PART I

Economics and Psychology

Introduction

Economic theorists and cognitive (decision behavior) psychologists agree on several core (maintained) hypotheses about human decision making: (1) rationality in social and economic contexts derives directly from the rationality of individual decision makers – if surveys of isolated individuals indicate irrational responses, ipso facto, markets and other group interaction decision systems will be irrational; (2) individual rationality is a self-aware cognitive process – if people get things right, it is through thinking about and understanding the processes in which they partake; and (3) the human mind is modeled as a general purpose problem-solving machine that governs reasoning, learning, memory, and decision making with "no features specialized for processing particular kinds of content" (Gigerenzer, 1996, p. 329). Thus, the economist's model of decision making is expected utility maximization in all decision making under uncertainty. Kahneman and Tversky's (1979) model is maximization of a weighted value function that modifies the objective probabilities (judgments) and utilities of expected utility theory to descriptively account for decision making under uncertainty.

The work of experimental economists has focused more explicitly on the behavior of markets and other interactive rule-governed institutional mechanisms in which individual decision making is not isolated from that of others. This perspective has generated methodological differences between experimental economics and cognitive psychology that have led to a divergence in the questions asked and the research procedures used.

The chapters in Part I address some of these issues in detail. One issue is whether the research results of cognitive psychologists are robust with respect to behavior in markets, to substantial monetary rewards, and to institutional context, although the last potentially overlaps the study of "framing" effects in psychology. Another is whether discrepancies between theory and observation can be resolved in a testable way by appropriate modifications of extant theory. Part I deals with cases testing whether this seems feasible, whereas the chapters in Part II, dealing with experimental results in two-person bargaining, suggest that a more

fundamental reorientation in theory, and particularly its interpretation, may be necessary, although I believe that most of the conceptual foundation for that reorientation is already contained within game theory. It is in this context that the perspective of evolutionary psychology is introduced in Part II. I and my coauthors believe that perspective may be promising and is worthy of serious attention from experimental economists as a means of generating alternative hypotheses to those based exclusively on noncooperative game theory and its elaboration.

Chapter 1 provides an overview of the economic and cognitive themes, as I see them, in the debate between the economic and the cognitive psychology views of decision, particularly from the perspective of experimental economics. One of the more significant discoveries in experimental market studies is that efficiency and convergence to competitive equilibria occur ubiquitously in experimental markets without subjects having the remotest awareness and understanding of the unconscious ends they have achieved. This issue is neither addressed nor recognized in either mainstream economics (Hayek and the Austrians are, of course, a long-standing exception) or mainstream behavioral cognitive psychology, although it is quite explicit in the evolutionary psychology program (see Chapter 9 in Part II).

The Endowment Effect

An important behavioral principle from prospect theory establishes that the marginal utility for losses is much greater than the marginal utility for a gain measured from the status quo state. Thaler has proposed that this fundamental principle implies that out-of-pocket costs receive a higher cognitive weight than forgone gains, a phenomenon he refers to as the endowment effect. This in turn implies a discontinuity in the individual's demand schedule at his existing asset position, which accounts for the well-known tendency for minimum willingness-to-accept to be much larger than maximum willingness-to-pay as measured in surveys. A corollary is undertrading. If you endow half of $2N$ people at random with a good (e.g., an emblem mug) and half with appropriate comparable amounts of money, an exchange market between the N buyers and N sellers should result in $N/2$ mugs being exchanged. In Chapter 2, using a market mechanism well known to yield very high efficiency and competitive outcomes, we find support for undertrading.

But one of the research problems in this test is that the revealed

supply and demand schedules are very gently sloped so that small errors in the supply and demand have a multiplied effect on trading volume.

A Decision Cost Model, the Predictions of Rational Theory, and Extending the Model

Chapter 3 develops the idea that decision making is cognitively costly and that observed decision outcomes are the result of an individual unconsciously weighing this cost against the value of the outcome. The underlying hypothesis is that this is the way the brain works; in the absence of disorder in its circuitry, it responds more or less aggressively in reaching decisions, depending upon whether the quality of the decision has high or low value. Hence, the failure of "rational" models is in part a failure to take into account all costs (or value since the decision process may have excitement value, relieve boredom, etc.). Is it irrational to devote few cognitive resources to a difficult decision problem when the consequences have little value?

The resulting model predicts that either increasing the monetary stakes or decreasing the complexity of difficult tasks in experiments will tend to reduce the variance in outcomes and, where there is a discrepancy, move them closer to the equilibrium predicted by reward maximization. The latter prediction follows in spades if the equilibrium is on the boundary of the decision's constraint set. These predictions are in qualitative conformity with a wide range of experimental observations, although, as always, the data exhibit noise relative to this prediction. The model also predicts that if subject experience (learning) enables cognitive effort to be reduced, then outcomes will move closer to the reward-maximizing equilibrium. Again, Chapter 3 reports experimental evidence relevant to this prediction.

But there are sure to be contrary cases because anomalies are inevitable in the most accurate and plausible theories. For example, in one version of the ultimatum game, when the stakes are increased from \$10 to \$100 (see Chapter 7), proposals are reduced (but not significantly – either economically or statistically), but the rejection rate increases significantly.

This suggests that the decision cost model may need to account for strategic considerations explicitly to encompass contrary cases. In fact, a shortcoming of Chapter 3 is that it treats strategically interacting subjects as if each were in a game against nature, an assumption better suited for *n*-person markets than to two-person bargaining. This shortcoming

has been corrected recently in Smith and Szidarovszky (1999) who show how the results of Chapter 3 can be extended to equilibrium bargaining between agents.

Fairness in Markets

Fairness – in the sense of interpersonal utility considerations, or perceptions of what constitutes a fair division – has been shown by Kahneman et al. (1986, 1987), using questionnaire data, to influence what people believe about the acceptability of price increases in retail markets in the short run. They do not claim that such fairness considerations will necessarily have an impact on market behavior in the long run but that it may account for sluggishness in a market's response to external conditions. This is an issue discussed briefly in Chapter 1, but examined more rigorously by explicit market experiments in Chapter 4. The particular experimental framework used to study this issue is adapted from studies by Kachelmier and co-workers (Kachelmier and Shehata, 1991; Kachelmier et al., 1991a, b). The bottom line in Chapter 4 is that such fairness considerations do limit short-run price increases compared with control experiments where such considerations do not apply, but over time market prices asymptotically approach equilibria predicted by the standard competitive equilibrium model of markets organized under posted offer retail pricing. This implies that "fairness" is a property of agent short-run expectations, rather than a property of agent utility functions: Buyers believe and expect that price increases, resulting from external market considerations, should not produce higher ("unearned") profits to sellers, whereas sellers temporarily accept this norm. This results in a temporary expectational equilibrium with no increase in price. But there is excess demand at this price, and seller competition for that excess demand causes price to rise gradually to the competitive equilibrium in successive market trading periods. Because economic theory provides no rationale for why markets impacted by external parameter changes do not leap to the new static equilibrium, psychology fills this gap with a testable explanatory hypothesis; of course, there may be others. Thus, behavior may become autonomic in a static equilibrium. A change in that equilibrium requires more cognitive resources to consciously reconsider old responses and to adjust, and this is time consuming.

CHAPTER 1

Rational Choice: The Contrast Between Economics and Psychology

Vernon L. Smith

Rational Choice (Hogarth and Reder, 1987) is about economics and psychology, or, as noted by Zeckhauser (1987, pp. 251–4), the rationalist versus behavioralist views of economics. One would have hoped that in this book, given the potential of psychologists and economists to learn from each other, the record would have shown more tangible evidence of this learning.

This chapter discusses the themes in this debate, a debate that is never quite joined: The psychologist's provocative claims are neither answered nor echoed by the economists. My comments will arise from the perspective of experimental economics, which reflects equally the rational and behavioral intellectual traditions. Generally, I want to address the reference to "a growing body of evidence – mainly of an experimental nature – that has documented systematic departures from the dictates of rational economic behavior" (Hogarth and Reder, 1987, p. vii). This suggests a contest between economic theory and the falsifying evidence from psychology. But there is a third view, that of experimental economics, which documents a growing body of evidence that is consistent with the implications of rational models, although there are many important exceptions. In the latter, often the data can be comprehended by modifying the original models. The result is to deepen the concept of rationality and simultaneously increase consistency between the observations and the models; better normative models more accurately predict the experimental results. Psychologists almost uniformly report results contrary to rational theory, which leads them to conclude that the "normative and descriptive analyses of choice should be viewed as separate enterprises" (Tversky and Kahneman, 1987, p. 91).

I. Rationality as Conscious Cognition

"My first empirical proposition is that there is a complete lack of evidence that, in actual human choice situations of any complexity, these [rational] computations can be, or are in fact, performed . . . but we cannot, of course, rule out the

possibility that the unconscious is a better decision maker than the conscious" (Simon, 1955, p. 104).

Throughout much of *Rational Choice*, one sees the frictional tension between psychology and economics. But from the perspective of experimental economics, I believe that the basic problem stems not from the numerous areas of claimed disagreement expressed in *Rational Choice*, but from two unstated premises on which there is implicit agreement between psychology and mainstream theory: (1) rationality in the economy emanates and derives from the rationality of individual decision makers in the economy, and (2) individual rationality is a cognitively intensive, calculating process of maximization in the self-interest. A third shared tenant, which is a correlate of points 1 and 2, is that (3) an acceptable and fundamental way to test economic theory is to test directly the economic rationality of individuals isolated from interactive *experience* in social and economic institutions.[1] Economists do not usually challenge this tenet. They are merely skeptical of the way psychologists implement it: by asking subjects how they would choose among stated hypothetical alternatives. It is reasonable to conjecture from this that the methodology would be acceptable if the decision maker had a "stake" in the decision, in which case the issue could in principle be resolved empirically. But according to point 1, nothing is added or addable by the conjunction of individuals in, and with, markets that cannot be captured by giving the subject a verbal description of the particular market decision-making context. Market rationality is then the direct result of individual choice rationality in that described context.[2] But experimental economics

[1] Arrow, recognizing point 1 as an implicit assumption in traditional theory, is concerned with correcting this view: "I want to stress that rationality is not a property of the individual alone. . . . It gathers not only its force but also its very meaning from the social context in which it is embedded" (1987, p. 201). But Arrow's point is about theory: His main theme is that the power of theory derives from the conjunction of rational individuals with the concepts of "equilibrium, competition, and completeness of markets" (p. 203). For example, theory assumes complete information and common knowledge as part of the rationality of individuals, making rationality a social phenomenon.

[2] Of course, psychologists are interested in studying cognitive processes in decision-making situations that appear to be remote from market processes. But such decisions may still have a social context, such as hospital and medical committees in the case of physician decisions. The study of isolated cognitive processes is of interest in its own right but also needs to be studied explicitly in other social contexts. It is desirable to know whether the strong effect of framing (survival versus mortality probabilities) on physicians' stated preferences is related to their actual decision to use one therapy rather than another. Presumably, "best practice" therapies evolve in a social context not from isolated individuals thinking about alternatives in terms of probabilities. Experiments that would attempt to capture these social processes would be analogous to the experimental economist's program of studying market decision making in particular institutional contexts.

research suggests that different results obtain when subjects' choices are interactively governed by an institution. Although the rediscovery of institutions in economic theory began about 1960 with the contributions by Shubik (1959), Coase (1960), Hurwicz (1960), and Vickrey (1961), the new thinking, hypothesizing that institutions matter, is still not well integrated with both theory and laboratory evidence.

That individual rationality is a consciously cognitive phenomena is fundamental in the rhetoric of microeconomic and game theory. The theorist, if called on, says that the model assumes complete information on payoffs (utilities) and more. "The common knowledge assumption underlies all of game theory and much of economic theory. Whatever be the model under discussion . . . the model itself must be assumed common knowledge; otherwise the model is insufficiently specified, and the analysis incoherent" (Aumann, 1987, p. 473). Without such common knowledge people would fail to reason their way to the solution arrived at cognitively by the theorist. This is echoed by Arrow when he notes that a "monopolist, even . . . where there is just one in the entire economy, has to understand all these [general equilibrium] repercussions . . . has to have a full general equilibrium model of the economy" (Arrow, 1987, p. 207). Indeed, it has been hard for either the theorist or the psychologist to imagine optimal market outcomes being achieved by other than conscious cognition; it can't occur by "magic," so to speak.[3] The reason is that neither has traditionally modeled markets as a learning process, capable of converging to a rational equilibrium outcome. A noteworthy exception is to be found in Lucas (1987), in which some examples are used to motivate the hypothesis that myopic agents with adaptive expectations converge to steady states, which sometimes correspond to a Muthian rational expectations equilibrium.[4]

What has emerged from 30 years of experimental research is that the preceding premises 1–3 are false. Plott (1987) summarizes many examples. In these experiments (also Smith, 1962), all information on the

[3] Simon (1955) is open to the possibility that unconscious decisions may be better than the conscious. But Simon (1987, p. 39) says that "in situations that are complex and in which information is very incomplete (i.e., virtually all real-world situations), the behavioral theories deny that there is any magic for producing behavior even approximating an objective maximization of profits or utilities." Yet there are a great many, very complex, experimental markets, with very incomplete information, that converge to outcomes that precisely approximate those derived from maximizing objectives. We badly need the kind of cooperation between economics and psychology that would help us to better understand how, in Simon's (1987, pp. 26–8) well-known terminology, the procedural rationality of the individual allows substantively rational outcomes to be achieved over time in these markets.

[4] Other important contributions to the study of the market process are provided by Blume and Easley (1982) and Bray (1982); see also Kalai and Lerher (1993).

economic environment (values) is private; far from having perfect or common information, subjects know only their own "circumstances." All trading is carried out by an institution such as the decentralized "open outcry" rules of the continuous double auction in which every agent is both a price maker who announces bids to buy (offers to sell) and a price taker who accepts a standing offer to sell (bid to buy). What these and many hundreds of other experiments have shown is that (1) prices and allocations converge quickly to the neighborhood of the predicted rational expectations competitive equilibrium, and (2) these results generalize to a wide variety of posted-price, sealed-bid, and other institutions of exchange, although convergence rates tend to vary and can be influenced by extreme parameter conditions.

Postexperiment discussion with the subjects in the earliest experiments made it plain that (1) subjects are not aware that they are achieving maximum profits collectively and individually, in equilibrium, and, in fact, deny this when asked; and (2) before seeing the results, subjects describe the market situation as confused and disorderly ("How can you get anything out of these experiments?"). When asked what strategies they used, they are unable to convey insight to the experimenter: "I tried to buy low (sell high)" or "I waited until near the end to squeeze the other side." These and other bidding, auctioning, and price-posting experiments show the predictive power of noncooperative equilibrium concepts (competitive or Nash) without any requirement that knowledge be complete and common. In these cases, economic theory works, predictively, under weaker conditions than expected, and no support is provided for the interpretation that the equilibrating process is consciously cognitive. The verbal behavior of subjects strongly contradicts what their actual behavior achieves.

The fact that private-information experimental markets converge more quickly and reliably to certain rational predictions than complete-information markets do directly contradicts the conclusion of Tversky and Kahneman (1987, p. 88): "Perhaps the major finding of the present article is that the axioms of rational choice are generally satisfied in transparent situations and often violated in nontransparent ones."[5] This is correct in their context, but in experimental markets rational theory often performs best in the "nontransparent" (low information) environ-

[5] According to one of my referees, "Isn't it odd that one would find this quote [by Tversky and Kahneman] in a book in which Plott demonstrated the operation of a near continuum of markets (the signaling example)? Somehow the psychologists miss the point of examples even when the examples are placed directly in front of them. As I reflect on these papers I do not recall any psychological explanation of any of the papers that have used experimental economics techniques. It seems to me that the psychologists have not done their homework."

ment and worst in the "transparent" (high information) environment. The leap is so great when one goes from data on responses to individual choice problems to observed behavior in experimental markets that conclusions of this sort are reversed! This underscores the criticism by Coleman (1987) of the implicit premise of the conference that the greatest gains for theory will come from a more sophisticated model of action. "It is deficiencies in the apparatus for moving from the level of the individual actor to the behavior of the system that hold the greatest promise of gain" (p. 184). I think this is the most important implication of experimental economic research. What is imperfectly understood is the precise manner in which institutions serve as social tools that reinforce, even induce, individual rationality. Such economic concepts as noncooperative equilibrium and incentive compatibility are helpful, but they are inexorably static and do not come to grips with the interactive process between agents and institutions. One misses all of this in research limited to the individual expressing an opinion about described situations or alternatives.

It is natural to expect that the unconscious can be a good decision maker only when complexity is absent. The single-market experiments discussed earlier are simple in the sense that there is but one isolated market characterized by stationary supply and demand, but the observed results still follow in some institutions when demand is constantly shifted privately without public announcement of any kind (McCabe et al., 1993). Furthermore, there are many examples showing that in much more complicated multiple-market experiments, convergence to competitive equilibria is observed.[6]

II. Verbal Behavior: Unreliable and Not Worth Studying?

The preceding discussion might lead some to infer, incorrectly, that nothing worth knowing can be learned by studying verbal behavior. Verbal behavior, when studied with the skills of the psychologist, tells one a lot about how people think about choice problems. Their choices

[6] See Smith (1986, p. 169) and Williams et al. (1986) for examples with three commodities and two markets; see Plott (1988) for an example with 19 connected markets. Another type of complexity occurs in experimental asset markets in which the asset dividend is not only uncertain but also dependent on a sample of likelihood information. It is well known that psychologists find judgment biases that contradict the Bayesian updating of subjective probabilities from sample information. One important study finds that "in eight experiments with inexperienced subjects, prices tend toward the Bayesian predictions, but there is some evidence of exact representativeness bias in prices and allocations. However, the degree of bias is small, and it is even smaller in experiments with experienced subjects. All other non-Bayesian theories can be rejected" (Camerer 1987, p. 995).