On Behavioral-Environmental Economics

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Introduction

This article examines how behavioral economics might advance the science of environmental and resource economics. Behavioral economics explores, catalogues, and rationalizes systematic deviations from rational choice theory. Mullainathan and Thaler (2000) have distilled these deviations or limits on human behavior down to three general categories: bounded rationality, bounded willpower, and bounded self-interest. Based on Simon’s (1957) ideas, bounded rationality implies that people do not have unlimited abilities to process all the information needed to make rational choices. Rather, they have inherent behavioral biases and use rules of thumb and shortcuts to make decisions (Mazzotta and Opaluch 1995). Bounded willpower reflects the idea that people lack self-control sometimes—we consume too much, save too little, make rash decisions, procrastinate, and so on. Bounded self-interest captures the other face of Adam Smith—that people can be selfless. People are concerned about other people too (Bergstrom 1989; Smith 1998). They have social preferences for emotive ideas like reciprocity, altruism, paternalism, and aversion to inequality.

In contrast to the argument that the formalism of rational choice theory provides the “necessary fiction” for guiding decisions, behavioral economists continue to strive toward reintroducing more psychology into economics (see Rabin 1998; Sent 2004). Some researchers have gone a step further to develop the so-called neuroeconomics—the study of brain imaging during decision-making—to gain more insight into the biological and psychological underpinnings of behavior (see, for example, Weber et al. 2007). They work to categorize and catalog the ever-expanding list of deviations from rational choice theory. Examples of anomalous behavior are numerous, including the status quo bias and endowment effect, loss

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aversion, framing effects, anchoring, preference reversals, the willingness-to-accept (WTA) willingness-to-pay (WTP) gap, self-control, time inconsistency, and coherent arbitrariness.\footnote{An endowment effect suggests people become overly attached to some goods; loss aversion is when people are risk averse for potential gains, but risk seeking for potential losses; framing effects suggest that how a question is asked matters as much as what question is asked; anchoring implies that people lock on to the external prices or information given to them; time inconsistency implies that people make a choice today about tomorrow, but when tomorrow comes, they change their minds; and coherent arbitrariness means people will focus on an arbitrary starting point, but will then make coherent choices. See McFadden (1999) for more explanation.} McFadden (1999) provides a useful catalogue of these and other biases. While appreciating that all economics is about “behavior,” this area of behavioral economics identifies and rationalizes empirical pattern recognition to help challenge existing ideas of rational choice and guide the foundations of new theories of choice (see Starmer 2000).

The field of behavioral economics has developed its own taxonomy of behavioral biases and general rules of thumb that we group together for rhetorical ease as \textit{behavioral failures}. We use the term \textit{behavioral failures} to parallel the familiar idea of market failures. For our discussion, behavioral failure means a person fails to behave as predicted by rational choice theory. A behavioral failure is also referred to as an anomaly, paradox, bias, heuristic misperception, fallacy, illusion, or paradigm.

Using recent research as illustrative examples, this article explores four questions concerning behavioral failures and environmental economics. First, how can behavioral failures affect thinking about environmental policy? Second, when are behavioral failures relevant to the science of environmental and resource economics? Third, is behavioral failure just another form of market failure? And lastly, our most speculative question, do we have a new behavioral-environmental second-best problem?

We address these four questions within the following context. When thinking about protecting nature, environmental economics has traditionally focused on the idea that market failure is the critical source of economic inefficiency (see Arrow 1969). More specifically, without well-defined property rights and well-functioning exchange institutions that move goods and services from low- to high-value uses, a society’s ability to allocate resources efficiently is constrained. Environmental market failure is grouped into the taxonomy of externalities, nonrival goods, nonexcludable benefits and costs, nonconvexities, and asymmetric information. Economists use this taxonomy to design and evaluate policies for environmental protection, which include collective sharing rules, Pigovian taxes, marketable permits, liability rules, and mechanism designs (see, e.g., Kolstad 1999).

The idea that economic theory can reverse market failure through the creation of new markets or market-like incentives rests on the presumption of rational behavior—that people facing these new incentives will act with purpose and make consistent choices that take into account the consequences of their choices. But relying on rational choice theory to guide environmental policy makes sense only if people make, or act as if they make, consistent and systematic choices. Here lies the rub. Numerous empirical studies over the last four decades reveal that rational choice might, in some circumstances, be a poor guide for economics in general, and for environmental economics in particular (see Tversky and Kahneman 2000). The problem is that rationality in economics is a social construct based on active market exchange, not an individual construct based on isolated introspection (Arrow...
Assuming rational behavior for environmental policy decisions may be problematic because nature’s goods and services frequently lack the active market-like arbitration needed to encourage consistent choice (Crocker, Shogren, and Turner 1998). So-called “anomalous behavior” may arise in private and public decisions, undercutting the rational underpinning of environmental policy.

Using their persistent rhetoric, behavioral economists continue to point out the limits to human nature, both in scholarly articles and now in popular books, e.g., The Economic Naturalist; Why Smart People Make Big Money Mistakes; Why Smart People Do Dumb Things; How We Know What Isn’t So; Decision Traps. As noted by Vernon Smith (2003), however, behavioral failure is about looking for and finding unexpected behavior out in the tails of the distribution of rational behavior. How fat or thin these behavioral distribution tails actually are remains the most contentious aspect of the debate about how much we need to change current practices and methods in economics, environmental and otherwise.

**How Can Behavioral Economics Affect Thinking about Environmental Policy?**

Some researchers in environmental economics have always been interested in what behavioral economics has to say about economic decisions relevant to environmental policy. For instance, read Kahneman’s (1986) comments on the state of the art of contingent valuation from two decades ago; the public goods experiments run by Brookshire, Coursey, and Schulze (1990); work on behavior and the Coase theorem by Hoffman and Spitzer (1982) and Harrison and McKee (1985); or the earlier work of Bohm (1972) on the behavioral regularities in alternative institutions to elicit values for public goods. But this research is the exception, not the rule. Models of agent behavior in environmental and resource applications have almost universally conformed with the standard neoclassical framework. Jack Knetsch has long advocated for more behavioral economics in environmental economics. A decade ago, Knetsch (1997, p. 209) argued that “in view of the evidence, the seemingly quite deliberate avoidance of any accounting of these [behavioral] findings in the design of environmental policy or in debates over environmental values, does not appear to be the most productive means to improvement.”

Economists who criticize behavioral economics argue that people can learn to be rational from a combination of market forces and evolution. The common view is that the market is more rational than the individual, and makes better allocation decisions concerning what people should specialize in and where resources should go. To illustrate this common market-orientated perspective, consider Nobel laureate Gary Becker’s opinion about behavioral economics and the experimental methods used for pattern recognition. Becker notes that “there is a heck of a difference between demonstrating something in a laboratory, in experiments, even highly sophisticated experiments, and showing that they are important in the marketplace. Economists have a theory of behavior in markets, not in labs, and the relevant theories can be very different. One reason is the division of labor in markets. . . . . I am dubious about behavior that won’t survive in an exchange economy with an extensive division of labor” (Becker 2002).
A behavioral economist’s response to this market-oriented criticism is to point out that the strict market-like arbitrage necessary to motivate more rational behavior and the ideal division of labor do not always exist for many genuine economic decisions. This observation holds with greater force for environmental goods and services in which direct exchange within active market institutions usually does not exist. The needed markets are missing—which is why we need environmental economics in the first place. In cases of missing markets, or constructed markets, it becomes possible for behavioral failures to affect policy outcomes. To illustrate this point, we discuss four examples where behavioral failures may well affect the way researchers and decision-makers think about environmental policy: nonmarket valuation, risk, conflict/cooperation, and control.

Non-Market Valuation

Behavioral economics has probably had the biggest impact on environmental economics through research on the nonmarket valuation for environmental goods. Here, behavioral and environmental economists have documented empirical deviations between theory and behavior. This work has chipped away at the idea that rational choice theory and welfare economics should remain the unchallenged analytical foundation for environmental valuation. People sometimes do not seem as if they have core preferences for the environment, or that they can articulate these into consistent monetary values. If people do not follow rational choice theory, and instead state values that are momentary declarations, one becomes concerned that preferences and stated values are transient artifacts of context, which undercuts the whole foundation of rational valuation.

The longest and the most visible research in this area concerns the oft-found disparity between the willingness-to-pay (WTP) and the willingness-to-accept (WTA) compensation measures of economic value. With small income effects and many available substitutes, the willingness to pay for a commodity and the willingness to accept compensation to sell the same commodity should be about equal. But evidence suggests a significant gap can exist between WTP and WTA, which the behavioral economics literature has argued could be due to a fundamental endowment effect (Knetsch and Sinden 1984; Knetsch 1989).

An endowment effect exists when people are more eager to retain something that they already own than to acquire something new (e.g., when people offer to sell a commonly available good in their possession at a substantially higher rate than they will pay for the identical good when it is not in their possession). One experiment run by Knetsch (1989) gave half of the participants a candy bar and the other half a coffee mug of approximately the same value. Subjects were then offered the opportunity to trade for the other commodity. Preferences for the mug over the candy bar varied from 10 to 89 percent, depending purely on which commodity the person was given first (also see Borges and Knetsch 1998). Kahneman, Knetsch, and Thaler (1990) further argue that the endowment effect explains why WTP diverges from WTA. They conduct experiments using an incentive-compatible auction mechanism where each individual can do no better than to reveal his/her true value for a good. Their results make a case for the existence of the endowment effect—WTA exceeded WTP in all treatments over all iterations. People’s preferences seemed to depend on their initial endowments of resources.
If revealed preferences are context-dependent, then the core of benefit-cost analysis is on shaky ground (see Kahneman and Knetsch 1992 and Tversky and Simonson 1993). But until researchers offer up a viable theoretical alternative to welfare economics, others will continue to rely on rational choice as the benchmark to guide benefit-cost analyses. Interested readers should consult the recent work of Sugden (2005), who defines a benefit-cost framework that is immune from preference anomalies. He relaxes the presumption of coherent and consistent preferences and replaces it with a weaker assumption of price sensitivity as the way to measure economic surplus (i.e., buyers prefer to pay less money than more; sellers prefer to receive more money than less). But whether one can operationalize this new framework for environmental and resource questions remains unresolved.

Not surprisingly, this behavioral challenge to fundamental welfare theory triggered many responses over the last two decades. Coursey, Hovis, and Schulze (1987) argued that the WTA-WTP gap was an illusion that will disappear with repeated experience with market exchange mechanisms. This market-driven rationality idea was supported by Shogren et al. (1994, 2001), who compared stated values with repeated market interactions. Loomes, Starmer, and Sugden (2003) have an alternative view and argue that seemingly rational bidders are actually using a behavioral rule of thumb in that they are “anchoring” on the posted price such that they are being led by the nose, so to speak. This is not inconsistent with the idea that people learn to be rational with market experience. Plott and Zeiler (2005a, b) take this argument a step further. They contend that the endowment effect can be turned on and off, depending on which experimental protocols are used. They contend that the WTA-WTP gap is less about a fundamental bias than about a subject’s misunderstanding of the valuation task. They run a series of experiments with alternative protocols to illustrate how it is possible for poorly understood experimental procedures to be confounded with fundamental behavioral biases (also see Braga and Starmer 2005).

Other behavioral anomalies that could affect nonmarket valuation (e.g., preference reversals, ambiguity aversion, anchoring) have been discussed in the literature (see Shogren 2006a or Flachaire and Hollard 2007 for more discussion). The debate, however, about whether researchers should be concerned about preference anomalies in nonmarket valuation is far from over. Moreover, among the topics studied by environmental and resource economists, behavioral economics may very well have the greatest implications for stated preference valuation research, where individuals are typically asked to make judgments and report economic values in isolated, unfamiliar decision situations.

**Choice under Risk**

Since nearly all environmental policy can be defined as a lottery, the second example focuses on choice under risk. No environmental policy makes an outcome happen with certainty, rather, it substitutes a baseline lottery for another lottery, hopefully with better odds of good health and a clean environment. Policy-as-lottery implies people think about a combination of probabilities and consequences that define the risks to human and environmental health. Researchers need to better understand how people react to the baseline lottery and how they respond to changes from this baseline due to private and collective risk reduction investments.

The expected utility model is the basis for many environmental economists’ thinking about how to value and control risks to health and nature. In contrast, behavioral economists
have provided substantial evidence to suggest that expected utility might not be the best model to guide good environmental risk policy. A good example of behavioral failure is when an outcome is potentially very bad, but the probability of its realization is low, i.e., climate induced shift in the Gulf Stream. Experience tells people little about how to react to these low-probability, high-consequence risks. Behavioral studies reveal that people tend to overestimate the chance they might suffer from such a risk, or they seem to have loss aversion—they tend to deal differently with potential losses than with equivalent gains. Here, a descriptive model might be a better guide to behavior than expected utility.

To illustrate, consider Mason et al.'s (2005) experiment designed to test the behavioral accuracy of the expected utility model over low-probability/high-loss scenarios such as those found in environmental policy. These experiments ask people to make choices between a pair of risky lotteries defined over potential losses. Mason et al.'s results support the behavioral economics literature, finding that for risks in which the probabilities of both the best and worst outcomes are relatively small, expected utility theory performed poorly. Their results suggest that policy based on expected benefits and costs could underestimate the real WTP to reduce environmental risk.

Incorporation of nonexpected utility models into the environmental economics literature has been relatively slow (see Shaw and Woodward 2007). One example is Ranjan and Shogren (2006), who construct a behavioral model to explain the sluggish development of water markets. Farmers have been reluctant to participate in water markets because they fear that their participation today will lead to a loss of water rights to urban users tomorrow. A farmer assigns greater weight to low probabilities of future water rights loss and lower weights to high probabilities. Their results suggest that subjective weighting of probabilities leads to discounting of resources when farmers overestimate probabilities of loss. When farmers have idiosyncratic time preferences, total water supply in the market depends on the level of heterogeneity in the population.

The next question then is whether misestimation of value or behavioral outcomes due to mismodeling of preferences is significant enough to change policy decisions. If people act as if they have a nonexpected-value utility function, can the expected utility still be close enough if the predictions fall within a reasonable approximation error? But this immediately leads to the next thorny behavioral question—do people form coherent beliefs over uncertain events, so we can define a probabilistic threshold to separate a reasonable from an unreasonable error (see, for example, Grether 1980)? These are underexplored questions.

Environmental Conflict and Cooperation

The third example considers the role of behavioral game theory for environmental conflict and cooperation. Game theory has been the breakthrough method for exploring likely equilibrium outcomes when two or more groups have strategic interactions. The behavioral economics literature has found that people frequently violate game theory assumptions (see Camerer 2003). First, people do not always perceive the game clearly and consistently. Evidence suggests that people's behavior changes when the description of the game changes, even though outcomes do not change. Second, the literature suggests that players are overconfident about their own relative skill. In addition, strategic reasoning principles that underpin game theory seem to be irrelevant to the average person.
Behavioral economics has advocated looking for a more pragmatic approach to environmental conflict policy that takes observed behavior, rational or otherwise, and reconstructs incentives to improve the efficiency of some program. To illustrate, consider the behavioral economics discussion of conflict in common property or public good games (see Ledyard 1995; Ostrom 2006). International environmental treaties between sovereign nations frequently suffer from weak enforcement and nonbinding voting rules, e.g., the Kyoto Protocol for climate change. Under rational game theory, free riding should dominate the behavior of the people in the group because there is no punishment for deviation. Evidence suggests that one can introduce an enforcement regime that emerges endogenously from the participants themselves (see Ostrom, Walker, and Gardner 1994). But the problem here is that endogenous enforcement is costly to each person. A person who chooses to punish a violator bears all the marginal costs himself, but earns only a fraction of the marginal benefits, which are shared throughout the group. No one individual should be willing to expend his own resources to punish violators, since his net benefits at the margin are negative.

Behavioral research has revealed that such people—the willing punishers—do exist in experimental settings, along with rational egoists and conditional cooperators (those who initiate cooperation when they expect others to reciprocate). These willing punishers will pick up the tab to punish violators even though they know they will not recoup all the benefits of their actions. By “taking one for the team,” they can increase the overall efficiency of the institution designed to reduce the costs of noncooperative behavior. Fehr and Gächter (2000) observed that cooperation rates increased when the willing punishers could police the collective. The simple threat to punish was enough to coerce others to cooperate. For example, Kroll, Cherry, and Shogren (2007) created a nonbinding voting public goods game with and without punishment. They found that willing punishers seem to drive the other players to increase their contributions, leading to increased cooperation and greater social efficiency. Including behavioral factors in institutional design suggests that one can correct for a global public goods problem more effectively by accounting for the behavioral failure of these willing punishers (also see Noussair and Tucker 2005).

Resolving environmental conflict frequently requires researchers to understand how people cooperate and negotiate a solution. Some people see collaboration as the future of environmental policy. The effectiveness of collaboration can be facilitated by a better understanding of the Coase theorem and transaction costs (Coase 1960). The Coase theorem says that disputing parties will bargain until they reach an efficient private agreement, regardless of which party initially holds the unilateral property rights. As long as these legal entitlements can be freely exchanged and transaction costs are zero, government intervention is relegated to designating and enforcing well-defined property rights. But Coase was not promoting a world of zero transaction costs. Instead, Coase said that since a zero-transaction-costs world does not exist, we need to study the world that does exist—the one with transaction costs. A behavioral economist might say we also need to study the world of cognitive bounds (see Sunstein 2000).

Policy-makers should be interested in how different bargaining rules and protocols affect behavior and outcomes. Concerning environmental collaboration, behavioral economics has explored how rules affect or are affected by bounded self-interest (entitlements and fairness) and bounded rationality (endowment effects; self-serving bias leading to an impasse). The first behavioral-style paper exploring the Coase theorem
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(Hoffman and Spitzer 1982) observed efficient outcomes, but found that bargainers were rather selfless, splitting outcomes equally rather than rationally. This suggested that other-regarding, or altruistic, behavior was affected by the institutional context of policy. In response, Harrison and McKee (1985) revisited the design, and showed that a person’s selflessness could be manipulated by the order in which he or she was exposed to property right structures. Because bargainers who are first asked to bargain without property rights grasp the legitimate nature of unilateral property rights, these bargains were both efficient and mutually advantageous.

Since then, behavioral economics has, with limited success, pushed bargaining models to the limit in an effort to isolate and identify selfless versus selfish behavior in bargaining games. The Dictator game is the extreme example of a bargaining game. Self-interested strategic behavior is controlled by giving a person complete control over the distribution of wealth. While theory predicts that people with complete control will offer up nothing to others, Hoffman, McCabe, and Smith (1996) found that they still share the wealth in about 40 percent of the observed bargains. Such other-regarding choice is another example of behavior that differs from what is predicted by standard game theory models. The results in Cherry, Frykblom, and Shogren (2002), however, suggest other-regarding behavior arises from strategic concerns, not altruism.

Using Mechanism Design to Control for Market Failure

The final example considers how behavioral failure can affect mechanism design to control for market failure. Mechanism design imposes constraints on individual rationality, and assumes rational responses to incentive-based menus (see, e.g., Bénabou and Tirole 2003). But as discussed throughout this article, people do not always react as predicted if their rationality and willpower are bounded. The general economics literature contains a few attempts to account for such behavioral failures in mechanism design. Esteban and Miyagawa (2006) construct a mechanism in which a person suffers from self-control problems and temptation. Within this mechanism, this person prefers to choose from a smaller rather than a larger menu, even if the tempting alternatives are off the equilibrium path. This smaller-is-better finding also emerges in Gruber and Mullainathan (2005), who argue that US and Canadian smokers are happier with higher cigarette taxes. Another example is Aronsson and Thunström (2006), who construct an optimal tax-subsidy scheme for people who suffer from self-control problems that lead to obesity and poor health (also see the optimal sin tax discussion in O’Donoghue and Rabin 2006).

Few such examples exist in the environmental literature. One exception is Johansson (1997), who considers how bounded selfishness—altruism—affects the design of a Pigovian tax. In general, he finds that the existence of altruism itself is insufficient to generate a lower Pigovian tax. Another exception is Löfgren’s (2003) work on optimal green taxation given addictive behavior, rational and otherwise. Using the theory of rational addiction, she considers how myopic and time-inconsistent addictive behavior might affect the design of an optimal environmental tax, given that consumption of the addictive good causes a harmful externality (e.g., car driving releases pollution). Her results suggest that the optimal environmental tax should exceed the standard Pigovian tax.
Interestingly, we found no papers (as of September 2007) that examine the existence or implications of behavioral failure within a marketable permit system. This may be because we did not look hard enough or because no one has written much about it; or, potentially more fascinating, it may be because the tradable permit mechanism designed to correct market failure also works to correct behavioral failure. We will return to this point.

When Are Behavioral Failures Relevant?

The previous examples illustrate why behavioral economics could well play a bigger role in how we think about environmental and resource economics. This conclusion, however, has not been accepted by all researchers. For instance, Rubinstein (2006) and Harrison (2005) provide biting assessments of the power and science that underlie many of the popular works in behavioral economics. They warn readers new to the field to read the literature more critically and to look out for the selling (or overselling) of scientific ideas, experimental control (or lack of it), the match (or mismatch) of theory and design, the muddling of concepts and terms, and the lack of critical peer oversight.

But the issue is not whether behavioral failure exists; it does. Rather, the issue is whether such behavioral failures exist only in the tails of the distribution, or whether these failures are robust to institutional designs and result in nontrivial deviations from efficiency (see Smith 1991, 2003). The key is to separate anecdotes from systematic behavior, and to understand the context of market experience and exchange institutions, which serve to push behavior more toward the “Homo Economicus” fiction we assume in our models. Before environmental economists sign up for the behavioralist union card, researchers should ask two related questions: Are these behavioral failures relevant to the markets of interest? Are these behavioral failures relevant to the policies prescribed to correct for missing markets?

Robustness and Order of Importance

When defining relevance, there are two issues one must consider—robustness and order of importance. First, an anomaly is relevant if it remains robust to the environment(s) of interest. An anomaly may be consistently observed in laboratory or field experiments, but this does not imply it will be robust to naturally occurring contexts of interest. There will always be a question about whether the constructed environment is sufficiently rich to elicit behavior that is consistent with what would be expressed in natural economic environments with real economic commitments. Empirical testing and observation from naturally occurring situations and data are necessary to establish relevance. We recognize this is not an easy charge, but it is a necessary condition to fully understand the relevance of any behavioral bias to economic phenomena.

Consider, for example, the case of altruistic behavior, which has been explored within a laboratory context for over thirty years (e.g., Guth, Schmittberger, and Schwarze 1982; Hoffman and Spitzer 1982). A recent study by Laury and Taylor (2006) suggests that even if altruistic behavior is observed in the lab, one cannot necessarily use it to predict behavior in naturally occurring environments. Laury and Taylor explored whether the selfless behavior in the lab would spill over to how people made contributions to a real public good. They
found that purely selfish players (zero contributions) were less likely to give to the naturally occurring public good. But, using their measure of altruism, they could not predict with any degree of confidence the other subjects’ level of contributions toward the naturally occurring public good.

Even if an anomaly is robust to policy-relevant environments, the next question is whether the phenomenon is of first-order or second-order importance. An anomaly must be nontrivial to be relevant for policy-making. An anomaly can be defined as nontrivial if it results in identifiable and significant reallocation of resources compared to the economic outcome that would occur without the anomalous behavior. If there is no detectable change in resource allocation due to a behavioral bias on the part of any agents involved, then the bias is irrelevant. But efficiency losses need not occur for a bias to be relevant. The comparison to a “bias-free” counterfactual may be of interest for equity, fairness, or other social concerns.

Identifying Relevant Anomalies

Identification of a relevant anomaly is a nontrivial task in itself. No single experiment or empirical paper can accomplish such a task; this is a long-term exercise based on replication across alternative contexts. Recall the idea of inductive inference, and Platt’s (1964, p. 347) description of a strong inference approach to scientific inquiry:

Strong inference consists of applying the following steps to every problem in science, formally, explicitly, and regularly:

1. Devising alternative hypotheses.
2. Devising a crucial experiment (or several of them), with alternative possible outcomes, each of which will, as nearly as possible, exclude one or more of the hypotheses.
3. Carrying out the experiment so as to get a clean result. Recycling the procedure, making subhypotheses or sequential hypotheses to refine the possibilities that remain; and so on.

Why restate a classic of modern hypothesis testing? Because much criticism within the profession has been aimed at the behavioral economics literature (and vice versa) with a seeming “you’re with us, or you’re against us” mentality (e.g., see Rubenstein 2006). This is certainly not new in economics or scientific inquiry. Again, Platt (1964) offers this insight (p. 146): “The conflict and exclusion of alternatives that is necessary to sharp inductive inference has been all too often a conflict between men, each with his single Ruling Theory.” He also offers this solution:

But whenever each man begins to have multiple working hypotheses, it becomes purely a conflict between ideas. It becomes much easier then for each of us to aim every day at conclusive disproofs – at strong inference – without either reluctance or combativeness.

A comparison can be made to the classic case of the perfect-price discriminating monopoly in which no loss in market efficiency occurs. This market structure is of interest, and has important normative concerns, even if it does not result in an efficiency loss.
If a research program is to become convincing evidence of the relevance of behavioral anomalies for naturally occurring economic phenomena, particularly for environmental and resource economics problems, it should begin with a strong inference approach. Vigilant hypothesis design, experimentation, and empirical investigation will move the field forward and reduce the number of studies reporting results that fail to reject a just so story.3

A key feature of social science research is that convincing evidence is only secured when we include empirical evidence from the naturally occurring world. Laboratory or field experiments alone cannot establish the relevance of a behavioral bias. They may strongly indicate relevance as the body of evidence grows, but such experiments are unlikely to stand on their own without empirical investigation. Within a market context, the work by DellaVigna and Malmendier (2004) is an example of research that seeks nonexperimental evidence of behavioral biases. They approach the question of behavioral biases from a background in contract theory. Their opening paragraph reiterates these points:

A growing body of laboratory and field evidence documents deviations from standard preferences and biases in decision-making. If deviations are systematic and persistent, profit-maximizing firms should respond to them and tailor their contracts and pricing schemes in response. (DellaVigna and Malmendier, p. 354).

They further note (p. 357) that “[t]he design of contracts is a key test for the relevance of deviations. Firms would not respond to consumer deviations that are not systematic or limited to small stakes.” DellaVigna and Malmendier develop a model of firm behavior in a market in which firms are assumed to be rational, and consumers are assumed to be time-inconsistent. Their model leads to competing hypotheses regarding a firm’s optimal contract design when consumers are time-inconsistent (and who are naïve about their time inconsistency) versus when they are time-consistent. While their empirical testing is more anecdotal than formal, their overall approach is the most important message—if behavioral biases are relevant, evidence in naturally occurring contexts should be discernable.

The search for relevance within the context of environmental and resource economics places a substantial burden on researchers, but it is a challenge that must be met before existing tools and prescriptions are discarded. DellaVigna and Malmendier had the luxury of looking at well-developed, naturally occurring markets for common private goods (credit cards, cellular phones, health clubs). But resource and environmental economists rarely have such luxury. Problems of interest typically involve missing markets and diffuse, largely undocumented economic behaviors. The effects of policy intervention on these diffuse economic activities are difficult to test using naturally occurring data, and constructed markets may lead to erroneous conclusions.

Most experimental results presented in the literature do not have naturally occurring markets against which we can shine a light on experimental methods and results—including field experiments.4 This holds especially true for research on environmental and resource

3Playing off the title of Rudyard Kipling’s Just So Stories for Little Children, a “just so story” is a term used in social sciences to refer to narrative explanations about natural phenomena that are not falsifiable.

4An exception is a well-cited study by Gneezy and Rustichini (2000), who tested the deterrence hypothesis using a field experiment to examine changes in behavior after a fine is imposed. The authors
economics problems, in which by definition real markets are missing. The relevance of past and present laboratory and field experiments for environmental decision-making is not necessarily clear-cut; social context matters, institutional design matters, and economic circumstances matter.

**Is Behavioral Failure Market Failure in Disguise?**

The answer to this question depends on whom you ask. If repeated market experience pushes people toward more rational behavior, the answer is “yes”; if you believe that these behavioral failures are hardwired into our genetics, the answer is “no.” The issue is how behavioral failures and market failures affect each other. Market experience affects behavioral failure by focusing on poor choices with high opportunity costs; behavioral failure affects the creation of new markets if behavioral biases prevent policy-makers and people from realizing how to capture potential gains. Two circular questions arise in the context of environmental policy: Does market failure lead to behavioral failure, which leads to continued market failure? Does behavioral failure prevent the creation of new markets that would eliminate the behavioral failure?

People are not always isolated decision-makers—they make decisions within, outside, and alongside the markets and social rules that punish and reward rational and consistent decision-making (see Bowles 1998). This view argues that tests of rational behavior should not be separated from the interactive experience provided by an exchange institution. These institutions matter because they provide a social context that rewards or punishes rational or irrational choices. The institution makes rationality a social, rather than an individual, construct—a key condition that separates economic rules from psychological rules of thumb. As noted by Tversky and Kahneman (2000, p. 223): “[t]he claim that the market can be trusted to correct the effect of individual irrationalities cannot be made without supporting evidence, and the burden of specifying a plausible corrective mechanism should rest on those who make the claim.” In light of this perspective, researchers interested in environmental policy might want to think more about the power and the limits of the ideas of rationality spillovers and rationality crossovers.

Recent research shows that people quickly respond to the feedback and discipline of an active exchange institution by adjusting their behavior to more closely match rational choice theory (see, e.g., Chu and Chu 1990). Cherry, Crocker, and Shogren (2003) show that this result can extend beyond the exchange institution. They find that arbitrage increases rational behavior, and that it is not limited to the decisions within that institution, but spills over to

imposed a flat fine of about $2 per child on parents who picked up their children late from daycare centers in Israel and found that, contrary to predictions that might result from a standard deterrence model, late pickups actually increased after the fine was imposed. In contrast, we found that standard fines for late pickups at daycare centers in the southeastern United States are $1 to $2 per minute, per child, and that late pickups are infrequent events at these centers. While the Gneezy-Rustichini field experiment suggests that at some low prices, a perverse effect may arise, the bigger issue is whether those field experiment prices are relevant to naturally occurring and evolving markets.
parallel decisions that lack any discipline or exchange.\(^5\) Cherry and Shogren (2007) take the idea one step further and examine whether rationality crossovers exist—to what degree the arbitrage-induced rationality can cross over to different decisions. They find that rationality crossovers do exist, but not always.

From a rationality spillover perspective, behavioral failure is a form of market failure. That said, even if markets exist, arbitrage does not guarantee the elimination of all behavioral failures from all choices and all people. If a market does not exist, behavioral failure is not guaranteed either—some spillovers could occur via other markets. Understanding this better will impact how researchers think about the elicitation of individual preferences and values in isolated and undisciplined settings. Given that most environmental policy questions fall within this messy confluence of market choices and missing markets, we need to learn more about the power of market-like arbitrage to remove behavioral failures. Understanding the institutions and contexts when and where rationality emerges seems most relevant for environmental economics and policy.

**Do We Have a New Behavioral-Environmental Second-Best Problem?**

We conclude with a discussion of our most speculative question about the interaction between behavioral failure and market failure. Recall that the theory of second-best says if you have two imperfections, correcting only one failure does not guarantee that social welfare will increase. One could conjecture that if behavioral and market failures exist simultaneously for some environmental good or service, correcting one failure without correcting the other could actually reduce overall welfare. This argument could hold whether or not one believes behavioral failure is hardwired into our genetics.

Think for a minute about the challenges that would likely arise if environmental and resource policy had to be designed to simultaneously correct for both market failure and behavioral failure. In the world of *ex-ante* policy design, where natural experiments are prohibited and *ex-post* policy changes are difficult if not impossible in the near-term, constructing policies or markets that promote efficiency without consideration of relevant behavioral failures would likely result in inefficient outcomes. For example, if a policymaker introduces a Pigovian tax/subsidy to address climate change externalities without accounting for the fact that people overestimate low probability/high severity events, he could create a behaviorally ineffective tax that reduces total welfare. In theory, the policymaker might be able to resolve this problem by adjusting the tax to account for the probability weighting issue, which would generate a behavioral first best out of a market failure. But then he or she would need more information than is normally assumed about the representative person, i.e., what is the curvature of the probability weighting function.

\(^5\)Additional evidence supporting the idea of a rationality spillover is found in List (2004). While not referring to it as a rationality spillover, he finds that experienced sports card traders have fewer tendencies to exhibit the endowment effect for both sports cards and different goods like chocolates and mugs.
We find the idea of avoiding a behavioral second-best problem through creative incentive design to be a somewhat staggering proposition. Consider five sources of market failure commonly considered by resource and environmental economists: externalities, nonrival goods, nonexcludable goods, nonconvexities, and asymmetric information. Currently, well over twenty-five behavioral failures have been identified as relevant to economic decision-making. With only five sources of market failure, this means there are 125 possible failure-interactions, and this is only if the behavioral failures are all independent of each other.

Our question is this: would policies designed to affect each market failure also need to be differentiated to correct for each interactive behavioral failure? For example, when considering corrective policies for externality problems, might we also have to correct for loss aversion (i.e., people are risk averse for potential gains, and risk seeking for potential losses)? Perhaps this would be doable by redesigning our marketable permit system or the Pigovian tax. But that is only part of the story. What if our agent also suffers from coherent arbitrariness by anchoring on a random point and then acting relatively rationally? Now the Pigovian tax needs to account for both behavioral failures. But what if our agent is also prone to reversing preferences, is time-inconsistent, or exhibits other behavioral failures?

Moreover, our previous discussion assumes that there is some form of separability across these behavioral failures—that we can correct for each one independently within each market failure context. But what if there is some behavioral complementarity or substitutability across these biases? Do economists know whether the marginal impact of loss aversion is attenuated or accentuated by an increase in the degree of coherent arbitrariness? Or whether the incremental effects of time inconsistency are increased with a greater tendency toward preference reversal? We have not seen these types of results documented in the economics literature because researchers usually focus on only one behavioral failure at a time. The preferred research strategy is to add the one degree of freedom needed to capture the behavior ignored by rational choice theory (Shogren 2006b). Granted, it is an excellent research strategy to start simple and add complexity, but for policy decisions, the separability assumption seems rather ad hoc. And if one works out the logic to the total number of behavioral failures thus far identified in the behavioral literature, there are thousands of potential interactions between biases to be explored. Would we need behaviorally differentiated taxes, with each tax targeted to each agent’s particular failing? If so, the sheer magnitude of the task implies policy impasse. Policy-makers might be able to reduce the number of relevant interactive biases based on ex-ante intuition, but these choices would still be subject to ex-post evaluation. Or researchers might be able to reduce the number of relevant biases by identifying irrelevant behavioral failures, in which case policy design might become more tractable.

Our arguments might not convince the reader to completely rethink economic analysis on account of the identified behavioral-environmental second-best problem. But analysts should be aware of instances in which the evidence points to a problem, and they should rigorously address these realities to advance the science of economics. Considering all possible simultaneous behavioral-market failure combinations in ex-ante policy design is surely too costly to undertake in meaningful policy settings. This suggests the use of adaptive regulatory schemes in which policy-makers adjust market-failure regulation for behavioral failures that may arise. Researchers need to explore options for flexible
institutional design that could be used to account for key failures—market, behavioral, or both. Perhaps this is all pointing to marketable permits as the best institution to avoid the behavioral second-best problem in environmental policy. Marketable permit systems, provided they are active exchange institutions, could be the most effective behavioral disciplining device, or at a minimum, the institutional design least affected by behavioral failures.

Conclusions

In some settings, individuals make isolated choices that are not accountable to others. If there are no consequences, an individual can change risk attitudes at will, reverse his or her choices on a whim, or make seemingly random choices based on unobservable fancy. In such cases, rational choice assertions about how people behave seem less relevant. Rational choice theory does not describe or predict such inconsistent behavior for environmental goods and services. Here, the standard model is simply “too thin” because it implicitly assumes individual decisions are being made within some (nonexistent) market that is making its own rational allocation and specialization decisions. As discussed earlier, environmental and resource economics may suffer if it relies on the standard model, since the model does not address the behavioral failures of human nature that are no longer attenuated by a well-functioning market.

Behavioral failures have prompted some researchers to argue that government intervention can be justified beyond the standard market failure motivation. The argument goes that government intervention in private decision-making is justified—even in a full functioning market—when people know what is good for them, but still cannot make those “correct” choices. This new form of intervention has been called soft paternalism, libertarian paternalism, or paternalism for conservatives (see Thaler and Sunstein 2003). This new paternalism captures the notion that people need sin taxes and outright bans to protect themselves from their own self-destructive biases and lack of self-control. If this new paternalism has merit, environmental policy-makers will have to consider how the taxonomy of behavioral failures might affect the design of efficiency-promoting rules and regulations. This means that environmental policy-makers might have to think about correcting for both market failure and behavioral failure, and doing so simultaneously.

Environmental economics has a long history of developing solutions to market failures. To the credit of environmental policy over the past 40 years, its focus on markets and market incentives is likely to attenuate the problems behavioral failure might present in the environmental policy process. That said, environmental and resource economics still must address questions of environmental lotteries, environmental valuation, and decisions made outside the confines of repeated market interactions. In these contexts, behavioral failures

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6The soft paternalism idea has not gained widespread acceptance among most economists. Smith (2007), for instance, offers a skeptical account of a paternalistic approach to guiding individual decision-making when the person is deemed incapable of improving his own welfare due to a behavioral failure. Who decides what choices are actually welfare improving for individuals? Experts? Policy-makers? And who says these people or groups are not without their own set of behavioral limitations—workaholism, procrastination, myopia, and so on?
might lead to inefficient policy design. The first step must be identifying those behavioral failures that are the most relevant for environmental policy. With the relevance of behavioral anomalies identified, or at least given a preponderance of evidential support, the search for solutions should begin in earnest.

While we applaud the challenge that behavioral economics presents to the economist’s modeling norm, we conclude that the evidence from behavioral economics remains insufficient to support the wholesale rejection of rational choice theory within environmental and resource economics. This does not mean, however, that anomalous behavior is nonexistent; as discussed above, nature’s goods and services frequently lack the active market-like arbitrage needed to encourage consistent and rational choice. We believe it is crucial to identify the economic circumstances, institutional designs, and social contexts in which rational choice theory works and those where it fails to capture observed behavior. Explicitly incorporating the idea of behavioral failures into the research agenda for environmental policy seems like a step worth pursuing, if only to rule some of them out as second-order effects. We also urge the reader to keep open a cautious eye—critical review of new evidence is necessary and the evidence should be germane to the questions and the policy contexts that resource and environmental economists think about.

References


Abstract

Traditional environmental and resource economics uses rational choice theory to guide the evaluation of alternative policy options to correct market failure. Behavioral economics, however, has challenged this conventional mindset by showing how people frequently make choices and state values that deviate from the presumption of rationality, i.e., behavioral failures. This article explores the potential of behavioral economics to advance the science of environmental and resource economics. We address four questions: (1) How can behavioral failures affect thinking about environmental policy? (2) When are behavioral failures relevant to the science of environmental economics? (3) Is behavioral failure just another form of market failure? (4) Do we have a new behavioral-environmental second best problem? We conclude that the evidence from behavioral economics remains insufficient to support the wholesale rejection of rational choice theory within environmental and resource economics. But this does not mean anomalous behavior is non-existent; nature’s goods and services frequently lack the active market-like arbitrage needed to encourage consistent and rational choice. We believe it is crucial to identify the economic circumstances, institutional designs, and social contexts in which rational choice theory works and those where it fails to capture observed behavior. (JEL: Q5, C9)