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FINANCE
WHITE PAPER

BhfS a spin off firm of the University of Zürich

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from Behavioral Finance Solutions GmbH

Behavioral Finance:
The Psychology of Investing

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INTRODUCTION AND WELCOME

Dear Reader,

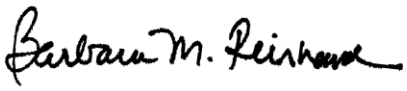
We are delighted to present to you Behavioral Finance: The Psychology of Investing, a white paper developed in collaboration with the University of Zürich. This report is intended to shed light on the emotional and psychological influence that can impact financial decisions and how this influence can result in irrational behavior. It also explores how to avoid the pitfalls that investors commonly face.

Behavioral finance is a fairly novel topic that has gained prominence since the early 1990s. Amos Tversky and Daniel Kahneman, winners of the 2002 Nobel Memorial Prize in Economic Sciences, helped popularize the topic with their development of Prospect Theory. Psychology plays a big part in investing. Understanding the psychological motivations can help investors avoid financial pitfalls.

Behavioral finance bridges the gap between theory and practice by scientifically recording human behavior. To date, research has focused on rational investors in efficient markets, while reality deals with day-to-day irrational investor behaviors and inefficient markets. Combining theory and practice allows us to use behavioral finance as the basis for advisory services, asset management, and financial product development.

At Credit Suisse, our holistic approach to providing clients with wealth management advice transcends the traditional financial advisory relationship. Our wealth management process enables us to understand our clients' needs and rationale in making financial decisions, and to assess their risk appetite and behavioral bias. Credit Suisse has had the privilege of serving many of the world's wealthiest individuals and families since 1856, proving our commitment to the needs of our clients and society.

We hope you find this white paper insightful and useful.



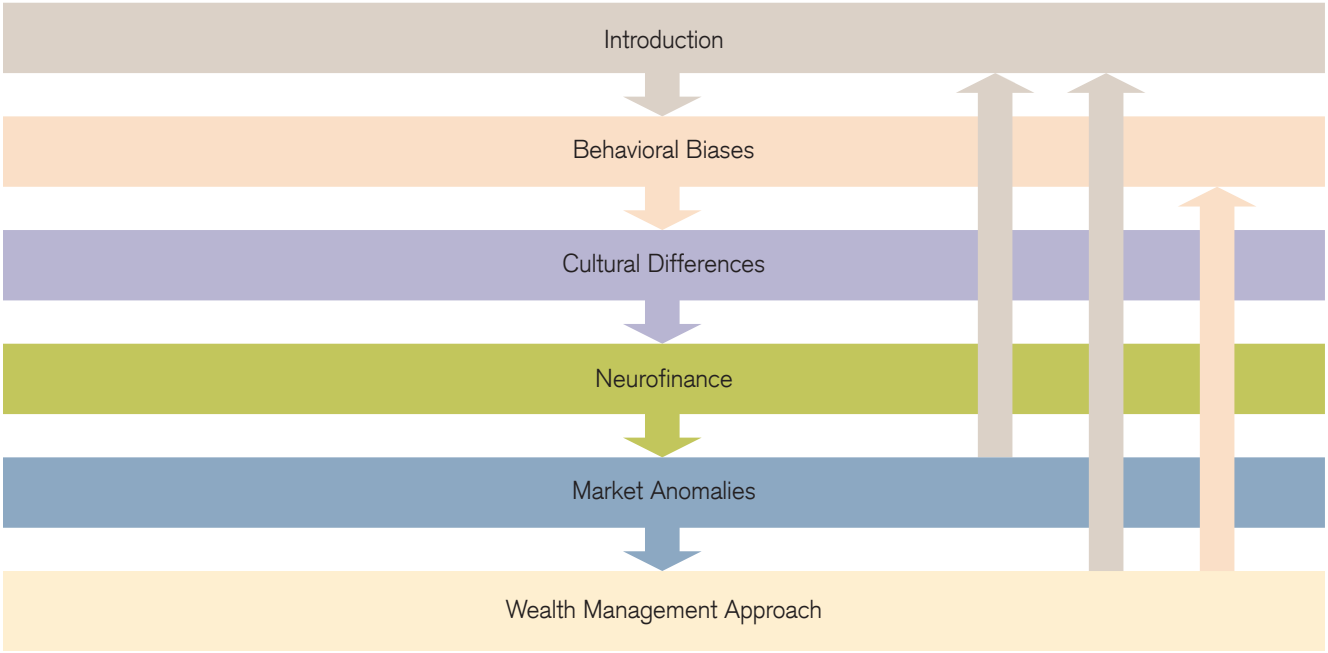
Chief Investment Officer
Private Banking Americas
Credit Suisse

ORIENTATION

This white paper is divided into five sections that should be read in sequential order.

The figure below shows which sections are prerequisites for later sections. Naturally, the introduction to each section is important. However, should you skip the remainder of each section, only the section on market anomalies will be difficult to understand without a solid background. Behavioral biases are the basis for understanding cultural differences, which in turn are the basis for understanding neurofinance. Behavioral biases are also fundamental to selecting a wealth management approach.

Figure I: Orientation

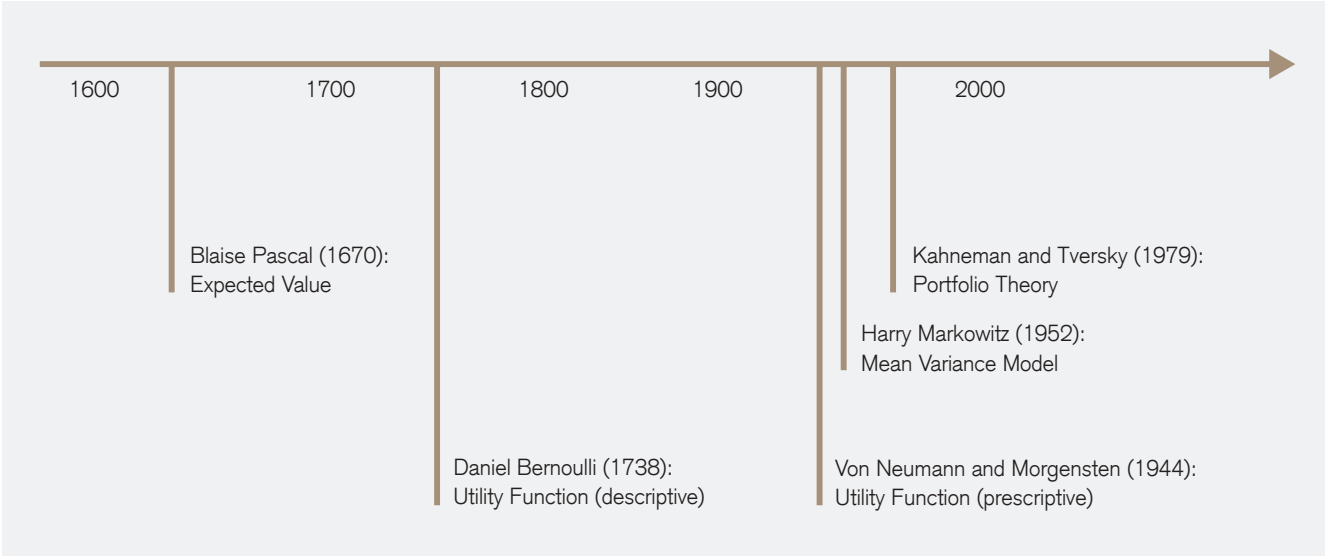


The small arrows in the middle of the figure show the typical reading pattern. The large arrows on the right show the prerequisites; here, you should refer back to the indicated sections.

HISTORY OF PORTFOLIO THEORY

Although the present functions without the past, we can understand it better if we look at its historical developments step by step. The same is true for financial market research. This research currently consists of fairly complicated mathematical and psychological models that, at first glance, can be confusing. The figure below highlights the history of portfolio theory, one of the primary areas of financial market research.

Figure 2: Milestones of Portfolio Theory



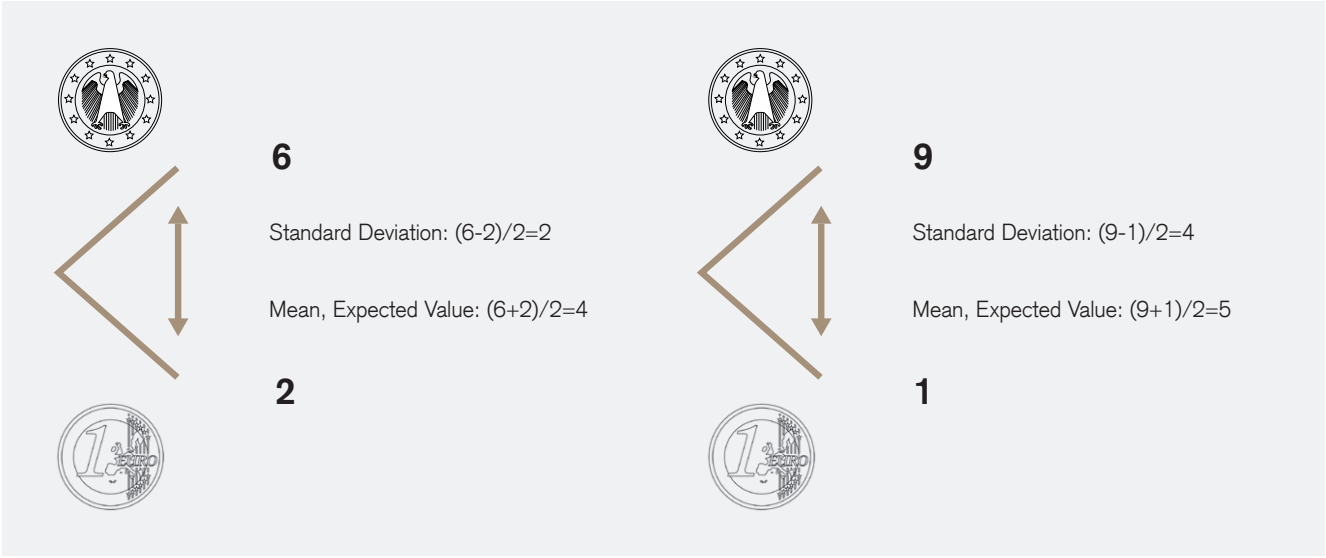
The first person to focus on how we make decisions in uncertain situations was French mathematician Blaise Pascal, who did this in 1670. Pascal looked at fairly simple situations and wondered which would be preferable. For instance:

a) a coin toss in which one could win 6 francs for heads but only 2 francs for tails, or

b) a coin toss in which one could win 9 francs for heads or 1 franc for tails

Pascal's suggestion was to make the decision based on the expected value, or the average payout.

Figure 3: Sample Coin Toss



For the first coin toss, the expected value is 4; for the second coin toss, it is 5. Therefore, in Pascal's view, one should choose the second coin toss. Daniel Bernoulli, a mathematician from Basel, had the same idea when his brother Nikolaus told him about the St. Petersburg game more than one hundred years later. Under Blaise Pascal's theory, the citizens of St. Petersburg should wager every cent they had to play on the St. Petersburg game, because it had an infinite expected value. This contradicted the observations of Nikolaus Bernoulli, which revealed an average payout of 2 ducats. The average payout of 2 ducats may seem like a paradox at first, but is explained by Daniel Bernoulli's generalization of the theory on calculating the expected payout. Bernoulli's function, as applied to Pascal's theory, is now known as the utility function. The utility function refers to a fundamental psychological law, the diminishing marginal utility of money. Or, as Daniel Bernoulli said, "There is no doubt that a gain of 1,000 ducats is more significant to the pauper than to a rich man, though both gain the same amount." It is important to note that the diminishing marginal utility of money embodies the risk aversion of the person making the decision. A decision maker is averse to risk if, instead of a random payout, he prefers the certainty of the expected fixed payout from a game. The St. Petersburg game shows that the people of St. Petersburg were averse to risk. Suppose someone made the decision to receive the expected payout. If he chose to gamble instead, in some cases he would win more, and in other cases he would win less. Due to the money's diminishing marginal utility, the utility of the higher payout would be lower than for a reduced payout. This is why it is more rational to take the average payout with certainty.

Figure 4: Utility Function for Various Level of Risk Aversion

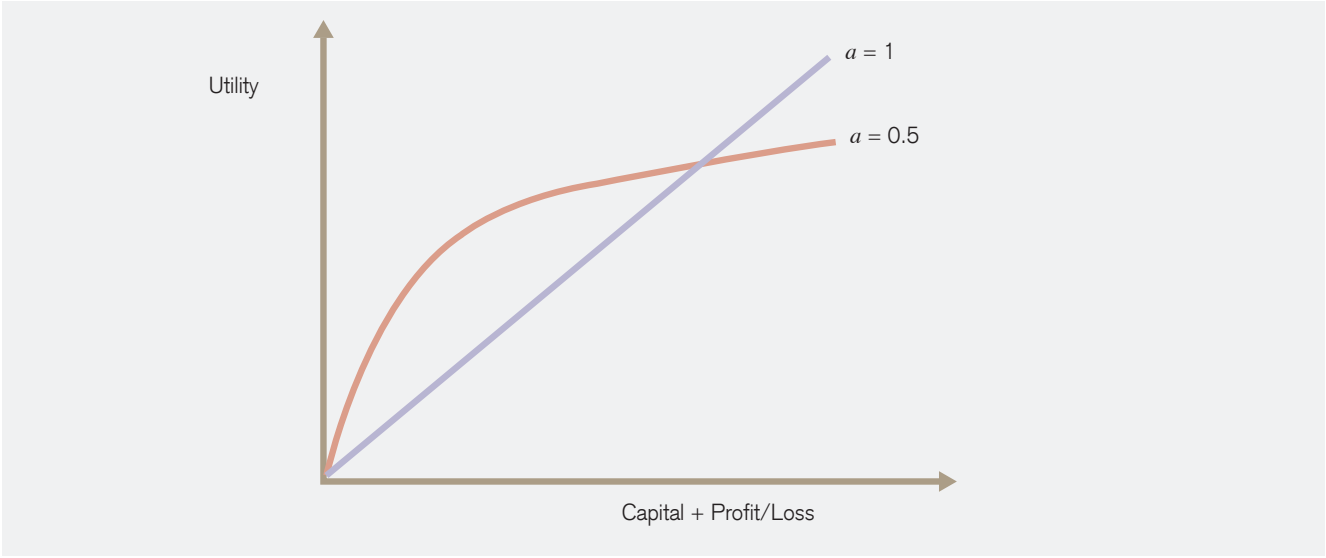


Figure 4 shows the utility function $u(x)= \frac{x^a}{\alpha}$ for various levels of risk aversion, α.[1] The larger parameter α, the less risk averse the decision maker.

The expected utility hypothesis offers a method of calculation that explains a variety of observed behaviors.[2] In 1944, mathematicians John von Neumann and Oskar Morgenstern determined that the expected utility hypothesis is also the only criterion that allows people to make rational decisions in uncertain situations. Every other criterion contradicted plausible fundamental conditions for behavior, known as axioms.

One example for these axioms of rational behavior is the axiom of independence, which states that when choosing between two lotteries, one should consider only the differing aspects of the lotteries.

For instance, two lotteries could each be based on throwing one die. Neither lottery has a payout for an odd number. The first lottery (A) has a payout for each even number, in the amount of the number cast. The second lottery (B) has the following payouts: a payout of zero for a two, a payout of four for a four, and a payout of ten for a six.

The axiom of independence states that when selecting a lottery, we can limit ourselves to those cases in which the two or the six is cast, because the payouts of both lotteries are identical in all other cases. Thus, the selection is reduced to whether the player wants two and six, or zero and ten, with the same probability.

1 A risk aversion of $\alpha = 1$ denotes a risk-neutral investor.

2 In the example shown in Figure 3, for all levels of risk aversion $\alpha > 0.326$, the right coin toss is chosen. For alpha <0.326, the left one is chosen. For a risk aversion of 0.326, both games are equal. This is calculated based on $u(x)= \frac{x^a}{\alpha}$. The result is $6^{0.326} + 2^{0.326} = 9^{0.326} + 1^{0.326}$.

Figure 5: Axiom of Independence

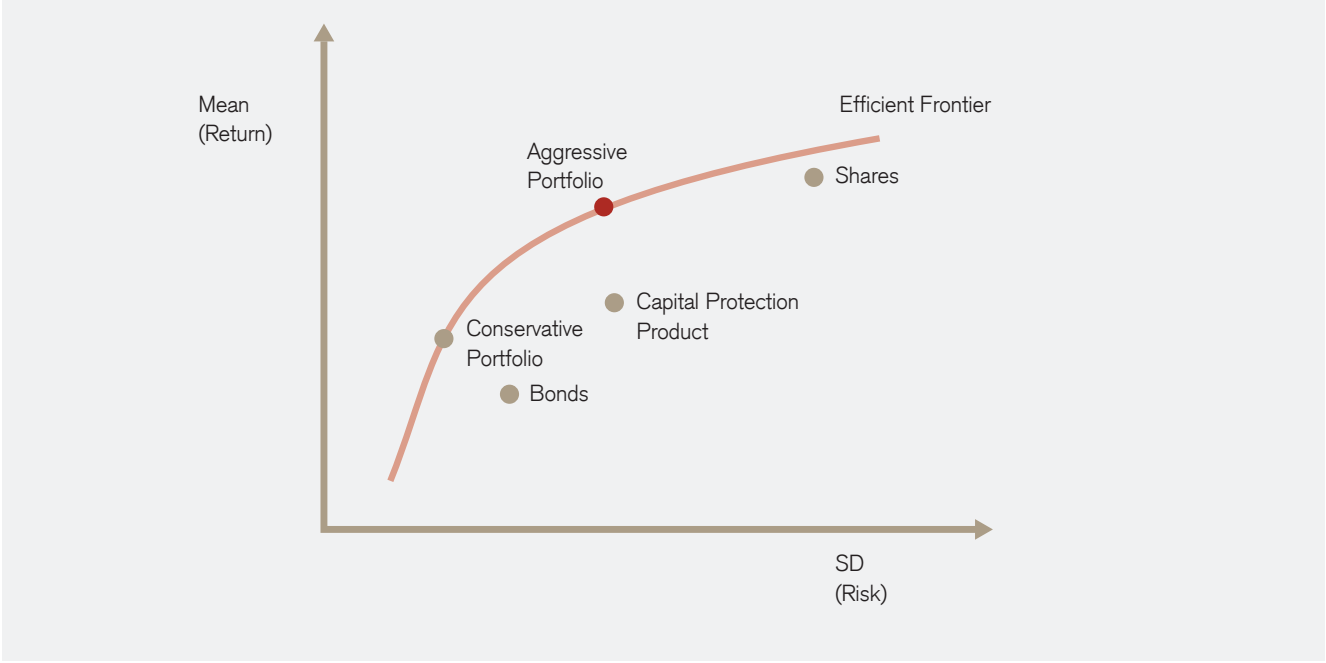
Outcome	1	2	3	4	5	6
Lottery A	0	**2**	0	4	0	**6**
Lottery B	0	**0**	0	4	0	**10**

This does not mean that everything had been figured out by the middle of the twentieth century. The expected utility hypothesis was flexible enough to illustrate different behaviors in uncertain situations and was the only sensible way to proceed in such situations. Unfortunately, there was a significant weak spot in this hypothesis: Where besides a coin toss could one find realistic probabilities for calculating the expected utility? For instance, how can we define the probabilities of returns on asset classes such as bonds, equities, or alternative investments, or even single securities within a class? These returns depend, among other things, on economic factors such as the economy itself, monetary policy, innovation, and growth alongside the behavior of other stakeholders. The sum of these factors results in an almost impossibly tangled mass of interactions. To unravel this Gordian Knot, Eugene Fama developed his efficient market hypothesis in the 1970s, which had its predecessors in the 1950s. If all market participants thought constantly about the factors behind the returns on securities and developed trading strategies based on these factors, their buying and selling decisions would ensure that all profitable information about these factors was priced into the securities. The market anticipates every predictability in prices. The remaining price developments result from previously unanticipated changes – in other words, surprise information. Because surprises are impossible to predict, the prices of securities develop by pure chance, statistically independent of one another. We know from statistics that the sum of random variables can be defined by normal distribution (bell curve). The distribution is well-defined by its mean and its standard deviation.

The efficient market hypothesis is a brilliant simplification of decision-making in uncertain situations because these decisions depend only on the mean and the standard deviation

of the distributions. In 1952, Harry Markowitz built on this idea to develop his mean variance model, which was based on two factors: returns, measured by mean, and risk, measured by standard deviation. It was clear to Markowitz that investors preferred a high average return with a low risk. We saw this in the two coin tosses in Figure 3. For the first toss, the average payout is 4 and the standard deviation is 2; for the second, the average payout is 5 and the standard deviation is 4. Decision makers will choose the first or the second coin toss depending on risk tolerance (here, the aversion to fluctuating returns). Therefore, Markowitz presented the various investment options in a return-risk diagram such as the one shown in Figure 6.

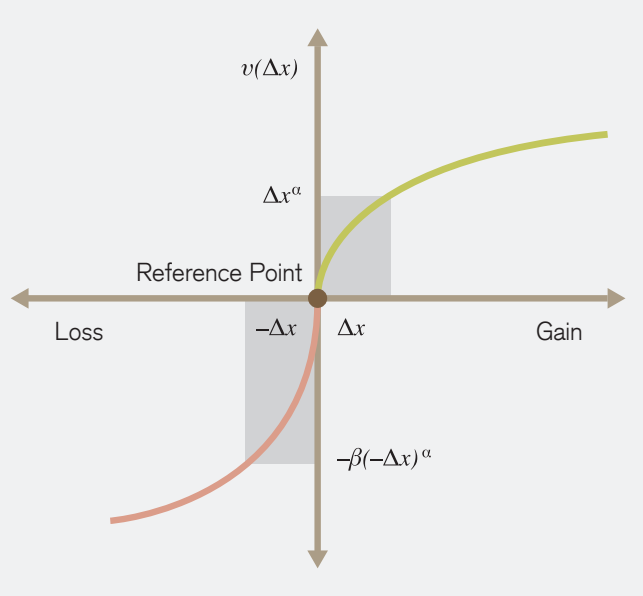
Figure 6: Risk-Return Diagram



As we can see in Figure 6, when the average return (mean) increases, the expected risk (standard deviation) of an investment also increases. For each return level indicated, an investor can minimize his risk by diversification. This sequence of minimization results in the efficient frontier, which denotes the minimum risk for a given return level. Depending on the individual risk tolerance of an investor, the best portfolio can be selected on the efficient frontier.

Behavioral finance is the newest chapter in the history of portfolio theory. Why do we yet need another theory? Behavioral finance explains the typical mistakes (behavioral biases) made by investors. It also provides a detailed picture of investors' risk preferences. This second aspect is covered by Daniel Kahneman and Amos Tversky's prospect theory (1979). Unlike the Markowitz analysis, the prospect theory focuses on the significance of investment losses. In their studies, Kahneman and Tversky found that most investors are averse to loss. This means that investment losses must be compensated through the opportunity for higher returns. For most investors, these returns must be at least twice as high as the potential loss.[3]

Figure 7: Utility Function of the Prospect Theory



The utility function of the prospect theory is shown in Figure 7. A maximizer of prospect utility evaluates the result of his investments using a reference point. For example, this can be the purchase price of a security. Loss aversion is reflected in the fact that the utility function initially has a much steeper curve than the profit area. The prospect utility theory draws from the expected utility theory the characteristic of declining marginal utility of the gains.

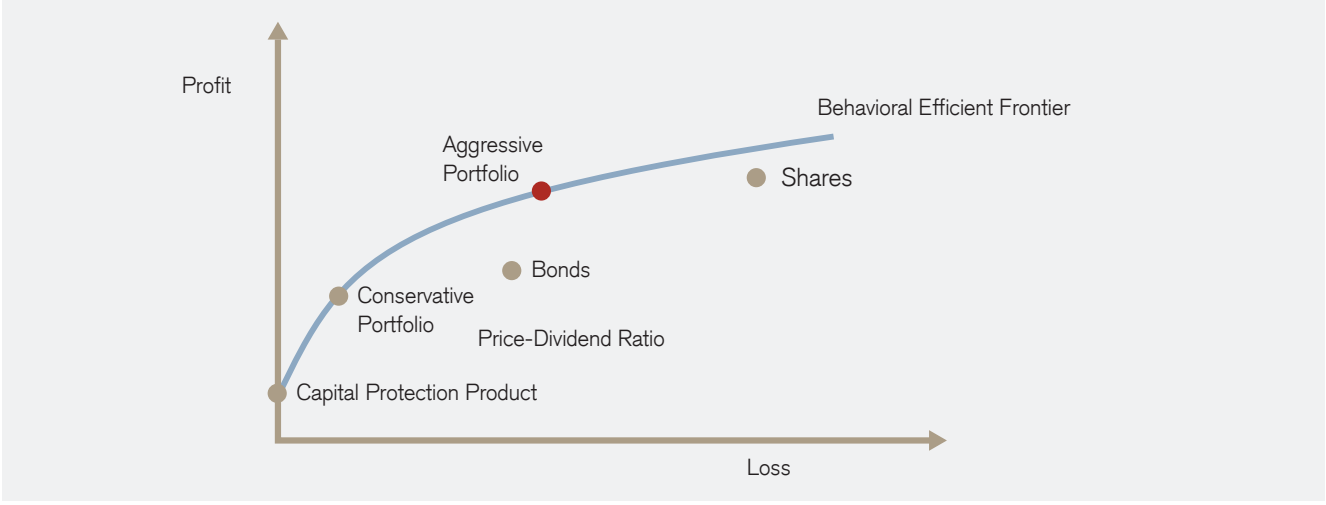
The loss area reflects the declining marginal damage of the losses. This is demonstrated by the fact that prospect utility maximizers would risk their investment for a break-even opportunity rather than face a definite loss. Thus, they prefer a random payout to the expected utility if it is negative.

If markets were efficient as per Fama's theory, all investment returns would have normal distribution and the application of the mean-mean standard deviation criterion would still be justified for prospect theory investors. In reality, the efficient market hypothesis is not valid, so very few investments have returns with normal distribution. For this reason, the loss aversion under the prospect theory is key to an optimal portfolio. We must replace the efficient market line in the mean-standard deviation model with a behavioral efficient frontier based on the prospect theory. The behavioral efficient frontier was first developed in a paper by Enrico De Giorgi, Thorsten Hens, and Janos Mayer (2011). It depicts the prospect theory using a risk-return diagram. Investment results are broken down into cases in which a profit is made and those in which a loss is sustained. The degree of loss aversion determines the selection of an optimal portfolio on the behavioral efficient frontier, as shown in Figure 8. If we compare the prospect theory portfolios with the Markowitz

3 To be precise, it is 2.25 times higher.

portfolios, we see that these have a lower portion of equities and hedge funds while weighting capital protection products more heavily. Equities and hedge funds are not largely represented in the prospect portfolios, because of their potential high losses. On the other hand, capital protection products are not very common in the Markowitz portfolios. Although they do not show a loss as long as the counterparty does not default, they have varying levels of high returns and thus a standard deviation. Practice has shown that clients whose portfolios are based on the Markowitz theory do not adhere to their investment strategy when the markets decline. As a result, they usually miss the rebound and performance is lower than if they had maintained their strategy. Thus, it is worth choosing a prospect theory so that investors can stick to the strategy both financially and emotionally.

Figure 8: The Behavioral Efficient Frontier Based on the Prospect Theory



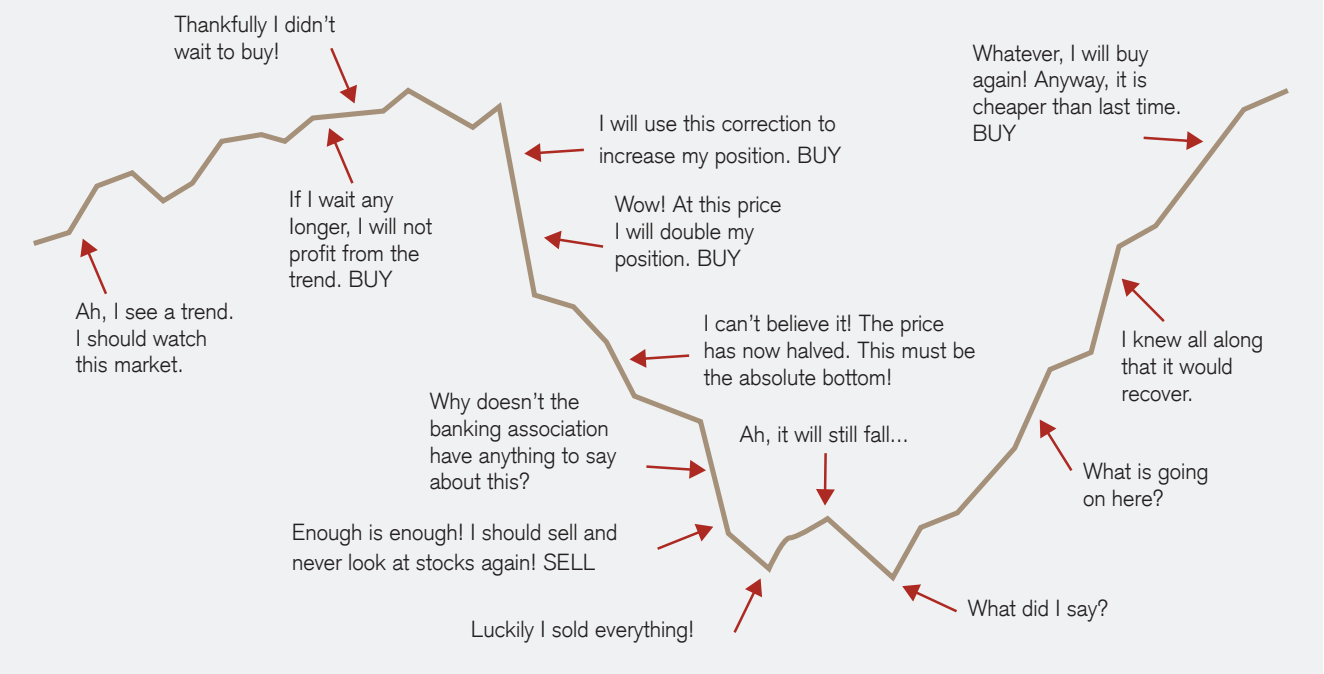
As a result, investment advice based on current research findings must optimally position prospect theory investors for inefficient markets.

BEHAVIORAL BIASES

The cyclical investment process – including information procurement; stock picking; and making, holding, and selling investments, followed by making a new selection – is full of pitfalls. These can come at a high price to investors. As Benjamin Graham liked to say, "The worst enemy of the investor is most likely himself." Purchasing investments is a rapid-fire process, and the value of these investments can decline just as rapidly – even to zero, making them a waste of money.

In this section, we will illustrate each step of the process and explain the potential pitfalls. In the next section, we will show how you can avoid these pitfalls with the help of Credit Suisse's wealth management approach. Let us start from the beginning: the investment roller coaster.

Figure 9: Investment Process – Roller Coaster of Emotions



The markets are on the rise, the stock exchanges register record highs, and the media waters down this news. Business journalists report on innovative, creative companies that are all making a profit in these markets. However, they fail to see that not all companies are successful using those same criteria. Thus, they do not falsify the theory of success, a mistake known as the **confirmation bias**. We cannot avoid reading the headlines about price gains and booming markets or the multitude of success stories. Unfortunately, these stories attract the interest of many amateur investors.

Readers follow developments in the bull market with baited breath; with some hesitation and a safe distance, they make note of certain stocks and shares. If the media spotlights a particular stock, it is more likely to attract investor attention. After a certain amount of watching from the wings, some investors will decide to participate in the uptrend before it is too late. With the wind of so many success stories beneath their sails, investors erroneously believe they have almost no chance of failing. So the survival error takes hold. The media and its readers love success stories; looking at the gossip magazines while at the hairdresser, for instance, all we see are glitz and glam. However, these publications only feature the rich and famous – wealthy entrepreneurs, writers, celebrities, singers, and other people who have made it.

Of course, there is never any mention of the hundreds of thousands, even millions, of people who have not succeeded. As a result, we grossly overestimate the stellar achievements of the success stories, which are as unlikely as a winning lottery ticket. Investors also fall victim to induction. They see a security rise and rise, until they are certain that it can only get better. Often they invest a large portion of their assets in this security – resulting in a serious cluster risk – and are likely to lose it all.

Because investors do not know they have fallen into the trap, they look for familiar company names when trying to find a good investment. In situations like these, it is very hard to avoid the **availability/attention bias**. Events that come up more frequently (often with additional media coverage) remain in our minds more than events we hear about less frequently. We forget that there are other scenarios.

On the other hand, rare, dramatic events that attract heavy media attention are overestimated. For example, if we ask a random person what the most common cause of death is, he or she might say a car accident or plane crash. This is because the media pounces on these sensational causes of death, which then stay in our minds whether we want them to or not. What is more, illustrated, easy-to-digest information is easier to remember than statistical figures. This distorts our perception between the frequency distribution and statistical reality. As a result, investors never choose information from the other side of the fence. Instead, they choose information based on their experiences and preferences. This means that we are more likely to recall the front page of a newspaper showing a CEO racing down the French Riviera in his convertible. We are less likely to remember that his company's net profit margin dropped by 30% and its earnings by 18%. Investors make positive associations with the company because they liked the car or the CEO had a nice smile in the photo. They may also remember the CEO's attractive companion with bright red lipstick. The image in their head is a good one, and so is their impression of the company.

Typical investors evaluate information according to how quickly it can be recalled. This means that in most cases, we do not continue to think of alternatives because we are satisfied with our initial thought. Investors who remember the CEO in his convertible associate the company with success and think it would be a good investment.

As soon as we remember a promising company, we begin to support our opinions about it with other publicly accessible information. This is not very rational, as the process does not permit a differentiated view. Once an investment has won the investor over, he often makes the mistake of looking for only positive information. We made reference to this at the beginning of this section when we mentioned business journalists. Confirmation bias is the phenomenon of supporting our own opinions with selective information. Investors seek confirmation for their assumptions. They avoid critical opinions and reports, reading only those articles that put the product in a positive light.

Suppose our investor's boss is also interested in market developments and likes to talk about the bull market during his coffee breaks. And suppose this boss recommends investing in the pharmaceuticals industry. Because the investor is afraid to contradict his boss or would not even consider doing so, he begins to do some research into these investments. The coffee break scenario is a good example of the authority pitfall that our investor falls prey to. He considers his boss an investment authority and, right or wrong, takes his recommendations to heart. However, the boss is no more or less correct than his employee. Because our investor does not know about this bias (or that he has succumbed to it), he begins to research the earnings made by three US pharmaceutical companies over the last few years.

The investor also reviews the returns on the companies' stock. Unfortunately, he looks only at the last three years. In addition, he cannot find the profits for one of the three companies. However, he sees that corporate revenues have grown steadily over the last three years. Thus, he incorrectly concludes that profits will continue to grow in the future and that the company must be successful.

Investors do not tend to use representative data. This means that the time period they examine is too short to determine the statistical population. Thus, it is not possible to draw conclusions about the statistical population. In the above scenario, it would be wrong to draw conclusions about the entire industry based on an analysis of three companies. Moreover, one to three years is too short a time period to draw a valid conclusion.

We refer to this as the law of small numbers. You may remember learning about the law of large numbers in school. If you toss a coin enough times, the number of times you get heads will be essentially equal to the number of times you get tails. Unfortunately, we often believe that this equality applies to smaller random samples. As a result, we look forward to very high returns based on very little information.

…back to the roller coaster

Suppose that while researching the profits of the pharmaceutical company, our investor finds an interesting article in a reputable business journal. It reports on a US company with a 40% chance of generating a 5% excess return over the S&P 500. Our investor is so excited that he decides to invest in this company. He probably would not have done so if he had read that there was a 60% chance of the company generating a less than 5% excess return over the S&P 500. Our investor has just fallen for the framing effect. In other words, the way information is presented will influence our decisions.

For instance, there is a huge difference in whether a sum is presented as a loss or a missed profit, even if these terms mean the same thing. Therefore, our decisions are based largely on how the data is depicted. The choice of scale on a chart is seldom random. It is chosen intentionally to influence the desired result as much as possible.

Such framing effects apply to everything in life. Imagine our investor is having dinner at a friend's house and she tells him that she made the sauce with 80% fat-free cream. Do you think she would have bought the cream if the package labeled it 20% fat? Now consider the package that says 98% fat-free as opposed to 2% fat. Most people would choose the 98% fat-free product even though factually, it has more fat than the product with 2% fat. Since he saved so many calories with the meal, our investor should treat himself to another beer. Imagine the beer bottle says 3.9% alcohol – how do you think consumers would feel about a beer label that boasts 96.1% water?

A company's presentation of a product is never random. It is usually intended to serve the seller's purpose, which does not always conform to the buyer's purpose.

Because our investor does not really care about cream sauce, he changes the subject and boasts about the investments he made in the stock market. He tells his friend that he invested in high-growth, successful companies, namely equities from Apple, Google, Facebook, and Credit Suisse. As he moves down the list, he does not realize most of these shares are country specific or target-customer specific.

The **home bias** is to blame. According to this bias, most investors choose the majority of their equities from their home country. These stocks seem more trustworthy, as we grew up with these company names. They are also mentioned more frequently in the local media. This is one reason investors do not diversify enough, but it is far from the only reason.

Once we invest in a stock, we hope the price will go up but worry it will go down. Of course, price developments depend on chance. Psychologically speaking, what counts is how we handle these fluctuations. When the price goes up, the optimists feel satisfied with their decision. They think, "Thank goodness I didn't wait any longer." However, our investor is not the only one; everyone wants to be part of the boom (herd instinct). This includes the pessimists, who feel lucky each time the price increases. This herd instinct is rooted within us and, once upon a time, was necessary for our survival.

After an uptrend phase – a phase of hoping for big profits, for instance – the price begins to drop. The optimists will say that these dips in price are bad luck, or a necessary correction. The pessimists will be furious if they suffered a loss. Pessimists do not remain invested for long – unless they are masochists. This is why the stock market tends to attract more optimists, who frequently invest out of hope. Thus, they invest in innovative technologies that have a low probability of generating enormous returns. We call this the **favorite long-shot bias**.

People who fall into this psychological trap always bet on the long shot because it promises very high returns. Unfortunately, they forget that the likelihood of the long shot winning cancels the profit. Of particular interest is the typical investor behavior during long-term loss, when the downward spiral persists and the prices plummet – a bear market. On the one hand, investors will initially ignore all information indicating a downward trend because such information does not support their preconceived notion that the investment is good and that there is an uptrend. Another common, irrational response is to buy more stock ("I'm taking advantage of the correction and reinforcing my position," or, "Great, I'll double my position at this price"). This behavior is caused by contrast and anchoring.

When making these decisions, investors do not rely on fundamental factors. Rather, they tend to base their decision on the price at which the stock was purchased. This price – also known as the acquisition cost – is the unfortunate anchor that causes irrational decisions. Unlike the acquisition cost, the new price seems cheap to the investor.

Anchoring influences decisions when investors do not realize how the information is presented. People are influenced by random data when making decisions, even if they know the data has no informational value or is outrageously high or low. For instance, suppose we ask one group of subjects whether Mr. Miller died before or after the age of 90 and another group of subjects whether he died before or after the age of 40. The subjects will be influenced by the anchors of 90 and 40 years. On average, those asked about 90 years would list a higher age of death for Mr. Miller than those asked about 40 years. But if we leave out the age entirely, most people will guess that Mr. Miller died at about the age of 80.

People want an anchor to cling to. Not even the experts are immune, as various experiments reveal. The price at which we last bought something is the psychological anchor. Financial institutions tend to provide investors with the acquisition price in standard form or, on request, in the safekeeping account statements (which is less sensible from a behavioral finance standpoint, given the bias stated above).

If the price drops below the psychological anchor (such as the purchase price), then investors are more likely to buy because the stock seems cheap, as if it were on sale at the supermarket. Private investors frequently will keep buying as the losses continue. This is because they want to make up for their initial losses. "I can't believe it! The price is 50% lower! That has to be a record low." No, it does not. This behavior can result in investors taking more and more risks, because they have to make up for greater and greater losses. It is like a bottomless pit.

People tend to be short-sighted, meaning that they overthink matters fairly often. As a result, they make decisions that they would not make over longer periods of time. Bernartzi and Thaler (1995) showed that investors would invest more in stocks, and thus with more risk appetite, if they made the decisions at longer intervals. This phenomenon is known as **myopic loss aversion**. Rational investors are unfamiliar with this type of behavior. They consider the consequences of their decision over a lifetime and not only for a limited time period. A discretionary mandate can keep investors from falling into the myopic loss aversion trap.

It is foreseeable that prices will rise again at some point. Although it usually takes a longer time for prices to rise again, the time period is not necessarily the critical factor in large investor losses. How sharply the prices drop is far more important. Most investors cannot handle large price losses from an emotional standpoint. Their psychological risk ability is too low. They suffer from insomnia, existential anxiety, or panic attacks. They look for external help ("Why isn't the Bankers' Association commenting on this?"). Financial risk ability is usually higher than psychological risk ability. Because psychological risk ability is initially triggered, it should be assigned equal or even higher priority than financial risk ability. Today's investment advisory services pay a great deal of attention to financial risk ability while casting aside psychological risk ability. Although psychological risk ability is sometimes evaluated, it rarely occurs systematically or with a process that is proven to deliver reliable, informative results.

You may be wondering why the investor in our story does not sell off his investments. Many private investors engage in **mental accounting**, meaning they make distinctions in their head that do not exist financially. Often, losses incurred are viewed separately from paper losses. This means that investors sell stocks from their portfolio too soon when they earn a profit and too late when they incur a loss. Turning a paper profit into real profits makes us happy, but we shy away from turning a paper loss into a real loss. Literature refers to this bias as the **disposition effect**. A second form of mental accounting is the distinction we make between money in the bank and money made on the financial market. The latter, known as house money, is often placed at a greater risk than bank balances, which usually come from savings. So mental accounting makes us think that a dollar is not worth a dollar – a dangerous attitude.

In addition, it is hard to admit our mistakes and confess that the investment might not have been the cash cow we once thought. At the very least, we want to earn back the acquisition cost from our investment.

All of these considerations – expenses already incurred (in this case, the purchase price), not wanting to regret our decision, or engaging in mental accounting – lead to irrational decisions and can cost a lot of money. Investors may reach the point where they cannot take it anymore just before the price bottoms out. Their nerves shot, they decide to sell everything. "Enough is enough! I'm never buying or even thinking about equities again!" they say. Then the prices drop a bit more and investors feel their decision was validated. "Good thing I sold it all," they think.

Looking back at their investment decision, we can see that the buyer underestimated market developments and overestimated his psychological risk appetite. This is a very common mistake. If the markets are up, investors become too confident – known as the **overconfidence bias**. This means they overestimate their own abilities and think they know more than they actually do. They are certain they possess above-average skills. Notably, most experts also overestimate themselves – frequently to a greater degree than laypersons. Many investors are too confident. This is often seen when the markets are on the rise. The sweet smell of success quickly clouds our judgment. Some individuals overestimate themselves more often than others. The opposite (underestimation) does not exist. There are merely varying degrees of overestimating oneself.

Back to our roller coaster. Stocks are getting cheaper and cheaper, the return on dividends is much higher than the interest on bonds, and eventually the market is oversold. Anyone still standing is very lucky indeed. However, the average private investor is just as surprised by the rebound as by the crash.

With the shock of the sales rally fresh in his mind, he is initially very cautious and does not trust the rebound. Despite small price gains, the investor is convinced that "it's still going to crash." The share price does in fact drop again and the investor feels happy and vindicated. "It's just as I said…" he tells himself. He becomes more confident again. Then the

rapid switch from a downward spiral to a sharp increase nearly takes his breath away. “Now what’s going on?” he wonders. The investor needs a little time to get back on board with the fast-paced market. Usually he gets himself together pretty quickly and that old familiar self-confidence is back. He thinks he saw the rebound coming and invests again once the price is high (or higher than the record low).

Hindsight is 20/20. The statement “I knew the whole time this would happen” shows that we have an explanation for everything after the fact. This **hindsight bias** keeps us from learning from our mistakes. Even if prices rise, we keep buying. “What the heck, I’ll buy it again because it’s cheaper than last time,” we say. This statement is also interesting because we have the last acquisition cost in our head as the anchor, and not the last selling price. In other words, the typical private investor buys high and sells low – wasting a lot of money in the long term.

Human behavior adapted to our natural environment over millions of years of evolution. However, the way we behave around the financial markets is anything but natural. We cannot use our adaptations to the natural environment in a profitable manner. We find ourselves in a complex system that we do not fully understand. If we apply human behavior in natural settings to the financial market, we usually buy when it is too late and do not sell early enough. By nature, people are adaptive learners, meaning that we keep doing what has worked well for us and we avoid repeating those actions that have not led to positive results. This is a bad idea on the stock market, as it causes pro-cyclical behavior. Investors tend to buy more of a share once the price has gone up, when maybe it is so high that they should consider selling instead.

We must remember that we cannot make money on a stock unless someone is willing to pay more for it than we did. So it is better to swim upstream through the financial market than follow the herd of investors. One consequence of the roller coaster ride and of irrational decisions is that private investors only rarely beat the returns on a highly diversified index, such as on the MSCI World. On average, investor performance is 4.3% worse than the index, according to a 2011 study US financial analyst Dalbar conducted. This is true not only for private investors but also for fund managers – the pros. Private investors typically do not realize they are investing more poorly than the market is. They succumb to various psychological pitfalls but do not realize it because they are not measuring their investment result in a systematic manner.

Overview – Definition of the biases mentioned in this paper

Confirmation bias - The confirmation bias refers to the phenomenon of seeking selective information to support one’s own opinions or to interpret the facts in a way that suits our own world view. Investors seek confirmation for their assumptions. They avoid critical opinions and reports, reading only those articles that put their point of view in a positive light.

Availability/Attention bias - The attention bias states that products, companies, and issuers that are more frequently highlighted in the media will be remembered more quickly by investors when they look for a suitable investment. Bad or scarcely accessible information is (unconsciously) not considered.

Home bias - Statistics show that most investors tend to buy stocks from companies in their home country. These stocks seem more trustworthy, as investors grew up with these company names. They are also mentioned more frequently in the local media.

Favorite long-short bias - People who fall into this psychological trap always bet on the long shot because it promises very high returns. Unfortunately, they forget that the likelihood of the long shot winning cancels the profit.

Anchoring - When making decisions, investors do not rely on fundamental factors. Rather, they tend to base their decision on the price at which the stock was purchased. This purchase price acts as the anchor that causes irrational decisions. Unlike the acquisition cost, the new price seems cheap to the investor. Anchoring influences decisions when investors do not realize how the information is presented. When making decisions, people are influenced by random data, even if they know the data has no informational value or is outrageously high or low.

Overview – Definition of the biases mentioned in this paper

Myopic loss aversion - Most investors fear losses more than they enjoy profits. If they check their stock performance too often, they will see they have lost money and sell everything off. A long-term view would be better. They should check their stock performance less often. The more they can keep their curiosity at bay, the more likely they are to turn a profit with their investments, provided that their portfolio is broadly diversified.

Mental accounting - Many private investors make distinctions in their head that do not exist financially. Often, losses incurred are viewed separately from paper losses. This means that people are too quick to sell stocks when they earn a profit and too slow to sell when they sustain a loss. So mental accounting makes us think that a dollar is not worth a dollar – a dangerous attitude.

Disposition effect - With the disposition effect, gains are realized too early and losses too late. Turning a paper profit into real profits makes us happy, while we tend to shy away from turning a paper loss into a real loss. One possible explanation for this is mental accounting (see above).

Overconfidence - In most cases, we overestimate our own abilities and think we are above average. Most experts overestimate themselves – frequently to a greater degree than laypersons do. Overconfidence is often seen when the markets are on the rise.

Hindsight bias - Hindsight is 20/20. The statement "I knew the whole time this would happen" shows that we have an explanation for everything after the fact. This hindsight bias keeps us from learning from our mistakes.

Get-even-itis - Once we have lost money, we take a greater risk to make up for it. Get-even-itis can cause us to place everything in one basket and potentially lose even more money.

Representativeness bias - After even a brief period of positive returns on the financial markets, we may think the world has changed for the better. People tend to think in terms of schemes and stereotypes experienced in the past. They arrive at a result too quickly, based on imprecise information.

Gambler's fallacy - Here, the effective probabilities are greatly underestimated or overestimated. For example, based on the (false) assumption that prices are about to drop, we sell too soon and vice versa (assuming that the prices will recover soon, even though they are not yet doing so).

Framing bias - Decisions are based largely on how facts are depicted in statistical terms. For instance, we do not think that "Four out of ten are winners" and "Six out of ten are losers" mean the same thing. The statements are identical, but most people do not realize it.

Regret avoidance - If we invest in a blue chip stock and it does not perform as hoped, we call this bad luck. However, if we invest in a niche product that fails to perform well, we tend to regret this more than we do the failure of the blue chip stock. This is because many other people have made the same mistake and thus our decision to buy it does not seem so wrong.

CULTURAL DIFFERENCES IN INVESTOR BEHAVIOR

One branch of behavioral finance that has evolved lies in the field of cultural research. Such research shows how behavior patterns differ from culture to culture. Cultural finance provides an essential foundation for globally active banks, and for good reason.

Despite advancing globalization, we can still identify some significant cultural differences around the world. Around 500 languages are spoken worldwide, eating habits vary from region to region, and there are some differences in our social conventions that we should know before crossing the globe. However, traditional finance barely acknowledges international cultural diversity. This is due to the premise that money is the great equalizer.

Nowadays, investors can trade nearly any security they want just by pressing a few computer keys. Traditional finance dictates that in the end, we all want the same thing: to achieve high returns without assuming too much risk.

For some twenty years, behavioral finance researchers have been trying to determine whether finance is indeed subject to cultural differences. Even if we assume that investors around the globe are focused on the return/risk trade-off, researchers believe that culture can influence investors differently in terms of investment type, investment time horizons, and risk aversion. Ultimately, behavioral finance shows that while there is only one way to act rationally, there are many ways to act irrationally. Thus, it would not be far-fetched to say that our culture helps determine which psychological pitfalls we are more likely to succumb to. In this section, we will explore the fascinating cultural differences in investment behavior and how they can influence returns on the equity markets.

What is culture?

In the broadest sense, culture is everything that people create. Examining the world's artistic treasures is an excellent way to identify the cultural differences that existed, and may continue to exist, in various regions of the globe. The question is how to measure culture and make a numeric correlation to something as mundane as investment behavior and market returns. Because investment behavior is also part of our social behavior, we can take a cue from the cultural dimensions identified by Dutch sociologist Geert Hofstede.

Figure 10: Professor Dr. Geert Hofstede found that our social behavior can best be described using the following five dimensions. The diagram shows which countries have the most extreme forms of the five dimensions Professor Hofstede identified.[4]

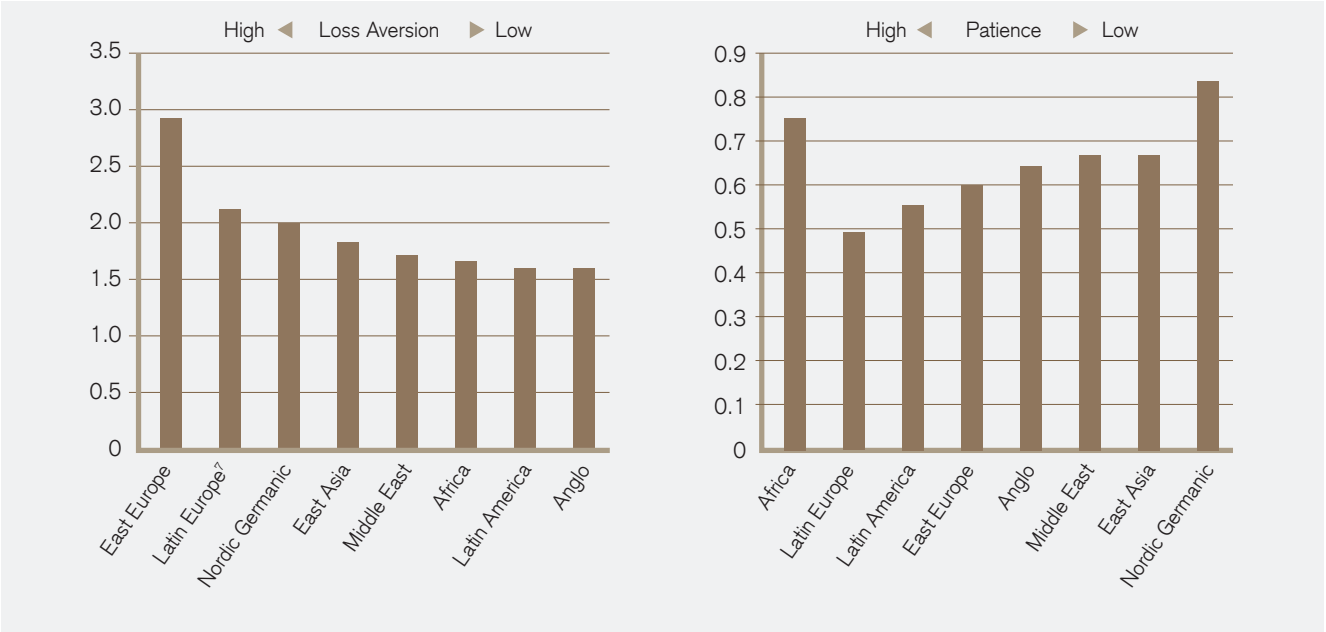
Hofstede (2001)		Lower Extreme	Higher Extreme
Power Distance Index	Imbalance between power and wealth	Austria	Malaysia
Individualism	Reward for individual or collective performance	Columbia	USA
Masculinity	Gender differences in society	Norway	Japan
Uncertainty Avoidance Index	Intolerance for uncertainty	Denmark	Greece
Long-Term Orientation	Respect for traditions	Czech Republic	China

4 Hofstede's web page, www.geert-hofstede.com, shows an interactive map of cultural differences.

How culture shapes investment behavior

In 2010, in the world's largest study of cultural differences in investment behavior to date, Professor Dr. Mei Wang,[5] Professor Dr. Marc Oliver Rieger,[6] and Professor Dr. Thorsten Hens looked at the time preferences, risk behavior, and behavioral biases of nearly 7,000 investors in 50 countries. If we group the results by cultural region, we find some astonishing differences. First, investors in Nordic and German-speaking countries are the most patient, while African investors are the least patient. Second, investors in Anglo-Saxon countries are the most tolerant of loss, while investors in eastern Europe have the greatest loss aversion (see Figure 11).

Figure 11: Loss Aversion and Time Preference



5 Chairholder at WHU – Otto Beisheim School of Management
6 University of Trier, Germany
7 Italy, Spain, Greece, and Portugal

The following figures show the international differences per country.

(Source: Study by Professor Dr. Mei Wang,[5] Professor Dr. Marc Oliver Rieger,[6] and Professor Dr. Thorsten (2010))

Figure 12: International Differences in Investor Patience

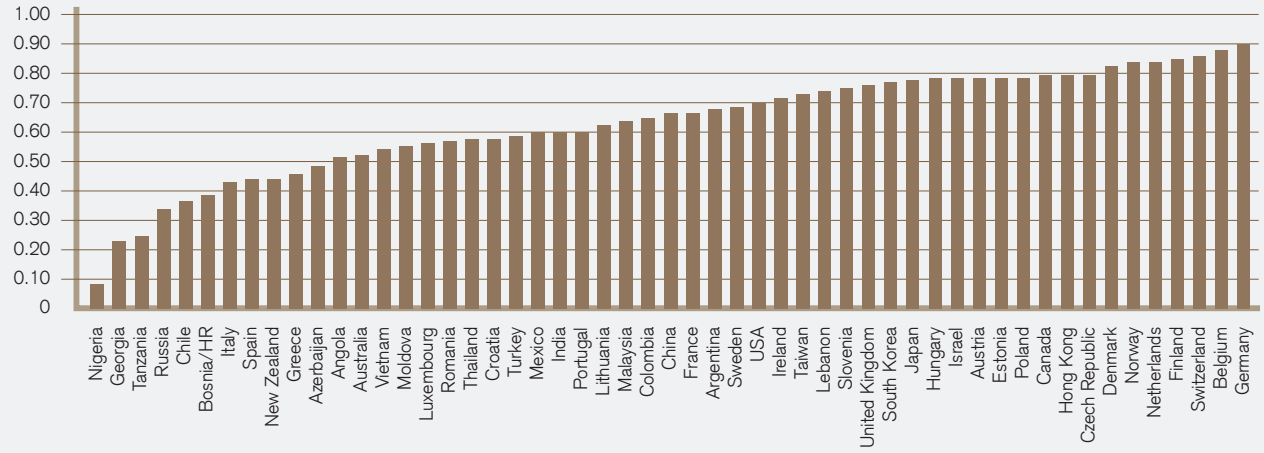
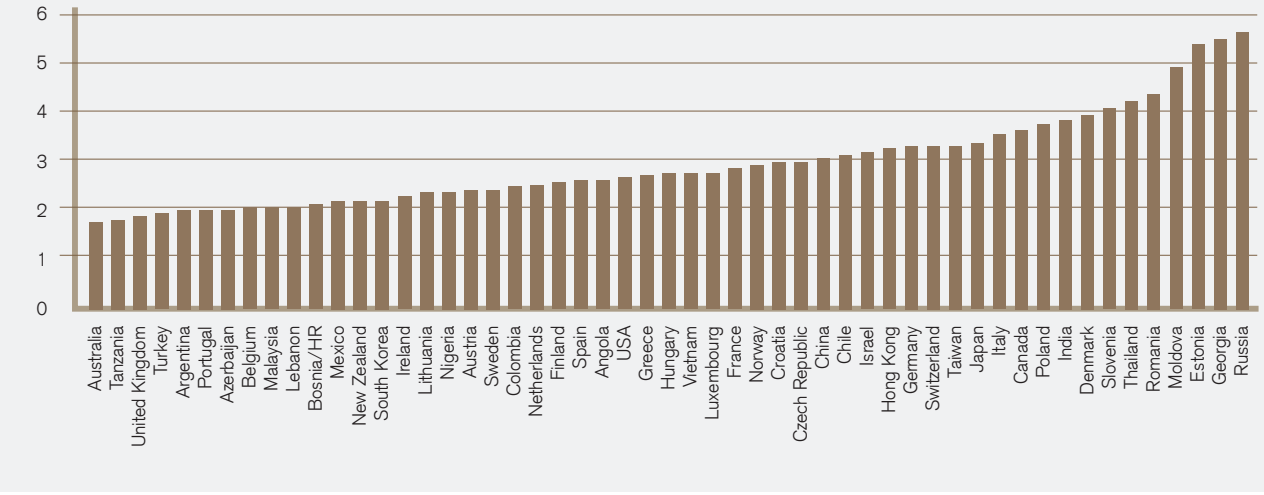
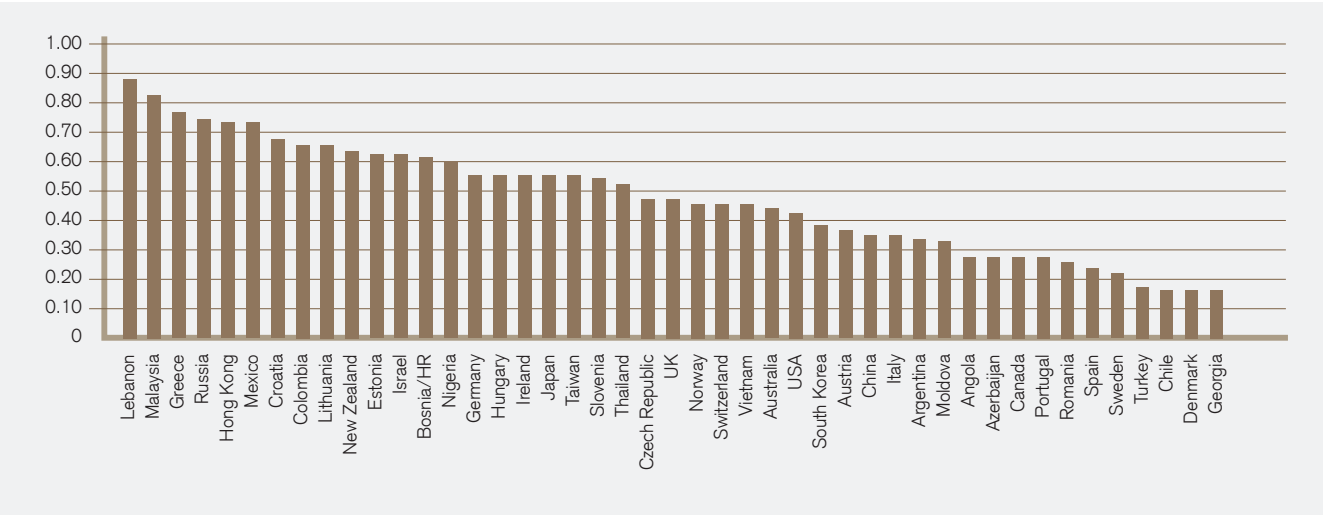


Figure 13: International Differences in Investor Loss Aversion



As far as behavioral biases are concerned, we see that in all cultural regions there is a high inclination to increase the risk after losing money (get-even-itis).

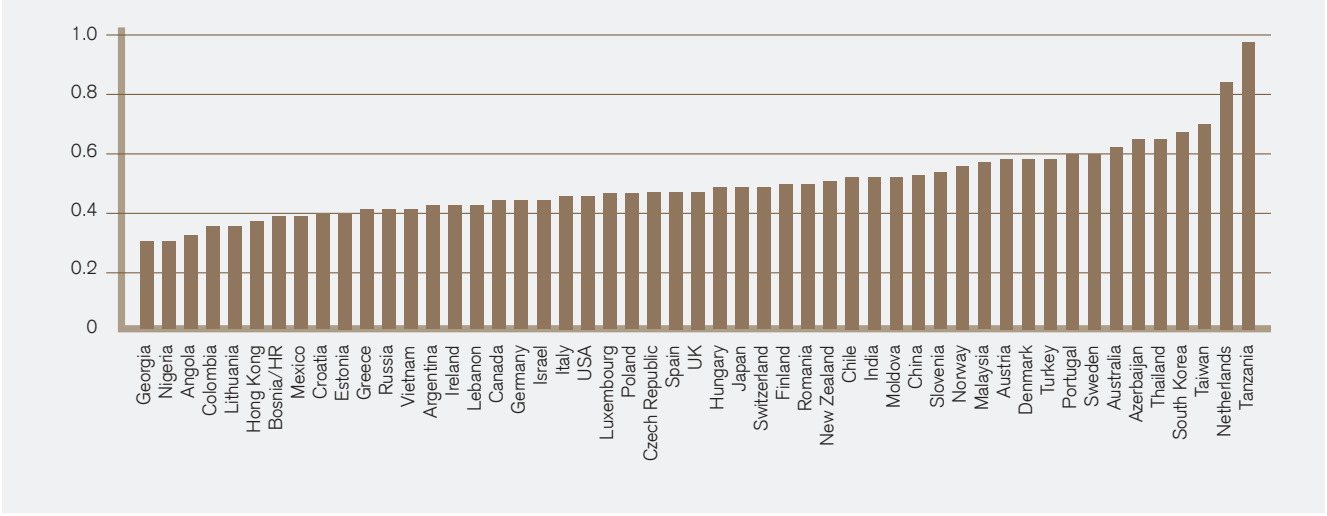
Figure 14: Get-even-itis: The inclination to risk more money to avoid a definite loss, even if this may result in a greater loss.



In most countries, there is a tendency to take unlikely events too seriously – whether they are largely positive or largely negative. In the first case, fantasies about what people could do with an extremely positive outcome are so tempting that people fail to realize how unlikely they are to win. In the second case, anxiety about an event with a very negative outcome is so worrisome that people fail to realize how unlikely this is as well.

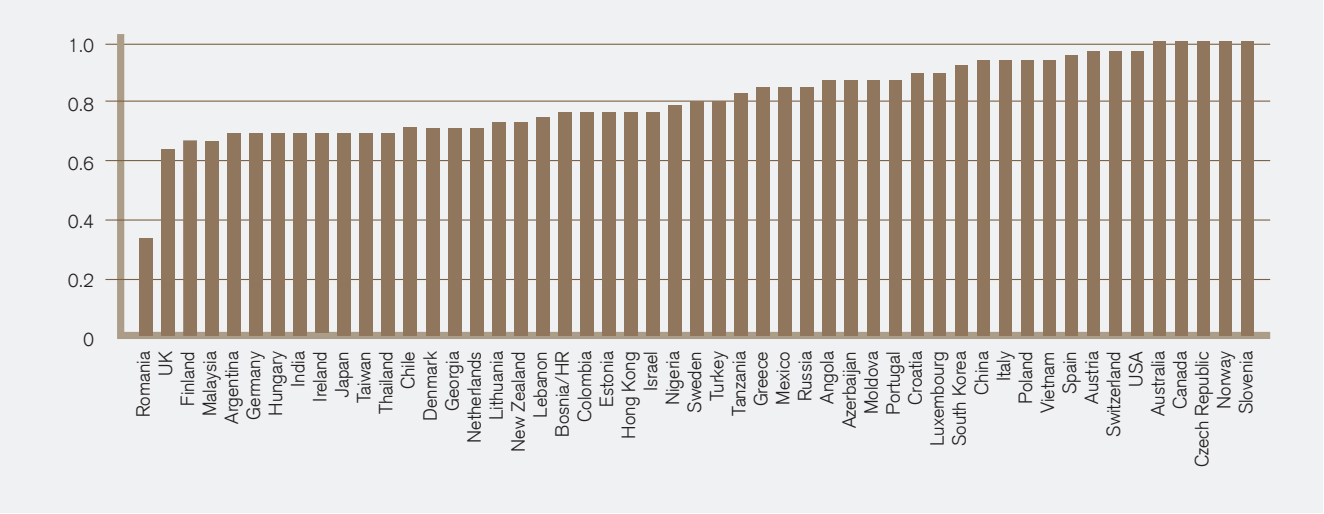
Figure 15: Inclination to Bet on Extremely Unlikely Events with a Very Positive Outcome

(Small numbers = high inclination)



These findings indicate that there are cultural differences in investor behavior. Further research is needed to determine whether, as globalization continues, these differences will decline just as our differences in language, eating habits, and social customs have declined.

Figure 16: Inclination to Avoid Extremely Unlikely Events with a Very Negative Outcome
(Small numbers = high inclination)



NEUROFINANCE: A NEW BRANCH OF BEHAVIORAL FINANCE

So far we have examined the behavioral biases that investors often fall prey to. Behavioral finance has not only drawn up a long list of these pitfalls, but it also has developed reliable diagnostic methods and suitable remedies for avoiding them. In addition, behavioral finance incorporates findings from neurofinance in the brain research field.

In recent years, researchers have applied this knowledge to economics, thanks to major technological advances, and are applying it to financial sciences. Neurofinance allows us to determine which pitfalls have a biological origin and are thus more difficult to avoid.

Evolution: the cause of bad financial decisions

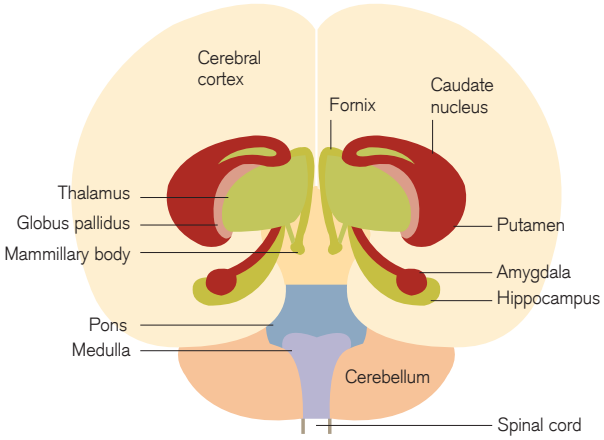
Everyone makes mistakes in life. Even if we know better, we make these mistakes over and over. In the financial world especially, we continually make decisions that economists consider to be irrational. We play the lottery even though we usually lose. We go to Las Vegas, play roulette, and when we lose we say, "I knew I should have bet on red." We buy that beautiful coat we saw in the shop window, even if it is beyond our budget. Our brain is not designed to make financial decisions or navigate complex financial markets.

When the human brain began its complex development, simple neural networks were created. From there, our brain continued to develop over millions of years. Our ancestors spent most of their time fighting for survival — foraging for food, reproducing, and avoiding natural enemies. It was not until the last millennium of this development that we began using our brain for financial decisions as well. No wonder, then, that investors (professionals and amateurs alike) systematically deviate from rational decision-making behavior.

The human brain

To understand neurofinance and its reasoning, we must first take a brief look at the neurosciences. The human brain consists of different parts, shown in the following figure.

Figure 17: The Functional Structure of the Human Brain



The oldest part of the brain, the inner core, is the stem (truncus cerebri). The brain stem controls key bodily functions such as circulation, respiration, and digestion. The limbic system is responsible for our senses (in the thalamus) and such instincts as survival and reproduction (in the hypothalamus), as well as positive emotions (in the nucleus accumbens) and fears (in the amygdala). Not surprisingly, this part of our brain plays a large part in managing intuition. What is more, three-quarters of the human brain comprises the cerebral cortex (telencephalon).

What distinguishes humans from other species is the prefrontal cortex, its role in short-term and long-term memory, as well as learning, planning, and self-control. The telencephalon also helps us reflect on feelings such as love, hate, and happiness.

It is important to note that the older parts of the human brain have not changed much over the course of evolution. Instead, new parts have developed, such as the telencephalon, which is in charge of additional functions including planning and social conduct. When we have to make decisions, our limbic system and telencephalon are activated. Here, intuition and emotions meet cognition.

These systems do not always act in unison. Emotions often get the upper hand, as best seen by measuring psychological and neuronal activity. To understand investment behavior, we need to ask: How does our brain respond to gains and losses? How about risks? What about instant versus long-term gains, losses, and risks? Can our brain assess gains, losses, and risks correctly?

Our neurons send signals to reveal an emotionally charged assessment of returns and risks. For instance, gains and losses sometimes affect different parts of the brain. Some of these parts, such as the striatum and the amygdala, clearly come from the limbic system rather than our rational prefrontal cortex. Thus, a clear separation of gains and losses, as the Nobel Prize-winning prospect theory of Kahneman and Tversky showed, is more natural than traditional finance intended. The main hypothesis of the prospect theory is loss aversion, meaning that the pain of financial loss is twice as acute as the happiness we derive from financial gains. When we talk about a painful financial loss, we are not exaggerating. Financial losses are processed by parts of the brain responsible for the pain network. One of these areas is the amygdala. Patients with damaged amygdalas are not afraid of loss and often take higher financial risks than they should.

MARKET ANOMALIES

Is individual error relevant to the market?

Behavioral finance shows that when it comes to risk and uncertainty, investor behavior deviates greatly from the ideal scenario of the rational investor. Typical investors fall victim to an array of psychological pitfalls, as described in the previous sections.

Are these behavioral biases also pertinent to market developments? Is it possible that individual errors ultimately balance each other out? If some investors are too optimistic and others are too pessimistic, the market may find its happy medium.

Is it true that investors who make errors lose money to rational arbitrageurs, such as hedge funds, meaning they keep losing relevance to the market? In spite of these plausible questions, behavioral finance research on market activity has found a wide range of market inefficiencies, known as **market anomalies**. So it seems that individual investment errors move in the same direction and occur more or less simultaneously. Ultimately, it is unclear whether irrational investors lose money to rational arbitrageurs. The reverse may be true. If the stock market is too cheap from a fundamental standpoint so that rational investors will buy, panic among irrational investors may still lead to further price losses. The famous British economist John Maynard Keynes[8] summed up this problem nearly a hundred years ago: "The markets can remain irrational longer than you can stay solvent." The great hope that rational investors can quickly make an impact on the market can be very dangerous.

Thus, good asset management should consider fundamental factors alongside behavioral finance, as Credit Suisse has been doing for years.

Empirical evidence and behavioral explanations

Whether financial markets are efficient is not a matter of faith. It can be measured empirically.

The starting point for an efficiency market hypothesis is that any profitable information has always been priced into shares. Thus, share prices should be statistically independent of one another, just like the repeated coin toss. However, this statistical independence does not apply to major share indexes such as the S&P 500. If the S&P 500 increases in a month, the probability that it will grow again the next month is 63%; the average return of the next month is then 0.11%. If the S&P declines in a month, the probability that it will decline again the next month is 48%; the average return of the next month is then 0.06% (Gerber, Hens, and Vogt, 2010).

This monthly momentum is also reflected by the positive correlation of the monthly returns from the S&P of 28%. This means that 28% of the returns from the next month have been defined by the previous month. In an efficient market, this figure would be 0%. Due to adaptive investor behavior, as described in the roller coaster section of this paper, even in highly liquid equity markets, there are escalation processes that ultimately collapse. If we look at the S&P not just from one month to the next, but over its 140+ year history, we

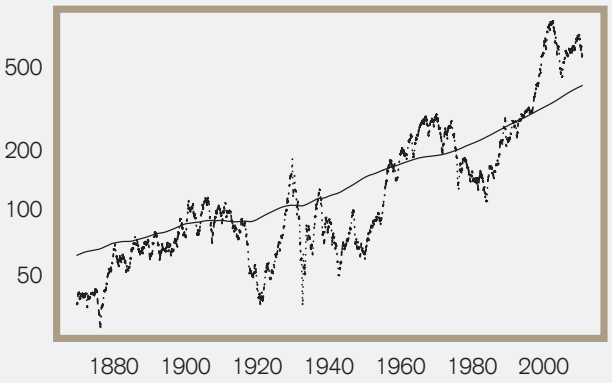
8 Keynes, ideas built the basis for the Keynesian economics.

see that there are long phases of deviation from the efficient market hypothesis (Figure 18). The largest deviations occur in times of speculative bubbles and crashes, such as in the roaring twenties and the subsequent global depression, the dotcom bubble and the crash of 2000–2003, and the subprime bubble and major financial crisis of 2007/2008.

The result of the escalation processes and subsequent collapses is that equity returns do not have normal distribution. Statistically speaking, there are too many months with very poor returns, as shown in Figure 19.

It is also true that not all profitable factors are always priced into share prices. Even very basic factors, such as the price/dividend ratio, can predict developments only to some extent, as seen in Figure 18. After a year with a high price/dividend ratio, the return of the S&P (in excess of the risk-free rate) tends to be lower than after years of a low price/dividend ratio.

Figure 18: Inflation-Adjusted Performance of the S&P 500 Compared with the Analysis under the Efficient Market Hypothesis



(Source: Gerber, Hens, Vogt (2010))

Figure 19: Abnormal Distribution of Returns on the S&P 500

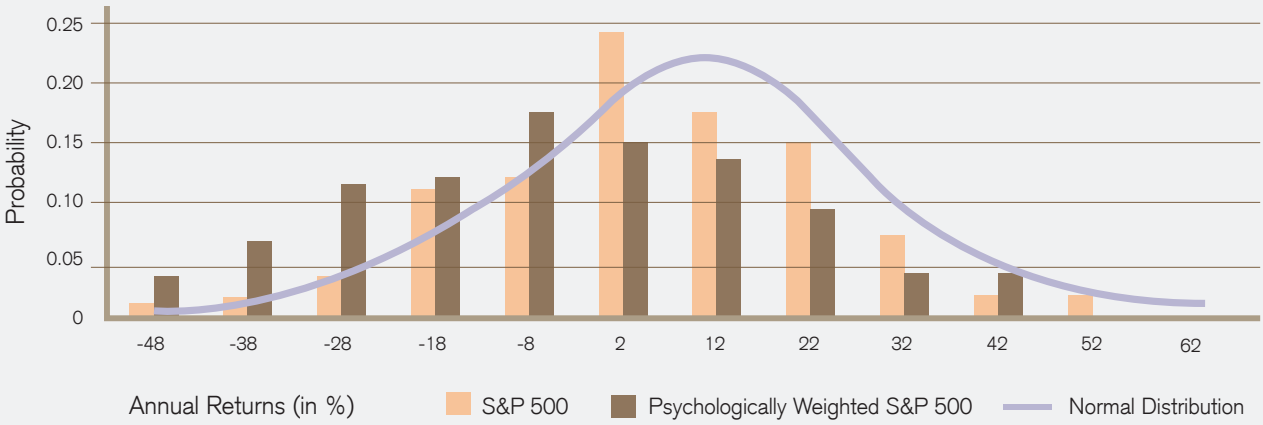
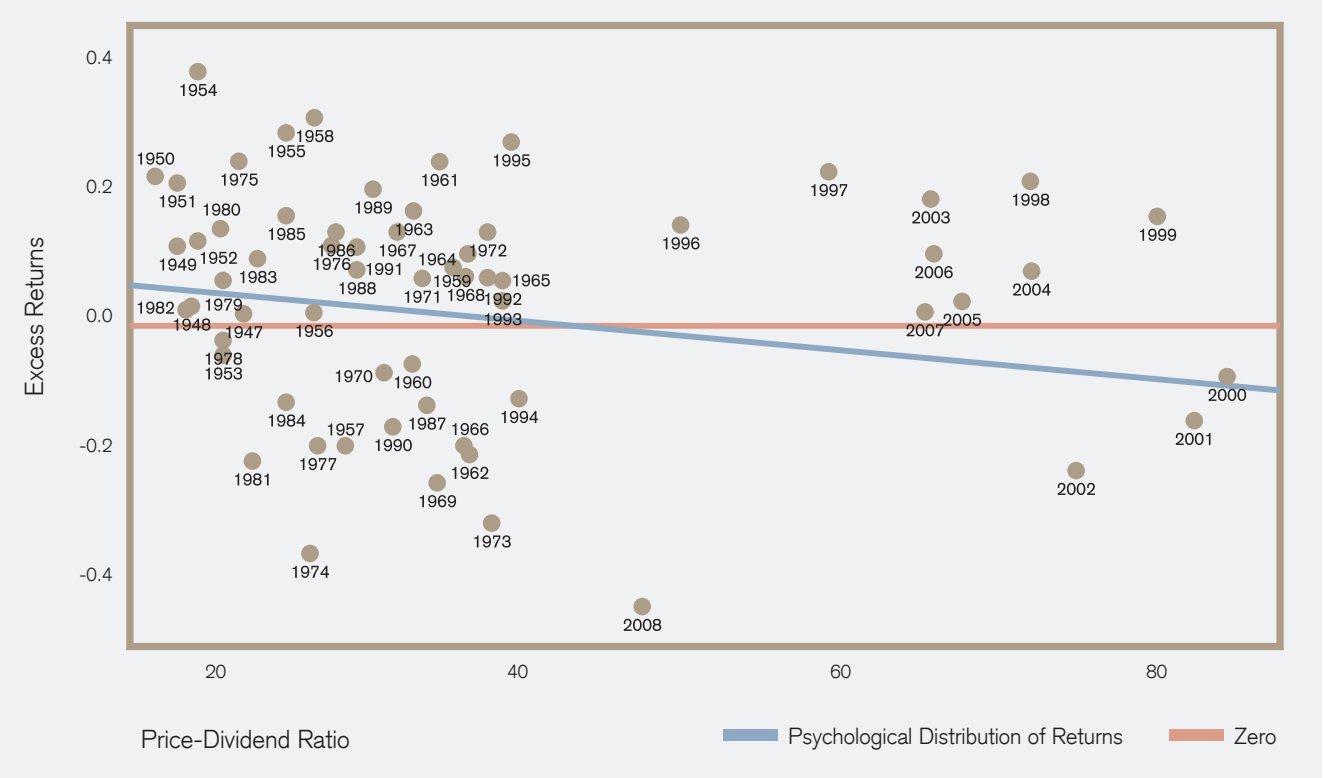


Figure 20: Returns of the S&P 500 (in Excess of the Risk-free Rate) and the Price-Dividend Ratio at the End of the Previous Year

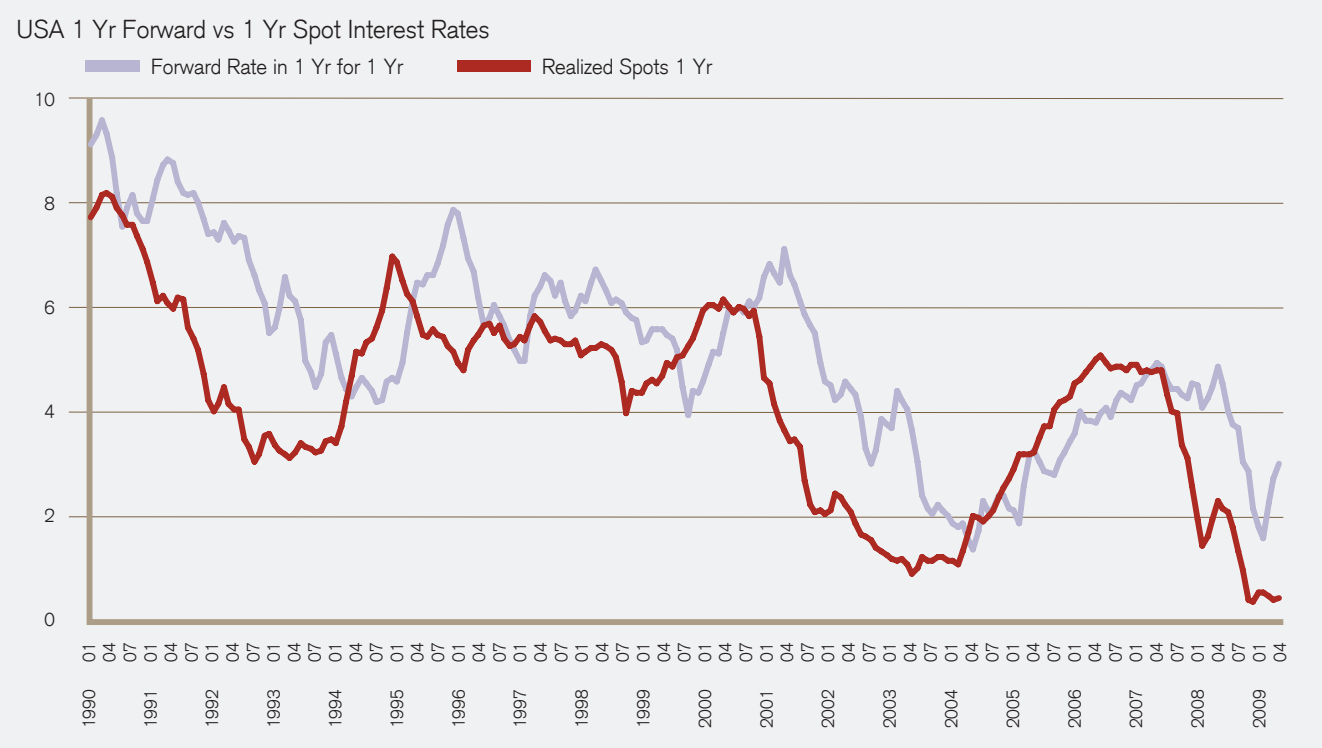
(Source: Gerber, Hens, Vogt (2010))



Other market anomalies on other asset classes exist, such as bonds. When we compare short-term and long-term interest rates, the efficient market hypothesis says that if long-term rates are higher today than short-term ones, short-term rates will soon rise. If we compare the expected short-term rates with the rates that later occur, we see that rise during a phase of interest growth in Figure 20. If we compare the expected short-term rates with the rates that later occur, we see that during a phase of interest growth, the expected rates from the comparison underestimate the actual rates that occur. During a phase of interest rate decline, the reverse is true.

Behavioral finance uses the **anchoring bias** to explain this phenomenon. Future interest rates that are implicitly expected based on current rates are too close to the current rates, which are used as the starting point (the anchor) for expectations. Even on the options markets, there are surprising deviations from the efficient market hypothesis. For example,

Figure 21: The Forward Rate Bias (Source: Burkhardt (2008))



out-of-money options[9] are more expensive than they should be from a rational standpoint. Options such as lottery tickets have a small probability of delivering high returns. As psychologists Kahneman and Tversky found in numerous studies, investors place too much value on low probabilities, which means they pay too much for out-of-money options like lottery tickets. If the probability under an alternative rises by 1%, the psychological appeal of the resulting situation depends on how high the probability was to begin with. If the original option had a 0% probability, the same 1% increase has a much greater psychological impact than if the original probability had been 49%. In the latter case, the increase was from fairly possible to slightly more possible; in the former case, the increase was from impossible to possible. For an example of this, see Figure 15 and 16 in the section on Cultural Differences.

9 Options that would have a zero value if the current date was the maturity date.

If we apply this psychological weighting of probabilities to the returns on the S&P 500, we obtain the brown bars shown in Figure 19. Thus, not only do equities have too many months of excess loss from a statistical standpoint, but also investors exaggerate the probability of these months occurring.

Rather than continue down the list of market anomalies, it is worth considering what would happen if everyone invested using the prospect theory portfolio model, identified their biases with a diagnostic test, and then abandoned these biases. The markets would ultimately be efficient under these ideal conditions. The Markowitz model would suffice as well: because the prospect theory portfolio model includes the Markowitz model, it also works in efficient markets.

After all, you still can drive a car cross-country with four-wheel drive in the summer.

WEALTH MANAGEMENT APPROACH

(Source: Credit Suisse (2015))

The goal of any investment advisory service is to explore the best personal strategy for the client and to review it on a regular basis. An investment strategy cannot be optimal unless it integrates the client's **risk ability**, **risk tolerance**, and **risk awareness**.

Risk ability refers to the client's financial situation. What are the client's assets and income, spending patterns, and earning sources? The client's risk ability limits the optimal portfolio if they cannot financially bear losses beyond a certain amount. This circumstance must be accounted for. **Risk tolerance** indicates how much risk an investor is emotionally willing to bear. The subjective assessment of the objective (measurable) risk of an investment is determined by **risk awareness**.

The client's risk awareness is often distorted and can change quickly. Due to the biases just mentioned, among other factors, they are unable to identify the real risk and evaluate it properly. One example is hedge funds, or collateralized debt obligations (CDOs), which became notorious during the financial crisis. Many investors considered these investments evil, due in part to media coverage.

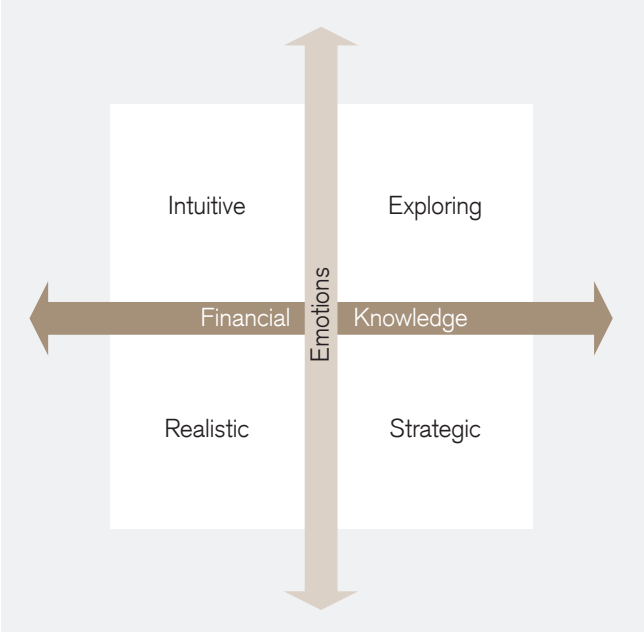
Despite its importance, subjective risk awareness is generally not given the attention it deserves, even in the year 2015. The goal of investment advisory services should be to review the investor's risk awareness and provide sufficient risk disclosure. Because we can assume that the client's risk awareness is distorted by many biases and influenced by the media, it should not be a part of optimal portfolios. Reputable

banks have a research department that uses the best methods to adequately assess the current risks of asset classes. The advisor must provide the client with this market view along with an explanation.

A structured advisory process can help investors explore their actual risk ability and risk appetite.

We also advise conducting a diagnostic test for behavioral biases and identifying the client's existing financial knowledge. The test will identify four categories of investors, based on their investment approach and financial knowledge. Does the client want to make his own investment decisions based on the investment advice received, or is a discretionary mandate preferable? The investor type determined by the diagnostic test can help answer this question.

Figure 22: Determining Investor Type



Intuitive investors - Intuitive investors make emotional decisions. Without the right investment strategy, they may be influenced too heavily by current market developments and lose sight of their investment goals.

Using a discretionary mandate can help intuitive investors to maintain a defined investment strategy. Research studies show that the investment strategy is responsible for about 80% of investment gains.[10] Otherwise, clients may make hasty purchases in a rush of euphoria when the markets are up (too expensive) and sell off stock in a panic when the markets are down, which likely will erode at their assets over time.

Exploring investors - Exploring investors are very familiar with the financial market but make emotional decisions. They have a good understanding of the opportunities and risks on the market. Although they are sometimes dazzled by new, innovative financial products, they always bear the risks in mind. Despite their vast financial knowledge, these investors sometimes abandon their predefined investment strategy for emotional reasons. This is why their investments must be reviewed periodically.

Realistic investors - These investors are not swayed by emotions. However, they lack the financial knowledge to assess risks and opportunities properly. Professional investment advice is recommended for realistic investors. Such advice can help them make investment decisions and improve their financial knowledge.

Strategic investors - Strategic investors have a good understanding of the financial markets, so they can assess the risks and opportunities they are facing. They are not swayed by emotions and can make objective decisions. Their strategic approach does not allow them to lose sight of their investment goals. They are qualified to implement their investment strategy in conjunction with a non-discretionary mandate.

Next, based on the investors' background, a holistic investment strategy is developed, taking into account the investor's assets, wealth building, obligations, and asset depletion. In particular, this proposal focuses on personal liquidity management – in other words, coordinating income with financial obligations.

10 Brinson, Hood, and Beebower (1986), and Ibbotson and Kaplan (2000).

This plan helps investors ensure that they can meet all of their expenses when due and that they do not run into any liquidity bottlenecks.

First, however, the client's investment goals must be determined. The focus is on the client's wishes and plans, which should be accounted for in the investment plan as expenses (income). Investors should rank these goals in order of importance. Goals can include obligations (paying off a mortgage, children's education, and so on) and plans and wishes for themselves and their family (vacation home, international travel, and so on). The defined goals should be used to determine the minimum investment horizon.

Once the obligations (including wishes/needs) have been prioritized over time, we can determine which part of the investments are freely available – in other words, not subject to an obligation. In this step, it is important to consider tax, legal, and personal restrictions.

Traditional finance uses the concept of value at risk (VaR) here. Value at risk is the amount of loss that will not be exceeded for a certain period of time (save for a few exceptions). Aside from the argument that VaR is not necessarily the right measurement tool, this viewpoint is somewhat unsettling in psychological terms because there are cases in which investors can lose so much money that they are unable to meet their obligations. This can mean that investors get nervous when prices are down and abandon their investment strategy. A better method is to cover the fixed obligations with secure investments. So instead of a value-at-risk view, an asset split is preferable.

From a behavioral finance viewpoint, asset splits are a very good idea. This is because clients still know that their obligations are not at risk (even when they are losing money from their free assets) and they can better maintain their investment strategy. This means clients will not have to make emergency selloffs and can act if attractive investment opportunities arise during turbulent times.

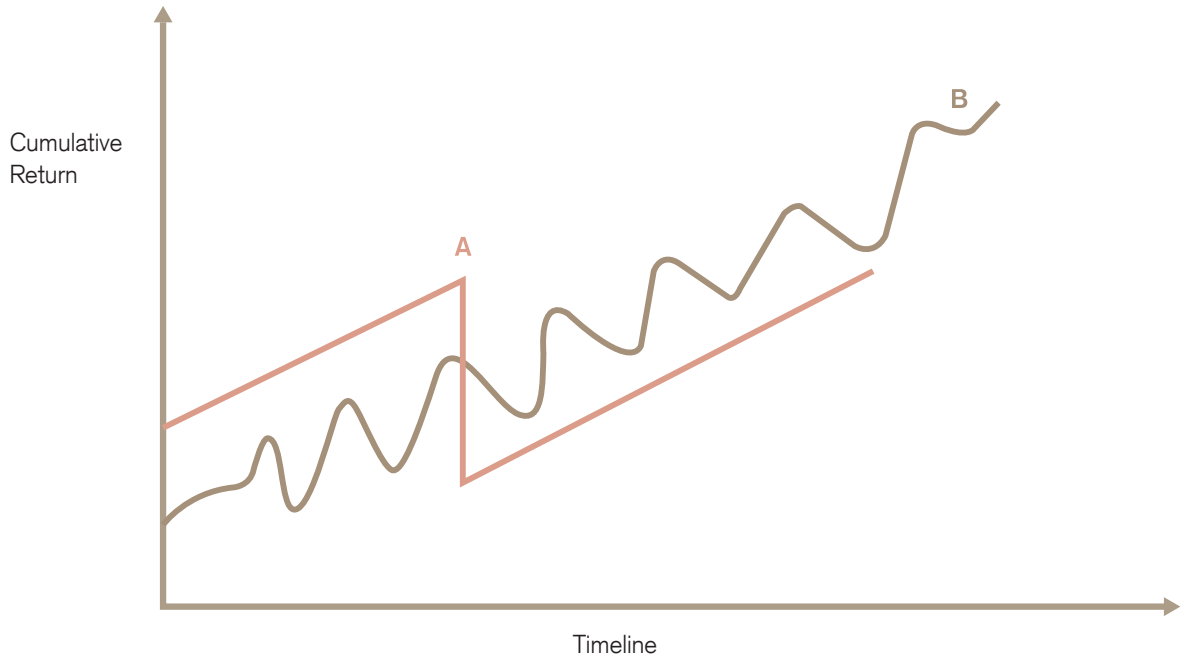
One of the most important steps is analyzing the client profile and risk analysis. The advisor and the investor try to determine the investor's actual psychological risk profile together. Specifically, they need to know which fluctuations the client can bear without losing sleep.

Of course, the client must be able to bear these fluctuations not only emotionally but also financially. The all-important decision is then how to define the investor's risk appetite. Under the traditional view, risk lies only in the fact that for some investments (such as equities), it is difficult to determine with certainty how high the returns will be at the end of the investment horizon. In empirical terms, the average returns and standard deviation in returns will rise along the investment class chain (money market, bonds, hedge funds, equities). From a traditional finance standpoint, determining risk appetite consists only of choosing from this trade-off. Some banks also use risk profilers that inquire directly about this trade-off by offering the client a few combinations of average returns and standard deviations.

Investors may be overwhelmed by this process. If an investor does not understand the question properly, their answer usually will result in an asset allocation that has draw downs (accumulated loss during a specific period) for them. They cannot maintain the strategy during times of crisis. Behavioral finance takes a different view of risk tolerance. Although uncertainty about the amount of the yield upon maturity is a key aspect of risk tolerance, loss tolerance is far more important. Because most asset yields do not have the same amount of opportunities for losses and gains, this distinction is very important for asset allocation. Equities, for instance, have many more losses than they normally should, given their standard deviations. Capital-protected products have a high standard deviation in their yields, although their losses are limited. Therefore, the inclusion of losses in risk tolerance means that the asset allocation has fewer stocks – but capital-protected investment products can play a key role.

Behavioral finance also integrates fluctuation (volatility) into the portfolio. The response to asset volatility, called investment temperament, is a key indicator of whether investors can maintain their strategy.

Figure 23: Various Risk Aspects



This figure illustrates that volatility (standard deviation of returns) is not easy to understand, especially for nonprofessionals. It shows that Investment A is subject to a higher (one-time) fluctuation in returns than Investment B. For Investment A, the difference between the minimum and the maximum return is higher than for Investment B. However, B has a higher volatility than A because the volatility is defined as the average standard deviation in the returns. However, because A fluctuates enormously only once, it has a lower influence on the average of the standard deviation. This is because the weight of a one-time deviation is less than if it were to fluctuate frequently, even if these fluctuations are smaller. This lies in the definition of average.

An investor who chooses Investment A due to the lower volatility and cannot withstand the drop due to an excessively low psychological or financial risk tolerance will suffer a greater loss than if he had invested in the higher risk Investment B (measured with the risk criteria of volatility). This example illustrates that volatility as a sole risk measurement tool must be treated carefully. It is also important to know how willing the client is to take risks. Once we know the client's financial situation and risk analysis, the foundation is set for creating the investment strategy.

The investment strategy can be implemented in an active or passive manner. This is a decision that clients must make and with which the advisor can assist. The investment strategy is based on the client's individual investment goals and personal risk profile.

After the plan has been implemented and the partnership has been cultivated, the process repeats itself continually.

By implementing the strategy, the research team protects clients from the availability/attention bias. The research team uses fundamental data and does not blindly apply the past to the future. This is why every disclaimer includes the caveat

"past performance does not guarantee future earnings" or something to that effect. Today's talents are not necessarily tomorrow's stars.

Typical investors evaluate information according to how quickly it can be recalled. Advisors also present sufficient timelines for returns and not just those from the last year.

If the client wishes to make the investment decisions (execution only):

People should not stop at the first best result that comes to mind. The attention bias states that investors will more quickly remember products, companies, and issuers more frequently highlighted by the media when looking for a suitable investment instrument. Instead, investors should look for arguments that refute their opinions. They must weigh the pros and cons.

An objective analysis protects an investment idea from the confirmation bias. This refers to the phenomenon of supporting our own opinions with selective information. We want confirmations of our views. We avoid critical opinions and reports, reading only those articles that put the product in a positive light.

The correct assessment of individual risk ability is particularly important during this process, but it is very difficult to achieve. Determining the client's risk preference is part of the risk profiler's job. The goal is to give an investment recommendation that reflects the client's risk preferences as accurately as possible.

That is why a good risk profiler is needed.

Finding the right risk profile for the client is probably the most important piece of investment advice. The risk profile defines the strategic asset allocation (SAA). Many studies show that investment success depends largely on SAA. The studies by Brinson et al. show that SAA accounts for 80% of investment gains. However, to reach this goal, the investor must be able to maintain the strategy, as Dalbar's study (2011) found.

Thus, SAA is the main component of investment success. Just a few years ago, most banks defined SAA solely on the qualitative opinion of investment advisors. But today nearly all banks use a formal questionnaire, known as a risk profiler or risk profile. In most industrialized nations, the regulatory agencies mandate this profile by law.

The same is true of risk profilers as it is for everything else: Some are good, and some are bad. Unfortunately for banks and clients, however, it is not easy to determine how the good differ from the bad. Controlled lab experiments are useful for designing risk profilers. Lab experiments conducted on decision making are one of the most important research methods in behavioral finance.

These experiments originated with Vernon Smith, an American professor who won the Nobel Prize in 2002 for economic sciences. The key advantage of lab experiments is that the lab manager retains control over the exogenous influences and thus can make direct comparisons – for instance, between the gains of investors with or without risk profilers before investing. This comparison can be applied to all market phases (rising, falling, sideways, and so on), as the lab manager can set these in the experiments. This is a huge advantage over the real world, where it is not possible to experiment with the client advisory process. For about five years, a group of researchers led by Thorsten Hens at the Institute for Banking and Finance, University of Zürich, has been developing risk profiles based on lab experiments.

The goal of a risk profiler is to determine asset allocation by asset class, which the investor tailors optimally to the return/risk trade-off so that he can tolerate fluctuations in the investment strategy financially and emotionally over the long term. The bar is set very high, as it requires a balance between the investor's rational and irrational aspects. If investors' behavioral biases have too much influence over their asset allocation, they will lose money. At the same time, the clients' psychology must be considered, so that they are not overwhelmed by the ups and downs of the investment strategy and do not abandon it at the wrong time. To diffuse the conflict between irrational behavior and mental overload, it is not

advisable to use the risk profiler in an isolated manner. Instead, the risk profiler should be used in context (for instance, with a diagnostic module and a training module before and good reporting after). A diagnostic module can reveal investors' behavioral biases, and a training module can teach the pros and cons of asset classes and investment strategies.

What questions should a risk profiler include?

The questions in a risk profiler must impart a logical thought pattern so that investors can see why they must answer them. One logical pattern is to start with the investors' goals, followed by the tools with which they want to reach these goals, followed by a definition of the potential restrictions to keep in mind when using the tools, and finally to analyze the solution.

In order to understand how the solution is defined by the goals, tools, and restrictions, it is important to return to these aspects time and again so that a dialogue based on the risk profiler can be held.

Portfolio design

Once the investment goals, obligations, investment tools, and risk tolerance have been determined, the question is how to link this information to asset allocation. Unfortunately, this step is not well covered in practice. Scoring methods are very popular. They assign a score to each answer in the risk profiler and add these numbers based on specific rules. The problem with this method is that all the hard-won, carefully extracted pieces of information are lost, because they are presented only on a scale (for example, between 0 and 10).

However, this is a simple procedure, because the points in the scale can simply be allocated to certain sample portfolios in the risk/trade-off.

A more detailed method is to evaluate the answers using a decision model. Based on the investor's answers, parameters of a target function and their restrictions are defined. The decision model is then optimized in line with a data set of returns. The central decision-making model of behavioral finance is the prospect theory of Kahneman and Tversky mentioned earlier (page 8).

Documentation and reporting

Individuals usually want to ponder the suggested asset allocation and may want to discuss it with others. For this reason, they should be given thorough documentation about the entire decision-making process. The documentation also can help manage certain biases, such as the hindsight bias and regret avoidance. Thus, each decision and the basis for it should be documented. This enables investors to learn from their mistakes. In making their own investment decisions, they should keep a trading diary, listing the reasons and goals for buying each stock. Before selling, the client should review the purchase entry and determine whether the facts consulted when making the original purchase are true.

Risk monitor

The optimal investment strategy for the client must be reviewed continually and revised if needed. Over time, the client's risk ability can change significantly for two reasons. Gains and losses on the financial market change their assets, and personal events such as marriage, birth, divorce, and retirement change their obligations. A risk monitor provides an ongoing review of the suitability of the investment strategy chosen. It shows which of the client's obligations and wishes can be met with current assets and which can likely be met in the future. Thus, the risk monitor provides valuable information to review the investment strategy. It should be based on long-term expected returns and anticipate a certain amount of tolerance to market fluctuations so that it does not lead to knee-jerk reactions in the portfolio.

Overview – De-Biasing			
	Countermeasure	**Client Advisor**	**Research**
Confirmation bias	Look for counterarguments. Be honest with yourself. Also, an objective analysis of an investment idea will protect you from a confirmation bias.	Helps the client get an objective viewpoint.	Fundamentals and long time periods help the client with an objective analysis.
Availability/ attention bias	Ask yourself why you have just thought of this particular instrument. Do not stop at the first best idea. Do not be taken in by glossy brochures. Ask a neutral party for advice.	Should be able to access a database with research reviews. The database should not contain any biases and should be objective in content.	Review companies regardless of the level of media coverage.
Home bias	Structure your portfolio top-down and start by defining the strategic asset allocation. It is best to let your client advisor assist.	A structured investment process helps. Diversification principles are standard.	Evaluates global stocks and markets based on fundamentals.
Favorite long-short bias	Be satisfied with smaller gains, which offer higher chances.	Your relationship manager can explain the risks and opportunities to you and prevent you from taking excessive risks.	Research analyzes each opportunity and risk in a neutral manner.
Anchoring	Ask yourself how the investment will pay off in the future. Whether you make or lose money with an investment is not relevant to future performance.	Decisions to buy or sell are made based on fundamentals. IT-based systems help the client advisors act without emotions getting in the way.	Research contributes to rational decision making.
Mental accounting	Try to avoid this distinction and be aware of when you fall prey to this pitfall.	Your client advisor will not even mention these distinctions so that you can avoid this pitfall.	N/A

	Countermeasure	Client Advisor	Research
Disposition effect	Stick to your predefined strategy. Keep a diary of your investment ideas. Why are you buying an investment, what do you want to achieve, and under what circumstances (based on what facts) is the investment to be re-sold? Consult your diary before you actually sell. Has the reason for selling occurred? If not, review your decision.	With the help of a relationship manager and a systematic investment process, it is easier to maintain the previously defined strategy.	With the help of a client advisor and a systematic investment process, it is easier to maintain the previously defined strategy.
Myopic loss aversion	Stick to a long-term strategy; do not let your emotions lead you in financial matters.	Your advisor will guide you along the way. He will provide you with information as required for your portfolio or the markets.	Research will review on a regular basis whether your strategy still meets the market conditions.
House money effect	Realize that a dollar is a dollar, no matter where it came from.	It is easier for an outsider to realize this than it is for us. Your client advisor will inform you if your risk ability has increased so much from financial returns that you can risk more.	Research will review on a regular basis whether your strategy still meets the market conditions.
Overconfidence bias	Look at the abilities of the average person and realize that everyone wants to be a winner.	Your client advisor will make it easier to realize your actual abilities, as long as he is honest.	Research provides you with peer group comparisons that you can use to see how much better or worse you are compared with others.
Hindsight bias	Realize that this will not help you. Try to learn from your mistakes. Look at your investment diary from time to time. You will then see what the situation was when you chose an investment.	Together you can accelerate the learning process and find the cause sooner.	Research will review on a regular basis whether your strategy still meets the market conditions.

Overview – De-Biasing			
	Countermeasure	**Client Advisor**	**Research**
Get-even-itis	Realize that losing money is as much a part of investing as making money. Maintain your long-term strategy and do not try to turn things around by taking extreme steps.	If you are suffering too greatly from financial loss and want to make up for it as soon as possible, your client advisor will counsel you to be patient and reasonable.	Research will review on a regular basis whether your strategy still meets the market conditions.
Representativeness bias	Look at longer time periods.	Your client advisor will be glad to show you the long-term performance of your investments in the past.	Statistical models try to track trends and are not led by emotions.
Gambler's fallacy	Consider the actual probability that the trend will reverse.	Your client advisor will be glad to show you the long-term performance of your investments in the past.	Statistical models try to track trend turnarounds and are not led by emotions.
Framing bias	Look at everything in the reverse. For example, if there is a 60% chance of X happening, there is a 40% chance that it will not happen (4 out of 10 cases).	Ask your advisor for further information. Consider the source's possible motivation for providing you with information.	Research institutes can give you additional public background information.
Regret avoidance	Learn from these situations and do not make excuses.	Your client advisor will help you look at the situation in a factual manner.	Research will provide you with the pros and cons of investments with a neutral tone.

CONCLUSION

Traditional finance, based on the hypothesis of efficient markets and the optimization of statistical figures such as means and variances, suggests that investing has a lot to do with mathematics. However, behavioral finance has put the spotlight back on people. People make mistakes – even in investment decisions, which results in inefficiencies at the market level. Based on behavioral finance, investment is 80% psychology.

In the meantime, behavioral finance has created methods that can help investors identify typical mistakes while finding the right portfolio for them. The hope is that as many investors as possible will make use of this school of thought and that the markets will become as efficient as traditional finance assumes. However, the saying “There is no such thing as a free lunch” will always apply.

Be aware of the risks before you make a decision, and choose the right combination of risk and return. The findings of behavioral finance can help you.

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Please note that this paper does not claim to be original research. To the best of our knowledge, we have cited all original work on which it is based.

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