Personality assessment* (pp. 147-68), Hoboken, NJ: Wiley.
- Miro, J., and Raich, R. M. (1992), "Personality Traits and Pain Experience," *Personality and Individual Differences*, 13, 309-13.
- Morgan, I. A., Matthews, G., and Winton, M. (1995), "Coping and Personality as Predictors of Post-traumatic Intrusions, Numbing, Avoidance and General Distress: A Study of Victims of the Perth Flood," *Behavioural and Cognitive Psychotherapy*, 23, 251-64.
- Morrin, M., Jacoby, J., Venkataramani Johar, G., He, X., Kuss, A., and Mazursky, D. (2002), "Taking Stock of Stockbrokers: Exploring Momentum Versus Contrarian Investor Strategies and Profiles," *Journal of Consumer Research*, 29, 188-98.
- Muermann, A., and Volkman, J. M. (2007), "Regret, Pride, and the Disposition Effect," Working paper, University of Pennsylvania, available at < <http://ssrn.com/abstract=930675>>.
- Neslin, S. (2002), *Sales Promotions*. Cambridge, MA: Marketing Science Institute.
- Nyhus, E. K., and Pons, E. (2005), "The Effects of Personality on Earnings," *Journal of Economic Psychology*, 26, 363-84.
- O'Curry Fogel, S., and Berry, T. (2006), "The Disposition Effect and Individual Investor Decisions: the Roles of Regret and Counterfactual Alternatives," *Journal of Behavioral Finance*, 7, 107-16.
- Odean, T. (1998), "Are Investors Reluctant to Realize Their Losses?" *Journal of Finance*, 53, 1775-98.
- Oliver, R. L. (1980), "A Cognitive Model of the Antecedents and Consequences of Satisfaction Decisions," *Journal of Marketing Research*, 17, 460-69.
- Parducci, A. (1968), "The Relativism of Absolute Judgments," *Scientific American*, 219, 84-90.

- Patrick, V. M., Chun, H. H., and MacInnis, D. J. (2009), "Affective Forecasting and Self-control: Why Anticipating Pride Wins Over Anticipating Shame in a Self-regulation Context," *Journal of Consumer Psychology*, 19, 537-45.
- Pieters, R., and Zeelenberg, M. (2007), "A Theory of Regret Regulation 1.1," *Journal of Consumer Psychology*, 17, 29-35.
- Rasmussen, H. N., Wrosch, C., Scheier, M. F., and Carver, C. S. (2006), "Self-regulation Processes and Health: The Importance of Optimism and Goal Adjustment," *Journal of Personality*, 74, 1721-48.
- Ratner, R. K., and Herbst, K. C. (2005), "When Good Decisions Have Bad Outcomes: The Impact of Affect on Switching Behavior," *Organizational Behavior and Human Decision Processes*, 96, 23-37.
- Reb, J. (2008), "Regret Aversion and Decision Process Quality: Effects of Regret Salience on Decision Process Carefulness," *Organizational Behavior and Human Decision Processes*, 105, 169-82.
- Richard, R., van der Pligt, J., and de Vries, N. (1996), "Anticipated Regret and Time Perspective: Changing Sexual Risk-taking Behavior," *Journal of Behavioral Decision Making*, 9, 185-99.
- Ringle, C., Wende, S., and Will, A. (2005), *SmartPLS 2.0 (M3) Beta*, available at <<http://www.smartpls.de>>.
- Rothbart, M. K., and Bates, J. E. (1998), "Temperament," in W. Damon (Series Ed.) and N. Eisenberg (Vol. Ed.), *Handbook of child psychology: Vol. 3. Social, emotional, and personality development* (5th ed., pp. 105-76), New York, Wiley.
- Sarris, V. (1967), "Adaptation Level Theory: Two Critical Experiments on Helson's Weighted-average Model," *American Journal of Psychology*, 80, 331-44.
- Semykina, A., and Linz, S. J. (2007), "Gender Differences in Personality and Earnings:

- Evidence from Russia,” *Journal of Economic Psychology*, 28, 387-410.
- Shefrin, H., and Statman, M. (1985), “The Disposition to Sell Winners Too Early and Ride Losers Too Long,” *Journal of Finance*, 40, 777-90.
- Shimanoff, S. B. (1984), “Commonly Named Emotions in Everyday Conversations,” *Perceptual and Motor Skills*, 58, 514.
- Simonson, I. (1989), “Choice Based on Reasons: The Case of Attraction and Compromise Effects,” *Journal of Consumer Research*, 16, 158-74.
- Simonson, I. (1992), “The Influence of Anticipating Regret and Responsibility on Purchase Decisions,” *Journal of Consumer Research*, 19, 105-18.
- Skinner, E. A., Edge, K., Altman, J., and Sherwood, H. (2003), “Searching for the Structure of Coping: A Review and Critique of Category Systems for Classifying Ways of Coping,” *Psychological Bulletin*, 129, 216-69.
- Stracca, L. (2004), “Behavioral Finance and Asset Prices: Where Do We Stand?” *Journal of Economic Psychology*, 25, 373-405.
- Sullivan, K., and Kida, T. (1995), “The Effect of Multiple Reference Points and Prior Gains and Losses on Managers’ Risky Decision Making,” *Organization Behavior and Human Decision Processes*, 61, 76-83.
- Summers, B., and Duxbury, D. (2007), “Unraveling the Disposition Effect: The Role of Prospect Theory and Emotions,” Working paper, University of Leeds, available at <<http://ssrn.com/abstract=1026915>>.
- Thaler, R. H. (1985), “Mental Accounting and Consumer Choice,” *Marketing Science*, 4 (3), 199-214.
- Thaler, R. H., and Johnson, E. J. (1990), “Gambling with the House Money and Trying to Break Even: The Effects of Prior Outcomes on Risky Choice,” *Management Science*, 36, 643-60.

- Theakston, J. A., Stewart, S. H., Dawson, M. Y., Knowlden-Loewen, S. A. B., and Lehman, D. R. (2004), "Big-Five Personality Domains Predict Drinking Motives," *Personality and Individual Differences*, 37, 971-84.
- Tracy, J. L., and Robins, R. W. (2007), "The Psychological Structure of Pride: A Tale of Two Facets," *Journal of Personality and Social Psychology*, 92, 506-25.
- Trope, Y. (1980), "Self-Assessment, Self-Enhancement, and Task Preference," *Journal of Experimental Social Psychology*, 16, 116-29.
- Tsiros, M., and Mittal, V. (2000), "Regret: A Model of Its Antecedents and Consequences in Consumer Decision Making," *Journal of Consumer Research*, 26, 401-17.
- Van der Sar, N. L. (2004), "Behavioral Finance: How Matters Stand," *Journal of Economic Psychology*, 25, 425-44.
- Von Neumann, J. and Morgenstern, O. (1944), *Theory of Games and Economic Behavior*. Princeton: Princeton University Press.
- Weber, M., and Camerer, C. F. (1998), "The Disposition Effect in Securities Trading: An Experimental Analysis," *Journal of Economic Behavior and Organization*, 33, 167-84.
- Weber, M. and Welfens, F. (2008), "Splitting the Disposition Effect: Asymmetric Reactions towards "Selling Winners" and "Holding Losers"," Working paper, University of Mannheim, available at <<http://ssrn.com/abstract=1176422>>.
- Westbrook, R. A., and Oliver, R. L. (1991), "The Dimensionality of Consumption Emotion Patterns and Consumer Satisfaction," *Journal of Consumer Research*, 18, 84-91.
- Williams, L. A., and DeSteno, D. (2008), "Pride and Perseverance: The Motivational Role of Pride," *Journal of Personality and Social Psychology*, 94, 1007-17.
- Wilson, T. D., and Gilbert, D. T. (2005), "Affective Forecasting: Knowing What to Want," *Current Directions in Psychological Science*, 14, 131-34.

- Wrosch, C., Miller, G. E., Scheier, M. F., and Brun de Pontet, S. (2007), "Giving Up on Unattainable Goals: Benefits for Health?" *Personality and Social Psychology Bulletin*, 33, 251-65.
- Yogo, M. (2008), "Asset Prices Under Rising Aspirations and Reference-dependent Preferences," *Journal of Business and Economic Statistics*, 26, 131-43.
- Zeelenberg, M., van den Bos, K., van Dijk, E., and Pieters, R. (2002), "The Inaction Effect in the Psychology of Regret," *Journal of Personality and Social Psychology*, 82, 314-327.
- Zeelenberg, M., and van Dijk, E. (1997), "A Reverse Sunk Cost Effect in Risky Decision Making: Sometimes We Have Too Much Invested to Gamble", *Journal of Economic Psychology*, 18, 677-91.
- Zeelenberg, M., and Pieters, R. (2004), "Beyond Valence in Customer Dissatisfaction: A Review and New Findings on Behavioral Responses to Regret and Disappointment in Failed Services," *Journal of Business Research*, 57, 445-55.

The Tinbergen Institute is the Institute for Economic Research, which was founded in 1987 by the Faculties of Economics and Econometrics of the Erasmus University Rotterdam, University of Amsterdam and VU University Amsterdam. The Institute is named after the late Professor Jan Tinbergen, Dutch Nobel Prize laureate in economics in 1969. The Tinbergen Institute is located in Amsterdam and Rotterdam. The following books recently appeared in the Tinbergen Institute Research Series:

- 448. L. PAN, *Poverty, Risk and Insurance: Evidence from Ethiopia and Yemen.*
- 449. B. TIEBEN, *The concept of equilibrium in different economic traditions: A Historical Investigation.*
- 450. P. HEEMEIJER, *Expectation Formation in Dynamic Market Experiments.*
- 451. A.S. BOOIJ, *Essays on the Measurement Sensitivity of Risk Aversion and Causal Effects in Education.*
- 452. M.I. LÓPEZ YURDA, *Four Essays on Applied Micro econometrics.*
- 453. S. MEENTS, *The Influence of Sellers and the Intermediary on Buyers' Trust in C2C Electronic Marketplaces.*
- 454. S. VUJIĆ, *Econometric Studies to the Economic and Social Factors of Crime.*
- 455. F. HEUKELOM, *Kahneman and Tversky and the Making of Behavioral Economics.*
- 456. G. BUDAI-BALKE, *Operations Research Models for Scheduling Railway Infrastructure Maintenance.*
- 457. T.R. DANIËLS, *Rationalised Panics: The Consequences of Strategic Uncertainty during Financial Crises.*
- 458. A. VAN DIJK, *Essays on Finite Mixture Models.*
- 459. C.P.B.J. VAN KLAVEREN, *The Intra-household Allocation of Time.*
- 460. O.E. JONKEREN, *Adaptation to Climate Change in Inland Waterway Transport.*
- 461. S.C. GO, *Marine Insurance in the Netherlands 1600-1870, A Comparative Institutional Approach.*
- 462. J. NIEMCZYK, *Consequences and Detection of Invalid Exogeneity Conditions.*
- 463. I. BOS, *Incomplete Cartels and Antitrust Policy: Incidence and Detection*
- 464. M. KRAWCZYK, *Affect and risk in social interactions and individual decision-making.*
- 465. T.C. LIN, *Three Essays on Empirical Asset Pricing.*
- 466. J.A. BOLHAAR, *Health Insurance: Selection, Incentives and Search.*
- 467. T. FARENHORST-YUAN, *Efficient Simulation Algorithms for Optimization of Discrete Event Based on Measure Valued Differentiation.*
- 468. M.I. OCHEA, *Essays on Nonlinear Evolutionary Game Dynamics.*
- 469. J.L.W. KIPPERSLUIS, *Understanding Socioeconomic Differences in Health An Economic Approach.*

470. A. AL-IBRAHIM, *Dynamic Delay Management at Railways: A Semi-Markovian Decision Approach.*
471. R.P. FABER, *Prices and Price Setting.*
472. J. HUANG, *Education and Social Capital: Empirical Evidences from Microeconomic Analyses.*
473. J.W. VAN DER STRAATEN, *Essays on Urban Amenities and Location Choice.*
474. K.M. LEE, *Filtering Non Linear State Space Models: Methods and Economic Applications.*
475. M.J. REINDERS, *Managing Consumer Resistance to Innovations.*
476. A. PARAKHONYAK, *Essays on Consumer Search, Dynamic Competition and Regulation.*
477. S. GUPTA, *The Study of Impact of Early Life Conditions on Later Life Events: A Look Across the Individual's Life Course.*
478. J. LIU, *Breaking the Ice between Government and Business: From IT Enabled Control Procedure Redesign to Trusted Relationship Building.*
479. D. RUSINOVA, *Economic Development and Growth in Transition Countries.*
480. H. WU, *Essays on Top Management and corporate behavior.*
481. X. LIU, *Three Essays on Real Estate Finance*
482. E.L.W. JONGEN, *Modelling the Impact of Labour Market Policies in the Netherlands*
483. M.J. SMIT, *Agglomeration and Innovations: Evidence from Dutch Microdata*
484. S.VAN BEKKUM, *What is Wrong With Pricing Errors? Essays on Value Price Divergence*
485. X. HU, *Essays on Auctions*
486. A.A. DUBOVIK, *Economic Dances for Two (and Three)*
487. A.M. LIZYAYEV, *Stochastic Dominance in Portfolio Analysis and Asset Pricing*
488. B. SCHWAAB, *Credit Risk and State Space Methods*
489. N. BASTÜRK, *Essays on parameter heterogeneity and model uncertainty*
490. E.GUTIÉRREZ PUIGARNAU, *Labour markets, commuting and company cars*
491. M.W. VORAGE, *The Politics of Entry*
492. A.N. HALSEMA, *Essays on Resource Management: Ownership, Market Structures and Exhaustibility*
493. R.E. VLAHU, *Three Essays on Banking*
494. N.E. VIKANDER, *Essays on Teams and the Social Side of Consumption*
495. E. DEMIREL, *Economic Models for Inland Navigation in the Context of Climate Change*
496. V.A.C. VAN DEN BERG, *Congestion pricing with Heterogeneous travellers*
497. E.R. DE WIT, *Liquidity and Price Discovery in Real Estate Assets*