

Comments: Behavioral Versus Rational Economics: What You See is What You Conquer

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Comments: Behavioral versus Rational Economics: What You See Is What You Conquer*

Among geologists a battle now rages whether the earth contains a substantial, buried pool of methane gas that was formed with the planet rather than from the decay of plant and animal bodies. Each side, though respecting the other's natural brilliance, looks askance at its science on this subject and its empirical support. One is reminded of the spirited battle between the rationalists and behavioralists in economics—but the geologists' conflict is subject to empirical test, a monumentally expensive bore. (It may be substantially resolved by a 3-mile-deep drill for gas now being undertaken by Sweden in an area where an ancient collision with a meteorite may have created a reservoir to trap such gas.) The behavioralist-rationalist debate, in contrast, is unlikely to be resolved any time soon because the two schools look for evidence in very different arenas. In some ways, it is more a debate between religions than between scientific theories.

Thomas Kuhn's (1970) notion of the struggle among paradigms offers another metaphor for thinking about battles among theories. Celestial bodies provide useful examples once again, whether it be replacing the heliocentric theory of the universe or supplanting the pulsating universe theory with the big bang. In most of the cases Kuhn describes, the struggle is titanic, in part, but only in part, because the evidence is hard to mount. The battle is usually won only after some time, often when disciplines of the new theory have come of age.

I. The Behavioral versus Rational Battle

This volume contains elegant, often persuasive documents in the battle between behavioral and rational economics. The specific papers I have

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been asked to comment on, by Arrow and by Lucas (in this issue), are deep and thoughtful presentations by as forceful combatants as either side could hope to muster. Supporters of the behavioral and rational schools will rally round their respective champions. But I believe that this battle will differ significantly from the intellectual struggles over theories regarding primordial gas or the origins of the universe. There are many common elements—deep passions, academic careers at risk, and the emergence of theories long before conclusive evidence could be marshaled. Ultimately, the other conflicts are (or will be) resolved. But prospects for a settlement of the rational-versus-behavioral battle seem dim.

Too Many Battlefields

I do not think that the conflict between rationalists and behavioralists will be resolved in an intellectual generation, or even 3 such generations. There are simply too many battlefields. Each side can select the ones most favorable to its own cause. From time to time there will be mutually agreed-on skirmishes. Major recent ones have centered on macroeconomics, where the evidence remains exceedingly controversial and inconclusive, and finance, where the markets work exceedingly well but not perfectly—an outcome sufficiently ambiguous to enable both sides to claim victory. In the future, I suspect, the behavioralists will continue mounting experiments or micro evidence of non-rational choices, for there are an infinite number to be found. The rationalists will take succor from the overwhelming power of their model, which had a lot to do with its success in the first place, and the absence of any equivalently powerful competitor.¹ Should behavior in certain salient areas be found to violate rationality, it will be treated as beyond economics. Decisions on religion and, conceivably, on family choices or personal habits thus may command the rationalists' attention, if they behave well; otherwise, they may be classified in the same category as the source of preferences or values, something about which we have little to add as economists.

This is not a Kuhnian struggle among paradigms, but a turf battle.² Each side has some secure territory. Figure 1 is perhaps suggestive,

1. Arrow demurs on this point. See the discussion of his contribution below.

2. Philosophers of science are hardly agreed on Kuhn's formulation. Harvey Brooks suggested to me that competing theories in physics tend to coexist for periods of time because each explains most of the facts. Moreover, "a new conceptual framework does *not* sweep away all that has gone before. Relativity *reduced* to Newtonian mechanics in the domains of parameters for which Newton's mechanics had been established. Newton's mechanics is entirely adequate for space vehicles and planetary probes, for example." Though the gap is not as large, the rational-versus-behavioral economics debate does not fit this pattern either, to judge by the assessments of most participants. There is too much disagreement on basic assumptions. Behavioral theories of economics do not readily reduce to rationality in limited domains.

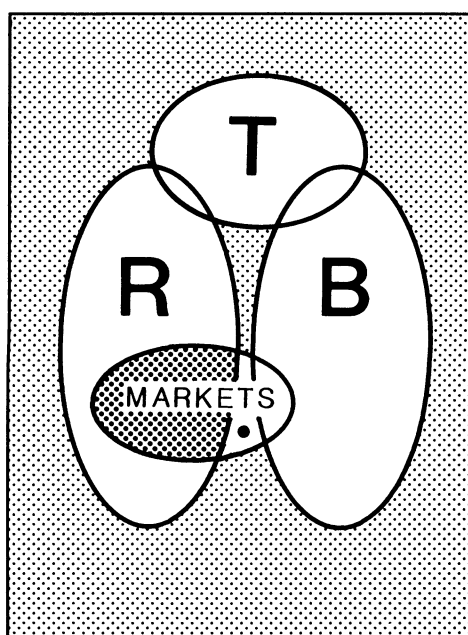


FIG. 1.—Domains of decision

revealing areas where each theory is likely to have its greatest strengths. An impartial draftsman has allotted equal space to the rational and behavioral explanations, denoted by the ovals R and B, but viewers can stretch the diagram where they wish along any dimension. Much territory is not covered by either model. Frequently, third categories of explanation—theology, oval T, is the example in the diagram—hold sway, though these may have a rational or behavioral accompaniment.

The shaded area, rational participants in markets, is the one most studied by the rational camp. That camp's most insistent claim, and one for which there is a great deal of evidence, is that no hypothesis other than rationality could describe the observed behavior with equivalent elegance and power. Most other explanations are introduced ad hoc, on an area-by-area basis, and hence consist of no explanation at all. Some braver souls (Gary Becker is the most celebrated) make forays into rational explanations of nonmarket behavior. And there are some market areas, perhaps the dot representing the market for poetry, that the rationalists gladly leave as booty for others.

The behavioralists, well schooled in understanding our pursuits of, say, food, take delight in showing nonrational market behavior. Occasionally the evidence consists of poorly behaving markets. Financial markets are too volatile (Shiller 1979); price variations from seller to

seller in competitive markets are too great (Pratt, Wise, and Zeckhauser 1979); people gamble. They also employ laboratory experiments and survey evidence to show that behaviors needed for effective performance in the market, the most salient being the accurate processing of information and adherence to consistent preferences for decisions under uncertainty, are beyond the inclinations or capabilities of most human decision makers (see the essays in Kahneman, Slovic, and Tversky [1982]).

But surely this formulation is too simple. To capture the confusion of the struggle between rationalists and behavioralists, perhaps we should imagine that the combatants have wandered into four-dimensional space. Each side resides in its own three dimensions, only two of which overlap the other's space. The three-dimensional boulders thrown by one side are thus highly unlikely to hit the other, though they will show up as direct hits on the launching side's radar screen.

II. The Moderate Assessment

If the four-dimensional battle analogy is apt, the moderate in this debate, seeing deep intellectual structure on both sides, is due for frustration. The debate is not being joined and will not be joined in the future, for each side is triumphant in the areas it surveys. When progress can no longer be made in an area, it is not uncommon to introduce some axioms, statements that are either so obvious or so untestable that they can enter the debate in no other fashion.

Axioms and Corollaries

AXIOM 1. For any tenet of rational choice, the behavioralists (e.g., Amos Tversky) can produce a laboratory counterexample.

AXIOM 2. For any "violation" of rational behavior discovered in a real world market (e.g., the fact that hardware stores do not raise snow shovel prices shortly after a storm), the rationalists (e.g., Gary Becker) will be sufficiently creative to reconstruct a rational explanation.

AXIOM 3. Elegant abstract formulations will be developed by both sides, frequently addressing the same points, but because there are sufficient degrees of freedom when creating a model, they will come to quite different conclusions.

If these axioms are accepted, we cannot expect much progress in convincing the diehard believers in either camp that the other is correct. Future disciples must be expected on both sides. The task of sorting out thus falls to the moderates. Empirical support should be our criterion. Moreover, we moderates should be happy if we can merely label the world, knowing where rational models effectively hold sway and where behavioral explanations are likely to be more successful. Each of the axioms has a corollary for the moderate's agenda.

COROLLARY 1. The behavioralists should focus their laboratory experiments on choice patterns with important real world implications or, better yet, directly on important real world phenomena.

COROLLARY 2. The rationalists should define the domains of economics where they can demonstrate that the preponderance of evidence supports their view.

COROLLARY 3. The choice among elegant abstract formulations that conflict with one another should not be based on their elegance, though that would surely tempt us behavioralists, or the opportunities they offer for additional work, a lure to us rationalists, but rather on the consistency of their predictions with real world observations. (This is not the place to rehash the hoary debate whether we must worry about the accuracy of the rationalist's assumptions.)

Responses of the Combatants

The behavioralists have produced work that is both dazzling and disturbing, particularly to those of us who worship at the Bayes-Savage shrine for decision making under uncertainty. But they have only begun to demonstrate the importance of their formulation. (Kahneman, Knetsch, and Thaler's article [in this issue] is a good example of a search for importance.)

The rationalists have been more interested in conquering new territory—the battle of the theory of rational expectations for the heart of macroeconomics is a salient example—than in identifying which areas within their identified spheres of influence are not critical to their well-being. Robert Lucas's article (in this issue) is a significant, welcome exception. In a highly conscientious fashion, it clearly identifies priority areas for explanation by rational models and other areas where the rational flag need not wave. He draws evidence from animal experiments and history and demonstrates that certain abstract "refutations" of rational explanations may not be refutations at all.

Arrow (in this issue) works in the spirit of my third corollary, examining abstract economic formulations to identify where the rationality assumption is critical. He concludes that it imposes an "extremely severe strain on information-gathering and computing abilities . . . incompatible with the limits of the human being" (p. S397). We moderates knew that and felt that the appropriate inquiry was then the following: given the distribution of economic decisions that citizens confront and their limitations as information processors, will they come reasonably close to a first-best performance? I know of no hard evidence on this question. But research through anecdote collection suggests that people do much better on recurring, everyday choices than on major decisions, such as the selection of a spouse, occupation, or retirement plan.

Arrow also raises two other classes of troubling observations. First,

theory suggests that, when markets are incomplete or information impounded, rational behavior is not sufficient to define a single equilibrium; rather, there is a continuum. Second, the exchange of assets due to differences in information, such as is found on stock markets, is inconsistent with a view that individuals rationally gather and process all information. I shall return to the arguments of Arrow and Lucas.

What the Two Sides See

In the debate between rationalists and behavioralists, each side is triumphant in the landscape it views. Let me now describe where I think each side holds sway.

Nonrational behavior in economics is a bit like an optical illusion. Just as you cannot always trust your eyes, you cannot always trust your behavior to be rational. But are optical illusions predominantly a laboratory curiosity or an important issue in problems ranging from the design of buildings to the training of athletes? I am inclined toward the former view, though I recognize that in special situations (e.g., warning a desert soldier where he will not find water), optical illusions may be a life-and-death matter. Although an understanding of the phenomenon may help explain how our brains work, it is probably irrelevant to our ability to perceive situations accurately in the overwhelming majority of real world situations.

If we believe that nonrational behavior in economics is as unimportant to real world resource allocation as optical illusions are to real world perception, the subject should be left to those few psychologists who wish to use economics as the area in which they explore thought processes. Importance here is a product of frequency of occurrence times impact—the magnitude of the deviation from what rational behavior would produce. Economics, unfortunately, seldom attempts to measure magnitudes of deviations. Thus, in welfare economics, for example, we have too often been satisfied to say, “Aha, the externality,” without worrying about its size. To repeat: measuring the real world consequence is the major challenge to the behavioralists.

An Underlying Agenda

Many, though not all, of the participants in these struggles see a deeper underlying agenda: once it is perceived that the individual participants are not rational, the important theorems on the allocational accomplishments of the market no longer hold. We can no longer make the efficiency claim that normally counterbalances arguments for greater central intervention in the economy. Intervention is thus more justifiable. This is an argument to convince not economists but rather those on the sidelines whom they have sometimes mesmerized.

Consider the following thought experiment. There are two equally important sectors of the economy, food and shelter. When making

transactions in one sector, food, the participants are highly rational. But their decisions in housing reveal numerous psychological traps.³ By law, we must impose a substantial government presence in precisely one of these two sectors. Which one should it be? I know of no theory or empirical study that provides an answer to this question; hence, there seems to be no logic to the nonrational-hence-intervene argument. Therefore, it is disturbing—though hardly surprising—to observe the correlation between political values and participation in the rational-versus-behavioral battle.

III. Assessing the Arguments

The central question in this debate is who controls which territory. That question is too controversial to settle here, but it should be possible to generate some agreement on comparative advantage. As is true in the world of international trade, as the resources of a productive entity—be it a nation or a scholarly school—expand, it will begin to produce an ever-increasing menu of products. Alas, the rational-versus-behavioral debate takes place in a many-factor world. Here is one man's speculation on how advantage might break down on various dimensions (see table 1). Most of these categories are clear. I shall elaborate on a few.

Identifying States and Alternatives

Since the time of Frank Knight, economists have paid attention to the distinction between risk (where probabilities are known) and uncertainty (where they are unknown). This distinction motivates a number of the early behavioralist “refutations” of the rational choice model, such as the Allais and Ellsberg paradoxes. But real world violations of the rational decision prescription, particularly under conditions of uncertainty, often relate to a third class of problems, namely, failure to define or consider alternatives. Even when alternatives are well defined, states of the world may be unknown.

Ignorance might be an appropriate term to describe situations in which states of the world or alternatives are simply unknown. Howard Raiffa tells an informative story about himself. In a lecture on fault trees at the National Academy of Sciences, he illustrated with the concept of a probabilistic diagnosis of a car failing to start. After finishing the lecture, he walked to his nearby rental car, got in, inserted the key, and found that he could not start it. He was embarrassed to discover not only that he had gotten into the wrong car but that getting into the wrong car was not an identified state on his fault tree.

3. For example, people may fail to change their consumption bundle when relative prices change, and the value of their house rises fantastically.

TABLE 1 Comparative Advantage

Rational		Behavioral	
Steady state	vs.	Adaptive	
Recurring situation	vs.	Unique	
Continuous allocation	vs.	Discrete	
States of the world identified	vs.	States of the world need to be identified	
Alternatives clear	vs.	Alternatives need to be identified	
Price taking	vs.	Negotiation or strategic	
Goods	vs.	Time, health, faith, love	
Subject to arbitrage	vs.	No poaching	

In many cases, even if one thinks for a very long time, one can only identify states of the world that capture, say, 90% of the possible outcomes. The less familiar the situation, the greater the density of the complementary catchall category. (For example, try to think of the possible ways the world may end.) When surprises arise, new models may be appropriate. Daniel Ellsberg used to discuss a hypothetical decision situation in which one flips a coin to determine whether it is fair or has two heads. Five trials produce two heads and three landings on edge. Merely stating that the odds are four to one for the two-headed coin does not seem to capture the situation.

In a strict sense, ignorance of alternatives is just a special case of ignorance of states of the world. But it causes problems so frequently that it merits separate investigation. In the typical economics text, the available alternatives are clearly delineated; in early chapters, for example, they are likely to lie along a budget line. But in the real world, even simple choice situations, such as which college to attend, often involve an anterior decision as to which goods should even be considered. In many instances, the space of alternatives may be hard to define. A likely, often significant, error is to fail to consider some attractive alternative, including the alternative of looking further.

Perhaps some of the laboratory irrational behavior that we observe, where the alternatives are usually well specified, is really due to people's attempts to protect themselves against unspecified states in a *hostile world*. In the Ellsberg and Allais contexts, for example, subjects may be concerned that the experimenter is working against them. After all, that is what usually happens in the real world, where most economic uncertainties relate to the behavior and interests of other parties, not nature's choices. If an unfamiliar mechanic disparages our car—"I don't like that right front ball joint; I wouldn't go over 40 mph. But it will probably last for a month or so"—we all suspect that he may not be giving us a fair portrayal of his assessment of the odds. If our customary decision making under uncertainty allowed for manipulation of the probabilities, usually against us, that would at worst be an instance of invoking reasonable rules of thumb, a form of bounded

rationality. In laboratory experiments, however, we cannot determine what other situations are being blended in the decision maker's mind.⁴ In this instance, the failure to consider alternatives is that of the experimenter, who is not alert to all that may be happening. The failure to identify alternatives may also be related to the misallocation of time.

Misallocation of Time

Among important economic commodities, time is perhaps the one that individuals allocate least well. Research by introspection will convince most readers that they consistently misallocate time and that their biases are predictable. For example, most of us spread time too evenly. Given a \$100 decision and a \$10,000 decision, we are likely to spend relatively too much time on the former. We have bias toward spasm response, at the expense of long-term planning. Many professors at Harvard, I have discovered, have not spent 1 hour selecting among alternative retirement plans and have not even considered some highly favorable, tax-advantaged programs.⁵ Though virtually every reader of this article is convinced of the importance of portfolio diversification, probably only a small percentage have any personal holdings in foreign stocks, which would substantially increase expected returns for any level of risk. Most people have never taken the 5 minutes needed to determine that the problem was worth considering and the 10 minutes to find out how to purchase.

IV. From Observations to Deductions about Behavior

I have attempted to define some areas where individuals will be able to make decisions that come closer to the rational ideal and others where greater explanatory power may be provided by behavioral models, which unfortunately do not carry over nearly so easily from situation to situation. But as the debate continues, we should also consider how to extrapolate from what we observe to what we believe about individual's behavior. For example, if we mistakenly assume an individual is deciding under nature's uncertainties, when in fact he believes himself to be in a hostile world, we will interpret his behavior incorrectly. Even

4. I earned my spending money through college by participating in psychological experiments. My principal conclusion was that, when the experimenter said something like, "You are each an undergraduate trying to estimate which design is better," the chances were nine in 10 that one of the subjects was a confederate, that the experiment had little to do with judging designs, or both.

5. Perhaps too equal spreading of time helps explain the Pratt et al. (1979) results. Price variations among standardized, high-priced goods were vastly too great to justify on a search theory basis, given estimates of the value of time, including estimates derived from price variability among low-priced goods.

if the experimenter is not hostile or the car mechanic is honest, is the suspicious decision maker necessarily irrational to think otherwise?⁶

Arbitrage versus No Poaching

The natural selection paradigm provides powerful comfort to supporters of the rational behavior assumption. Even if there are many nonrational participants, they will in effect starve. When economic activity is judged on a value-weighted basis, we will find that rational behavior predominates. A small variety store may misprice, but not a major chain. This formulation applies as long as there is free poaching, that is, that rational actors can move in on arenas where irrational decisions now prevail. This requires that entry be feasible and that rational capabilities spread readily. Financial markets offer poaching opportunities. It is as easy to buy 1,000,000 as 100 shares of stock, and K-Mart may be able to expand so as to drive even local variety stores out of business. But it is hard to see how one could make a profit capitalizing on the irrationality of the Harvard professors who failed to consider their retirement plans adequately.

The implication is that, if we look in areas where poaching is easy, prices and quantities will be arbitrated into relationships predicted by rational formulations. The stock market will look pretty good on this basis. But the aggregate outcome of a cluster of personal nonpoachable decisions—such as insuring appropriately, planning for retirement, or having babies in or out of wedlock—will be more heavily influenced by a behavioral component.

Decisions versus Games

Las Vegas is an affront to the rational decision model unless one gives weight to the pleasure of playing games. The vast volumes that are often traded on commodities and futures exchanges are no less an affront, not only because, as Kenneth Arrow points out, information-based trades strictly between speculators cannot make sense for both parties but also because these markets cost so much to operate, particularly in terms of the gains of the floor traders and certain big players. If we ever do come to understand gambling behavior, I suspect we will find that it offers powerful psychological benefits such as hope, ego gratification, and reward for outsmarting the other player or the system. Each person keeps his or her own score; perhaps a single big win offsets many losses that are larger in total. Gambling, of course, is an area where there are effective poachers, the effective professionals and

6. Some decision situations are rigged in your favor. Television game shows such as "Let's Make a Deal" are designed to let the contestants come off as winners. Smart children learn that their parent competitors make purposeful mistakes or even cheat to help their offspring.

those who run the house. Presumably they design their games to maximize the dollars extracted per unit of benefit offered. The possibility of injecting a little pseudoscience seems to help in creating additional rewards for the suckers. In the commodities markets, you can chart, guess the weather, be a fundamentalist, or undertake correlational analyses. Without such opportunities, perhaps fewer people would want to play the negative-sum game (see Niederhoffer and Zeckhauser 1983).

Individual Choice versus Working for Others

When we use small classroom gambles in discussing the elements of utility theory, we find that some married students are peculiarly risk averse. Though they invest far larger sums in the stock market, they cannot bear to tell their spouse that they lost money on a gamble. A good time to join many poker games is near the end of the evening, when some men bet against odds to get positive and “go home to the wife” as a winner. Corporate executives keep the profits increasing at a steady rate, often sacrificing substantial expected profits for their diversified shareholders. When others are kibitzing our decisions, we may suppress information on the performance of alternatives, even if we might make a subsequent switch.

If such actions were taken by an isolated individual, they might appear irrational. But once others are involved, even the most thoroughly rational individual will take actions that appear to violate Savage’s prescriptions. With prediction the goal, whether we adhere to the rational or behavioral paradigm, we would undoubtedly prefer a world in which agency problems vanished along with other problems, for example, so that everyone would be always a price taker and never a negotiator.⁷

But that is not the real world. Hence, we must calibrate the inferences we draw from observed behavior to the circumstances in which it occurred. If we are willing to admit to a limited amount of bounded rationality and assume that individuals adopt good overall decision procedures that are not necessarily perfect in each instance, we must also recognize that they learn to operate in a world where nature is rarely the generator of uncertainties, hostile people manipulate perceptions, and one must worry about monitoring and being monitored. Think of the unreliability of predictions made in a group decision situation, such as a faculty appointment or a Washington tax bill delibera-

7. The rationalists, for reasons that may relate to the underlying agenda, tend to accord less importance to agency problems, non-price-taking behavior, and so on. Greater recognition of such difficulties would provide a more secure defense of rational behavior. For example, a corporate executive who seeks a satisfactory level of profits, rather than trying to maximize their expected value, may be behaving in a fully rational behavior given directors’ and shareholders’ monitoring limitations.

tion, where preferences strongly influence alleged judgments of outcomes.

V. The Arrow and Lucas Contributions

The papers by Arrow and by Lucas (in this issue) push forward the debate substantially. As primary protagonists, they took the unusual course of focusing more on clarifying arguments than on scoring points.

Arrow identifies the vacuous nature of the assumption of rational behavior by itself, showing that virtually all observed microeconomic and macroeconomic phenomena can be derived from other foundations. Moreover, to derive interesting predictions from the rational behavior model, additional assumptions of a quite different nature are required, such as the assumption that differences in individuals' utility functions depend on observable magnitudes, for example, family size. Arrow's logic is penetrating. But his beliefs, as revealed in his writings more generally, show a deeper appreciation for the contributions of the rationality assumption, a perspective shaped by Arrow's observations of real world behavior. He appears to be a closet moderate.

I suspect that Arrow would agree that no alternative theory would predict nearly as well as rationality over a wide range of economic circumstances. With bounded rationality (see Simon, in this issue), a theory of behavior favored by Arrow, most predictions are much less precise, unless we add additional information. Perhaps rationality explains 50% of the variance, and boundedness explains an important additional 5%.

Arrow provides a valuable service with his crisp historical overview of the use of the rationality assumption in economics. He reminds us that, with incomplete or imperfect markets, the predictions of rationality are weak. Often there are continua of equilibria, for example. Arrow suggests that limiting rationality may offer a way out, reducing the number of equilibria. But my guess is that a theorist as brilliant as Arrow could easily conjure up seemingly reasonable situations where limitations on rationality multiply rather than reduce the number of feasible outcomes.

The deep conundrum about real world outcomes is that they look so sensible relative to the ranges of possibilities that our models permit. Dramatic disequilibria rarely arise. Prices, for the most part, move reasonably. Signaling equilibria fall within familiar bounds. Undoubtedly there are other determining factors selecting equilibria, and with experience we have learned what to expect. (A mother is much better at predicting the behavior of her child than would be any psychologist armed with theoretical models.) Perhaps there are some forces of natural selection that drive out unreasonable equilibria. In the microeco-

conomic domain, it appears, the world is vastly more tractable than our models would predict. Nowadays, even self-confident macro modelers employ fudge factors to adjust their predictions with judgment.

Lucas took seriously the challenge of the behavioral approach to economics, deriving primarily from psychologists views of human behavior. He concedes that economic theory does not “usefully model the adaptive process by which subjects have themselves arrived at the decision rules they use.” He thinks of economics, which includes the assumption of rational behavior, as “studying decision rules that are steady states of some adaptive process, decision rules that are found to work over a range of situations and hence are no longer revised appreciably as more experience accumulates” (p. S402).

His explicit choice of battlefield is in the spirit of my comparative advantage discussion and indeed helped inspire it. I judge him the victor on this turf and suspect that most behavioralists would do so as well. Accepting Lucas’s formulation, there remains the question of defining likeness classes, situations in which the same forms of behavior should be employed. At my university, the dean normally sets faculty salaries—or so I assume. If a faculty member acts as a price taker when he or she is really in a negotiating situation, is he irrational, boundedly rational, maximizing given his psychological propensities, or merely buying relief from a minute of embarrassment by sacrificing an expected thousand dollars or two?

Lucas takes to the battle, having achieved many successes from such behavior in the past. He identifies a great range of areas where rational, steady-state behavior provides a sound explanation for important phenomena. His discussion of the quantity theory of money and the implied relationship between inflation and M1 growth under certain circumstances (see his fig. 1) is convincing, though it seems fair to point out that, if agents were merely boundedly rational with the same motivations, the pattern might be the same.⁸

Lucas observes that the quantity theory may fail during hyperinflations and concludes that this should “reinforce our view that figure 1 is an important confirmation of the quantity theory: the theory works well when it ‘ought’ to and fails when it ‘ought’ to as well” (p. S407). He invokes an analogy to Newton’s theory of gravitation as a special case of great usefulness. But wouldn’t Lucas have been even more pleased if the quantity theory worked even in extreme circumstances? And would we not think Newton’s mechanics more robust if they applied even when velocities were comparable to the speed of light?

Lucas ranges widely in marshaling evidence. He reports on experi-

8. Lucas, appropriately, is not troubled that any of a variety of adaptive menus might have led to this pattern as well, for the steady state reflects “rational” behavior. In this spirit, pigeons who consume according to demand theory reinforce the rational model.

ments with pigeons whose behavior converged to adhere to the weak axiom of consumer preference. We all know that nature optimizes, at least over the long run. Leaves turn to the light effectively; bumblebee economics is well established. The question is whether human beings can do as well in the much richer and more rapidly changing environment they confront. Experiments reveal that pigeons' brains can respond to information on the prices of nourishment. But if we found that pigeons gave insufficient pecks to "invest" to get a new, more generous control key to operate, would we therefore begin to worry about the adequacy of capital theory? And would we be concerned if in a choice of lotteries mice violated stochastic dominance?⁹

Lucas attacks the multiple-equilibrium problem head on and refutes a too common mode of attack on rational models, that is, the use of an adaptive model that singles out a particular equilibrium. Other adaptive schemes may lead to other equilibria; as Lucas observes; he then makes the important point that we need models that "genuinely single out a particular equilibrium as being of more substantive interest than the others" (p. S420–S421). Lucas concludes with an elegant, intriguing proposed experiment to determine how price expectations are formed in an overlapping-generation, finite-horizon model with two kinds of money, white chips for trading and blue chips for trading or eating. This experiment might provide the basis for a reputational bet between Arrow and Lucas, both concerned with models with multiple equilibria.¹⁰ But I suspect Arrow would not ante up since this is a battlefield constructed by Lucas. When the experiment is conducted, the results will probably support his side.

VI. Conclusion

The battle between rational and behavioral economics is likely to remain predominantly an effort to stake turf.¹¹ Little blood need be shed if, as I have suggested, the two schools operate in substantially different dimensions. But substantial progress will require spilled blood or at

9. There is the possibility that human beings have been too harsh on animals. See Griffin (1984) for an interesting speculative account.

10. See Hofstee (1984). With most proposed reputational bets, one side can intuit what will happen. The other, understanding the Arrow article better than most investors, knows enough not to bet. Three criteria for a reputational bet are (1) neither side knows the answer, (2) the matter is important, and (3) both sides will accept. Given the multiple-battlefields problem, it would be pleasing, though surprising, if the two sides could agree on reputational bets.

11. We should not lose track of the sibling rivalry nature of this struggle. When someone outside the economics family ventures in—say, to propose the use of price controls in an oil shortage—we are likely to close ranks. Whether we are rational, boundedly rational, or adaptive, we still believe in elasticity of demand. Maybe we can even learn to divorce the rationality debate from our views on how well the market performs.

least bumped noses. Success will mean that we can systematically employ our understanding of psychology to make nonobvious predictions about behavior in a range of problems of economic import.

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