An Introduction to Behavioral Economics

2nd EDITION
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Preface

The first edition of this book started out by saying that there should not really need to be a book entitled ‘Behavioral Economics’. The same still applies some four years later. All economics is behavioral in the sense of examining how people choose to act and allocate resources in different types of situation. However, over the last three decades the standard model of economic rationality, based largely on the assumption of expected utility maximization, has come under increasing criticism from both outside and inside the economics profession. The recent global financial crisis has exacerbated this situation. There are a large number of empirical anomalies that the standard model fails to explain.

Behavioral economics attempts to answer many of these criticisms by taking a broader approach to studying economic phenomena. It is behavioral in the sense that it combines the approaches of all the behavioral sciences, in particular economics, psychology, sociology and biology. This is currently not easy to do, since these different disciplines have traditionally adopted different and in many ways conflicting approaches. It is the essential philosophy of this book that economics is ‘at its best’ when it takes a cross-disciplinary approach.

Yet, in spite of building criticisms and the considerable interest and debate in the profession, there are still hardly any current texts available on behavioral economics. There are books on behavioral aspects of other disciplines, such as marketing, finance, and even managerial accounting; there are collections of papers on behavioral economics; and there are books on particular aspects of behavioral economics, such as behavioral game theory. Thus there appears to be both high demand and low supply for a text in this area.

Many undergraduate students are now starting to study aspects of behavioral economics. The book is particularly appropriate for students in the third or fourth years of undergraduate study, or in a postgraduate program, once they have become familiar with the standard economics curriculum, its assumptions and methods, and to some extent its limitations. For postgraduate students in particular the text should serve as a foundation of linked themes and materials, providing a jumping-off point for further reading of the original papers on which the book is based.

The objectives of the text remain the same as with the first edition:

1. Present the principles and methods of behavioral economics in a logical and amenable manner, contrasting them with those of standard models.

2. Illustrate how behavioral approaches have begun to supplement standard models and in many contexts offer superior explanations and predictions, using a wide variety of empirical examples from both observational and experimental studies.

3. Provide a critical examination of the rapidly growing literature in behavioral economics.

4. Explain the policy implications of behavioral approaches, particularly when these differ from those of standard economics.

5. Provide a coherent psychological and social scientific framework underpinning the findings of behavioral economics.

6. Indicate the current trajectory of the subject, in terms of future challenges and areas meriting further research.
It should not be inferred from this that there is a single behavioral model that has universal acceptance. Within particular areas, like intertemporal choice and social preferences, there is often a profusion of models. Indeed, one main criticism of behavioral economics has been that there is an excessive number of different models, many of which may apply in a given situation. However, this issue arises in different guises with standard approaches as well, notably in the context of solution concepts in game theory, or more generally in response to ‘ad hoc’ model specifications in applied areas such as industrial organization or the theory of the firm. Economics has a common analytical language but it has certainly moved away from grand unifying frameworks of analysis that general equilibrium theory once promised to offer.

As stated above, the central theme of the book is that it is intended to be highly cross-disciplinary in nature. Any book on behavioral aspects must of course involve psychology, but it is important to consider other areas too, notably evolutionary psychology and neuroscience, social psychology and sociology.

Many economists and psychologists reject the theories of evolutionary psychology as being largely speculative. They are frequently dismissed in the social sciences as being ‘just-so’ stories, meaning that they are not true scientific theories in terms of proposing testable hypotheses. This view is caused by two main factors: (1) it is impossible by definition to perform experiments on the past; and (2) the past record of facts is highly incomplete. But on closer inspection there is considerable evidence in support of key tenets of evolutionary psychology. Furthermore, the tendency of many economists to limit explanations to economic phenomena is even more unsatisfactory as far as ‘just-so’ stories are concerned. For example, many readers would not be satisfied with the explanations that people tend to succumb to temptation because they have short time horizons in decision-making, and that they make bad decisions when they are angry. These can also be regarded as ‘just-so’ stories because they both beg the questions regarding why people have short time horizons, and why we have seemingly harmful emotional responses like anger.

The fast-developing area of neuroscience can also be of great benefit to economics. The conjunction of the two disciplines has led to the birth of neuroeconomics. Economists have traditionally relied on ‘revealed preference’, meaning choice, in market behavior to develop their theories, but this approach has significant limitations. We will examine situations where choice and preference do not coincide, and where intertemporal choice and framing effects cause preference reversals. These anomalies have important welfare implications. Cognitive neuroscience is offering fresh insights into the neurological basis of individual behavior. We now know, for example, that different types of cost and benefit are processed in different areas of the brain, and that both altruistic and spiteful behavior, in the form of punishment, give pleasure, in spite of what the doer might say about their motivation. Admittedly, much of the extant research in neuroscience is not yet fully connecting to economic decision-making as such, and neuroeconomics, like evolutionary psychology, has attracted some strong criticism from within the economics profession. But we feel that students of behavioral economics will benefit from studying the underlying debates to sharpen their understanding of the evidence base and methodological basis of behavioral frameworks of analysis.

This edition of the text has significantly expanded from the first edition, with some 80,000 words of new material. Virtually all the chapters have undergone detailed revision, and two new chapters were added, one on methodology, and one on beliefs,
heuristics and biases. The expansion has been caused by several factors: (1) there has been a large amount of relevant research over the last four years, requiring substantial updating of much material; (2) there were some significant omissions in the first edition which needed to be rectified, and many of these were drawn to our attention by reviewers, to whom we are most grateful; (3) experience of teaching various courses in behavioral economics over the last few years has prompted us to change the presentation of some materials for pedagogical reasons; and (4) additional rigor of analysis has been provided in certain areas.

In summary, the intention is to provide a book which is comprehensive, rigorous and up-to-date in terms of reviewing the latest developments in the field of behavioral economics; cross-disciplinary in approach; and user-friendly in terms of exposition, discussing a large number of examples and case studies to which the reader can relate. Typically three case studies are included at the end of each chapter, with questions reviewing the relevant material.

It is also appropriate here to give a note of apology: readers may find some repetitiveness in the materials in the various chapters. We offer the following excuses. Some readers or instructors may wish to skip certain chapters, like the more technical chapter on game theory. Also, many of the themes in different chapters are linked, with the features of prospect theory and mental accounting in particular applying in many different areas. As a final point, it seems appropriate to hammer home certain points of behavioral analysis, especially when these are at variance with other commonly-held theories or beliefs.

Lastly, some words of thanks are in order regarding several people who have helped to improve this edition of the book. Matthew Rablen, from Brunel University, invited the first author to share the teaching of a course in behavioral economics, and discussions with him have aided various aspects, notably the mathematical exposition in the text. The students there, and at other institutions, have also made various suggestions and contributions. In particular, we would like to thank Thomas Matura for drawing attention to the phenomenon of celebrity contagion. Finally, we would like to thank our anonymous reviewers for their comments and suggestions, which have allowed us to improve the text in many respects. Of course, any remaining inaccuracies and oversights are the sole responsibility of the authors.
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PART I

Introduction
At the time of writing (August 2011), financial markets around the world have been leaping up and down with wild abandon for four years. The financial crisis, normally dated from 2007 to 2009, is certainly not yet over. Many markets, certainly in the US, made a good recovery after 2009, only to plunge once more this summer. For the first time in history the US lost its AAA rating for Treasury bonds, as the government teetered on the edge of default. Currencies also have been subject to violent fluctuations in value, as the European Monetary Union has been threatened by the financial problems of various European governments, notably Greece.

But how can the world’s stock markets lose 5% or more in value in a single day? According to standard economic theory market value should be a reflection of companies’ long-term economic prospects in terms of output and growth, referred to as their economic fundamentals, and these cannot possibly change so quickly. There must be something else happening here. Financial markets are notoriously fickle, and while much of this may have to do with ever-changing expectations of investors regarding uncertain future prospects, at times of crisis one cannot help but surmise more systematic failings of economic rationality. In the 1930s, Keynes coined the term ‘animal spirits’ as an emotive urge to action in the absence of that action’s justification on conventional grounds of economic rationality.

Similar factors have also affected commodity and housing markets. Many countries experienced a property boom in the years leading up to 2007. Not only have prices fallen substantially since then, but house owners have also been reluctant to sell at these lower prices, as banks have been reluctant to write off bad debt in time. This displays another psychological phenomenon known as the endowment effect: individuals are reluctant to part with what they have acquired even if this is the economically rational thing to do.

We cannot hope to understand these anomalies in standard economic theory unless we also consider the behavioral factors involved. This, in a nutshell, is the focus of behavioral economics, and this textbook.

### 1.1 Behavioral economics and the standard model

**What is behavioral economics?**

Economic phenomena relate to any aspect of human behavior that involves the allocation of scarce resources; thus economics is very wide-ranging in its subject area. For example, all of the following can be described as economic phenomena, although they may also of course involve other disciplines of study: searching for a future spouse on the internet, watching a documentary on television, making a charitable donation, giving a lift to one’s neighbor in order to make it easier to ask them for a favor later, deciding to take a nap rather than mow the lawn, teaching one’s child to play tennis, and going to church.

Economics, like any other social science, is concerned with developing theories whose ultimate aim it is to help us better understand the world we live in. Economic theories attempt to describe and explain relationships between economic phenomena.
In order to do this they need to proceed on the basis of a number of assumptions or premises. Sometimes these assumptions are made explicit, but in many cases they are implicit, and it is often important to tease out these implicit assumptions: if a theory proves to be inaccurate in its empirical implications this tells us that if we have deduced these implications correctly from the underlying assumptions of the theory, we should query those assumptions themselves.

This is where behavioral economics is relevant. As Camerer and Loewenstein (2004) succinctly put it:

Behavioral economics increases the explanatory power of economics by providing it with more realistic psychological foundations (p. 3).

Hence, behavioral economics is not seeking to replace the standard framework of analysis. It seeks to add to this framework:

It is important to emphasize that the behavioral economics approach extends rational choice and equilibrium models; it does not advocate abandoning these models entirely (Ho, Lim and Camerer, 2006, p. 308).

In order to understand these claims, and also to understand various critiques of behavioral economics, let us examine the major assumptions underlying the standard model, and then consider various important and widespread phenomena that this model has run into some difficulty to explain.

As we will also see, however, unrealistic assumptions as such may still yield useful empirical insights. It is difficult to conceive of economic theories that are not built on some kind of abstraction from the rich complexity of economic phenomena. In many ways, debates in economics on the strengths and weaknesses of the standard model are debates on useful and less useful ways of arriving at economic concepts and theories through abstraction from concrete phenomena. Methodological considerations are thus at the heart of many debates in behavioral economics, and the best starting point for understanding these debates is to look at some of the methodological foundations of economic rationality and how they are captured within the standard model.

**Economic rationality**

Throughout this book we will make reference to a ‘standard model’ of economic rationality, and we will draw comparisons between this model and various theories in behavioral economics. Two points of caution should be noted at this stage:

1. While we refer to a standard model of economic rationality as if it were a static and monolithic body of theory, regarding which economists are in universal agreement, there are numerous controversies within that model and its boundaries are not precisely delineated.
2. The various approaches and analytical frameworks in behavioral economics also constitute a dynamic, shifting body of theory; many economists would agree that behavioral economics, instead of offering a single coherent behavioral model of rationality as an alternative to the standard model, currently resembles a somewhat *ad hoc* collection of hypotheses, many of which are mutually conflicting in terms of their premises and predictions.
The standard model of rationality in economics is essentially a decision-making model, which claims to be both *descriptive* and *normative*. This means that the model is supposed to both accurately describe how people behave, and to prescribe how they should behave to achieve a certain given objective.

Unfortunately, the term *normative* is used in two main different senses by economists, causing confusion. Sometimes it is used in the sense of being opposite to positive. *Positive statements* relate to descriptions involving factual information. Such statements can be judged to be correct or incorrect, often with a margin of error, based on empirical observation. *Normative statements* in this context relate to value judgments, which are necessarily subjective, and cannot be judged to be correct or incorrect empirically. An example is statement 1:

**Statement 1**  
It is not fair that Firm A pays its workers such a low wage.

Such statements often include the words ‘ought’ or ‘should’; for example, we might modify the above statement by saying:

**Statement 2**  
Firm A ought to pay its workers a higher wage.

However, care must be exercised here, because statements including these words are not always normative in the sense of involving a value judgment. An example is:

**Statement 3**  
Firm A ought to pay its workers a higher wage if it wants to maximize profit.

Statement 3 does not involve a value judgment, and can be evaluated empirically. Of course, one can question the social value of profit, but that is a separate issue.

Confusion can arise because the last type of statement is also often referred to as normative. In this context the term *normative* is interpreted as a statement that refers to behavior *as it should be* if it were to accomplish goals in an optimal way, in contrast to a descriptive statement that describes behavior *as it actually is*.

It is perhaps preferable to label it as prescriptive, as opposed to descriptive.  
*Prescriptive statements* can be considered as policy implications, for individuals, firms or governments, in terms of being guides to behavior, *assuming* a particular objective or set of values. Thus such statements, or ‘normative theories’ as they are often referred to, tend to involve some kind of optimization. A fundamental example is the theory of expected utility maximization. Prescriptive statements in the above sense always follow logically from descriptive statements; for example, Statement 3 can be restated as follows:

**Statement 4**  
In Firm A's situation a higher wage will maximize profit.

A more precise prescription would determine the specific level of wage that would maximize profit. Thus such prescriptive statements can also always be evaluated empirically.

Normative, in the sense of prescriptive, statements have various sources of appeal to social scientists (Niv and Montague, 2008):

1. Throughout evolutionary history animal behavior has been shaped and constrained by its influence on fitness, so a reasonable starting point for theory or model development is to view a particular behavior as an optimal or near-optimal adaptation to some set of problems (Kacelnik, 1997).
Discrepancies between observed behavior and the predictions of normative models are often illuminating. They can shed light on the neural and informational constraints under which animals make decisions, relating to Simon's concept of bounded rationality, leading to heuristics and biases. Alternatively, they may suggest that animals are in fact optimizing something other than what the model assumed.

Treating behavior as optimal allows for the generation of computationally explicit hypotheses that are directly testable. A simple example is the 'marginal cost equals marginal revenue' rule for profit maximization.

When referring to normative statements as value judgments, it should be noted that sciences in general, including social sciences like economics, are not in any privileged position in terms of making such statements. The privilege which scientists enjoy is that they are better able to understand the factual implications of value judgments. Thus while an economist may not have any superior 'moral authority' in judging whether Firm A is acting fairly, she may be able to point out that its existing low wage strategy is likely to cause more labor unrest, higher labor turnover, and higher recruiting and training costs.

As far as this book is concerned our interest is not the validity of normative statements as value judgments but the question why people make certain value judgments; this is a psychological issue that has important policy implications in the prescriptive sense. We will also see that the standard model is essentially a normative model in this prescriptive sense, while behavioral approaches are largely based on descriptive models. Indeed, Tversky and Kahneman (1986) claim that no theory of choice can be both normatively adequate and descriptively accurate.

Take the example of a game of tic-tac-toe ('noughts and crosses'), where two players compete on a three-by-three grid to first succeed in placing three of their own marks in a straight line. As is well known, in this game the best play from each player results in a draw. In other words, there exists a strategy for each player that ensures that they will not lose regardless of how their opponent plays (and if their opponent makes a mistake it will allow them to win). Call this their rational strategy. It is clear that if they seek to win they should adopt this strategy. Likewise, assuming that they know this and behave accordingly, this strategy will accurately account for their moves in the game.

Most situations faced by economic actors are more complex than a game of tic-tac-toe. A purely rational decision model will not account for how most individuals react in a large range of situations. If we still want to understand and explain their choices, what we need is not a model that is able to explain moves along the best-response strategy path but instead a model that explains moves along the actual-response strategy path which in many instances could be bettered. In this sense, individuals appear to act irrationally to the extent that they deviate from the best-response path.

But what do we mean by ‘rational’ here? The terms ‘rationality’, and its opposite, ‘irrationality’, are used extensively in economics, and particularly in connection with behavioral economics. It is in many ways a fundamental assumption underlying the whole of the discipline. Indeed many people think of behavioral economics as being an approach to understanding why people act irrationally. For example, the behavioral economist Dan Ariely has written extensively about the subject in his popular books Predictably Irrational and The Upside of Irrationality (2008; 2010). In the context of our game of tic-tac-toe, players knowingly deciding against the adoption of the best response strategy would act irrationally in the sense that they would not choose the means best suited to further their end of seeking to win the game.
It is important to understand that the term ‘rationality’ is used in many different senses, depending on the discipline of the user of the term; even within the discipline of economics there are different meanings. When we refer to people acting rationally in the everyday sense we usually mean that they are using reason. This kind of action is often contrasted with people being prompted either by emotional factors or by unconscious instinct. However, economists have tended to regard this interpretation of rationality as too broad and imprecise.

Instead, they have started out from a tightly specified means–end framework of rational decision-making, as a particular interpretation of instrumental rationality. In that framework, individuals are assumed to entertain preferences over a set of available courses of action and act such as to realize their most preferred outcome. At the heart of this model lie several basic assumptions about the nature of these preferences:

**Completeness** Individuals entertain a preference ordering across all alternative courses of action that they face.

**Transitivity** Individuals make consistent choices, in the sense that if A is preferred to B, and B is preferred to C, then a rational individual will prefer A to C.

These two axioms together ensure that individuals will be able to pick at least one most preferred course of action out of the various alternatives they face. Both axioms may be relaxed in certain ways while it will still be possible to meaningfully talk of instrumentally rational choice. But for the most part, economists have added stronger assumptions in addition to these rationality axioms, either to simplify technical treatment, or sometimes just out of tradition. Two important additional assumptions, sometimes referred to as the ‘economic’ assumptions that are added to the two rationality axioms above, are that more of an economic good is preferred to less of it (‘monotonicity’), and that averages are preferred to extremes (‘convexity’).

However, this simple model of economic rationality is only applicable to decisions under certainty, such that outcomes are unambiguously tied to actions. As soon as one allows for uncertain outcomes, more complex frameworks of analysis become necessary, based on mathematical theories of uncertainty such as probability theory. The standard model for these contexts is usually augmented by the twin assumptions of expected utility maximization and Bayesian probability estimation. Further assumptions are necessary to adapt the model to decision-making stretching over a period of time into the future, notably assumptions regarding time preference and discounting of future horizons.

But even this framework is not yet sufficiently general for all decision contexts studied by economists. Uncertainty may not just be an exogenous factor, in the sense of being given independently of the decision taken. You may, for example, decide to act on a weather forecast predicting sunshine with 90% probability by leaving your umbrella at home. Unless you are subject to superstitious beliefs, you would not accept that this decision has any effect on whether it will actually rain in the end or not.

Many economic problems are subject to yet a different kind of uncertainty that is endogenous to the situation studied. This is behavioral uncertainty that arises from the mutual dependencies involved in the strategic interaction of two or more individuals. Assume you are walking down a narrow lane and find yourself walking towards another individual heading in the opposite direction. Whether or not you will brush coats with
that individual will not just depend on your own actions but also on how the other
side behaves. Economists have used a strong assumption known as the common
knowledge assumption as a further augmentation of the standard model. This is a
strictest assumption, whereby it is not sufficient for each person or player to be rational,
they must also know that all other players are rational, and that all other players know
that all other players are rational ... ad infinitum.

Finally, some economists hold the view that the rationality of individual behavior
should be judged not on the level of the individual but on the level of systemic
outcomes. This tends to be the view of Vernon Smith, who has been particularly
concerned with examining the predictions of economic rationality in terms of long-run
market equilibria. Smith does not accept the norms of the standard model in terms of
individual behavior, and believes that individuals can violate these norms and still act
rationally according to his view of rationality. This view equates rationality with the
end results of the decision-making process as far as market efficiency is concerned. For
Smith, if markets are efficient, for example, in terms of market clearing, then this is
evidence that individuals are rational.

On the other hand, by other definitions of rationality, people may act rationally
and the predictions of the standard model may prove incorrect; this tends to be the
view of Kahneman and Tversky, whose approach will be discussed in detail in Chapter
5. Unlike Smith, Kahneman and Tversky do accept the norms of the standard model
as a benchmark for judging rationality. By these standards they claim that individuals
frequently act irrationally. However, they also argue that the systematic errors and
biases that they find in their empirical studies do not necessarily constitute irrational
behavior. We see here a theme emerging that will run through the other chapters of this
book, by which the standard model of economic rationality, under which a considerable
amount of frequently observable behavior would have to be classed as irrational, gives
way to alternative conceptions of rationality that more properly account for observed
behavior.

At one extreme we have a view, which was perhaps first formulated by Ludwig von
Mises (1949), that any action must by definition be rational. This approach essentially
defines rationality in terms of revealed preference. If we perform a certain act it must
be because we have a preference for doing so; if we did not have such a preference
then we would not perform the act. Associated with this approach is the view that
‘a pronouncement of irrational choice might seem to imply nothing more than our
ignorance about another’s private hedonic priorities ... individual tastes are not a
matter for dispute, nor can they be deemed rational or irrational’ (Berridge, 2001).
The problem with such an approach is that it obscures the important factors involved in
terms of the determination of revealed preference, and therefore, while it is a coherent
view, it is not very useful in terms of aiding analysis and understanding since it remains
consistent at the price of becoming a tautology.

Similar to the above view is the argument that evolution has necessarily produced
organisms that form true beliefs and that reason rationally (Fodor, 1975; Dennett,
1987). However, this view has been much criticized as misunderstanding the role of
natural selection in the evolutionary process. Most evolutionary biologists agree that
natural selection does not guarantee that rational beings will evolve, or even intelligent
beings for that matter.
Behavioral perspectives on economic rationality

Psychologists tend to take a different approach to rationality. For example, according to Baumeister (2001): ‘A rational being should pursue enlightened self-interest.’ This definition draws attention to three crucial concepts: ‘enlightened’, ‘pursue’ and ‘self-interest’. However, it is only a starting point, since all of these concepts need further examination.

First, the description ‘enlightened’ implies that an individual has perfect knowledge, something that is obviously not realistic. Sometimes the term ‘long-run self-interest’ is employed, which is definitely more useful, since we will observe many instances of conflicts between short-run and long-run considerations. However, an even more useful qualification in this context is the term ‘perceived self-interest’. Many behavioral economists take the view that if we misjudge what is in our self-interest then this is not a failure of rationality; it may even not be a failure of ‘bounded rationality’, as we will explain shortly. There may be many reasons why we fail to judge what is in our ‘self-interest’ (leaving until later a discussion of how this term can or should be interpreted). We may have incomplete knowledge or we may have cognitive failures in terms of the processing of information within given time constraints. These failures are often ascribed to ‘bounded rationality’, and behavior that fails to achieve self-interest because of bounded rationality is therefore not irrational according to this criterion.

We now need to focus on a second concept: Is pursuing the same as maximizing? The standard model is a normative model in the prescriptive sense of achieving optimality because it equates pursuing perceived self-interest with maximizing expected utility. Again the constraints of bounded rationality are relevant. The work of Kahneman and Tversky in particular concludes that people tend to take a heuristic approach to decision-making. The term ‘heuristic’ means that people use simple ‘rules-of-thumb’, often unconsciously, in order to make decisions when there is a lot of information involved, much uncertainty, and a realistic time constraint. Thus we may have a personal rule always to pay by cash for purchases of less than $100, even if we have a credit card handy. Sometimes this can result in inconsistent or incoherent behavior, as we will see shortly, particularly in the various examples of preference reversals. What can be said at this stage is that bounded rationality is not concerned with optimality, or even sub-optimality; the heuristics involved in the decision-making processes of bounded rationality are more related to ‘satisficing’.

What about cases where we misjudge what is in our self-interest even according to the more forgiving criterion of bounded rationality? Such instances tend to relate to the influence of ‘self-serving’ biases, discussed in Chapter 4. An often-quoted example of self-serving bias is the ‘above-average’ effect: well over half of survey respondents typically rate themselves in the top 50% of drivers (Svenson, 1981), ethics (Baumhart, 1968), managerial prowess (Larwood and Whittaker, 1977), productivity (Cross, 1997) and health (Weinstein, 1980). Some economists and psychologists would claim that such acts are irrational.

We can now move on to the third concept; the term ‘self-interest’ also lends itself to different interpretations. Economists have traditionally measured this concept in terms of utility, where utility is a measure of subjective value. With the formalization of rational choice theory in economics, it assumed a technical shorthand for underlying preference orderings that obey the rationality axioms.
There is another aspect that merits discussion in this context. Arguably, actions where no deliberation is involved, sometimes called instinctive, are neither rational nor irrational. These actions tend to occur on the spur of the moment, like ducking a flying object likely to cause harm. Such actions are sometimes referred to as arational. Of particular relevance here are experiments carried out by Libet (1983 et al.; 1985; 1993). These showed that brain electrical activity occurred at a significant interval (about 300 milliseconds) before conscious willing of finger movements. There has been much speculation and criticism regarding Libet et al.’s research findings and their interpretation, in particular regarding the suggestion that our sensation of conscious will as a cause of action is an illusion (Wegner, 2002). Wegner and others hold the view that the sensation of will is not the real cause of our actions, but is merely an accompanying or following phenomenon, or epiphenomenon in philosophical terms.

The implication of this would be that many or indeed all of our actions may be arational in terms of not being caused by any kind of conscious deliberation. This is not to assert that conscious deliberation does not take place in many cases, but raises the possibility that, contrary to our intuitions, such deliberation merely accompanies events rather than causing them. Wilson, Lindsay and Schooler (2000) have proposed that we may have dual attitudes toward many things in our lives, one a rapid response and the other a more studied reaction that takes into account the context and our personal theory of what we ought to be feeling. Wegner (2002: 58) adds: ‘The conscious attitude will only govern our responses when we have had time to consider the situation and get past the automatic reaction.’

The preceding discussion introduces another factor into the consideration of rationality: Does rationality relate just to decision-making, involving choice and actions, or does it relate to attitudes and beliefs? In general, economists have tended to concentrate on decision-making and actions, while psychologists have often taken the view that, while decision-making involves deliberate choice, the formation of attitudes and beliefs may be beyond our conscious control, and therefore outside a discussion of rationality. If, as evidence like Libet’s experiments suggests, our decisions involving action are also outside conscious control, then attitude and belief formation can be claimed to be arational in the same way.

This leads us to one other view of rationality that can be considered at this point. Sen (1990) is perhaps the best-known proponent of this view, stating:

**Rationality may be seen as demanding something other than just consistency of choices between different subsets. It must, at least, demand cogent relations between aims and objectives actually entertained by the person and the choices that the person makes.**

It may appear that this focus on the correlation between objectives and choices has the advantage that it no longer makes any assumptions regarding the nature of the objectives; these are simply taken as given. Sen thus considers the nature of our objectives to be outside the realm of rationality, on the grounds that people are concerned with more than wellbeing and happiness. The weakness in this view is that it takes an excessively narrow view of wellbeing. Our wellbeing does not just include material factors, it includes psychological aspects that relate to our emotions. Furthermore, these aspects are becoming easier to identify and measure using neural imaging.
**Nature of the standard model**

Economists generally try to eliminate the many ambiguities surrounding the notion of ‘pursuing enlightened self-interest’ by using the more precise and formal model of rational behavior described in the (augmented) standard model. Although it may seem daunting at first, it will facilitate the exposition of the material throughout the book if we now consider a stylized version of the standard model, modified from Rabin (2002b) and proceeding from the three components of rationality psychologically defined as above, and being covered in the rest of the book as described.

The reader should not be intimidated by the mathematical language of this model; it is designed to make it easier to understand, not more difficult. The expression of the Standard Economic Model (referred to hereafter as the standard model) in mathematical terms enables us to achieve three important objectives:

- A concise description of the relevant factors affecting decision-making.
- An illustration of the various components of the model that will be examined in the following chapters.
- A general consideration of the assumptions underlying the model in terms of how they relate to the various components.

The model can be stated in the following terms:

**Individual i at time \( t = 0 \) maximizes expected utility subject to a probability distribution \( p(s) \) of the states of the world \( s \in S \):**

\[
\max_{x_i \in X_i} \sum_{t=0}^{\infty} \delta^t \sum_{s \in S_t} U(x_i^t | s).
\]

(1.1)

The utility function \( U(x | s) \) is defined over the payoff \( x_i^t \) of individual \( i \) and future utility is discounted with a (time-consistent) discount factor \( \delta \).

We can now disaggregate (1.1) into four main components as follows:

\[
\max_{x_i^t \in X_i} \sum_{t=0}^{\infty} \delta^t \sum_{s \in S_t} p(s) U(x_i^t | s).
\]

(1) max \hspace{1cm} (2) \sum \delta^t \hspace{1cm} (3) \sum p(s) \hspace{1cm} (4) U(x_i^t | s).

The main assumptions underlying the standard model can now be stated in terms of how they relate to these components:

1. Economic agents are motivated by expected utility maximization (1), (3) and (4).
2. An agent’s utility is governed by purely selfish concerns, in the narrow sense that it does not take into consideration the utility of others (4).
3. Agents are Bayesian probability operators (3).
4. Agents have consistent time preferences according to the discounted utility model (2).
5. All income and assets are completely fungible (4).

We will examine the meaning and implications of these assumptions in detail in the relevant chapters, since in some cases this will merit a considerable amount of
discussion. The various components of the standard model, along with the chapters where each aspect is discussed, are outlined below:

1. Value formation (4) and choice (1) – Chapters 3 and 10
2. Belief formation (3) – Chapter 4
3. Expected utility theory or EUT (1), (3) and (4) – Chapter 5
4. Discounting (2) – Chapters 7 and 8

At this point, in view of the abstract nature of the exposition of the standard model above, it is useful to provide a simple example that will illustrate some of the above points, in particular, the first, third and fourth components of the model. You are a new student of behavioral economics and you are considering what to drink before going to class. The canteen offers only coffee and beer. There are also two ‘states of the world’ as far as the class is concerned: it could be interesting or it could be boring. You believe from what you have heard that there is a probability of 0.8 that the class will be interesting and a probability of 0.2 that it will be boring (these are subjective ‘Bayesian priors’). Table 1.1 shows the payoffs that result from either drink in either state of the world.

<table>
<thead>
<tr>
<th>Decision</th>
<th>State of the world</th>
<th>Probability</th>
<th>Payoff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coffee</td>
<td>Interesting</td>
<td>0.8</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Boring</td>
<td>0.2</td>
<td>2</td>
</tr>
<tr>
<td>Beer</td>
<td>Interesting</td>
<td>0.8</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Boring</td>
<td>0.2</td>
<td>4</td>
</tr>
</tbody>
</table>

If the class is interesting it is a good idea to drink coffee beforehand in order to get the most benefit. However, if the lecture is boring, drinking beer is better than drinking coffee (it is assumed here), because then it allows the student to drift off to sleep which is better than staying awake and not getting any benefit from listening to the class. Therefore, the optimal decision, which maximizes expected utility, depends on the probability estimates of the states of the world. The student should verify that the expected payoff or utility of drinking coffee is 8.4, while the expected utility of drinking beer is 5.6. Thus the best decision in this situation is to drink coffee. However, if the probabilities were reversed, so that it was estimated that the probability of an interesting class was only 0.2, then the optimal decision would be to drink beer. We can see from this example that the estimation of Bayesian prior probabilities has an important effect on decision-making. The rational person will update these in the light of new information, so that if the class turns out to be boring this will reduce the estimated probability of the next class being interesting, and may affect the student’s drink decision next time round.

**Applicability of the standard model**

Over the last two or three decades behavioral economists have drawn increasing attention to various limitations in the standard model. Consider the following questions:

1. Why is the return on stocks so much higher on average than the return on bonds?
2 Why do sellers often value their goods or assets much higher than buyers?
3 Why are people willing to drive across town to save $5 to purchase a $15 calculator but not to purchase a $125 jacket?
4 Why are the fresh fruit and vegetables usually found at the entrance of the supermarket when they are easily damaged in the shopping trolley?
5 Why are people delighted to hear they are going to get a 10% raise in salary, and then furious to find out that a colleague is going to get 15%?
6 Why do people forever make resolutions to go on a diet or stop smoking, only to give in later?
7 Why do people go to the ATM and withdraw a measly $50?
8 Why do people prefer to postpone a treat like a luxury dinner rather than have it sooner?
9 Why is someone unwilling to pay $500 for a product, but then delighted when their spouse buys them the same product for the same price using their joint bank account?
10 Why is someone willing to drive through a blizzard to go to see a ball game when they have paid for the ticket, but not when they have been given the ticket for free?
11 Why are people willing to bet long odds on the last race of the day, but not on previous races?

None of these questions is readily answerable using the standard model, because of the restrictive nature of the assumptions involved. In some cases there are anomalies, meaning that the standard model makes inaccurate predictions; in other cases the standard model is incomplete or silent, meaning that it cannot make predictions at all. Both aspects together have been key drivers in the rapid development of behavioral economics as an emerging subdiscipline of economics.

The relationship between the standard model and behavioral economics in the light of those limitations may be described as follows: every model has a **domain of application** which comprises those phenomena that it seeks to explain. There is also a **domain of validity**, the range of phenomena for which the model offers a valid account or explanation. The traditional domain of the standard model, ranging over all economic decision-making, is vast. The limitations listed here all indicate that its domain of validity may be much smaller than its traditional domain of application. Whether and to what extent alternative models from behavioral economics are able to offer complementary and even competing accounts of decision-making, depending on whether their domain of validity overlaps with or extends to the original domain of the standard model, is one of the most hotly debated questions in economics today and it has, as we shall see, a long and distinguished trajectory in the history of the discipline.

### 1.2 History and evolution of behavioral economics

As we will see, behavioral economics finds its twentieth-century origins in various empirical critiques of the standard neoclassical model of economic decision-making. That model itself only came to dominate the discipline as economics gradually severed its traditional ties to psychological, sociological and historical inquiry. An instrumental
factor in this shift has been the so-called formalist revolution in economics during the immediate post-World War II era (Blaug, 2001). But in order to appreciate the emergence and position of behavioral economics within the wider context of the development of economic thought, one needs to bear in mind that for much of its history, economic thought has evolved in close proximity to psychological reasoning.

**The classical and neoclassical approaches**

There tends to be a widespread belief that the economists of the eighteenth and nineteenth centuries who pioneered the discipline had no time for psychology. The neoclassicists in particular are often portrayed as systematizers who wanted to bring mathematical rigor to their subject by imposing some simplifying assumptions regarding motivation. A good example is the work of Daniel Bernoulli (1738), who might be regarded as the originator of the theory of choice under risk, explaining risk-aversion in terms of the diminishing marginal utility of money.

However, the portrayal of the classical and early neoclassical schools as economic schools of thought that developed in disregard of psychological and sociological insight gives a misleading impression. Although Adam Smith is best known for his *Wealth of Nations*, in 1776, he was also the author of a less well-known work, *The Theory of Moral Sentiments*, in 1759. The latter contains a number of vital psychological insights and foreshadows many more recent developments in behavioral economics, particularly relating to the role of emotions in decision-making.

Similarly, Jeremy Bentham, best known for introducing the concept of utility, had much to say about the underlying psychology of consumers. Francis Edgeworth wrote *Mathematical Psychics* in 1881, the title indicating his concern with psychology; this is reflected in the well-known ‘Edgeworth Box’ diagram, named after him, which relates to two-person bargaining situations and involves a simple model of social utility. However, psychology was in its infancy at this time as an academic discipline, and many economists wanted the also-new science of economics (then still largely referred to as political economy) to aspire to a more rigorous grounding, comparable to that of the natural sciences. Hence the birth of the concept of *homo economicus*, that embodiment of economic rationality as self-interested utility maximization.

**Post-war economic approaches**

In the first half of the twentieth century there were still economists who considered and discussed psychological factors in their work, for example Irving Fisher, Vilfredo Pareto and John Maynard Keynes. The latter famously speculated, both figuratively and literally, on the stock market, with notable success. However, the general trend during this time was to ignore psychology, and by World War II psychologists were *persona non grata* in economists’ circles.

This trend continued after the war, aided in many ways by the advent of better computational methods. As computers became more powerful it became possible to build and estimate mathematical models of both markets and the economic system as a whole. The sub-discipline of econometrics became a vital tool for economists as a means of both developing and testing theories. Economists became obsessed with mensuration, meaning the measurement of variables, and the estimation of economic parameters using mathematical equations and econometric methods. Much progress
was made in terms of theoretical development, and the emphasis on mathematical
treatment led to greater rigor and more precise, if not accurate, results.

Some economists realized that the behavioral assumptions underlying their models
were unrealistic, but there has been a methodological approach, typified by Milton
Friedman, that economic theory had little to do with the accuracy of these behavioral
assumptions, or with understanding why individuals behave as they do. This approach
is discussed in the next chapter.

The resurgence of behaviorism in economics

Some heretics, like Herbert Simon, viewed the standard approach as somewhat
blinkered. He was not prepared to accept the host of ready excuses that were
offered when predictions went astray: temporary ‘blips’, the introduction of new and
unpredictable factors, measurement discrepancies, and so on. He believed it important
to understand the underlying motivation behind the behavior of economic agents in
order to improve existing theories and make more accurate predictions. Simon (1955)
introduced the term ‘bounded rationality’ to refer to the cognitive limitations facing
decision-makers in terms of acquiring and processing information.

There were a number of seminal papers written in the 1950s and 1960s which
complemented the work of Simon. These papers all pointed to various anomalies in
individual decision-making if seen through the lens of the standard model, and suggested
theoretical improvements. Notable contributions included those by Markowitz (1952),
Allais (1953), Strotz (1955), Schelling (1960) and Ellsberg (1961).

However, it was really at the end of the 1970s that behavioral economics was born.
Two papers were largely responsible for this. The first, in 1979, was entitled ‘Prospect
theory: An analysis of decision under risk’, and was written by two psychologists,
Daniel Kahneman and Amos Tversky, being published in the prestigious and technical
economic journal *Econometrica*. Both Kahneman and Tversky had already published a
number of papers relating to heuristic decision-making, but prospect theory introduced
several new and fundamental concepts relating to reference points, loss-aversion,
utility measurement and subjective probability judgments.

The second paper, ‘Toward a positive theory of consumer choice’, was published
by the economist Richard Thaler in 1980. In particular he introduced the concept of
‘mental accounting’, closely related to the concepts of Kahneman and Tversky, and this
is discussed at length in Chapter 6.

Since 1980 the field of behavioral economics has become a burgeoning one, as both
economists and psychologists have expanded and developed the work of the pioneers
mentioned above. As more success has been achieved in explaining the anomalies of the
standard model and in developing a more complete body of theory, the field has now
become a more respectable one, with a variety of journals publishing relevant research.

However, it should be made clear that behavioral economists do not conform to
a uniform school of thought. Although they all are concerned with the psychological
foundations of economic behavior, they may have quite conflicting beliefs regarding
fundamental aspects. For example, we will see that the views of Kahneman and
Tversky, Vernon Smith and Gigerenzer all differ substantially regarding the role and
nature of assumptions, appropriate methods of investigation, the value of various kinds
of empirical evidence, and conclusions regarding issues such as rationality, efficiency
and optimization.
1.3 Relationship with other disciplines

One of the main criticisms of behavioral economics that has been leveled at it ever since its inception has been that it is essentially an *ad hoc* collection of observations relating to behavioral biases that has no underlying uniform theoretical foundation. At first sight this criticism may seem to have some justification, in that over the last three decades many biases have been discovered that present themselves as anomalies within the confines of the standard model, some working in opposite directions from each other, and many researchers have been content to record and model these in a narrow behavioral context. However, it is a fundamental objective of this book to examine not only how people behave in ‘idiosyncratic’ ways, but also why they behave in these ways. This approach is discussed in more detail in the next chapter, but at this point it is sufficient to propose the idea that our behavior is determined by a mixture of biological and environmental factors, sometimes inextricably blended together. It is, therefore, necessary to have a basic understanding of some of the fundamental concepts related to biology, psychology and sociology.

**Evolutionary biology**

Theodosius Dobzhansky, a field naturalist and evolutionary biologist, once famously said ‘nothing in biology makes sense except in the light of evolution’ (Dobzhansky, 1973). Scientists in this field have for several decades reached a general consensus regarding evolutionary theory, sometimes referred to as ‘the modern synthesis’ or the ‘neo-Darwinian synthesis’ (NDS). There are four main features of this synthesis:

1. **Inheritance** – genes are the unit of inheritance, and are transferred from parents to offspring.
2. **Variation** – there is a diversity of genes in any population, sometimes referred to as the ‘gene pool’.
3. **Change** – the mixing of genes from parents (recombination), and mutation from one generation to another, result in offspring having different genes from parents.
4. **Natural selection** – the genes of those members of a population best able to survive and reproduce tend to spread and predominate over time, leading to adaptations to the environment.

The last feature has tended to be the most controversial among biologists, and is what distinguishes the general theory of evolution from the more specific ‘Darwinian’ theory, although these terms are often used interchangeably. While no serious scientist doubts the process of evolution, some have questioned the relative importance of natural selection in relation to other factors that cause intergenerational change, such as ‘genetic drift’.

Closely related to the discipline of evolutionary biology is evolutionary psychology. Evolutionary psychology is a relatively new discipline, and it is fundamentally an offshoot of evolutionary biology. While it may be hazardous to try and condense all psychological explanations into a universal protocol, we believe that evolutionary psychology can be a significant aid in understanding and relating many of the different findings from empirical studies. The foundation of this area of science is that, just as our
anatomical and physiological systems evolved over millions of years in the crucible of natural selection, so did the anatomy and physiology of our brains, resulting in evolved psychological mechanisms (EPMs) which are essentially mental adaptations. Our beliefs, preferences and decision-making processes are therefore heavily shaped by our evolutionary past. One important implication of this, which will be explored in various aspects of the book, is that some of our EPMs may be obsolete, and even harmful in our current vastly changed social and natural environment; an often-quoted example is our nearly universal desire for sweet and fatty food. This may indeed have aided the survival of our Pleistocene ancestors, but when food is plentiful it causes obesity and disease. Readers who are interested in learning about evolutionary psychology in more detail should peruse one of the many good texts on the subject, for example that by Buss (1999). The more casual reader can be referred to Mean Genes, an eminently readable bed-side book, written by Burnham and Phelan (2001), who combine the disciplines of economist and biologist.

Now it should be made clear from the start that it is certainly not proposed that every psychological mechanism determining behavior is of genetic origin resulting from natural selection. This caricature of evolutionary psychology, combined with the misleading label of genetic determinism, is one that is unfortunately both pervasive and pernicious in many social sciences. There are many differences between individuals, groups and societies that have obviously arisen for cultural reasons, and no evolutionary psychologist denies this. However, what is also striking in many of the empirical studies that will be examined throughout this book is that there are certain universal features of human, and even primate, psychology which lend themselves to an evolutionary explanation. Such explanations will not be attempted here in terms of argument; suggestions will be made, but it is not appropriate to delve at length into the various factors that relate to whether psychological mechanisms are likely to be evolutionary or cultural. However, one particular area of behavior can be mentioned here as an example of this approach, and this is the evolution of time preference. There have been several recent papers in the American Economic Review on this topic (Robson and Szentes, 2008; Netzer, 2009; Robson and Samuelson, 2009); these have discussed the role of intergenerational transfers of wealth, uncertainty concerning survival rates, and the conflict between short-term and long-term interests. The implications of this research will be considered in Chapter 8.

Many economists and psychologists reject the theories of evolutionary psychology as being largely speculative. They are frequently dismissed in the social sciences as being ‘just-so’ stories, meaning that they are not true scientific theories in terms of proposing testable hypotheses. This view is caused by two main factors: (1) it is impossible by definition to perform experiments on the past; and (2) the past record of facts is highly incomplete. We will show that this dismissal is largely unjustified, and that evolutionary psychology can indeed produce testable hypotheses, many of which have been confirmed by substantial empirical evidence. Furthermore, the tendency of many economists to limit explanations to economic phenomena is even more unsatisfactory as far as ‘just-so’ stories are concerned. For example, many readers would not be satisfied with the explanations that people tend to succumb to temptation because they have short time horizons in decision-making, and that they make bad decisions when they are angry. These are also fundamentally ‘just-so’ stories because they both beg the questions regarding why people have short time horizons, and why we have seemingly harmful emotional responses like anger.
As mentioned above, a caricature of evolutionary psychology has persisted among some people, relating to the claim that this new science can explain all human cognitive, affective, and moral capacities. However, most evolutionary psychologists would instead support a model of **gene-culture coevolution**. This model takes the view that these capacities are the product of an evolutionary dynamic involving the interaction of genes and culture (Cavalli-Sforza and Feldman, 1982). For most of the evolutionary history of living species, information has been passed on from one organism to another purely by genetic means. The genetic code incorporates instructions for building a new organism, and for making decisions based on sensory inputs. Because learning is costly and prone to mistakes, it is efficient for the genome to encode all aspects of the environment that are constant or changing only slowly, so that decisions can be easily and automatically made in familiar circumstances. When environmental conditions vary considerably or change rapidly, organisms need to have more flexible responses, which means they need to be genetically programmed to be able to learn in order to deal with less familiar circumstances. In relatively recent times on an evolutionary scale, meaning over the last seven million years or so, a different method of information transmission has assumed increasing importance, labeled epigenetic. This nongenetic mechanism for transferring intergenerational information is cultural in nature. It can be vertical (from parents to children), horizontal (peer to peer), oblique (older to younger), or can take other directions, such as from higher status to lower status. Dawkins (1976) has proposed that the method of transmission of cultural information is broadly analogous to that involved with genetic transmission, introducing the term ‘meme’ as a unit of information. Thus memes are replicated from one person to another, but imperfectly, in that they mutate, just as in a game of ‘Chinese Whispers’ or ‘Telephone’. Furthermore, a process of selection operates so that those memes that enhance the fitness of their carriers tend to survive and be passed on more frequently and faithfully. Memes can be as simple as the opening four notes of Beethoven’s 5th symphony, or highly complex, like a religious dogma. This large variability in nature has led to some criticism of the gene-meme analogy, but, as Gintis (2009) has pointed out, modern research has shown that genes also often have ill-defined and overlapping boundaries.

The interaction of genes and culture has been of vital importance in providing the foundation for the rapid evolution of human traits, for example, the development of speech and language, and the development of morality and sophisticated social emotions such as jealousy, shame, pride, envy, empathy and guilt. The capacities for these traits are ultimately determined genetically since they depend on neurological development, but their survival value depends on the culture in the relevant environment.

The importance of this concept of gene-culture coevolution is explored in more detail in the next chapter, since it represents a worldview that is not incorporated in all the different behavioral sciences. As a result, it has been claimed to be a fundamental component of the framework for unifying these sciences (Gintis, 2009), an approach sometimes referred to as **consilience**.

**Cognitive neuroscience**

This is another relatively new discipline, which took off in the 1980s, and it essentially forms the nexus of evolutionary biology and evolutionary psychology. Cognitive neuroscience seeks to relate neural states in the brain to mental states, and to events
in the world external to the organism under study. In many ways thus, cognitive neuroscience studies behavior, and decision-making in particular, in ways that are relevant for the attempts of economists to understand the material basis of decision-making. This led to the formation of the new field of neuroeconomics, which refers to the use of empirical evidence relating to brain activity in order to come to conclusions relating to economic behavior.

Cognitive neuroscience has seen significant empirical advances made possible by a number of recent technological developments, particularly in terms of brain scanning and imaging techniques like PET (positron emission tomography), fMRI (functional magnetic resonance imaging), EEG (electroencephalography), rCBF (regional cerebral blood flow) and TMS (transcranial magnetic stimulation). These methods detect (or in the case of TMS, block) brain activity in particular areas in terms of electrical activity or increased blood flow, and this has been used to shed light on various topics of interest in behavioral economics. Relevant results have been influential in the area of decision-making heuristics, learning processes and the role of the emotions.

Perhaps the most fundamental discovery in neuroscience has been the concept of brain modularity. This means that different types of thinking or mental process are performed in different parts of the brain, indicating the importance of brain structure or anatomy, and it is attributed to evolutionary processes, whereby new parts of the brain have been successively added to older more primitive parts, and have become more developed over time. One of the most profound consequences of modularity, certainly as far as behavioral economics is concerned, is that humans have different decision-making systems that operate in different circumstances. The most obvious illustration of this is that we have a ‘cold’ rational system for reasoning through some problems, like doing a crossword puzzle, and a ‘hot’ system involving emotions, that tends to operate, for example, when somebody cuts in front of us in a traffic jam. We also find that we tend to perform some processes automatically, like a skilled musician playing the piano, without conscious thought about what keys to play, whereas other actions require conscious decisions, for example, where a beginner is attempting to play the same piece. The reason why this aspect of brain modularity is significant for behavioral economics is that there are often conflicts between different systems, and these can cause phenomena such as preference reversals and time-inconsistent preferences, that are frequently observed anomalies in the standard model. There are executive control systems that mediate these different systems, and these are necessary in order to bring into effect some action when there are internal conflicts. However, it is important that we do not think of these control systems as being the ‘self’, or the ‘I’, that decides. This would amount to Cartesian Dualism, or a belief in what the philosopher Gilbert Ryle has termed ‘the ghost in the machine’ (Ryle, 1949). Executive control systems may indeed operate subconsciously, for example, when we run from a wasp flying toward us.

Another important discovery in neuroeconomics is that different chemicals and hormones have a significant influence on behavior. Given these developments, various examples of neuroeconomic studies will be given throughout the book. It is important to realize, though, that relevance and application of neuroeconomics has remained a controversial issue in the discipline.
1.4 Objectives, scope and structure

Objectives

In view of the foregoing discussion, this book has the following major objectives:

1. Present the principles and methods of behavioral economics in a logical and amenable manner, comparing and contrasting them with those of the standard model.

2. Illustrate how behavioral models represent an improved modification and refinement of the standard model in terms of power of explanation and prediction, using a wide variety of empirical examples from both observational and experimental studies.

3. Provide a critical examination of the existing literature relating to behavioral economics.

4. Explain the policy implications of behavioral economics, particularly when these differ from those of the standard model.

5. Provide a coherent psychological framework underpinning the findings of behavioral economics.

6. Indicate the way forward for the subject, in terms of future challenges and areas meriting further research.

Structure

In order to achieve the objectives described at the beginning of the section, the book is divided into five parts. Following the two introductory chapters in Part I, Part II is concerned with the foundations of behavioral economics, in which the fundamental concepts of preferences, beliefs, decision-making under risk and uncertainty and mental accounting are discussed. This relates to the first, third and fourth components of the model in (1.1). Part III of the book examines intertemporal decision-making, where costs and benefits of decisions are incurred in different time periods. This relates to the second component of the model in (1.1). Part IV examines strategic interaction and the applications of game theory, which relates to aspects of the third and fourth components not discussed earlier. Part V represents a conclusion. We are concerned here with summarizing the various aspects of behavioral economics and presenting an integrated view of rationality; this part also relates to the sixth objective stated above: looking at the future of the discipline.

Within each chapter there is also frequently a typical structure. The principles and assumptions of the relevant aspects of the standard model are examined first, with a description of shortcomings or anomalies. Various behavioral models are then introduced, and these are evaluated in the light of the empirical evidence available, with comparisons being made between different models. Normative or policy implications are also discussed. Finally, some important applications of behavioral economics are examined in more detail in case studies at the end of each chapter.
1.5 Summary

- Behavioral economics is concerned with improving the explanatory power of economic theories by giving them a sounder psychological basis.
- Behavioral economics relaxes key assumptions of the standard model in order to explain a wide variety of anomalies in that model.
- Behavioral economics is a relatively new discipline, becoming recognized around 1980; before that time psychology had largely been ignored by economists for many decades.
- Behavioral economists use a variety of methods or approaches, based on both traditional economics and psychology, and also borrowing from those commonly used in other sciences as well. Thus both observational and experimental studies are used, and sometimes computer simulations and brain scans. This relates to the concept of consilience.
- There are various methodological issues related to the behavioral approach, and in particular to the application of related disciplines – such as evolutionary psychology and cognitive neuroscience – to economics.
- Evolutionary biology and psychology are best viewed in terms of the broader concept of gene-culture coevolution.
- Rationality can be defined in a number of ways. In economics, a standard model of economic rationality is used but is subject to considerable variation depending on context and sub-discipline.

1.6 Review questions

1. What is behavioral economics?
2. Summarize the assumptions of the standard economic model.
3. Give four examples of phenomena that cannot be explained by the standard model.
4. Explain what is meant by evolutionary psychology and why it is related to behavioral economics.
5. Explain the difference between a descriptive and a normative theory.

1.7 Applications

Three situations where behavioral economics can be usefully applied are now presented. In each case it is not appropriate at this stage to engage in a detailed discussion of the issues involved, since these are examined in the remainder of the book; instead a summary of the important relevant behavioral issues is given in outline form. However, these applications should serve to give the reader a flavor of what behavioral economics is about in general terms.
Case 1.1 Loss aversion in monkeys

Monkeys show the same “irrational” aversion to risks as humans

ECONOMISTS often like to speak of Homo economicus — rational economic man. In practice, human economic behaviour is not quite as rational as the relentless logic of theoretical economics suggests it ought to be. When buying things in a straight exchange of money for goods, people often respond to changes in price in exactly the way that theoretical economics predicts. But when faced with an exchange whose outcome is predictable only on average, most people prefer to avoid the risk of making a loss than to take the chance of making a gain in circumstances when the average expected outcome of the two actions would be the same.

There has been a lot of discussion about this discrepancy in the economic literature — in particular, about whether it is the product of cultural experience or is a reflection of a deeper biological phenomenon. So Keith Chen, of the Yale School of Management, and his colleagues decided to investigate its evolutionary past. They reasoned that if they could find similar behaviour in another species of primate (none of which has yet invented a cash economy) this would suggest that loss-aversion evolved in a common ancestor. They chose the capuchin monkey, Cebus apella, a South American species often used for behavioural experiments.

First, the researchers had to introduce their monkeys to the idea of a cash economy. They did this by giving them small metal discs while showing them food. The monkeys quickly learned that humans valued these inedible discs so much that they were willing to trade them for scrumptious pieces of apple, grapes and jelly.

Preliminary experiments established the amount of apple that was valued as much as either a grape or a cube of jelly, and set the price accordingly, at one disc per food item. The monkeys were then given 12 discs and allowed to trade them one at a time for whichever foodstuff they preferred.

Once the price had been established, though, it was changed. The size of the apple portions was doubled, effectively halving the price of apple. At the same time, the number of discs a monkey was given to spend fell from 12 to nine. The result was that apple consumption went up in exactly the way that price theory (as applied to humans) would predict. Indeed, averaged over the course of ten sessions it was within 1% of the theory’s prediction. One up to Cebus economicus.

The experimenters then began to test their animals’ risk-aversion. They did this by offering them three different trading regimes in succession. Each required choosing between the wares of two experimental “salesmen”. In the first regime one salesman offered one piece of apple for a disc, while the other offered two. However, half the time the second salesman only handed over one piece. Despite this deception, the monkeys quickly worked out that the second salesman offered the better overall deal, and came to prefer him.

In the second trading regime, the salesman offering one piece of apple would, half the time, add a free bonus piece once the disc had been handed over. The salesman offering two pieces would, as in the first regime, actually hand over only one of them half the time. In this case, the average outcome was identical, but the monkeys quickly reversed their behaviour from the first regime and came to prefer trading with the first salesman.
In the third regime, the second salesman always took the second piece of apple away before handing over the goods, while the first never gave freebies. So, once again, the outcomes were identical. In this case, however, the monkeys preferred the first salesman even more strongly than in the second regime.

What the responses to the second and third regimes seem to have in common is a preference for avoiding apparent loss, even though that loss does not, in strictly economic terms, exist. That such behaviour occurs in two primates suggests a common evolutionary origin. It must, therefore, have an adaptive explanation.

What that explanation is has yet to be worked out. One possibility is that in nature, with a food supply that is often barely adequate, losses that lead to the pangs of hunger are felt more keenly than gains that lead to the comfort of satiety. Agriculture has changed that calculus, but people still have the attitudes of the hunter-gatherer wired into them. Economists take note.

Source: The Economist, June 23, 2005

Issues

This ingenious experimental study illustrates three particularly important aspects of behavioral economics:

1. **Methods**
   The experimental approach, traditionally followed by psychologists, is used here, in order to achieve a degree of control that would be impossible to gain through mere observation. Three different trading regimes are used in order to compare responses and test the basic hypothesis of loss-aversion. Note the use of deception, although it is unlikely in this case to cause a general increase in cynicism among the population of capuchin monkeys available as subjects.

2. **Evolutionary psychology**
   The purpose of the experiment is not just to test whether capuchin monkeys have loss-aversion, but more importantly to test whether the widely-observed loss-aversion in humans is likely to have an evolutionary explanation. The fact that loss-aversion has been observed in many different countries and societies constitutes evidence of an evolutionary origin, but the observation of the same characteristic in a fairly closely related species is even stronger evidence. This is a typical type of experiment carried out by evolutionary psychologists to test their hypotheses. It is also notable that the issue regarding why loss-aversion should be an evolved psychological mechanism or adaptation is also raised. This issue will be discussed in more detail in Chapter 5 on prospect theory.

3. **Rationality**
   We have seen that the concept of rationality is a highly ambiguous term, which can be used in many different senses. However, in the current context, a ‘rational’ individual behaving according to the standard model should have no preference between the two ‘salesmen’ in the second and third trading regimes, since the outcomes from each are ultimately identical. The ‘irrationality’ observed in the monkeys is explained by the concept of loss-aversion, an important aspect of prospect theory. Thus behavioral economics is better able to explain the behavior observed in the experiment.
Case 1.2 Money illusion

The issue of money illusion is one that has been much discussed by economists since the days of Irving Fisher (1930). It has been defined in various ways, which has been the cause of some confusion, but a brief and useful interpretation has been given by Shafir, Diamond and Tversky (1997) in a classic article:

A bias in the assessment of the real value of transactions, induced by their nominal representation.

It should be noted that such an interpretation does not limit money illusion to the effects of inflation, as will be seen.

Economists have tended to take an attitude to the assumption of money illusion that Howitt describes in the New Palgrave Dictionary of Economics (1987) as ‘equivocal’. At one extreme there is the damning quotation by Tobin (1972): ‘An economic theorist can, of course, commit no greater crime than to assume money illusion.’ The reason for this view is that money illusion is basically incompatible with the assumption of rationality in the standard model. Thus a rational individual should be indifferent between the following two options:

Option A Receiving a 2% yearly pay increase after a year when there has been inflation of 4%.

Option B Receiving a pay cut of 2% after a year when there has been zero inflation.

In each case the individual suffers a decrease in pay in real terms of 2%. However, some empirical studies indicate that people do not show preferences that are consistent with rationality in the traditional sense, and that money illusion is widespread.

Perhaps the best-known study of this type is the one quoted earlier by Shafir, Diamond and Tversky (1997; hereafter SDT). This used a questionnaire method, asking people about a number of issues related to earnings, transactions, contracts, investments, mental accounting, and fairness and morale. We will concern ourselves here with questions related to earnings and contracts, since these will illustrate the main findings.

An earnings-related situation was presented as follows:

Consider two individuals, Ann and Barbara, who graduated from the same college a year apart. Upon graduation, both took similar jobs with publishing firms. Ann started with a yearly salary of $30,000. During her first year on the job there was no inflation, and in her second year Ann received a 2% ($600) raise in salary. Barbara also started with a yearly salary of $30,000. During her first year on the job there was 4% inflation, and in her second year Barbara received a 5% ($1500) increase in salary.

The respondents were then asked three questions relating to economic terms, happiness and job attractiveness:

- As they entered the second year in the job, who was doing better in economic terms?
• As they entered the second year in the job, who do you think was happier?
• As they entered the second year in the job, each received a job offer from another firm. Who do you think was more likely to leave her present position for another job?

Of all the respondents 71% thought that Ann was better off, while 29% thought that Barbara was better off. However, only 36% thought Ann was happier, while 64% thought that Barbara was happier. In the same vein, 65% thought that Ann was more likely to leave her job, with only 35% thinking Barbara was more likely to leave.

A contracts-related question was designed to test people’s preferences for indexing contracts for future payment to inflation. From a seller’s viewpoint this would be preferred by decision-makers who were risk-averse in real terms, while those who were risk-averse in nominal terms would prefer to fix the price now. The situation featured computer systems currently priced at $1000; sellers could either fix the price in two years at $1200, or link the price to inflation, which was expected to amount to 20% over the two years. The options were framed first of all in real terms (based on 1991 as the current year) as follows:

**Contract A** You agree to sell the computer systems (in 1993) at $1200 a piece, no matter what the price of computer systems is at that time. Thus, if inflation is below 20% you will be getting more than the 1993 price; whereas, if inflation exceeds 20% you will be getting less than the 1993 price. Because you have agreed on a fixed price your profit level will depend on the rate of inflation.

**Contract B** You agree to sell the computer systems at 1993’s price. Thus if inflation exceeds 20% you will be paid more than $1200, and if inflation is below 20%, you will be paid less than $1200. Because both production costs and prices are tied to the rate of inflation, your ‘real’ profit will remain essentially the same regardless of the rate of inflation.

When the options of fixing the nominal price and index-linking were framed as above in real terms, a large majority of the respondents (81%) favored the option of index-linking, indicating risk-aversion in real terms. However, when the equivalent options were framed in nominal terms, as shown below, a different result was obtained:

**Contract C** You agree to sell the computer systems (in 1993) at $1200 a piece, no matter what the price of computer systems is at the time.

**Contract D** You agree to sell the computer systems at 1993’s price. Thus instead of selling at $1200 for sure, you will be paid more if inflation exceeds 20%, and less if inflation is below 20%.

In this case a much smaller majority (51%) favored the index-linking option, which now seemed more risky.
When the contract situation was reversed, so that respondents were now in a buying situation, it was also found that the framing of the options affected the responses. Once again respondents were risk-averse in nominal terms when the options were framed in nominal terms and risk-averse in real terms when the options were framed in real terms.

**Issues**

The discussion of money illusion raises a number of important issues in behavioral economics. Some of these are similar to the previous case:

- **Methodology**
  Economists have criticized the validity of the SDT results on two main grounds. First, they have doubts about the questionnaire methodology, suspecting that there may be considerable differences between what people say they might do in a hypothetical situation and what they would actually do in the real world when motivated by economic incentives. Second, they point out that it is not sufficient to show money illusion at the level of individual behavior; it must also be present at the aggregate level in order to have real economic significance. Individual differences may cancel each other out, thus resulting in no overall economic effect.

- **Rationality**
  It is usually argued that money illusion is not rational at the level of the individual. However, it is notable from the SDT study that the majority of the respondents realized that Ann was better off in economic terms, even though a majority thought that Barbara was happier. This perceived decoupling of absolute economic welfare from happiness is not necessarily irrational, and will be discussed further in Chapter 3. Furthermore, it may well happen that a majority of individuals do not themselves suffer from money illusion at the individual level, but may believe that others do. Therefore, in order to understand the existence of money illusion at the aggregate level, it is necessary to examine the strategic interaction of individuals in the economy.

- **Mental accounting**
  It is notable that the SDT study not only attempts to test for money illusion in a descriptive sense, it also goes some way towards trying to explain its existence in psychological terms. This involves general aspects of mental accounting, more specifically the theory of multiple representations. These aspects are discussed in detail in Chapter 6, but at this stage we can outline the theory by saying that it proposes that people tend to form not just a single mental or cognitive representation of information, but several simultaneously. Thus we may form both a nominal and a real mental representation of different options, but, depending on how they are framed, one or the other may be salient. Thus the concepts of framing effects and saliency are important. The SDT study maintains that normally the nominal representation tends to be salient, since it is cognitively easier to handle, demanding less information. This therefore tends to give rise to money illusion. Later on we will see that there are similarities here with types of optical illusion.
• **Strategic interaction**
  As already stated, it is important to consider strategic interaction in order to understand money illusion at the aggregate level. If some economic agents act irrationally, for example by raising prices without any inflationary cause, then it may be optimal for other agents who are rational to react in the same way and ‘follow the crowd’. This effect is of vital importance in stock markets, as noted by many researchers in behavioral finance, particularly in relation to the financial crisis that began in 2007. Strategic interaction also has to take into account the possible existence of ‘super-rationality’, as discussed by Fehr and Tyran (2003). These aspects are all examined in Chapter 9.

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**Case 1.3 Altruism**

**The joy of giving**

Donating to charity rewards the brain

Providing for relatives comes more naturally than reaching out to strangers. Nevertheless, it may be worth being kind to people outside the family as the favour might be reciprocated in future. But when it comes to anonymous benevolence, directed to causes that, unlike people, can give nothing in return, what could motivate a donor? The answer, according to neuroscience, is that it feels good.

Researchers at the National Institute of Neurological Disorders and Stroke in Bethesda, Maryland, wanted to find the neural basis for unselfish acts. They decided to peek into the brains of 19 volunteers who were choosing whether to give money to charity, or keep it for themselves. To do so, they used a standard technique called functional magnetic resonance imaging, which can map the activity of the various parts of the brain. The results were reported in this week’s *Proceedings of the National Academy of Sciences*.

The subjects of the study were each given $128 and told that they could donate anonymously to any of a range of potentially controversial charities. These embraced a wide range of causes, including support for abortion, euthanasia and sex equality, and opposition to the death penalty, nuclear power and war. The experiment was set up so that the volunteers could choose to accept or reject choices such as: to give away money that cost them nothing; to give money that was subtracted from their pots; to oppose donation but not be penalised for it; or to oppose donation and have money taken from them. The instances where money was to be taken away were defined as “costly”. Such occasions set up a conflict between each volunteer’s motivation to reward themselves by keeping the money and the desire to donate to or oppose a cause they felt strongly about.

Faced with such dilemmas in the minds of their subjects, the researchers were able to examine what went on inside each person’s head as they made decisions based
on moral beliefs. They found that the part of the brain that was active when a person donated happened to be the brain’s reward centre — the mesolimbic pathway, to give it its proper name — responsible for doling out the dopamine-mediated euphoria associated with sex, money, food and drugs. Thus the warm glow that accompanies charitable giving has a physiological basis.

But it seems there is more to altruism. Donating also engaged the part of the brain that plays a role in the bonding behaviour between mother and child, and in romantic love. This involves oxytocin, a hormone that increases trust and co-operation. When subjects opposed a cause, the part of the brain right next to it was active. This area is thought to be responsible for decisions involving punishment. And a third part of the brain, an area called the anterior prefrontal cortex — which lies just behind the forehead, evolved relatively recently and is thought to be unique to humans — was involved in the complex, costly decisions when self-interest and moral beliefs were in conflict. Giving may make all sorts of animals feel good, but grappling with this particular sort of dilemma would appear to rely on a uniquely human part of the brain.

Source: The Economist, October 12, 2006

Issues

1 The nature of economic behavior

Economic behavior is not just about monetary transactions. ‘Altruistic’ acts and spiteful acts also are relevant. We need to understand the basis of such acts in order to explain and predict human behavior in a wide variety of different situations, such as donating to charity, labor strikes, lending the neighbor one’s car and remonstrating with people who litter the streets.

2 Fairness and social preferences

This aspect is closely related to the first one. We need to understand the importance of inequality aversion, the perceived kindness of others, reciprocity and the intentions of others if we are to predict behavior in social situations when strategic interaction is important. This area is covered in Chapter 10.

3 The role of neuroscience

The study described above demonstrates clearly how useful neuroscience can be in explaining behavior that cannot easily be explained by the standard economic model. In particular it shows that ‘self-interest’ needs to be understood in a broad context. Charitable acts are thus self-interested acts because they make us feel good, contrary to the common narrow understanding of self-interested acts. It is important to realize that only by performing neuroscientific studies involving techniques like functional magnetic resonance imaging (fMRI) can we establish firm evidence regarding the real motivations behind ‘altruistic’ and spiteful acts, since people often deny these motivations, and even ‘honest’ introspection may not reveal them. This aspect is discussed in more detail in the next chapter and also in the concluding chapter.
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