

# The Psychology of Decision Making

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Three areas of "cognitive illusion" that violate basic assumptions of the classical economic model of decision making are risk attitudes, mental accounting, and overconfidence. Their existence indicates that the rational economic model is incomplete in a systematic way. The three phenomena also provide clues to many market anomalies and investor phenomena, and understanding these biases may suggest ways to exploit them in the market.

Financial markets are influenced by many complex factors, including economic processes, institutional and political constraints, the flow and dissemination of information, and last but not least, people's reactions to and perceptions of risk. Studies of judgment and decision making indicate that people do not always behave in accord with the classical rational model of economic decision making. The classical analysis assumes that people are perfectly consistent, satisfy criteria of coherence, and have unlimited computational power. The evidence, however, shows that human rationality is bounded by both emotional and cognitive factors.

This presentation addresses some basic elements of the psychology of risk. It does not attempt to provide a comprehensive theory of investor psychology; instead, it reviews and illustrates a few salient findings. Specifically, the discussion focuses on three phenomena - risk attitudes, mental accounting, and overconfidence - that violate basic assumptions of the classical economic model of decision making. These phenomena are often referred to as cognitive illusions because, like visual illusions, they relate to perceptions that often remain compelling and tempting *even when people realize they are illusory or fallacious*.

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## Risk Attitudes

One of the fundamental assumptions of the economic analysis of risk that is built into portfolio theory is the assumption of risk aversion. Analysts assume that, holding expected value constant, people would rather have a certain return than an

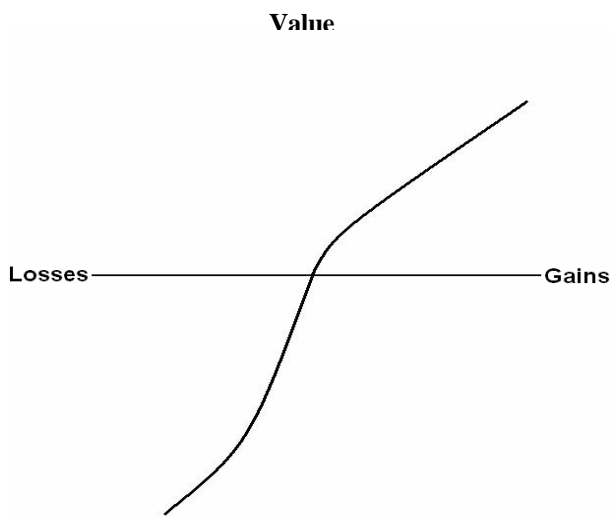
uncertain return and that people need to be compensated for bearing risk. Although risk aversion is quite common, it fails in some situations.

Consider the following problem. You have a choice between a sure \$85,000 or a risky prospect that offers an 85 percent chance to receive \$100,000 and a 15 percent chance to receive nothing. Both prospects have the same expected actuarial value: If you play them over and over again, you will receive on average the same amount. The great majority of people, however, would rather receive \$85,000 for sure than take the chance of receiving nothing. This preference illustrates the notion of risk aversion.

Now consider the mirror-image problem. In this case, you face a sure loss of \$85,000 or an 85 percent chance of losing \$100,000 and a 15 percent chance of losing nothing. The great majority of people would rather take an 85 percent chance of losing \$100,000 with a 15 percent chance of losing nothing than a sure loss of \$85,000. This preference exhibits risk seeking rather than risk aversion. Thus, risk aversion is not always valid, especially in the domain of losses, where risk seeking is frequently observed.

Because risk aversion does not hold in all cases, a different model from the classical model is called for. Figure 1 presents a hypothetical value function that captures observed human responses to gains and losses. This S-shaped function has three features that distinguish it from the concave utility function of classical economic analysis. First, it is defined in terms of gains and losses rather than in terms of asset position, or wealth. This approach reflects the observation that people think of outcomes in

**Figure 1. A Hypothetical Value Function**



Source: Amos Tversky, based on data from Tversky and Kahneman (1986).

terms of gains and losses relative to some reference point, such as the status quo, rather than in terms of a final asset position. Because people cannot lose what they do not have, classical economic theory does not address losses. The language of losses presupposes that people evaluate things relative to some reference point; so, the domain of this value function is gains and losses rather than wealth.

The second feature is that the value function is concave above the reference point and convex below it, which results in the characteristic S shape. This feature means that people are maximally sensitive to changes near the reference point: The first \$1,000 gained is the most attractive, and the first \$1,000 lost is the most unattractive. This observation is consistent with a great deal of research on perception and judgment. For example, the illumination inside a room at noon may be several orders of magnitude less than outside, yet the people in the room adjust to the inside level and see each other quite clearly. They are not aware that the room is dark in comparison with the street. However, they instantly notice even a small change in the brightness of the light in the room. The same is true for many dimensions of human experience, including monetary changes.

The third feature of the value function is that it is asymmetrical; the loss curve is much steeper than the gain curve. A loss appears larger to most people than a gain of equal size; a loss of, say, \$5,000 is generally perceived to be much more aversive than a gain of \$5,000 is attractive. This characteristic,

called loss aversion, explains why most people are not willing to toss a fair coin to decide whether they will win or lose \$100. Experiments show that faced with a 50/50 chance to win or lose, people require a potential gain of \$200 to offset a potential loss of \$100. In other words, a 50/50 chance to win \$200 or lose \$100 is barely acceptable to most people. Mark Twain put it best when he said, "Wives do not so much object to their husbands gambling. They object to their husbands losing." The losses, not the risk per se, are what drive people's preferences.

Loss aversion -the greater impact of the downside than the upside- is a fundamental characteristic of the human pleasure machine. Think of how well you feel today and use that as your reference point. You probably can think of days on which you were a little more energetic and felt a little better. Do you imagine things could be a great deal better or only slightly better? Now imagine how much worse they could be. You probably imagine things could be *slightly* better but *infinitely* worse. We have probably evolved to be very sensitive to losses and much less sensitive to gains.

People exhibit inconsistent attitudes toward risk.. As noted earlier, most people are risk averse in gains and risk seeking in losses; they prefer a sure gain of \$100 to a 50/50 chance to get \$200 or nothing, and they prefer a 50/50 chance of losing \$200 or nothing to a sure loss of \$100. Now consider this experiment: People are given money before the game begins; they are to imagine themselves with \$300 for the gain game and \$500 for the loss game. In both cases, they have a choice between a sure \$400 and a 50/50 chance to get either \$300 or \$500. Although the problems are now identical, people continue to exhibit risk-averse behavior in the gain problem and risk-seeking behavior in the loss problem. In short, people act differently depending on the "framing" of the problem; the perception of what is gained and what is lost can be manipulated by the way the outcomes are arranged.

The following example illustrates the kind of problems this tendency can produce in portfolio decisions. In a study, people had the following options:

*Decision I*

- A. A sure gain of \$240
- B. A 25 percent chance to gain \$1,000

*Decision II*

- C. A sure loss of \$750
- D. A 75 percent chance to lose \$1,000

Given the choice between A and B, 84 percent of the participants chose A; they preferred a sure gain of \$240 to a 25 percent chance of winning \$1,000. Given the choice between C and D, 87 percent chose D; they preferred a 75 percent chance of losing \$1,000 to a sure loss of \$750. Overall, 73 percent selected A and D and only 3 percent chose B and C. But consider the *aggregated* outcomes:

A&D = a 25 percent chance of gaining \$240 and  
a 75 percent chance of losing \$760

B&C = a 25 percent chance of gaining \$250 and  
a 75 percent chance of losing \$750.

Aggregating the decision outcomes makes evident that A&D is inferior to B&C, although the former was much more popular than the latter.

This example illustrates the consequences of the combination of risk aversion and risk seeking. People pay a premium to obtain a sure gain, and they pay a premium to avoid a sure loss. In combination, these actions lead to inferior choices. This example demonstrates that the tendency to make risk-averse choices in gains and to make risk-seeking choices in losses can cause people to choose suboptimal portfolios.

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## Mental Accounting

People's preferences depend on their reference points, not on objective outcomes alone. Standard economic analysis assumes that people combine all relevant outcomes and make choices accordingly, but many behavioral phenomena are inconsistent with this assumption. Through a process of mental accounting, people construct systems of evaluation and combination of outcomes in their own minds that influence their choices.

In classical economic theory, money is fungible: A dollar is a dollar is a dollar. People, however, tend to organize their transactions in a way that makes money much less than wholly fungible. In many organizations, for example, various budget constraints make it possible to do one thing but not another, such as making photocopies but not long distance phone calls. Similar constraints often operate within individuals, and these constraints are called mental accounting.

Mental accounting explains a lot of behavior. In the Decision I/Decision II problem, for example, most people evaluated the two problems as individual decisions rather than as a portfolio decision. The result was a suboptimal portfolio decision. For another

example of mental accounting, suppose someone loses \$100 in the morning and makes \$100 in the afternoon. When evaluating the day, that person is likely to judge it a down day because the evaluation is likely to be made on a transaction-by-transaction basis and because the loss of \$100 is more upsetting than the later gain of \$100 is uplifting. If the person were to combine the transactions, he or she would realize it was not a bad day because money was neither lost nor made.

The following example is a variation of the problem. Imagine you have decided to see a play for which admission is \$20 a ticket. When you arrive at the theater, you discover you have lost a \$20 bill. Would you still pay \$20 for the play? Most people say yes. Now imagine that you have purchased an admission ticket for \$20 and, as you enter the theater, you discover that you have lost the ticket. Would you pay \$20 for another ticket? Of course, the choice would depend on the real price and the person's level of income, but in tests, most people say no. Fewer than half are willing to pay \$20 to buy another ticket.

Why are most people quite willing to pay \$20 if they lose a \$20 bill but not willing to pay another \$20 if they lose the ticket? After all, there is no real difference between the two problems. So, why the different attitudes?

Evidently, people think of the problems differently. In the second case, the act of buying the ticket involves opening what might be called a "going-to-the-theater account." By the time the ticket is lost, this account is down \$20, and buying a second ticket would mean a cost of \$40. A person who considers the play probably worth \$20 may not consider it worth \$40, so that person does not buy the second ticket. In the case of the lost \$20 bill, however, the money has not become part of the going-to-the-theater account. It is part of general accounting, so the lost \$20 can be allocated to another account. The different internal accounting for the losses makes people behave differently.

This phenomenon is quite common. For example, many people save money for their children's college tuition, and many of these same families borrow money to buy a car at an interest rate that far exceeds the interest rate they receive on that college education account. Thus, unlike the classical economic conception that money is fungible and people move it from one place to another at will, behavioral finance recognizes that people have boundaries that control how transactions are organized and evaluated and what transactions are carried out.

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## Overconfidence

Classical economic theory posits the notion of rational expectation: People are efficient information processors and they act on that information. The classical theory does not assume that people know everything, but it does assume that they make good use of the information that is available to them and that their evaluation of the evidence is unbiased. Study after study indicates, however, that people's judgments are often erroneous -and in a very predictable way. People are generally overconfident. They acquire too much confidence from the information that is available to them, and they think they are right much more often than they actually are.

One of the earliest demonstrations of this phenomenon involved evaluations of the predictive power of interviews. Many people believe that they can make reasonable predictions about a person based on a brief interview, although much research indicates that this is not so. Nevertheless, superficial impressions often dominate people's behavior and are hard to shake.

Another example of overconfidence comes from the records of medical experts diagnosing medical conditions. A recent study of physicians showed that when they had 90 percent confidence in a diagnosis of pneumonia, they were right, on average, about 50 percent of the time.

Overconfidence seems to be built into humans, in the sense that the mind is probably designed to extract as much information as possible from what is available rather than to assess how little is known about a particular issue. Evaluation of stocks is no exception. In one recent study, security analysts were asked such questions as what is the probability that the price of a given stock will exceed \$X by a given date. On average, analysts were 80 percent confident, but only 60 percent accurate, in their assessments.

In other studies, analysts were asked for their high and low estimates of the price of a given stock. The high estimate was to be a number they were 95 percent sure the actual value would fall below. The low estimate was to be a number they were 95 percent sure the actual would fall above. Thus, the high and low estimates should have bounded 90 percent of the cases, and if people were realistic or unbiased, the number of cases in which the actual price fell outside the range the experts gave -that is, either below the low estimate or above the high estimate- should have been 10 percent. In fact, the actual numbers fell outside the range about 35 percent of the time.

Rather than operating on rational expectations and unbiased estimates, people are commonly biased in several directions: They are optimistic; they overestimate the chances that they will succeed; and they overestimate their degree of knowledge, in the sense that their confidence far exceeds their hit rate.

Overconfidence has many implications. Perhaps the most obvious is that people should be careful in making predictions. Just because something seems correct does not mean it is correct. Overconfidence also may help explain excessive trading and a great deal of the volatility in the market. If each person has a limited amount of information and is confident that his or her predictions are right, the result is a great deal of trading, much more than would be expected under a rational model.

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## Conclusion

The phenomena reviewed here involving risk attitudes, mental accounting, and overconfidence are based on psychological principles of judgment and choice that are clearly at variance with the general precepts of classical economic theory. These phenomena have three implications for behavioral finance. First, they indicate that the rational economic model that informs much of financial analysis is incomplete in some essential respects, and the departures are systematic rather than random. Second, they offer a way to explain many market anomalies and investor phenomena that are puzzling from a classical perspective. Third, an understanding of risk attitudes, mental accounting, and overconfidence may provide opportunities to exploit these biases in the market and improve investment strategies and performance.