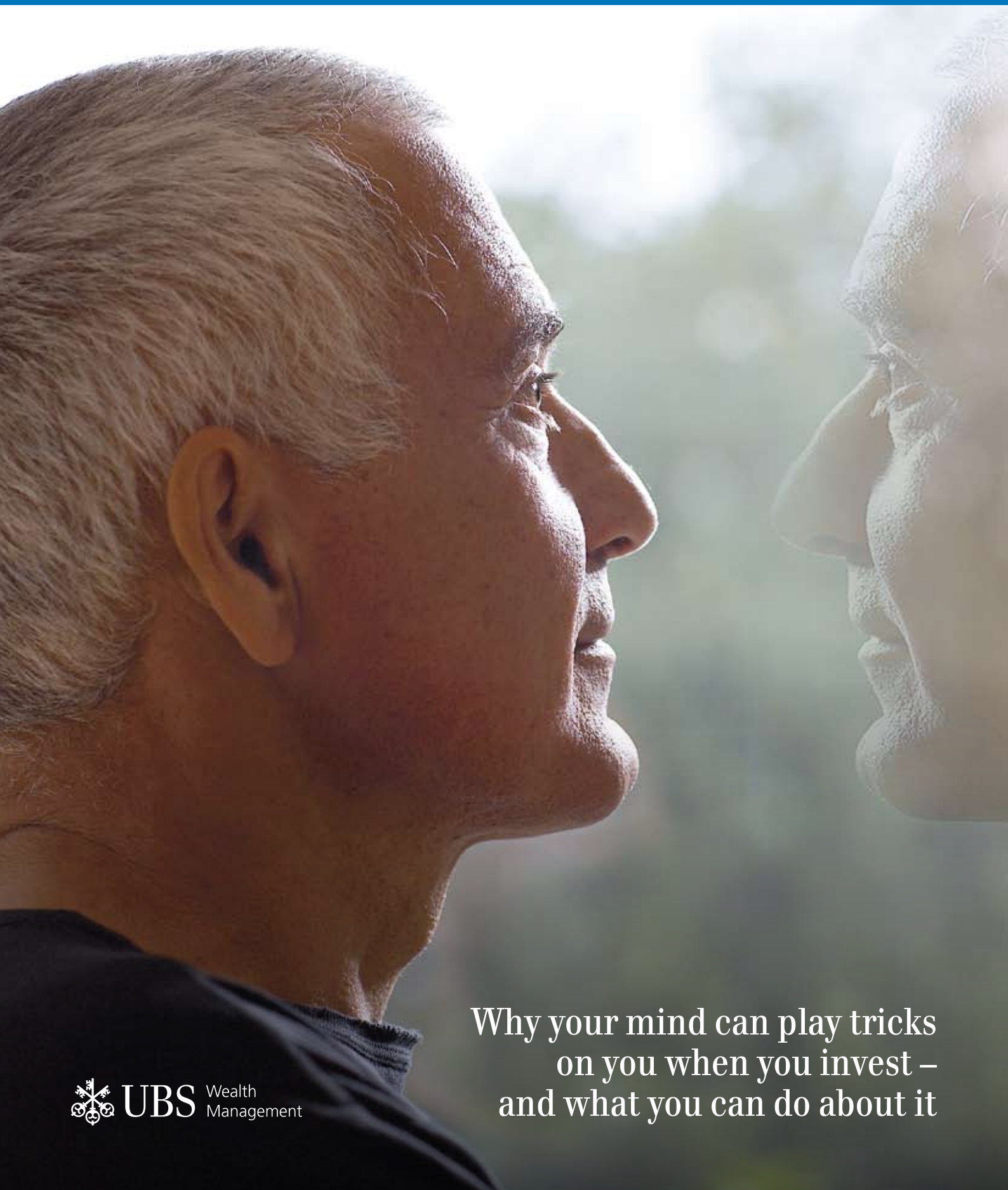


# Behavioral Finance



Why your mind can play tricks  
on you when you invest –  
and what you can do about it



**This UBS Wealth Management Research (WMR) publication contains the complete series of 7 Education Notes on "Behavioral Finance."**

**Education Notes explain financial topics.**

Other Education Note series:

- Foreign Exchange
- Portfolio Diversification
- Understanding Bonds

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# Emotion and rationality. Understanding to gain awareness.

**Behavioral finance analyzes investors' decision-making by relying on theories and tools that are typically utilized in psychology, sociology and traditional economics.**

While traditional economics bases its theories on the assumption of a "rational investor" that is almost exclusively oriented towards profit-maximization, behavioral finance analyzes the emotional dynamics which guide the investor in his or her financial decisions.

Reality has, however, shown us that the concept of a "rational investor", cold and calculating, only exists in theory. Investor behaviors are, in fact, often based upon psychological and emotional elements such as, for e.g., risk attitudes, the search for thrills and emotion, a desire for recognition by peers or self-affirmation.

As a result, a distinction must be made between the "rational" and the "emotional" investor.

In this publication of UBS Wealth Management Research, certain typical behaviors of the "emotional" investor are analyzed in more depth: topics

range from the selective perception to risk aversion and group influence. This is an important area of study which can allow each of us to gain greater awareness of certain behavioral anomalies influencing our attitudes and occasionally determine the lack of success in our investments.

In UBS, in fact, we believe that the first investment is knowing oneself.

It is for this reason that we dedicate any time that is required - with great passion and attention - to knowing and understanding your financial needs and requirements in addition to any emotional and character-based elements which make you a unique investor. We like to believe that each individual is unique in terms of objectives, ideas and plans as well as attitudes and personal experiences which inevitably influence our decisions in the financial realm.

We are therefore convinced that it is increasingly important to acquire knowledge of non-financial elements in order to help you make financial decisions with the greatest degree of trust and serenity.



# Introduction

## Education Note 1

**In this series of Education Notes we explore behavioral influences on investors' decision-making and the effects these have on investment success.**

### Background

- The concept of the homo oeconomicus, the rational economic man, forms the basis of the most widely used economic theories.
- Among these, Modern Portfolio Theory is probably one of the most successful, providing clear guidelines for efficient portfolio investing.

### Reality

- Observing actual behavior, however, we recognize that neither markets as a whole, nor individual investors consistently behave rationally.
- In fact, markets and investors seem to regularly display only limited, or bounded rationality.

### Decision-making

- We thus introduce Behavioral Finance as the field of research in which social, cognitive and economic human biases – and how these influence economic decision-making – are investigated.
- Recurrent, systematic biases with the propensity to threaten investment success will be at the center of our attention.

### Goal

- Our goal is to highlight the most important behavioral biases thus helping investors to avoid pitfalls and improve their portfolios' investment performance.

### Structure

- This series on Behavioral Finance consists of seven Education Notes published every two weeks from September to December 2007.
- Following this first Note in which Behavioral Finance is introduced, we will explore those behavioral biases that we believe to be most relevant to the private investor.

### Quiz

- We conclude this Education Note with a Quiz. We have chosen these questions to make our analysis more tangible.
- Please write down your quiz answers – we will provide an explanation to each question in one of the later Education Notes in this series. We challenge you to test your rationality!

## The market can stay irrational longer than you can stay solvent.

John Maynard Keynes

### Introduction

Why do many clever people make severe errors in their financial investments?

Investing can be tricky, and all too often private investors might find themselves behaving like our investor in Fig. 1. Beyond being plagued by indecisiveness, a lack of time, certain experiences and restricted information, our investor is driven by his own emotions and behavioral biases.

To understand behavioral biases, we must understand the norm that is implicitly referred to when we speak of a bias. In the world of investing this norm is the homo oeconomicus, or economic man, a concept of man used in economic theory that ascribes the qualities of perfect rationality and self-interest to human economic actors. The concept is thought to have originated among eighteenth century thinkers, among them Adam Smith, who wrote:

*"It is not from the benevolence of the butcher, the brewer, or the baker that we expect our dinner, but from their regard to their own interest."*<sup>1</sup>

Beyond this 'regard to their own interest' the homo oeconomicus is believed to have the ability to make perfectly rational judgments which lead to the best possible fulfillment of his goals.

The existence of altruism and philanthropy, in other words, the concern and effort to increase the well-being of others, has long hinted at there being more to mankind than perfect self-interest. In these Education Notes we will, however, focus on the second dubious characteristic of the homo oeconomicus: perfect rationality.

### Modern Portfolio Theory

Assuming precisely this perfect rationality, Modern Portfolio Theory, introduced in 1952 by Harry Markowitz, provided the groundwork according to which portfolios in current investment practice are constructed. Instead of investing all money in the investment object with the highest expected return for a certain level of risk, Markowitz showed that – while maintaining the same total portfolio risk – higher returns can be achieved by investing in assets with low return

**Fig. 1: Stock market development 1992–2007**

Clever people make severe investment errors



Source: UBS WMR, A. Hinder (2005) as of June 2008

<sup>1</sup> Smith, Adam. "On the Division of Labor," *The Wealth of Nations*, Books I–III. New York: Penguin Classics, 1986, p. 119



## Investing is simple, but not easy.

Warren Buffett



correlations. Thirty-eight years later Markowitz shared the Nobel Prize in Economics with Merton Miller and William Sharpe, for what has become probably the most widely implemented theory of portfolio selection.

However, putting Markowitz's theory of diversification into practice requires a rational investor – a homo œconomicus – who cares only about maximizing his future total wealth irrespective of the investment circumstances or his current financial situation. This is where behavioral effects often start to take their toll on investment success.

### Irrational markets

In contrast to the homo œconomicus and Modern Portfolio Theory, a lack of rationality in the global markets is regularly observed. Stock market bubbles are an example of this, as the majority of investors continues to buy even when they know that stocks are significantly overvalued. Not only stocks, but any traded good, can fall prey to this communally irrational behavior. The term 'tulip mania', metaphorically referring to any large economic bubble, has its origins in the Netherlands of the 17th century, where tulip bulbs became increasingly popular and prices increased, until finally huge amounts were paid for an individual tulip bulb.

### Investor returns do not match market returns

However, it is not only the market as a whole that is caught lacking communal rationality. Individual investors can become the victims of their own

behavioral biases, thereby negatively affecting their portfolio returns. In fact, Fig. 2 shows that, on average, the returns of private investors do not match market returns. This means that individual investors tend to underperform the more sophisticated institutional investors and the market as a whole.

Hence, it comes as no surprise that the majority of private investors consider themselves to be unsuccessful. Fig. 3 indicates investor happiness by country, showing that an unweighted average of 77% of investors feel unsuccessful. And many of these investors are probably less successful than they could be.

### Bounded rationality ...

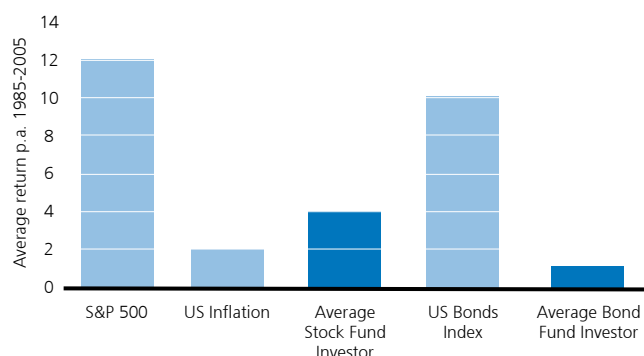
Surprisingly, investors seem to lack rationality in very systematic ways. A simple example of this is that investors' expectations follow past performance. As illustrated in Fig. 4, strong returns in the equity markets over the previous twelve months act as a catalyst for positive future market expectations. This strongly contrasts with the economic reality that periods of high returns result in less favorable valuations and subsequently lower returns in the following periods.

### ... can be analyzed

If this type of behavior is at least in part systematic, we do, however, have the opportunity to explore it. Behavioral

**Fig. 2: Investor returns do not match market returns**

Returns p.a. 1985–2005



Source: Dalbar, Inc., "Quantitative Analysis of Investor Behavior", July 2005

Finance is the field of research in which recurring social, cognitive and economic biases – and how these influence economic decision-making – are investigated, using insights both from psychology and neo-classical economic theory. Once decision-making is better understood, the effect of behavioral biases on market prices and portfolio returns can be evaluated and steps to mitigate or avoid negative effects can be established.

In fact, the results of behavioral research have shown that the first step in avoiding investment mistakes based on behavioral biases is to know of the existence of these biases and to understand how they work. Hence, the goal of this series of Education Notes on Behavioral Finance is to highlight and explain those behavioral biases that we believe to be most relevant to the individual investor.

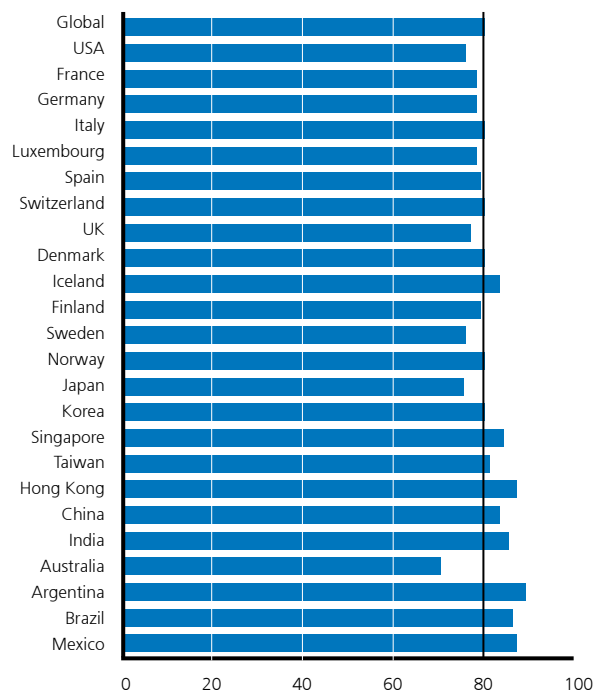
#### Highlights of future Education Notes

In this series we will investigate and explain the effects of perception and cognitive dissonances<sup>2</sup>, which lead us to conclude that framing of decisions has a strong influence on our opinions. The people around us also weigh on our judgments, and we will look into effects such as 'groupthink', through which the thinking within a group of people is aligned, and 'herding behavior', whereby behavior is copied, without self-conviction. Pride and regret are human characteristics that explain why decisions we take are not always in our best interests. Another situation in which we tend to harm ourselves is when facing speculative, risky decisions: We discover that when private investors face losses they are particularly prone to taking on excessive risk.

A frequent trait of individual investors is overconfidence: the belief of 'knowing' what will happen, or even just the belief of being more familiar with investment details, and more knowledgeable than they actually are. These investors risk suffering from reduced returns, through unexpected shortcomings in their judgments. Judgment failings also occur when investors use the status quo as a benchmark, or become aware of specific information,

**Fig. 3: Investor happiness**

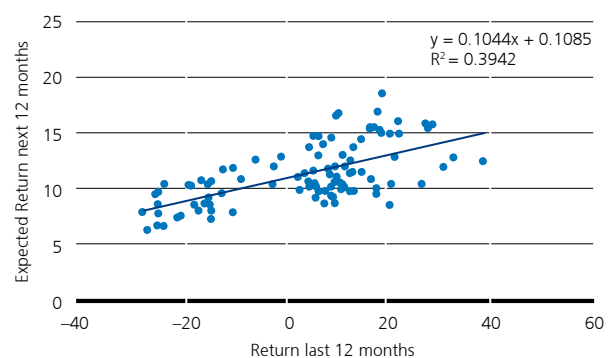
Percentage of investors that feel unsuccessful



Source: AllianceBernstein Global Investor Literacy Research (2006)


**Fig. 4: Investor expectations follow past performance (May 1998 – June 2007)**

Investors' return expectations were higher, the higher the returns (here: S&P 500) were in the 12 months prior



Source: Gallup, Bloomberg, UBS WMR, as of June 2008

<sup>2</sup> The uncomfortable tension that may result from having two conflicting thoughts at the same time, or from engaging in behavior that conflicts with one's beliefs, or from experiencing apparently conflicting phenomena.

A vertical photograph on the left side of the page shows a person in a light blue shirt and dark pants climbing a rope. The rope is attached to a metal structure and runs vertically along a wall made of large, grey stone tiles. The person is positioned near the bottom of the frame, and the rope extends upwards towards the top of the image.

which they use as anchors for further decisions. And finally, investors often classify and evaluate their assets and transactions into certain categories, through so-called mental accounting, frequently oversimplifying their decisions with sub-optimal results.

### Exploring behavior

Each behavioral topic we investigate will be structured so as to shed light on the following questions:

- What is the bias and how can it be explained?
- What effect does this behavior have on portfolios?
- How can negative effects to performance be avoided or minimized?
- Advanced topic: Indepth analysis for specialists.

### Conclusion

In this series of seven Education Notes on Behavioral Finance we explore behavioral influences on investors' decisionmaking.

In this Introduction we have seen that the economic models of the homo oeconomicus and Modern Portfolio Theory provide a sound theoretical framework on which investors should base their portfolio decisions. However, actual investor behavior deviates significantly from these models, often to the detriment of portfolio returns. The surprising consistency of irrational behavior makes it possible to investigate and analyze biases and their effects of returns. Behavioral Finance helps us to understand our behavioral weaknesses, which in turn will help each investor to guard against these pitfalls and improve their investment success.

**Test your own rationality: Read our Quiz on the next page and write down your answers. We will explain the background to each question in one of the later Education Notes in this series. By reflecting on your answers our Behavioral Finance analyses should become more tangible to you.**

# Behavioral Finance – Questionnaire

After learning about behavioral biases, most of us will intuitively think this applies to all others but not to me. To help you overcome the “I knew it all along” effect, we have prepared a little questionnaire. We very much hope that you will enjoy the quiz and we will come back to all questions in our future Education Notes on the respective topics.

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**1. If you were faced with the following choice, which alternative would you choose?**

- ☐ A 100% chance of losing USD 50  
☐ A 25% chance of losing USD 200, and a 75% chance of losing nothing

---

**2. As the president of an airline company, you have invested USD 10 million of the company's money into a research project. The purpose was to build a plane that would not be detected by conventional radar. When the project is 90% complete, another firm begins marketing a plane that cannot be detected by radar. Also, it is apparent that their plane is much faster and far more economical than the plane your company is building. The question is: Should you invest the last 10% of the research funds to finish your plane?**

- ☐ No – it makes no sense to continue spending money on the project  
☐ Yes – As long as USD 10m is already invested, I might as well finish the project

---

**3. Which is the more likely cause of death in the United States – being killed by falling airplane parts or by a shark?**

- ☐ Falling airplane parts  
☐ Shark

---

**4. For each pair, circle the cause of death that is most common in the United States**

Diabetes / Homicide  
 Tornado / Lightning  
 Car accidents / Stomach cancer

---

**5. A piece of paper is folded in half. It is folded in half again, and again. After 100 folds, how thick will it be?**

My best guess is that the paper will be \_\_\_\_\_ thick.  
 I am 90% sure, that the correct answer lies between \_\_\_\_\_ and \_\_\_\_\_.

---

**6. Including 29 February, there are 366 possible birthdays in a year. Consequently, a group would need to contain 367 members in order to be absolutely sure that at least 2 people shared the same birthday. How many people are necessary in order to be 50% certain?**

The group would need \_\_\_\_\_ members.

---

**7. The mean IQ of the population of eighth graders in a city is known to be 100. You have selected a random sample of 50 children for a study of educational achievements. The first child tested has an IQ of 150. What do you expect the mean IQ to be for the whole sample?**

Answer: \_\_\_\_\_

---

**8. “Memory can be likened to a storage chest in the brain into which we deposit material and from which we can withdraw it later if needed. Occasionally, something gets lost from the ‘chest’, and then we say we have forgotten.” Would you say this is a reasonably accurate description of how memory works?**

- ☐ Yes      ☐ No      ☐ Not sure
-

9. A man bought a horse for USD 60 and sold it for USD 70. Then he bought it back for USD 80 and again sold it for USD 90. How much money did he make in the horse business?

The man ended up with a final profit of USD \_\_\_\_\_.

10. Without actually calculating, give a quick (five-second) estimate of the following product:

$8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 =$  \_\_\_\_\_

11. Suppose you performed well on a variety of tests over a range of occasions, but other people taking the same tests did not do very well. What would you conclude? (Check one answer that comes closest to your view)

- ☐ A) The tests were probably easy.  
☐ B) The other people were probably low in ability.  
☐ C) I am either good in taking tests or must have known the material well.

12. If you were faced with the following choice, which alternative would you choose?

- ☐ A sure gain of USD 240  
☐ A 25% chance to gain USD 1000, and a 75% chance to gain nothing

13. If you were faced with the following choice, which alternative would you choose?

- ☐ A sure loss of USD 750  
☐ A 75% chance to lose USD 1000, and a 25% chance to lose nothing

14. If you were given a choice, which of the following gambles would you prefer?

- ☐ USD 1,000,000 for sure  
☐ A 10% chance of getting USD 2,500,000, a 89% chance of getting USD 1,000,000, and a 1% chance of getting USD 0

15. If you were given a choice, which of the following gambles would you prefer?

- ☐ An 11% chance of getting USD 1,000,000, and an 89% chance of getting USD 0  
☐ A 10% chance of getting USD 2,500,000, and a 90% chance of getting USD 0

16. Suppose a coin is flipped three times, and each time the coin lands on Heads. If you had to bet USD 100 on the next toss, what side would you choose?

- ☐ Heads  
☐ Tails  
☐ No preference

17. Does the act of voting for a candidate change your opinion about whether the candidate will win the election?

- ☐ Yes      ☐ No      ☐ Not sure

Source: Plous (1993)





# Selective Perception

## Education Note 2

**This Education Note examines how we perceive new information.**

### **Behavioral biases**

- Even if we think we look at something in a completely unbiased way, we selectively perceive what we expect to see. In addition, we put more trust in information provided by someone we like.
- Acting against our beliefs makes us feel uncomfortable. If we can blame someone else for errors, we experience no dissonance.
- If there is no one to blame, we unconsciously adapt our attitudes to justify our decisions to ourselves.

### **Application to investment decisions**

- Our view on a stock influences how we perceive new information about it. We tend to focus on the information that supports our existing view and to underestimate contrary information.
- We tend to hold on to a negative view on an investment that led to a loss with even if it is highly attractive now.

### **How to handle the selective perception bias**

- Use a trading system that relies on numbers generated either from technical or fundamental analysis. Act on these signals in a disciplined way.
- Establish and use strict stop-loss benchmarks.



**Notice anything odd here?  
Just look at it briefly**

**“Bias and prejudice are attitudes  
to be kept in hand, not attitudes  
to be avoided.”**

Charles Curtis (1860–1936)  
31st US Vice President

### Selective perception

Look at the picture on the left. Do you notice anything special? Most people who just look at this picture briefly fail to recognize that there is a black three of hearts. If the picture is taken away and people are asked which cards were shown, most are sure that the card was either a normal red three of hearts or a normal black three of spades.

These results show what selective perception is all about; The way we perceive things is strongly influenced by what we expect or hope to see. We tend to underweight or ignore information that conflicts with our preconceptions and put undue emphasis on affirming information. Past experience with similar situations very much influences our assessment of a new situation. Even if we recognize that the new situation is not exactly the same, we try to compromise and put it in a scheme with which we are familiar.

Besides the information itself, its source is also very important. Think of a situation where someone you like has an argument with someone you dislike. Unless the evidence against the one we like is overwhelming, we will tend to sympathize with our friend and react in accordance with his view. Selective perception also applies to opinions or versions of a story endorsed by a favorite newspaper or TV show.

Placebo experiments have shown that expectancy can even have physical effects. Individuals often react to an inert treatment because they believe that it will work. In a study, subjects that were told they drank an alcoholic beverage that in fact was just tonic water showed reactions to social stress that were similar to those who actually received an alcoholic beverage. Even the change in heart rates throughout

**Prejudice is a great  
timesaver. It enables you  
to form opinions without  
having to get facts.**

E.B. White

the experiment was dependent on what the subjects believed they had been given, not what they actually received.

### Application to investment decisions

We offer a simplified example to contrast the decisions of an investor who is highly susceptible to selective perception, called SP, and another one, who acts quite rationally, called QR. We track their thoughts following several events and the rationale for their decisions.

Both SP and QR follow the stock of a company WMR and both decide to buy 100 shares for USD 100 each.

- SP: “This stock is really attractive. They have a bright future and I am convinced this company will deliver strong performance.”
- QR: “WMR is well-positioned for the future. However, quite a lot of this is already reflected in the current stock price. I will set a Stop Loss at minus 15% (USD 85).”

WMR announces its first-quarter results in line with expectations. Earnings have grown by 8% versus last year and the company affirms its full-year guidance. The stock is down by 5% at USD 95.

- SP: "Who is selling this stock? Everything looks fine and WMR affirmed its targets for this year. If it falls further, I will buy some more."
- QR: "Either the market has expected even better figures from WMR, or there are some in the market who know more than I do. I will stick to my Stop Loss at USD 85 and watch the situation closely."

The company announces that a member of the management board has sold 250,000 stocks recently. The share price is down to USD 85 now.

- SP: "What an overreaction. It does not mean something bad; managers need to diversify their portfolios, too. The company is a real bargain at this price. I will buy another 100 shares and average down my purchase price."
- QR: "This is not a good sign at all. I don't know if there is really something wrong here, but I will sell my position as my Stop Loss at minus 15% of my purchase price is now reached."

Second-quarter results are published and WMR reports both sales and earnings below expectations. The company says it is facing minor operational issues, but those should be fixed within the next two quarters. Full year guidance is revised downwards. The stock price drops to USD 75.

- SP: "This is really unfortunate. However, the problems appear to be minor and the company said they will be fixed soon. It would be a big mistake to sell at such a low price."
- QR: "Obviously the market is always right and something was wrong. Fortunately I stuck to my Stop Loss mark."

WMR announces its third-quarter results and earnings are down again. However, the company states that the operational issues are solved and confirms its full-year targets. The market reacts negatively and the stock price slides to USD 68.

- SP: "Earnings are down again and the stock price continues to fall. This lousy management is trying to string us along. I am fed up with them and will sell my stocks."
- QR: "The decline in earnings was to be expected given their problems. WMR affirmed its full-year earnings guidance, which is positive. The valuation looks very attractive now. I will wait for the stock to stop its decline and buy into it then."

Fourth-quarter results meet expectations and the stock recovers to USD 75.

- SP: "I don't trust this company any more. One good quarter means nothing."
- QR: "They seem to be back on track now and valuation is still very cheap. Maybe it is too soon, but I will buy 150 shares now and set a Stop Loss mark again at minus 15%."

The company announces to enter the fast-growing Asian market and raises its earnings guidance. The stock jumps to USD 88.

- SP: "Everybody is running into the Asian market nowadays. That does not mean they will be successful there. I don't know why all those buyers believe in that story."
- QR: "WMR is expanding significantly. Its growth estimate even appears to be conservative now. I will buy another 100 shares."

### Stock-investor example (1)

Event	Stock Price		SP	QR
Buy	100	# of Shares	100	100
		Value	10.000	10.000
		Profit/Loss	0	0

Source: UBS WMR

### Stock-investor example (2)

Event	Stock Price		SP	QR
Q1 Results	95	# of Shares	100	100
		Value	9.500	9.500
		Profit/Loss	-500	-500

Source: UBS WMR

### Stock-investor example (3)

Event	Stock Price		SP	QR
Insider Sale	85	# of Shares	200	0
		Value	17.000	0
		Profit/Loss	-1.500	-1.500

Source: UBS WMR

### Stock-investor example (4)

Event	Stock Price		SP	QR
Q2 Results	75	# of Shares	200	0
		Value	15.000	0
		Profit/Loss	-3.500	-1.500

Source: UBS WMR

### Stock-investor example (5)

Event	Stock Price		SP	QR
Q3 Results	68	# of Shares	0	0
		Value	0	0
		Profit/Loss	-4.900	-1.500

Source: UBS WMR

### Stock-investor example (6)

Event	Stock Price		SP	QR
Q4 Results	75	# of Shares	0	150
		Value	0	11.250
		Profit/Loss	-4.900	-1.500

Source: UBS WMR

### Stock-investor example (7)

Event	Stock Price		SP	QR
Expansion	88	# of Shares	0	250
		Value	0	22.000
		Profit/Loss	-4.900	450

Source: UBS WMR

### Stock-investor example (8)

Event	Stock Price		SP	QR
Q2 Results	115	# of Shares	0	250
		Value	0	28.750
		Profit/Loss	-4.900	7.200

Source: UBS WMR



The results for the first half-year are significantly above expectations. WMR has grown strongly in Asia and the stock is rated "Buy" by the majority of the analysts. The price climbs to USD 115.

- SP: "How could I miss this? I can't believe it. I will watch out for another undervalued company. Next time, I will hold on to it if I believe in the story."

- QR: "Wow – that was great. I am glad I bought more when they announced the expansion. I will lift my Stop Loss limit up to USD 100 now to secure my gains."

Our investor SP, who was unable to handle his selective perceptions, viewed events with excessive optimism initially. It took him a very long time to accept that something was wrong with the company. After he sold, he contin-

ued to have a very negative view, even as the news from the company grew more positive.

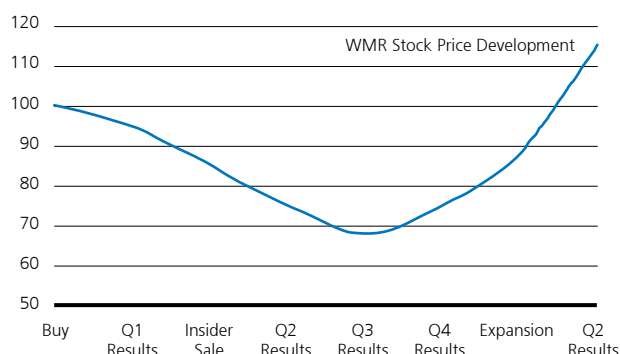
### Mitigating selective perception bias

We are all subject to some degree of selective perception. The purely rational investor as such does not exist. However, we can mitigate the drawbacks of our biases by following some simple rules:

- Use a defined system to determine when you should buy or sell an investment. It does not matter if the system is based on a fundamental or technical analysis, or a mixture of both. Define what triggers a buy and what triggers a sell and stick to the system.
- Use Stop Loss marks. The deviation from the purchase price should be adapted to the volatility of the specific investment. Highly volatile stocks should be granted a wider limit, while conservative investments should have tighter Stop Loss marks. Ideally, the Stop Loss should be executed automatically.

## Stock price development in our example

WMR stock

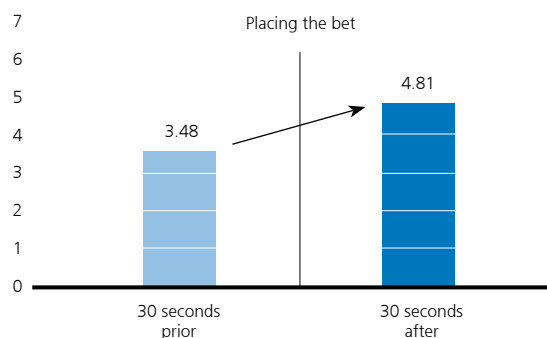


Source: UBS WMR.



### Estimated probability to win on a scale of 1 to 7

Confidence is a lot higher after placing a bet



Source: R. Knox, J. Inkster (1968)

#### Advanced Topic: Cognitive Dissonance

Having two conflicting thoughts at the same time, or acting against one's beliefs, usually causes an uncomfortable tension that psychologists call "cognitive dissonance". Unless there is a good reason to justify acting contrary to one's beliefs, we usually try to reduce this dissonance by changing our attitude or by compensating or even over-compensating for it in some way.

Investors who buy or sell a security on their advisor's recommendation usually do not feel dissonance, even if they invest in something they would never otherwise have bought. Should the investment perform poorly, there is someone to blame for it. Positive performance, however, is generally attributed to their own investment abilities.

Remember question #17 on the questionnaire in our introductory Education Note on Behavioral Finance:

*Does the act of voting for a candidate change your opinion about whether the candidate will win the election?*

Voters were asked before and after an election to estimate the probability of their candidate winning the election. After voting for the candidate, the estimated probability was significantly higher.

Knox and Ingster (1968) have demonstrated that people tend to overestimate the probability of success after they have made a commitment. They approached 141 horseracing bettors, 72 who had just placed a small bet within the past thirty seconds and 69 who were about to bet in the next thirty seconds. To reduce their postdecisional dissonance, most bettors believed more strongly than ever that their horse would win after having placed the bet. People were asked to rate the chances of winning on a scale of 1 ("slight chance of winning") to 7 ("excellent chance of winning"). Before placing their bets, the average was 3.48 – a fair chance of winning. After placing their bets, the belief in winning was significantly more optimistic with an average rating of 4.81.

This experiment is also frequently used in the context of discussing "sunk costs." Sunk cost situations are characterized by two things: assigning overly optimistic probabilities of success and the requisite of personal responsibility.

#### Application to investing

The horseracing betting example above is similar to buying shares in a company. Investors tend to be a lot more confident that a stock price will rise after they own a position in the company. This emotional commitment to a company may lead to an inappropriate assessment of the risks involved. We will elaborate on why people tend to hold losing investments too long in Education Note 4 in this series, "Pride and Regret."



# Group Dynamics

## Education Note 3

**In this Education Note we examine the effect of groups on the decision-making of individual investors.**

### **Group behavior**

- The nature of decision-making in groups differs significantly from that of individuals. In general, well-orchestrated groups can make more accurate decisions than individuals operating alone.
- However, effects such as Groupthink, which is characterized by uncritical thinking and conformity of group members through in-group pressures, can result in a qualitative deterioration in decision-making.
- Herding Behavior refers to individuals acting as a group, often losing sight of their own convictions and principles, which can result in sub-optimal investment decisions.

### **Portfolio effects**

- Group Dynamics can have a negative impact on the quality of investment decisions – and can affect any investor.
- Each investment has certain characteristics making it suitable for a particular type of investor. Following fashions indiscriminately increases the risk of investing in assets that do not suit you.

### **How to handle Group Dynamics**

- Only follow an investment fashion if it fits with your existing personal portfolio, your risk tolerance and your own investment approach.
- Take advantage of the strengths of group decision-making, such as improved accuracy and a broader range of possible solutions. But be aware of the pitfalls of group influences – these include in-group pressures that can suppress opposing ideas, and an illusion of invulnerability within the group.



**Fig. 1: Groupthink**  
**Do we all agree?**

Source: CartoonStock,  
reprinted with permission

The people around us influence our judgments, whether we are part of a group or acting as an individual in a group environment. As this influence can affect our decisions and thus our investment success, this Education Note investigates some of the most important aspects of Group Dynamics.

### Groupthink

One high-profile instance where Groupthink may well have had a detrimental effect on decision-making was the 1986 Challenger space shuttle disaster. The decision-making process at NASA displayed ample symptoms of Groupthink and was ultimately held partially accountable for the catastrophe. Bad or irrational group decisions can be explained by Groupthink if each group member attempts to tailor his or her opinions to what they believe is the consensus view. In the Challenger disaster, it was found that NASA managers and the agency's overall culture subtly discouraged any thinking that questioned its decisions – thus leading everyone to conclude that conditions were safe on board the Challenger when they actually were not.

In investment practice, Groupthink can occur when you discuss investments with your neighbors, your colleagues or your golf partners. There might be an implicit pressure for you to agree with the latest investment trend – even if you think that the opportunities are actually already past or that the risk is too high relative to the return. This conformity has repeatedly been shown to weaken the quality of decision-making within groups.

### Symptoms of Groupthink

Overconfidence and the illusion of invulnerability ("this space mission cannot fail"/"this investment cannot fail") within a group are symptoms of Groupthink. Warnings of the risks involved in a decision are shrugged off lightly and opposition, or even skepticism, is disparaged as being weak or naïve. When there is always consensus and team members work together without friction, we should probably become wary – and look out for Groupthink.

### Herding Behavior ...

As the name indicates, Herding Behavior is a phenomenon observed in the animal kingdom. Schools of fish and great herds of antelope demonstrate a remarkable coordinated behavior, with individuals acting in unison, as if choreographed, without an apparent leader or planned course of action.

In human society, we recognize Herding Behavior in a variety of situations: If a restaurant is empty but the one next door is full, people tend to enter the full restaurant, even if this means having to wait to be seated. When a building is evacuated in an emergency, people tend to use those exit routes that most other people are using. By following others, bottlenecks can occur at those exits and the total time needed to evacuate the building increases (see Fig. 2).

Herding Behavior in animals such as the wildebeest and zebra on their annual migrations across the African plains reduces vulnerability to predators for each individual animal. In the restaurant analogy, Herding Behavior might prevent you from entering a mediocre establishment. But as the bottlenecks and increased evacuation time in our third example show, the feeling of security we get from following the herd can be deceptive, and may instead actually increase our risks. The same is true when it comes to investing.

### ... usually leads to 'buy high, sell low'

An example of the extent to which we follow others' behavior and the effect this can have on investment success is shown in Fig. 3, where the performance of 128 technology mutual funds over the past 10 years is con-

trasted with the inflows and outflows of these funds. Investors poured ever more money into technology funds from early 1999 on as the spectacular prior returns made the sector ever more popular. However, asset prices were already very high in 1999 due to the impressive performance of the previous years. And with more investors following the herd, prices were pushed to unsustainable levels: a bubble. Asset prices fell during the correction of 2001 to 2003 and investors – displaying classic Herding Behavior – sold their technology mutual funds, thus closing their unintended “buy high, sell low” loss-strategy.

### Effects on investment success

Group Dynamics can have significant negative effects on investment returns. Not only can Herding Behavior end in buying high and selling low once the bubble has burst, but Herding Behavior and Groupthink can lead investors to buy assets that are unsuitable for them. For example, many private investors who suffered losses when the technology bubble burst in 2001 did not really have the high risk tolerance needed to invest a high proportion of their portfolio in such stocks. Furthermore, most did not structure the rest of their portfolios to suitably balance the risk they took in the technology sector.

### Are two heads better than one?

Interestingly, research has repeatedly shown that group judgments can be more accurate than those of individuals operating alone – but they do not have to be. Are two heads better than one after all?



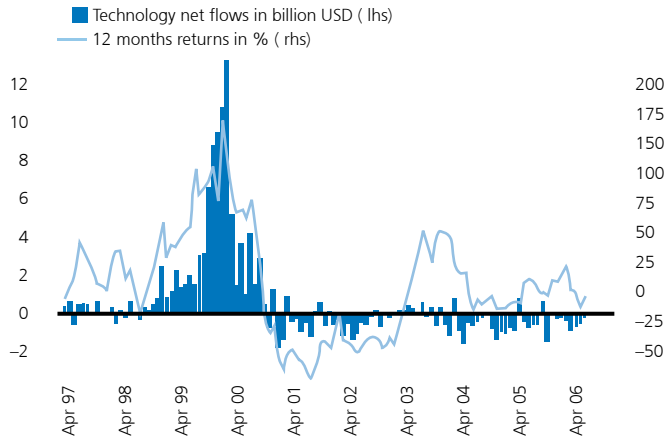
**Fig. 2: Following the herd**  
Herding Behavior is also observed when people choose the exit that most other people have chosen.

Source: Stanford University, Computational Modeling of Nonadaptive Crowd Behaviors for Egress Analysis, 2004–2005 and 2005–2006 CIFE Seed Project



**Fig. 3: Herding behavior in markets**

Inflows with rising markets, outflows with falling markets



Source: FRC, UBS Global Asset Management, based on monthly data of 128 technology mutual funds, as of December 2006

**Trends are highways to develop further ideas on them, whereas hypes are deadend roads. Only the first player will profit.**

Michael Hänni  
Cofounder of trendguide.com

The accuracy of group decisions depends on how the group makes its decisions. Following a few simple rules can help avoid negative effects such as Groupthink and Herding Behavior, and enable us to gain the most out of discussions with peers, neighbors and investment advisors:

- If you feel confident and at ease (invulnerable) about an investment after a group discussion, you should become wary of the possible effects of Group Dynamics. Specifically, look for counterarguments that support the opposite of your own opinion. Take seriously aspects that were played down. This can help you to recognize risks that were overseen due to Groupthink.
- In a decision-making group ask the most junior person to give his opinion first, followed by the second most junior person, etc. This increases the probability that contrary opinions will be expressed freely. The opinion of a leader often quickly becomes the framework for discussion, which can limit the airing of opposing ideas.

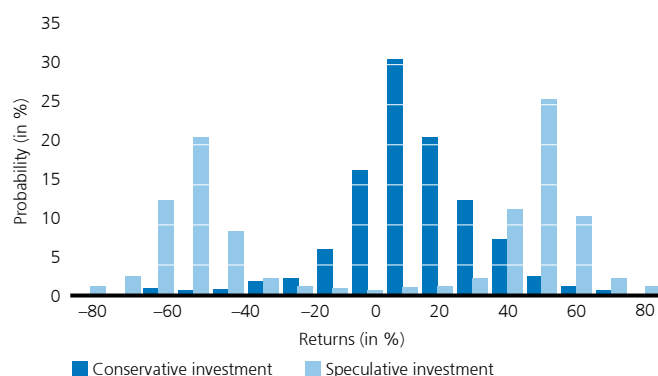
- Each investment is suitable only for certain investors. Ask yourself: Am I making this investment decision in a portfolio context? Does this investment maintain the integrity of the concept on which my portfolio is based (level of willingness to take risks, diversification etc.)?
- Surround yourself with people who will challenge your ideas or “give you a hard time” when it comes to investing. Their advice is more valuable than that of someone who always agrees. Alternatively, nominate someone in your investment team to act as a Devil’s Advocate, or get an external “reality check” for important decisions.
- Try to ignore “noise” (random events/information that have no lasting effect on prices) even if others think they are of great relevance. In the long run, acting on noise will reduce returns through additional trading costs. Base your decisions on a thorough analysis and a good portfolio match.
- Follow a systematic investment process. Carefully reconsider any investment for which you would have to adapt or change your investment process.

#### Advanced topic: Speculative investments

Speculative investments are characterized by a low probability of making a moderate return, but a high probability of either receiving an exceptional return or losing (nearly) everything. An example is the stock of a small pharmaceutical company whose main drug may or may not be approved for sale. If it is approved, profits will soar; if not, the company’s stock is worth nothing. This is in contrast to more conservative investments, where the probability of a moderate return is high, and the probability of an exceptional profit or loss is low (see Fig. 4).

**Fig. 4: Return distributions for hypothetical assets**

Speculative investments: An exceptional profit, or an exceptionally bad loss



Source: UBS WMR, as of June 2008

Motivated by the question, “Why do the prices of speculative assets fluctuate so much,” many economic researchers explain the origin of excessive volatility in terms of Group Dynamics. Already in 1984, Robert J. Shiller proposed that the prices of speculative investments were significantly driven by investment fashions due to unsophisticated investors who follow fads.<sup>1</sup>

Another explanation is that in speculative markets little information is available and there is high insecurity about the investment outcome. Thus, when investors become aware of information – though it might well be unimportant noise with no lasting effect on prices – the lack of other balancing information and the insecurity regarding the investment can amplify the reaction through Groupthink or Herding Behavior. The results are often large price movements, that is, excess volatility. Thus, highly speculative investments seem to suffer an even greater risk of being affected by Group Dynamics.

### Conclusion

In this Education Note we have examined how the people around us and the groups we are a part of influence our decision-making. We identified two important effects that can negatively impact investment success: Groupthink can cause a deterioration of cognitive focus and realism through in-group pressures. And Herding Behavior – when individuals in a group act together without planned coordination – often contributes to stock market bubbles and crashes. To avoid these effects and make optimal use of the strengths of group decision-making, promote a culture of critical reflection that challenges prevailing ideas. Additionally, testing each investment in terms of your willingness to take risks, your portfolio context and your investment process, will ensure that the investments you enter are suitable for you.

**Ask the most junior person to give his opinion first, followed by the second most junior person etc. The opinion of a leader usually becomes a framework for further discussions which limits opposing ideas.**

<sup>1</sup> Shiller, Robert (1984). “Stock Prices and Social Dynamics.” The Brookings Paper on Economic Activity, vol. 2, p. 457–510.



# Pride and Regret

## Education Note 4

This Education Note explores the consequences of the loss-aversion mind-set common to most investors and how it can lead to significantly lower returns in their portfolios.

### Facts

- Investors generally fear losses more than they value gains.
- As a result of loss-aversion, investments with a loss are held too long, while investments with a gain are sold too early.

### Tips

- Evaluate portfolio performance only as often as needed, but not too often.
- Place automatic stop-losses on your investments.
- Use structured products with (partial) capital protection.

### Advanced Topic: Myopic loss aversion and the equity premium

- Myopic loss-aversion can explain the historically high excess return of stocks vs. bonds or money market investments.

### Introduction

Over the last year and a half, my parents have been trying to sell their house. They bought the house about ten years ago for an amount – let's say, USD 500,000. Over the last ten years, house prices in their region have declined somewhat so they had difficulties finding a buyer for their target price of USD 520,000. In fact, they even had difficulties finding a buyer who would be willing to pay USD 500,000 for their house. Month after month, my parents looked for a buyer, but the real estate agents all told them their price was too high given the current market environment. My parents turned down several offers because, they said, they "at least want to break even." At last, they sold their house for USD 480,000 and now spend every week complaining to their son about the loss they have made...

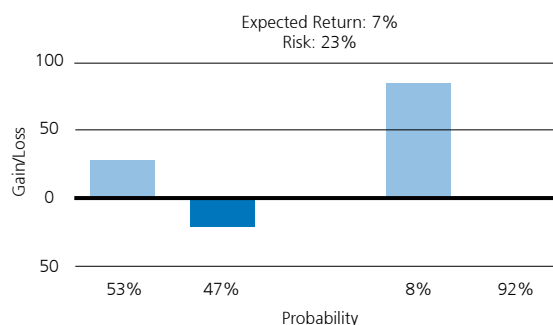
This behavior is not at all uncommon. Studies have shown that house owners who face the likelihood of a nominal loss set prices too high and as a result hold onto their houses for too long before selling.

### Investors fear losses more than they value gains

Investing in securities, just like investing in houses, exposes the investor to uncertainty about future prices. We innately try to avoid uncertainties and risks, or at least we want to be ade-

### Fig. 1: Loss aversion

Gains are not the same as losses



Source: UBS WMR, as of June 2008

quately compensated for undertaking them. But in fact what we fear is not so much risk in itself, but specifically the risk of losing money.

To illustrate this, consider the following example (Fig. 1): You can either invest in an asset that will return a gain 27% with a probability of 57% and a loss of 20% with a probability of 43%, or invest in an asset that returns a gain of 84% with a probability of 8% and returns zero with a probability of 92%. Both assets have the same expected

return of 7% and the same risk of 23%, but most people would choose to invest in the second asset, where they face no losses.

Investors do not merely look at the expected risks and returns of assets. Investors differentiate between "good" and "bad" risks with respect to a certain reference point. And, ample research has shown, they fear the bad risks of losing money more than they value the good risk of winning money.





### How to win a Nobel Prize in four steps

This observation is at the heart of the so-called “Prospect Theory” developed by Daniel Kahnemann and Amos Tversky in 1979. Kahnemann was awarded the Nobel Prize for economics in 2002 for this work (unfortunately, Prof. Tversky died in 1996). Prospect theory recognizes four distinctive features of how people evaluate securities:

- Investors evaluate outcomes with respect to a certain reference point.
- Investors want to avoid losses with respect to this reference point.
- Confronted with losses, investors’ attitude towards risk changes dramatically.
- Investors commonly overestimate the probability of unlikely events.

We will tackle the last two aspects of Prospect Theory in Part 5 of this series of Education Notes. Here we want to focus on loss aversion and the resulting disposition effect.

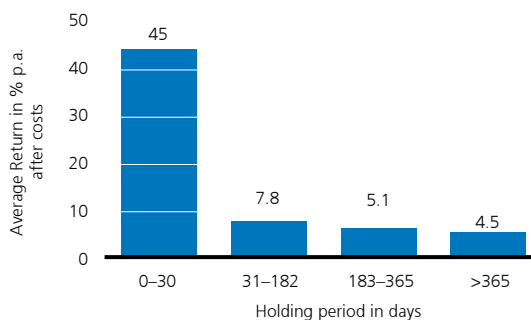
### Pride and Regret

Consider Bob, who purchases a stock for USD 50 per share. At the end of the year, the stock trades at USD 100 per share. Bob decides to hold on to his stock because he thinks it will go up even further. Six months later, the stock trades at USD 75 and Bob decides to sell his shares at this price. He has made a profit of USD 25 per share, but do you think he will feel good about it, or will he regret the loss of USD 25 since the beginning of the year? Will he take USD 100 as his reference point?

In fact, most investors evaluate each investment they make with respect to a reference point. Often, this is the purchasing price of the stock, but every time we see the stock go up, we tend to raise the reference point to the new all-time high. If the stock starts to decline, we then experience a loss with respect to this reference point. We regret that we haven’t sold the stock at the highest point and hope for it to recover and make up for our loss in the future.

### Fig. 2: Disposition effect

On average, stocks that are held longer in an investor’s portfolio, have a lower return, as investors tend not to sell losing stocks



Source: Schlarbaum, Lewellen and Lease (1978), as of June 2008

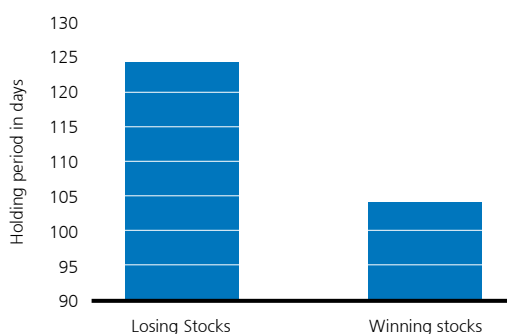
### Selling winners too soon and losers too late

Many investors decline to sell a stock at a loss, or do so only very reluctantly. On the other hand, we feel proud of our decision to buy a stock that subsequently increases in price. In these cases, we want to take profits soon in order to show everyone how good our investment decision was (and, of course, to avoid the regret of selling the stock at a later stage for less money). As a result, a dramatic decline in average stock returns in portfolios can be observed the longer a stock is held in the portfolio (Fig. 2).

Historically, investors have often held losing stocks until it was too late. The shareholders of Enron, Swissair and other companies have learned the hard way that often it is much better to bite the bullet and sell a stock at a significant loss in order to avoid a total loss. Fig. 3 shows the average holding period of stocks in investors’ portfolios. Losing stocks remain in the portfolio on average for 124 days before being sold, while gaining stocks are sold on average after 104 days. Denying the poor performance of losing stocks in order to avoid the regret of selling them at a loss has significant

### Fig. 3: Riding losers too long

Stocks with a loss stay in portfolios longer than stocks with a gain



Source: Odean (1998), as of June 2008

consequences for investor performance. Fig. 4 shows the average performance of the stocks in the twelve months after the winning stocks were sold (but the losers were retained in the portfolio). The winners that were sold subsequently gained another 11.6%, while the loser stocks still held in the portfolio earned just 5% in the subsequent twelve months.

Interestingly, this disposition effect of sticking too long with losers declines significantly in December, when US investors can sell stocks at a loss that can be claimed to reduce taxes on profits made during the year with other investments. It seems like the short-term incentive to reduce taxes overrides the denial reflex to hold on to losing stocks for longer.

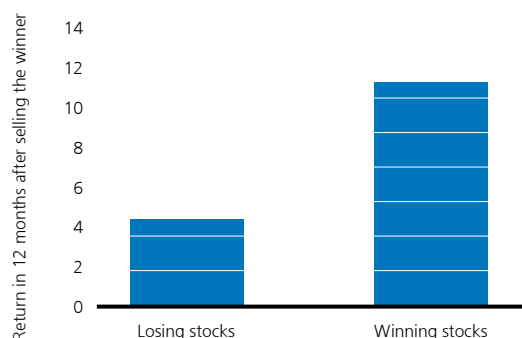
### Three ways to improve your portfolio

Basically, there are three possibilities to tackle behavioral biases like loss aversion or the disposition effect:

- Review your portfolio less often to avoid short-term regret over losses and focus more on long-term developments.
- Establish automatic stop-loss triggers as soon as you purchase a security in order to avoid holding on to losing stocks for too long.
- Invest in structured products or derivatives that limit your losses.

### Fig. 4: Selling winners too early

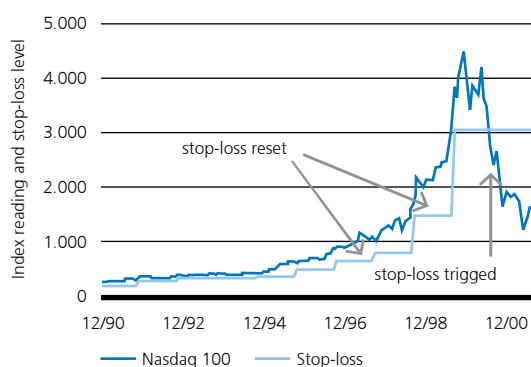
Stocks that are sold with a gain have higher returns in the twelve months after the sale than stocks kept in the portfolio



Source: Odean (1998), as of June 2008

### Fig. 5: Stop-loss investing

Tracking the NASDAQ from 1995 to 2000 with a 20% stop-loss level



Source: UBS WMR, as of June 2008

### Review your portfolio less often

This may sound like a strange advice, given that a regular review of an investment portfolio is usually considered a cornerstone of investing. However, reviewing a portfolio too often can over-emphasize the short-term fluctuations of financial markets, which can lead investors to lose sight of their overall goals. In the advanced topics section of this Education Note, we show that excessive portfolio review leads to so-called "myopic loss aversion" because with each review the investor resets the reference point for every investment. Once the investment suffers short-term losses, the investor starts to feel uncomfortable and wants to change something in the portfolio to get it back on track, sometimes with disastrous results.

For a long-term investor, with a horizon of five years or more, we think a quarterly portfolio review makes little sense because quarterly profits and losses usually do not influence the overall portfolio very much. (There are exceptions, for example, if a company gets into legal trouble or the stock market contracts sharply). As a rule, the shorter the investment horizon, the more frequently the portfolio should be revised.



### Place stop-losses

In order to avoid clinging to losing stocks for too long, we recommend placing stop-losses at a predefined level below the purchasing price (Fig. 5). The stop-loss level can then regularly be increased if the investment has increased in value. This way some of the profits are locked in and the investment will automatically be sold as soon as the incurred losses cross the predefined threshold.

The level of the stop-loss needs to be determined for every investment. The more volatile an investment, the higher the threshold should be in order to avoid the circumstance that typical market movements trigger the sale of the asset prematurely. But the stop-loss should be tight enough to avoid any major damage to portfolio performance.

The stop-loss orders should be set for every investment on the day of the purchase, to be executed automatically as

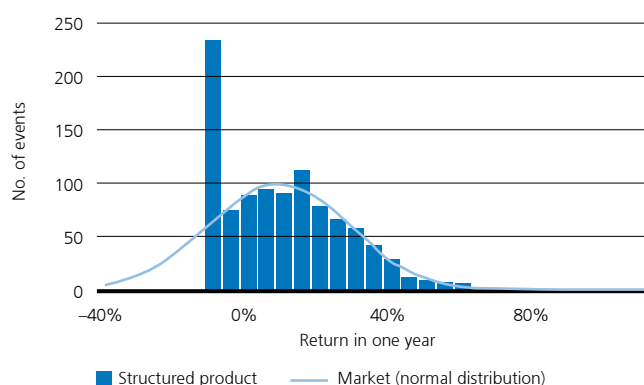
soon as it is triggered. If the trigger is not automatic, many investors will not execute the stop-loss at all, instead going into denial and arguing that the share price will eventually revive.

### Structured products with capital protection

The third way to deal with loss-aversion is to buy protection against severe losses. This can be done with derivatives like put options, or by investing in assets via structured products that have partial or full capital protection. The advantage of these investments is that the investor can profit from rising asset values, but is also protected against losses of a certain magnitude. Of course, this insurance comes at a price, which usually means that the structured product's scope for potential gain (upside) is slightly less than with an outright investment. But many investors are willing to forego some upside in order to avoid downside risks.

**Fig. 6: Avoid losses with structured products**

Hypothetical structured product with 90% protection

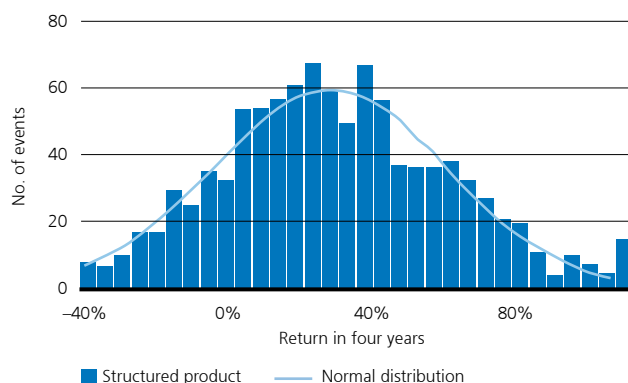


Source: UBS WMR, as of June 2008

Fig. 6 shows the payoff of a hypothetical structured product on a stock market investment. The structured product has a capital protection of 90% of the invested capital and a maturity of one year. Because of the costs for insurance, the expected return of the structured product is 7.1% vs. 8% for the market. Many investors are willing to pay such a low price in order to avoid losses of more than 10% in one year.

**Fig. 7: Rolling structured products over**

Rolling structured products over many times erases the downside protection



Source: UBS WMR, as of June 2008

## Beware the central limit theorem

One factor must be considered with these investments. If the maturity of the structured product is shorter than the investor's time horizon, the structured product has to be rolled over in another product. Assume an investor aims to reach a certain financial goal in four years' time. To do this, the hypothetical structured product of Fig. 5 with a maturity of one year is bought. After the product expires, the proceeds are reinvested in the same product, again with one year maturity.

In this case, the central limit theorem of mathematics tells us that the final distribution of cash flows after four years will not be as asymmetrical as in Fig. 6, but will essentially be normally distributed again, with almost no capital protection at all. Fig. 7 shows the payoff of the structured product that has been rolled over four times in comparison to the market return without capital protection. The capital protection of the structured product is essentially erased because it may well happen that in every year the market drops by 10% or more, resulting in four years with a total loss of 35%. We thus recommend choosing maturities for such products that coincide with your investment horizon.

## Conclusions

Most investors strive to avoid losses and at the same time take pride in having bought a highly profitable investment. In so doing, all investments are evaluated with respect to a specific reference point. Once the value of the investment drops below the reference point, the investor experiences a loss. Very often these investments are not sold at a loss but are retained in the portfolio for much longer. The result is inferior investment returns in the long run.

We suggest three ways to mitigate these detrimental effects. Portfolios should not be reviewed too often, in order to avoid reacting to short-term market movements. Investors should place automatic stop-loss orders when buying securities in order to avoid large losses. And investors can invest in products with partial or full capital protection to limit the overall size of losses.









## Advanced Topic: Myopic Loss Aversion and the Equity Risk Premium

### The equity risk premium puzzle

It is widely accepted that equities are in general riskier investments than bonds or money market instruments. Consequently, investors think they should be compensated for taking on that higher risk with a higher expected return. In Fig. A.1 we show the historical returns of US equities, US Treasury Bills and the corresponding equity risk premium between 1900 and 2004. Historically, the equity risk premium in the US has been an impressive 8% per year.

In 1985, R. Mehra and E. Prescott tried to explain the historically observed equity risk premium using a standard capital asset pricing model and assuming rational investors. The result was surprising. According to the standard model, the equity risk premium should either have been as low as 0.1% (no risk premium at all) or the risk aversion of investors must be unbelievably high. In fact, all investors need to be so risk averse that they would decline a 50% chance to earn USD 50,000 or a 50% chance to earn USD 100,000 in favor of a certain income of just USD 51,209. In reality, only a few people are so risk averse.

### Myopic loss aversion

The equity risk premium puzzle has triggered an entire line of research that seeks to explain the historically high return of equities compared to money market investments or bonds. One plausible explanation has its roots in prospect theory and the loss-aversion of investors.

Consider the following investment (Fig. A.2): You have a 50% chance of earning USD 200 and a 50% chance of losing USD 100. Not everyone would engage in this investment be-

cause of loss aversion. However, what if one can invest in it fifty times in a row? Most people would take the investment even if it is played twice, let alone fifty times. The payout after investing twice is a 25% chance to earn USD 400, a 50% chance to earn USD 100 and just a 25% chance to lose USD 200. This sounds like a much more interesting investment to take on than the original one played just once.

While the investment seems attractive if made very often, every single outcome seems rather unattractive because of the potential losses associated with it. This myopic aversion to losses thus can explain the historically high premium for equities.

### Explaining the risk premium puzzle with myopic loss aversion

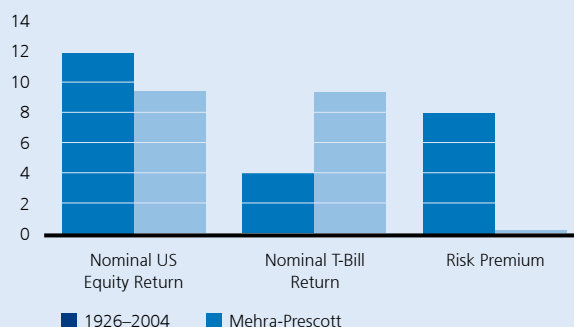
While, over the long run, equities generally have much higher returns than bonds or money market investments, in the short run – over the course of a year, say – the return of equity investments might be much lower. Rational investors should know this and invest for the long run. As a result, the risk premium these investors demand for equity investments should be very low, because the likelihood of underperforming money markets with equity investments in the long run is small.

In reality, long-term investors monitor their portfolio regularly. Even with a stated investment horizon of 20 years, a long-term investor tends to check the performance of the investments at least once a year. But if one checks the performance on a more frequent basis, the phenomenon transpires that we have seen with our investment example in Fig. A.2. Through repeated checking, investors become aware of the significant short-term losses possible with equity investments and want to be adequately compensated for them with a higher risk premium.

Fig. A.3 shows how much more equities should return compared to bonds if investors would evaluate their portfolio performance annually, every 2, 5, 10 or 20 years. An investor with a one-year investment horizon would not distinguish between stocks and bonds if stocks pay 6.5% more than bonds, while someone with a 20-year horizon would be indifferent if stocks pay just 1.4% more than bonds on average per year. The difference of 5.1% can be seen as a fee payable to those who are able to resist the temptation to count their money too often. In a sense, the 5.1% difference is the price of excessive vigilance.

**Fig. A.1: The equity risk premium puzzle**

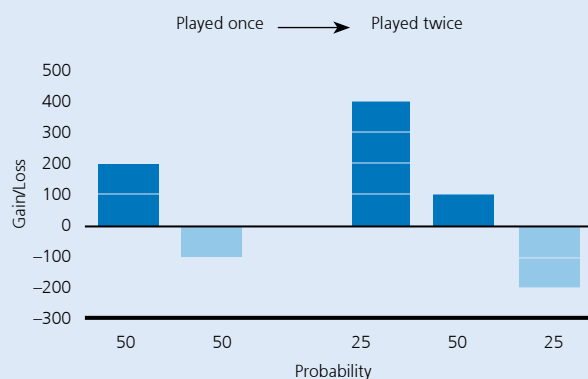
Standard capital market models cannot explain the high risk premium of equities in the past



Source: UBS WMR, Siegel (2005,) as of June 2008

**Fig. A.2: Myopic loss aversion**

Few investors would take the investment on the left; but if played several times in a row, it becomes much more attractive



Source: UBS WMR, as of June 2008

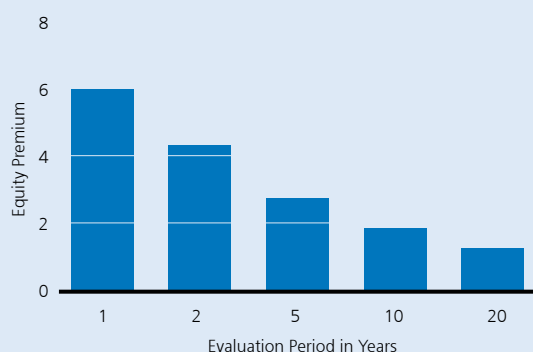
### Conclusion

In theory, rational long-term investors would demand only a very small premium for equity investments, since the probability of equities underperforming money market investments is very small in the long run. However, even long-term investors such as pension funds monitor their portfolio regularly. Thus, investors are made constantly aware of the potentially significant

short-term losses of equities. Because investors are loss averse, they demand adequate compensation for these short-term risks and will invest in equities only if they have much higher returns than bonds or money market investments. Myopic loss aversion may thus account for the historically high returns of equity investments.

**Fig. A.3: Myopic and the equity premium**

The more frequently we evaluate our portfolio, the more we want to be compensated for short-term losses



Source: Benartzi and Thaler (1995), as of June 2008

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# Speculative Investments

## Education Note 5

In this Education Note we examine how investors' attitude towards risk changes when faced with losses. When confronted with losses, many investors respond by taking on much more risk, sometimes with disastrous results.

### Facts

- When confronted with losses, many people tend to become more risk-seeking rather than more risk averse.
- While investors generally try to avoid losses, some level of highly speculative investments is common.
- Resulting portfolios are considered in different mental accounts with different attitudes towards risk.

### Tips

- Limit the size of speculative investments.
- Don't throw good money after bad.
- Always invest based on a solid investment case.



### Introduction

Remember question #12 of our quiz in the introduction to this series?

If you were faced with the following choice, which alternative would you prefer?

- A sure gain of USD 240.
- A 25% chance to gain USD 1000 and a 75% chance to gain nothing.

Most people in this situation would opt for the safe alternative and not gamble. This is what we know as risk aversion. People want to avoid risks if the profit that can be earned is not big enough compared to the safe option.

Now, do you remember question #13?

If you were faced with the following choice, which alternative would you choose?

- A sure loss of USD 750.
- A 75% chance to lose USD 1000 and a 25% chance to lose nothing.

When confronted with losses many people suddenly become more risk-seeking in their behavior, opting to gamble in order to get a chance to break even (by the way, this is similar in Question #1 of the quiz even though the smaller loss in question #1 might induce more people to take the loss instead of the gamble). This risk-seeking behavior of investors wanting to avoid losses is one of the key findings of prospect theory (see Part 4 in this series: Pride and Regret) and can be observed regularly in private and professional investors alike.

### Nick Leeson and Barings Bank

The consequences of such changes in attitude towards risk can be dramatic. Nick Leeson and the bankruptcy of Barings Bank is a famous example of a professional investor falling into this behavioral trap. When Leeson – a derivatives trader at Barings Bank in Singapore – suffered losses in his trading activities, he tried to break even by increasing the risk of his trades. The result was an even bigger loss that needed even bigger trades to be made in order to cover these losses. Finally the losses became so big that the entire Barings Bank could not cover the liabilities created by these losses and eventually had to file for bankruptcy.

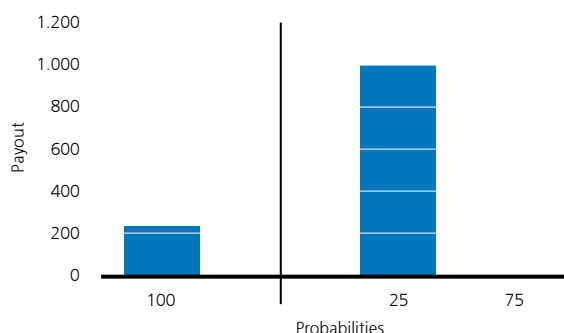
### How to win at the racetrack

Horse race betting displays similar dynamics – a growing urge to recover earlier losses. In fact, it does so to such a degree that the clever bettor can try to exploit this behavior to his or her

own advantage. Racetrack betting – like state lotteries or casino gambling – is designed to be profitable for the house while the gamblers on average lose money. In racetrack betting, for example, the track typically keeps about 15% of the stakes to cover for expenses and profits. Because of this, many bettors face losses towards the end of a racing day. As a result, more and more bets are placed on the long shots, horses with a small probability of winning. For instance, a horse with the winning odds of 100 to 1, or a 1% chance, may accumulate 2% or more of all the money bet on the race. On the other hand, fewer bettors place their money on the favorite horses late in the day as they look for long shots and loss recovery. Indeed, some studies show that betting on the favorite to show (to finish among the first three) on the last race of the day can be a profitable bet despite the track's take.

**Fig. 1: Risk averse behavior**

Most people normally choose to avoid risks

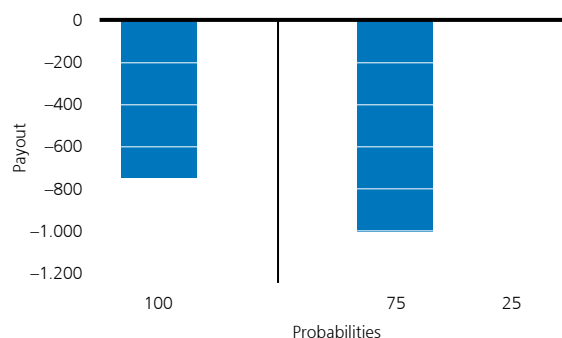


Source: UBS WMR, as of June 2008



**Fig. 2: Risk-seeking behavior**

When confronted with losses, risk aversion often turns into risk seeking behavior



Source: UBS WMR, as of June 2008

### Lottery tickets and speculative investments

The risk-seeking “reflex” in response to losses is reinforced by an inclination to overestimate the likelihood of rare events while underestimating the likelihood of frequent events. For instance, winning the lottery is an incredibly rare event and, obviously, most people lose the money they spend on their lottery tickets. Yet most people overestimate the likelihood of winning the lottery and buy tickets believing they will strike it rich.

The stock market is fairer than the race track and, on average, it is not a losing proposition. But similar things happen in stock markets, where many people invest in IPOs, exotic stocks or options or instruments that will be profitable only if a stock moves dramatically in the coming months. If these “get rich quick schemes” result in a loss, which may be very likely given the often extreme nature of the investment, investors regularly fall into the trap of considering the events to be a buying opportunity and double their bets (see the example in Part 2 of our series on Selective Perception).

### Risky investments are fun – literally

We do not want investors to stop playing the lottery or taking on speculative investments. Even though such investments may be a long shot to big profits, it still is possible to win and many investors would feel uncomfortable with a portfolio that shuns such potential opportunities altogether. After all, if only a small amount is invested

speculatively, only minor losses can occur. This might be a small price to pay for the increased happiness and excitement of such investments.

Neuroeconomic studies have shown that, independent of their outcome, investments in risky stocks trigger biological processes in the human brain that are similar to those activated when people are under the influence of drugs like alcohol. One of the relevant brain regions for such gambles is the nucleus accumbens, which is activated when rewards are expected, whether these rewards are received afterwards

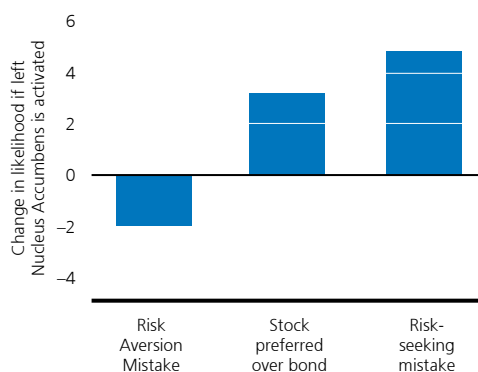
or not. Risky investment choices are more likely when these brain regions are activated and these brain regions in turn are more active when investors expect risky investments to be profitable (Fig. 3). Hence activation of these brain regions correlates with risky investment decisions.

### When standard risk measures fail

We have seen in Part 4 of this Education Note series that investors generally are loss averse and try to avoid losses as far as possible. At the same time, we have shown that very risky investments promising high returns at low

**Fig. 3: Risky investments and pleasure**

Activation of *Nucleus accumbens* (brain area commonly associated with the feeling of pleasure) correlates with risk-seeking investment decisions.



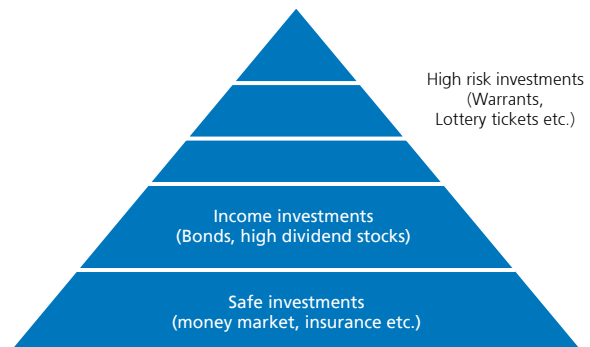
Source: Kuhnen and Knutsen (2005), as of June 2008

investment costs may give excitement and pleasure to the investor. If both effects are combined, we can see why many investors build behavioral portfolios that consist of several discreet and independent investment “layers” (Fig. 4). The bottom layer consists of safe investments (money market investments or capital-protected investments) that reflect risk aversion. Above that come more and more risky assets that have different purposes. The top layer consists of highly speculative investments like IPOs or stock options. Each of these layers is considered independently and not in a comprehensive portfolio context, which would be optimal.

In fact, investors’ attitude towards risk changes for each layer of investment. While the bottom layer focuses on avoiding “bad” risks (loss of wealth), the top layer focuses on “good” risks (the possibility of striking it rich with one extraordinary investment). Standard financial theory cannot capture such effects because traditional risk measures like volatility are always symmetrical between upside and downside risks. This might explain why many private investors feel uncomfortable with a traditional well-balanced portfolio, preferring to deviate to some extent from such

**Fig. 4: Behavioral portfolios**

Portfolio layers are evaluated differently



Source: Shefrin and Statman, UBS WMR, as of June 2008

norms in search of high-risk/high-reward returns. Many investors actually reduce the efficiency of their portfolios through this approach but seem happy to do so.

### Three ways to improve your portfolio

As financial analysts, we want to provide investors with three tips on how investing can be successful without taking the fun out of it:

- Limit the size of your speculative investments.
- Do not throw good money after bad.
- Always invest based on a solid investment case – not gut feeling.

### Limit the size of your speculative investments

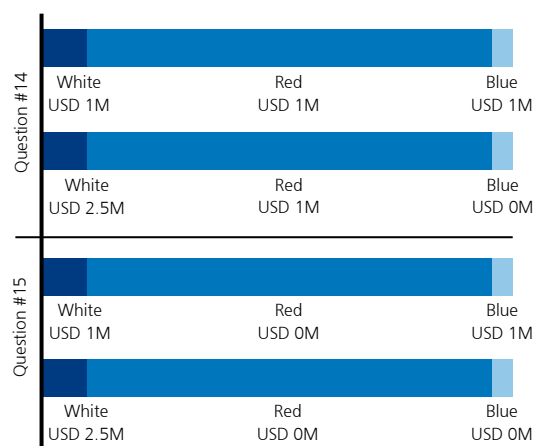
Do not invest too much of your total wealth in speculative investments. After all, speculative investments might end up as total losses and this should not result in significant reduction of your total wealth. We cannot give a general rule for the upper limit on speculative investments, because it depends primarily on the comfort level of every individual investor. However, we think that all speculative investments taken together should normally form a satellite investment of no more than 15% to 20% of total wealth.

### Do not throw good money after bad

High-risk investments often incur losses. Do not consider these moments to be a buying opportunity and generally abstain from the strategy of buying on dips. As the old Wall Street adage goes: “Never catch a falling knife.” Admit to yourself that the investment did not

**Fig. 5: The Allais Paradox**

Two identical experiments with different outcomes in investor choice



Source: UBS WMR, as of June 2008

## Advanced topic: Testing expected utility theory

One of the assumptions of classical economics inherent in the homo economicus – the notion of the Economic man, who rationally pursues gain and avoids effort and risk – is utility maximizing behavior. This concept implies that investors, given various options, always choose based on the expected return and the associated risk. This assumption, however, is frequently violated in real life.

One way to demonstrate this is to think of questions #14 and #15 in Part 1 of this Education Notes series. In question #14, we asked:

If you were faced with the following choices, which alternative would you prefer?

- USD 1,000,000 for sure.
- A 10% chance of getting USD 2,500,000, an 89% chance of getting USD 1,000,000 and a 1% chance of getting nothing.

The expected gain in the second alternative is USD 1,140,000 and thus USD 140,000 above the profit in the first alternative. Yet most people choose the second alternative in this example, which can be interpreted as a sign of risk aversion.

Now, let's look at this experiment a little differently, as shown in Fig. 5. This figure refers to the behavioral paradox identified by French economist Maurice Allais to describe the seemingly irrational choices of people confronted with options similar to those in our questions.

Imagine a jar of 100 colored balls: 10 white balls, 89 red balls and 1 blue ball and you want to draw one ball from this jar. In question #14, the first alternative would pay out USD 1,000,000 independent of the color of the ball you select, while the second alternative still pays USD 1,000,000 for every red ball, but now pays USD 2,500,000 for every white ball and nothing for the blue ball (Fig. 5, upper half).

Now let's alter the experiment: for every red ball you don't get USD 1,000,000; rather, you get nothing, as shown in the lower half of Fig. 5 or question #15:

If you were faced with the following choices, which alternative would you choose?

- An 11% chance of getting USD 1,000,000 and an 89% chance of getting nothing.
- A 10% chance of getting USD 2,500,000 and a 90% chance of getting nothing.

Interestingly, in this circumstance most people would choose the second alternative because they reason that the difference in probability is small, while the difference in payoffs, if one wins, is big.

One of the cornerstones of expected utility maximization and of probabilistic theory, too, is the so-called cancellation principle, which states that in choosing between two alternatives a rational investor should only decide based on the outcomes that differ in both alternatives not based on the outcomes that are identical. In questions #14 and #15, the difference between the two alternatives is the payoff for the white and blue balls, while the payoff for the red balls stays the same. But if this payoff for the red balls is changed, people start to switch between alternatives, violating one fundamental assumption about expected utility theory and how homo economicus acts.

go as expected and when stop-loss levels are triggered, be disciplined, sell the investments and close the account with a loss. Look for better opportunities elsewhere and before investing in these, consider our third tip.

### Always invest based on a solid investment case

Investments should be made based on facts rather than feelings. Many investors rely on perceived information like a brand name, a TV commercial or tips from friends and coworkers. At the end of the 1990s companies could ensure much more interest in their stock by adding a .com to their name. Good investors should always rely on facts rather than hopes, stories or gut feeling. If investments are based on facts and research, they tend to fail less often. And if they fail, the reasons can be examined afterwards in order to avoid repeating the mistake. If investments are based on gut feeling, mistakes are likely to be repeated. To be clear: a well-documented research report forms a solid investment case; a newspaper report about the latest investment craze does not.



# Heuristics and Biases

## Education Note 6

This Education Note examines decision-making rules of thumb (heuristics) and biases. While these analytical methods may give the human brain a competitive advantage over computers, they also unconsciously influence our decisions. Most of the items in the questionnaire on page 10 and 11 are answered below.

### Key biases discussed in this Note

- The more a scenario is representative of what we have in mind, the higher we estimate its probability.
- We tend to expect that bad luck is self-correcting over time and expect probabilities to hold in small samples.
- The availability heuristic reflects the likelihood we assign to certain events; the chances of highly unlikely events that capture a lot of attention are usually overestimated.
- Anchoring and adjustment describe the problem of insufficiently adjusting estimates to new information. Even unrelated values are used as an anchor for an estimate, leading to errors.
- In ex post evaluation, successful decisions are usually attributed to personal abilities; whereas failures are blamed on external factors.



### All investment decisions are uncertain

Almost all our decisions are subject to a degree of uncertainty. Even if we are sure about what we are doing and why we are doing it, we rarely are aware of all relevant factors. Investment decisions are usually based on several assumptions, like an economic trend, interest rate expectations or earnings estimates.

The ability to learn and to modify concepts quickly to reach decisions amid uncertainty is the major reason the human brain is superior to any computer applying artificial intelligence. Heuristics, or rules-of-thumb, enable us to form fairly good and quick decisions despite a lack of necessary information. Unsurprisingly, those decisions are subject to a certain rate of error. We will introduce the most important heuristics and biases here and look at their impact on investment decisions.

### Memory is reconstructive

In the first Education Note in this series on Behavioral Finance, we had the following statement as #8 in our questionnaire:

- "Memory can be likened to a storage chest in the brain into which we deposit material and from which we can withdraw it later if needed. Occasionally, something gets lost from the 'chest,' and then we say we have forgotten." Would you say this is a reasonably accurate description of how memory works?

In a study of college students, roughly 85% agreed with this view. But it is fundamentally wrong. The human brain does not store events, but reconstructs them on the spot, based on logical inferences. Any missing details are filled in using associated memories or other relevant information. The problem is that we are unable to separate original from "borrowed" elements. When recalling past experiences, we often act

as film editors, and many people often see themselves as if from a distance, as "actors," which contradicts how they actually experienced the event when it happened.

We have a tendency to forget negative experiences faster than positive ones. This is probably why older people often assert that everything was a lot better in the past. Just as we retain positive experiences longer, we also remember our successful investment decisions better than those that resulted in losses.

Another tendency resulting from how our memory works is hind-sight-bias, also called the "I-knew-it-all-along" effect. After something happens, there are always people who claim that the event was obvious and that they have predicted it all along. In one study, people were asked to estimate the probability of certain events in the near future. Six months later, they were asked to state what their estimate was, as far as they could remember, and if they think their prediction actually happened or not. Most thought they had assigned higher probabilities than they actually did to events that had indeed transpired and lower ones to events that did not occur.

The conclusion for investment decisions is to keep accurate records to mitigate biases in memory. Pros and cons for decisions should be recorded and maintained for an unbiased analysis.

### Representativeness Heuristic

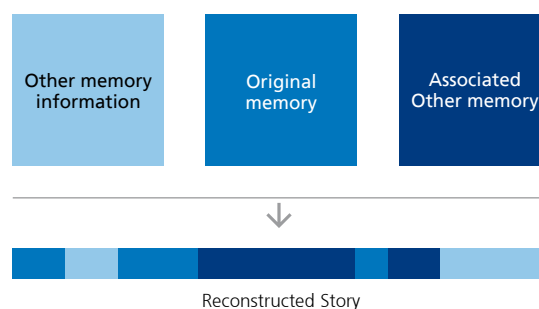
Compare the following statements and think about their likelihood:

- The US economy may enter a recession.
- Rising concerns on inflation could drive interest rates higher, leading to pressure on the US housing market. Corrections in house prices weigh on consumption and the US economy may enter a recession.

For many people, the second scenario appears more likely, because it has the appeal of arguments and details. The more details we add to a scenario, the more it becomes representative of a picture that we have in our minds. However, this contradicts a basic rule of probability theory: that an event becomes less likely, the more details we add. Obviously, it would be more likely to have a recession for any kind of reason, than because of the specific reasons given in the example.

**Fig 1: Reconstructing memories**

Gaps are filled with information from other sources



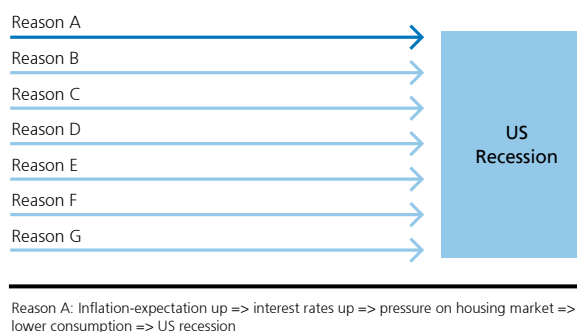
Source: UBS WMR, Myers (1990) 'Social Psychology'.

“Experience is simply the name we give our mistakes.”

Oscar Wilde

**Fig 2: More details reduce the probability**

Use less detailed scenarios



Source: UBS WMR

Question #7 of our questionnaire asked for a guess:

- The mean IQ of the population of eighth graders in a city is known to be 100. You have selected a random sample of 50 children for a study of educational achievements. The first child tested has an IQ of 150. What do you expect the mean IQ to be for the whole sample?

The correct answer is 101. However, most people think it should still be 100. If the first child has an IQ of 150 and the other 49 children have the expected average IQ of 100, our sample average would be  $((49 \times 100) + 150) / 50 = 101$ . People assuming the result is 100 think that the outlier, the extreme deviation, is balanced out within the sample. This would be the case for a very large sample; in fact, the closer the sample size gets to the population size, the closer the result gets to the average for the population.

Let's look at another example of the "law of small numbers" with question #16 from the questionnaire:

- Suppose a coin is flipped three times, and each time it lands on Heads. If you had to bet USD 100 on the next toss, which side would you choose?
  - ☐ Heads
  - ☐ Tails
  - ☐ No preference

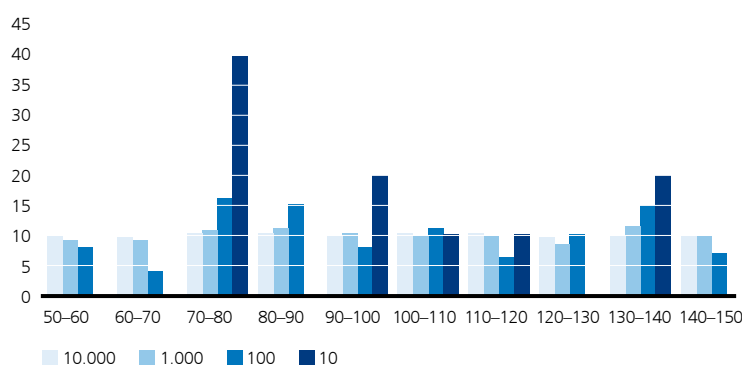
With the previous example in mind, it is clear that we should have no preference. However, most people are subject to the "gambler's fallacy" and assume that chance is self-correcting. In reality, a period of bad luck does not mean that there must be a period of good luck afterwards. Similar examples include the probability of a red number in roulette after three black ones or the historical frequency of certain numbers being drawn in the lottery.

### Availability Heuristic

When assessing the probability of certain outcomes, we attempt to filter out less likely scenarios using the availability heuristic. The more frequently an event has occurred in the past, the easier it is for us to imagine it happening again. Events that have not already occurred are more difficult to imagine and consequently seen as less likely. The availability heuristic is one of the reasons why it is difficult

**Fig 3: Random distributions**

Small samples may not reflect the population



Source: UBS WMR

Random numbers between 50 and 150 have been generated and assigned to ranges. The smaller the size of the sample of random numbers, the less does the distribution reflect the expected equal distribution.

## “The odds of a meltdown are one in 10,000 years”

Vitali Sklyarov,  
1986 Minister of Power  
and Electrification, Ukraine  
Two months before  
the Chernobyl accident

for innovators to find venture capital. On the other hand, the probability of highly unlikely events, like winning the lottery, is often overestimated because there is always someone winning it, making the event seem more available on our minds.

Questions #3 and #4 in our questionnaire provide other examples of events that capture much public attention versus less prominent ones.

- Which is the more likely cause of death in the United States – being killed by falling airplane parts or by a shark?
- For each pair, circle the cause of death that is most common in the United States  
Diabetes / Homicide  
Tornado / Lightning  
Car accidents / Stomach cancer

Shark attacks receive quite a lot of attention. However, in fact, being killed by falling airplane parts is 30 times more likely. This becomes obvious when comparing the statistical probability of other forms of death. Homicide and car accidents receive a lot of attention. However, far more people die from diabetes and stomach cancer. The odds are a lot closer for tornados versus lightning. When Kahneman and Tversky used this question in their 1974 study, lightning claimed more lives, but the increased frequency of tornados in recent years has made

them the greater risk to life. But still, only roughly one in 70,000 deaths is caused by a tornado, whereas cancer is the reason for one in every seven deaths.

### What death statistics tell us about investment decisions

As we judge death odds based on how often we hear about something, we also tend to assess probabilities of bond defaults or rising stock prices based on recent experience. After the defaults of Parmalat, Enron and Worldcom made headlines for months, most people estimated a significantly higher probability of other bond issuers failing to meet their obligations. On the other hand, investors tend to underestimate the default risk of High Yield bonds after several years of low default rates.

People always tend to project past experience into the future when asked to forecast future developments. The more unemotional and fact-based an investor analyzes the market, the more likely he will be able to identify turning points.

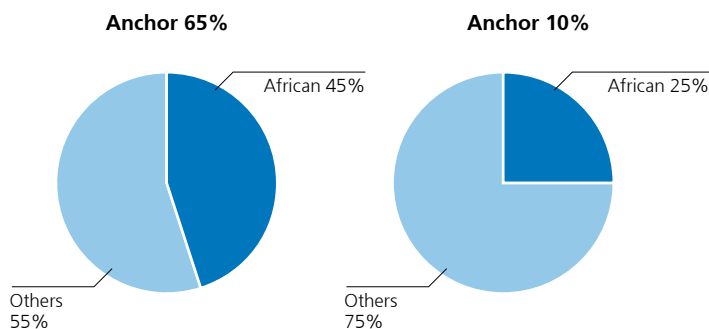
### Anchoring and Adjustment

If we are asked to estimate something we cannot know for certain, we tend to look for an anchor value as a starting point. The problem with this approach is that most people are influenced by irrelevant anchors.

The most cited example for anchoring is an experiment done by Kahneman and Tversky in 1974: Two groups have been shown a wheel of fortune with numbers from 1 to 100 on it. After a spin, the needle landed on 65 for the first group and on 10 for the second. All were then asked to write down if the percentage of African countries in the United Nations was greater or less than 65 (10). Next, they were asked to write down the exact percentage of African countries.

**Fig. 4 Estimated share within United Nations**

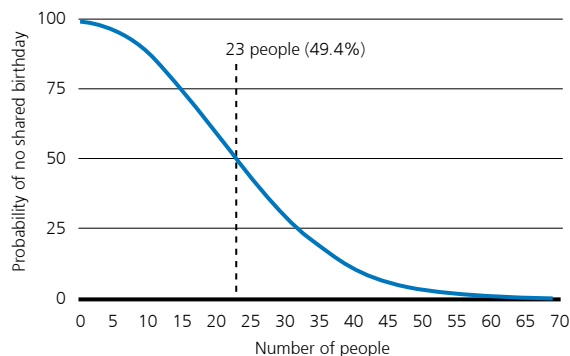
Random anchors influence the estimates



Source: UBS WMR

**Fig. 5: Chance of sharing birthdays**

Solution to question #6



Source: UBS WMR

The average estimate was 45% for the group with the wheel landing on 65 and 25% for the group that received a reference number of 10 from the wheel (Fig. 4). Even the fact that people were aware that the reference number was totally random did not prevent them from using it as an anchor value. The adjustment from the anchor was insufficient, a result that findings of several similar studies have also supported.

In our questionnaire, we have asked two rather difficult mathematical questions designed to force all non-mathematicians to guess their answer. Question #6 is:

- Including February 29, there are 366 possible birthdays in a year. Consequently, a group would need to contain 367 members in order to be absolutely sure that at least 2 people shared the same birthday. How many people are necessary in order to be 50% certain? The group would need \_\_\_\_\_ members.

Most estimated something around 183, which is half the days of the year. The correct answer, however, is 23 people. Those who had some statistics at school usually remember that the solution is not as easy as dividing the number of days by two, but their estimate was still far too high, as they insufficiently adjusted downward from the starting point at 183 days.

Without delivering a lecture on statistics, here is how to get to 23 people: We turn the problem around and look for the probability of people not sharing the same birthday. If a person was born on April 1, there are 365 days left in a year of 366 days that could be the birthday of person 2. So the probability for them not to share the same birthday is  $365/366 = 99.73\%$ . Adding a third person, we would still have 364 days left, which are different from both the birthday of person 1 and 2. The probability for all three not sharing a birthday is then  $365/366 \times 364/366 = 99.18\%$ . We continue to add people until the probability falls below 50%, which is the case for 23 people. If the probability for them not to share a birthday is lower than 50%, the opposite has more than a 50% chance (Fig. 5).

Question #10 is easier:

- Without actually calculating, give a quick (five-second) estimate of the following product:

$$8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 = \underline{\hspace{2cm}}$$

This question has been given to students and the median answer was 2250. However, the correct result is 40320. Interestingly, the average result

differs substantially when the question is turned around to:  $1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8$ . With only five seconds to guess, the focus is on the first 4 to 5 numbers. Therefore, the median estimate was only 512 for group of students that were confronted with the ascending order. The quick result of multiplying the first numbers is the anchor and is adjusted upwards to guess the rest of the calculation. However, in both cases, the adjustment is far too small.

Another example is given in question #5;

- A piece of paper is folded in half and folded in half again, and again. After 100 folds, how thick will it be?  
My best guess is that the paper will be \_\_\_\_\_ thick.  
I am 90% sure, that the correct answer lies between \_\_\_\_\_ and \_\_\_\_\_.

A sheet of paper is roughly 0.1 millimeters thick. Most people start to think about the first folds and then adjusted upwards. As with other anchoring problems, the anchor is very low here and the adjustment is insufficient. The correct answer can be calculated by multiplying 0.1 millimeters with the total number of layers after 100 folds, which is 2100. The result is 1.27x10<sup>23</sup> kilometers, equal to 845trn times the distance from the earth to the sun.

### **Anchoring and adjustment are the most relevant behavioral concepts for investment decisions**

Price targets, company earnings, inflation, interest and growth rates, and all kinds of other input variables in financial analysis are estimates, usually consensus estimates. In addition, an analyst or investor often has already estimated a specific variable in the past. Once there is new information available, a new evaluation should be made, regardless of past estimates. However, most companies, analysts and investors are heavily influenced by their prior forecast and insufficiently adjust the old value up or down. This is

why companies frequently surprise to the upside in an economic expansion and estimates are often not met in a downturn. To avoid being influenced by anchoring, there should always be a new estimate without considering past ones.

### We are biased when looking for reasons of success and failure

In our second Note of this series, we discussed cognitive dissonance. One finding was that we do not perceive dissonance if we are able to blame someone else for a decision that turns out to be wrong. The broader theory of how we evaluate decisions after the fact is called Attribution Theory. The key message is that we tend to attribute successful decisions to our own superior abilities and we find external reasons for failures. This phenomenon is omnipresent in evaluating investment performance. Investors are convinced that gains are attributable to their superior ability to select attractive investments. If stocks incur losses, there is usually a reason available as to why this happened: an advisor may have talked us into it, the company may have drawn too positive a picture and consequently may have misled us. Another common excuse for wrong forecasts is the "it-didn't-happen-yet" argument. Many unjustified claim for damages can be explained by attribution theory.

Question #11 on our questionnaire covers attribution theory;

- Suppose you performed well on a variety of tests on several occasions, but other people taking the same tests did not do very well. What would you conclude? (Check one answer that comes closest to your view)
- A) The tests were probably easy.
- B) The other people were probably low in ability.
- C) I am either good in taking tests or must have known the material well.

All those who prefer answer C attribute the good performance to personal abilities, which is what attribution theory would predict for successful outcomes.



### Escalating commitment

- How long do you wait for a busy call center to take your call before you hang up?
- How long do you wait in front of a busy elevator if you only need to go up or down a few floors?
- How long do you continue to invest into a project that has less and less chances of success?

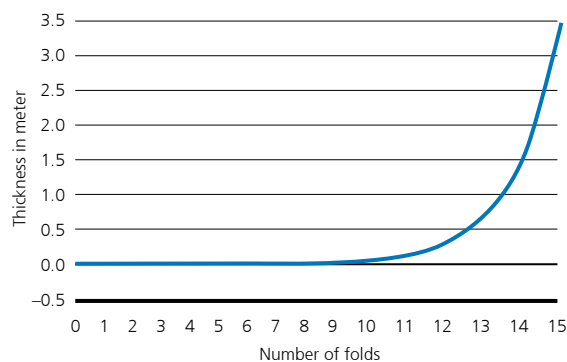
What goes on in our mind while we live through these kinds of situations? After some point, we run out of patience and evaluate if it makes sense to hang on or if we should try something different. The longer we hang on, the more we feel regret

about having invested so much time (and/or money) and the more desperate we become for a successful resolution.

From an economic standpoint, it does not matter how much time and money we have invested into something. The only thing that matters are future costs and benefits. If the situation has changed and expected benefits do not warrant continued investments, we should immediately stop investing to avoid "throwing good money after bad." However, this is one of the most difficult decisions for an investor to take, as we tend to have an emotional attachment to our past decisions.

### Fig 6: Folding a piece of paper

Thickness doubles with every fold



Source: UBS WMR

Only the first 15 folds are shown here. However, the chart would look the same for any number of folds, as the thickness continues to double until it reaches 126'765'060'022'823'000'000'000 kilometers.





An example is given in question #2 of our questionnaire:

- As the president of an airline company, you have invested USD 10 million of the company's money into a research project. The purpose was to build a plane that would not be detected by conventional radar. When the project is 90% complete, another firm begins marketing a plane that cannot be detected by radar. Also, it is apparent that their plane is much faster and far more economical than the plane your company is building. The question is: Should you invest the last 10% of the research funds to finish your radarblank plane?
  - No – it makes no sense to continue spending money on the project.
  - Yes – As long as USD 10m is already invested, I might as well finish the project.

This is part of a study by Arkes and Blumer (1985), where 85% recommended finishing the project. When they surveyed a second group on the problem without telling them about the initial investment, only 17% supported finishing it. Mentioning the sunk costs of USD 10m made the difference.

Sunk costs are an important issue for corporations when deciding on projects, business segments or retaining key employees. Private investors are also highly susceptible to the sunk cost trap. Buying further stocks to lower the average purchase price after a sharp decline is an example of the sunk cost trap.

### Summary and recommendations

- Keep accurate records of important information used in investment decisions to mitigate biases in memory.
- Do not put too much confidence in highly detailed scenarios.
- Be careful not to assign overly high probabilities to desirable events – wishful-thinking frequently occurs with portfolio positions that trade at a loss.
- Chance is not self-correcting; a period of bad luck does not presage a period of good luck.
- Past frequency of events does not necessarily increase their future probability. Events that have never occurred tend to be underestimated.
- Ignore your past estimates when new information is available; only a completely new assessment prevents anchoring and adjustment biases. Avoid looking at consensus figures or past estimates when reassessing an investment's attractiveness.
- Try to be honest when it comes to attributing success and failure. Only if we acknowledge that a losing investment was our own decision can we effectively find ways to avoid repeating such errors.
- Avoid information about the costs already incurred when deciding on the future of an investment project. Focus only on future benefits and future costs.

### Bibliography

Arkes H. R., Blumer C. (1985), "The psychology of sunk cost", *Organizational Behavior and Human Decision Process* 35, p. 124–140



# Mental Accounting

## Education Note 7

**This Education Note, the final in our series on Behavioral Finance, examines how we manage our spending and investments by unconsciously applying intuitive accounting techniques.**

### **Components of mental accounting**

- Like corporations, households use accounting schemes to keep spending under control.
- Mental accounting affects the way decisions are made and how their outcomes are perceived, influencing the cost-benefit analyses both before and after the fact.
- We all tend to assign activities to accounts, sometimes consciously, sometimes not. As in regular accounting, the sources and uses of funds are labeled. Expenditures are often grouped and spending is often constrained by implicit or explicit budgets.
- The frequency with which accounts are evaluated varies, and overly frequent assessment can lead to wrong decisions.

### **Consequences for investment decisions**

- Hedonic Framing, preference for reward (pleasure) that color how outcomes are assessed, explains why gains and losses are treated differently depending on their size, order and frequency.
- The Behavioral Life Cycle Model argues that the source or current allocation of funds influences our willingness to spend in ways that contradict the economic theory of saving.

### **Benefits and drawbacks of Mental Accounting**

- The primary benefit of Mental Accounting is that it manages “time and thinking costs” in an economical way. Mental budgets help individuals deal with self-control problems.
- The drawback is a potential misallocation of funds. We may refrain from good investments, and make poor ones instead.

“You got to know when to hold  
‘em, know when to fold ‘em,

Know when to walk away and  
know when to run.

You never count your money  
when your sittin’ at the table.  
There’ll be time enough for  
countin when the dealin’s  
done.”

The Gambler,  
Country Song by Kenny Rogers

### Questions from everyday life

Mental Accounting is not specific to investment decisions, but deeply embedded in our everyday life (see Fig. 1). To illustrate this practice, we discuss the following questions in this Education Note:

- Why are flatrate pricing and all-inclusive vacations so popular?
- Why does everyone have at least one pair of shoes at home that does not fit?
- Why do people prefer dividend payments over share repurchases?

### Costs are acceptable only if there is value

The goal of accounting is to end up with balanced accounts. On the one side, there are costs incurred when buying something. To balance the account, the value of the purchase has to cover the cost. If the value is too low, costs prevail, yielding a loss. And if value exceeds cost, we realize a gain.

The inescapable fact in assessing the utility of transactions is that we fear losses more than we value gains. In other words, a loss of USD 100 hurts more than a gain of USD 100 yields pleasure. In addition, our sensitivity to gains and losses diminishes as numbers rise. A gain of USD 10 on an item that is worth USD 20 is seen as a lot

more valuable than the same gain on an item worth USD 1000. We are more influenced by the difference in value than by the value of the difference.

### We buy useless things

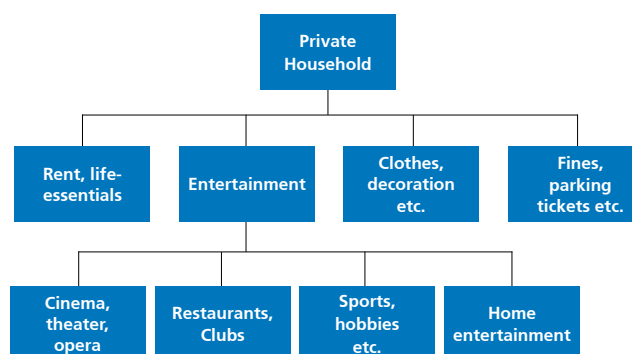
Almost everyone has something hanging in a closet that was purchased but never worn. Why do we spend money on something we do not need or cannot use?

Thaler (1985) provided an answer to this vexing question by introducing the concept of transaction utility. He found that besides the value of the thing itself, people also value the deal they make (see Fig. 2). The value of a deal is high if the price that we think an item should cost is higher than what we actually paid for it. Consequently, we often buy something simply because we think it is a great bargain (see Fig. 2).

Unsurprisingly, marketing specialists are well aware of transaction utility. This is why there are inflated “recommended retail prices” mentioned besides a store’s offer price. Credit card surcharges are translated into cash discounts and most stores have always something “On Sale.” The fact that we cannot make any use of some “bargain” we acquire only dawns on us later.

**Fig 1: Household accounting**

An example of mental accounts



Source: UBS WMR

### How we set reference prices

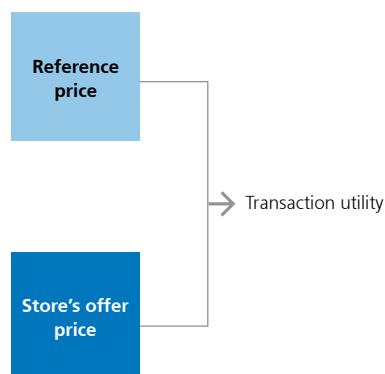
The following has been told to two groups, using the phrases in brackets for one and the phrases in parentheses for the other:<sup>1</sup>

"You are lying on the beach on a hot day. For the last hour you have been thinking about how much you would enjoy a nice cold bottle of your favorite brand of beer. A companion gets up and offers to bring back a beer from the only nearby place where beer is sold (a fancy resort hotel) [a small, run-down grocery store]. He says that the beer might be expensive and so asks how much you are willing to pay for the beer. He says that he will buy the beer if it costs as much or less than the price you state. But if it costs more than the price you state, he will not buy it. You trust your friend, and there is no possibility of bargaining with the (bartender) [store owner]. What price do you tell him?"

The median responses for the two versions were USD 2.65 (resort) and USD 1.50 [store] in 1984 dollars. For the thirsty drinker on the beach, the place of purchase should be irrelevant. However, the average consumer would not have enjoyed a beer for USD 2.50

### Fig. 2 Transaction Utility

The value of a deal



Source: UBS WMR

from the store, because the transaction utility would have been negative. The context of where the money is spent influences how we set reference prices. Non-drinkers may think about how much their reference price for a decent lunch is influenced by how "expensive" a restaurant looks like when entering it.

### Transaction utility with stocks

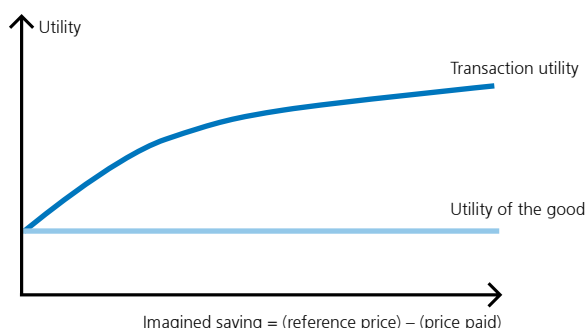
Much as we sometimes buy things just because our reference price is a lot higher than the offer price, we also buy stocks that appear cheap. When markets fall sharply after a long upturn, many investors believe there are a lot of great bargains to be had. They still remember the high prices and view current prices as cheap. Many who missed the stock market rally in 1999/2000 felt like the first setback was the chance to jump on board. Transaction utility is also high for stocks that are very prominent or stocks that all one's friends and neighbors already own. Investors feel a certain pride when investing in such a company, an appeal that can sometimes carry more weight than facts do (see Fig. 3).

### We keep useless things

Anyone who has ever purchased an expensive pair of shoes that fit well in the store but hurt terribly afterwards has probably had the following experience: The more expensive the shoes were, the more often we try to wear them before we give up with stabbing pain. Of course, we don't throw them away once we gave up wearing them. If we would do so, costs would turn into a loss, as we would give up hope of recovering some value.

### Fig. 3 Savings that only exist in our mind

Transaction utility may exceed the purchased item's utility



Source: UBS WMR

<sup>1</sup> Thaler (1985): "Mental accounting and consumer choice", Marketing Science, 4 (1985), p. 199-214.



However, as in real accounting, investments are depreciated over time. This is why we will probably get rid of this pair of shoes after some years. How long we store them depends on both the costs and our rate of depreciation. What applies to illfitting shoes also applies to poorly performing stocks in our portfolio. Many investors hold stocks in companies that went bankrupt years ago, and will only delete them from the account once the costs have been written down in their mind.

### How to enjoy more gains and incur fewer losses

We tend to prefer a small gain every day of the week rather than one of equal size on the first day of the week. The reason is that joy does not rise proportionally with the size of the gain; Receiving USD 100 does not cause 10 times the pleasure of a USD 10 gain. The opposite is true for losses. A large one-time loss does not hurt as much as ongoing small losses. Losing USD 10 every day for a week annoys us more than losing USD 70 all at once.

Psychological research calls this behavior "Hedonic Framing" (see Fig. 4). The rules we unconsciously apply to maximize pleasure in life are:

- Spread out gains to enjoy more positive reinforcement.
- Integrate losses to have as few negative experiences as possible.
- Integrate smaller losses with larger gains so that the loss is less felt, since a reduced gain hurts less than facing the loss would do.
- Segregate small gains from larger losses, since small gains generate more pleasure than reducing a large loss by this small amount.

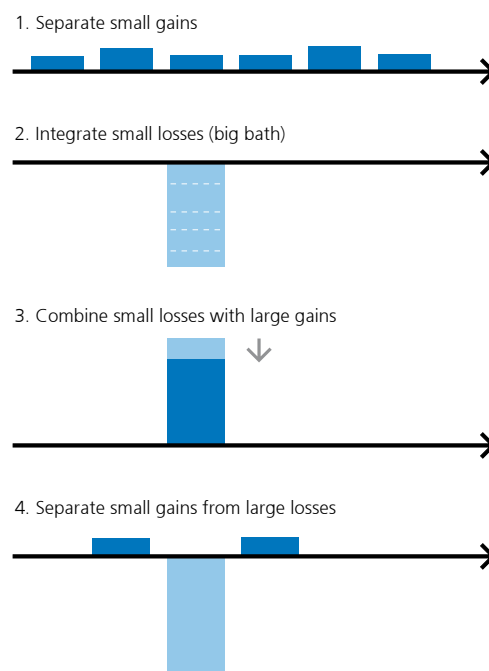


We can easily apply the Hedonic Framing concept to single assets in an investment portfolio. Investors tend to regard stocks that gained in value separately and enjoy each one, even if the gain is small. Positions with a loss are often classified as long-term investments, which are part of a portfolio strategy. We tend to summarize losing investments by sector or asset class instead of facing each individual loss.

Companies tend to do the same. Burgstahler and Dichev<sup>2</sup> have shown that quarterly earnings of some few cents per share are much more frequent than losses of the same amount. Accounting measures tend to be used to turn small red numbers into a "black zero." If larger losses occur, companies tend to take advantage of the situation and clear up other positions as well, called "big bath behavior."

**Fig. 4: Maximize pleasure with Hedonic Framing**

Gains and losses are treated differently



Source: Shefrin/Thaler (1988)





**“Rational is not necessarily happy, and irrational gives you the rare opportunity to enjoy ‘free’ drinks”**

Shafir / Thale

### **Hedonic Framing makes overpaying feel like having a free lunch**

Remember the first question we raised in this Note:

- Why is flatrate pricing and all-inclusive vacation so popular?

Internet access, mobile phones and fitness centers often come with flatrates: pay a fixed amount per month or quarter and use the service as often as you like. Most resort hotels offer all-inclusive packages that include food, drinks and using all facilities. This fits our second rule of Hedonic Framing, because several small payments are integrated into one larger up-front payment. Decoupling the payment from actual consumption reduces the perceived costs. Funnily enough, we feel like getting something for free every time we then use the service.

A hotel offering all-inclusive vacations even gains if we consume goods and services that are equivalent in value to the payment. Would we have to pay for everything peruse, we would most probably consume less, as single payments make us more aware of the costs.

Sports clubs and spas usually charge semi-annual or annual membership fees. A study by Gourville and Soman<sup>3</sup>

shows that usage of a health club surged right after the bills were sent out, and dropped back significantly over the next months, just to increase again after the next bill. Della Vigna and Malmendier<sup>4</sup> even demonstrated in a three-year study with nearly 8000 health club clients that people using flat-fee contracts overpaid for services, as they used them far less frequently than they initially thought. They attribute this to overconfidence about future efficiency or about future self-control.

### **Application to investment decisions**

Hedonic Framing contributes to the common dynamic of taking profits too early and holding on to losing positions for too long. If we put Hedonic Framing in the context of Mental Accounting, we can derive an explanation for this behavioral bias. We therefore introduce the concept of wealth accounts (see Fig. 5).

### **Money is not fungible – at least not in our mind**

Economic theory proposes that money is fungible. This means, it does not matter how a dollar is earned or where it is currently invested when it comes to spending decisions. Research in Mental Accounting proves the opposite to be true.

Shefrin and Thaler<sup>5</sup> proposed a hierarchy of money locations based on how tempting it is for a household to spend it. Current account money and cash at hand is routinely spent. However, the source of funds influences on what it is spent. Money earned through hard work is primarily spent on essentials like rent, food and household bills. Windfall profits like lottery gains or bonus payments on the other hand are often spent for amusement or accessories. Even indebted people often spend windfall profits for having fun instead of paying down debt. The reason is that the money is booked into a separate account.

The next wealth account level is invested assets like stocks, bonds and mutual funds. To spend this money, positions have to be sold, which significantly reduces the temptation to spend it. Therefore, transferring funds from a current account to an investment account can be viewed as actually “saving.” Home equity is even safer from being spent; however, the rising trend of home equity loans has somewhat increased the propensity to spend from home equity. Future income is most sheltered from being spent, because it would involve raising debt.

2 Burgstahler, Dichev, 1997, Earnings management to avoid earnings decreases and losses, *Journal of Accounting and Economics* 24 (1): p. 99–126.

3 Gourville, Soman. “Payment depreciation: the effects of temporally separating payments from consumption”, *Journal of Consumer Research* (1998).

4 Della Vigna, Malmendier: “Paying Not to Go to the Gym” UC Berkely, Stanford University and NBER, (2005).

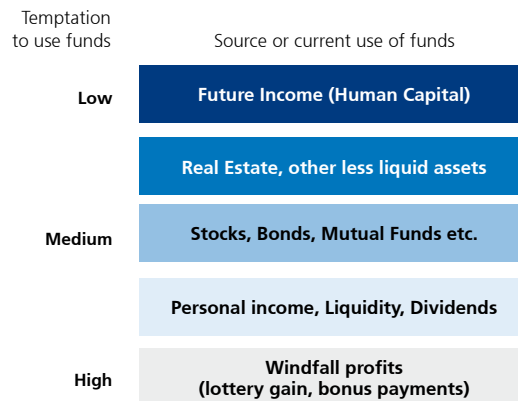
5 Shefrin, Thaler: “The behavioral lifecycle hypothesis”, *Economic Inquiry*, 26 (1988), p. 609–643.

“To control their consumption, consumers pay more for less of what they like too much”

Klaus Wertenbroch  
Marketing Professor

**Fig. 5: Wealth accounts**

Behavioral Life-Cycle Model



Source: Shefrin/Thaler (1988)

If we think about these wealth accounts for a minute, we can derive the answer to the third question in the introduction;

- Why do people prefer dividend payments over share repurchases?

Dividends are booked into the current account, whereas share repurchases lead to an increase in asset values. This means that dividends are available for spending right away, but paper gains on stocks are less tempting to use. The preference for cash dividends even holds where taxation of price gains is more favorable.

Going back to the earlier question of why small gains tend to be realized early, we have to refine the hierarchy of money locations to include the concept of Hedonic Framing. If money needs to be withdrawn from the investment account to meet spending needs, positions with a paper gain are more likely to be sold than positions with a paper loss. So winners tend to be sacrificed for spending and losers tend to be held.

### The good, bad and loopholes of Mental Accounting

We have concentrated on the drawbacks of Mental Accounting in this Education Note. The good thing about most drawbacks is that we can overcome them by being aware of them when forming decisions. Having said that, we should not forget that Mental Accounting is a very useful mechanism to solve self-control problems.

The lower an individual's wealth, the more need there is for strict budgeting. The balancing frequency of Mental Accounts is higher for lower-income groups. However, mental budgets also play an important role for wealthy people, who use small budgets to control their use of "sinful" purchase, items like tobacco, alcohol or sweets. "A glass of wine a day," or "one chocolate candy after lunch only," or other such explicit food budgets are used to avoid gaining weight.

While we try to control ourselves, we are also experts in fooling the controller in our mind. One way we prevent "reporting" some costs is to decompose them into very small units that are unworthy of being reported. Examples



are money we spend on a coffee break or little snacks. Again, marketing experts have found ways to make use of this Mental Accounting loophole. Membership fees or subscriptions are often advertised by showing the daily cost, 27 cents a day, say, rather than the total of nearly USD 100 a year. Antismoking campaigns turned the decomposition ploy around, by pointing out that stopping a three-dollar-a-day habit can save around USD 1100 per year, paying for a nice vacation.

#### Summary and checklist

- Try to view investments in a portfolio context instead of evaluating every position separately. Even if assets are booked in separate accounts or with separate banks, they all belong to the same portfolio. Remember to include retirement and savings accounts and positions acquired in employee stock ownership programs when analyzing your portfolio allocation.
- When buying a stock, do not look at where the price once was. Try to determine the fair price and ignore past reference prices.
- Do not evaluate performance too frequently. Overly frequent balancing of accounts often leads to wrong decisions.
- If money needs to be withdrawn, check the effect of a sale on the portfolio allocation.
- When going after a presumed good deal, hold on for a minute and check for reasons to invest other than the value of the deal.

#### A final suggestion for dealing with life's unpleasant surprises

Define a sufficiently large budget to cover unpleasant spending like speeding tickets, fines and similar annoying cash drains throughout the course of the year. Attribute this amount to your favorite charitable organization. Then deduct all fines, tickets, etc. you receive over the year from this account and donate the remainder to the organization at year's end. This will not save any money – you have only “spent” this sum in your Mental Accounts so far – but now it feels as if the fine is paid by someone else and therefore it may hurt a bit less.

**“Ice cream is exquisite – what a pity it isn’t illegal.”**

Voltaire

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