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WITH BOUNDEDLY RATIONAL ACTORS

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Abstract

This essay, prepared for *The Law and Economics of Irrational Behavior* (Francesco Parisi and Vernon Smith eds., 2004), examines implications of bounded rationality for traditional economic analysis of public law enforcement. A brief application to the enforcement of employment discrimination laws by public agents is offered.

^{*} Professor of Law, Harvard Law School. Thanks to Louis Kaplow, Steven Shavell, and Cass Sunstein for helpful discussions and suggestions.

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Christine Jolls

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[I]n deciding whether to double park, a resident of Econville will compare his benefit from double parking to the expected fine Therefore, to achieve optimal deterrence—that is, deterrence only of those double-parking violations in which the benefits are less than the [previously stipulated] \$10 congestion cost—it is necessary for the expected fine to equal \$10. ...

Given each possible expenditure on enforcement and the resulting probability of detection, the fine can be set so that the *expected* fine equals \$10. ... If detection is certain, then the fine should be \$10. If the probability of detection is .1, then a \$100 fine will result in a \$10 expected fine. And if the probability of detection is .001, a fine of \$10,000 is necessary to generate an expected fine of \$10. Thus, if the fine is set appropriately, the optimal deterrence of double-parking violations can be achieved with each expenditure on enforcement.

This observation immediately suggests what the efficient system of law enforcement is for Econville. Because optimal deterrence can be achieved with each expenditure on enforcement, there is no reason not to spend the least amount possible. In other words, the City Council should hire a part-time inspector for \$500 per year [previously stipulated to be the least amount possible], catch one out of every thousand double-parking violators, and fine each violator \$10,000. Because [the probability of detection is .001], the expected fine is \$10.¹

The potential parking violators in the foregoing account by A. Mitchell Polinsky, in his classic law and economics text, are assumed to calculate in a fully rational way the costs—given the probability of detection—and benefits of double parking and then to make fully optimal decisions about how to behave. Bounded rationality, by contrast, refers to the important limits that exist on human cognition.² As emphasized by the burgeoning literature in behavioral economics,

¹ A. Mitchell Polinsky, *An Introduction to Law and Economics* 77-78 (2d ed. 1989).

² Herbert A. Simon, *A Behavioral Model of Rational Choice*, 69 *Q.J. Econ.* 99 (1955).

“actors often taken short cuts in making decisions” and, as a result, make systematic errors in choosing their preferred courses of action.³

Bounded rationality may be understood as either a challenge or a complement to traditional economic analysis, which typically assumes unbounded rationality.⁴ Generally speaking, bounded rationality—together with other aspects of behavioral economics⁵—is more likely to be understood as a challenge to traditional economic analysis when that analysis produces questionable or implausible predictions or prescriptions, and is more likely to be understood as a complement to traditional economic analysis when that analysis produces predictions or prescriptions that seem sensible. Thus, for instance, behavioral economics is generally viewed as a challenge to traditional economic analysis in contexts in which traditional economic analysis predicts that sunk costs will not affect actors’ behavior (as empirical evidence strongly suggests they do affect actors’ behavior⁶); but behavioral economics is most naturally viewed as a complement to traditional economic analysis in thinking about the question whether workers will demand fully compensating wage differentials for unsafe workplace conditions, given that both imperfect information (from traditional economic analysis) and optimism bias (from behavioral economics, as described more fully below) suggest that they may not demand fully compensating wage differentials.

The same pattern of complementing versus challenging traditional economic analysis is true within behavioral law and economics, which involves the application of behavioral economics insights to legal topics.⁷ An important illustration of the pattern here involves the area of public law enforcement—how laws against behavior ranging from double parking (as in the excerpt above from Professor Polinsky’s text) to employment discrimination should be enforced by public agents. If traditional economic analysis of public law enforcement had rested at the point described in the Polinsky excerpt—prescribing that few parking tickets be issued to double-parkers and that a fine of \$10,000 be assessed on those unfortunate enough to be ticketed—then bounded rationality would probably be understood as a challenge to traditional economic analysis of public law enforcement. But because traditional economic analysis of public law enforcement has produced a large literature (as described more fully below) by

³ See Russell B. Korobkin & Thomas S. Ulen, *Law and Behavioral Science: Removing the Rationality Assumption from Law and Economics*, 88 *Calif. L. Rev.* 1051, 1075 (2000).

⁴ See Christine Jolls, Cass R. Sunstein & Richard Thaler, *A Behavioral Approach to Law and Economics*, 50 *Stan. L. Rev.* 1471, 1476 (1998).

⁵ See *id.* (describing behavioral economics in terms of bounded rationality, bounded willpower, and bounded self-interest).

⁶ See Hal R. Arkes & Catherine Blumer, *The Psychology of Sunk Cost*, 35 *Org. Behav. & Hum. Decision Processes* 124 (1985).

⁷ See generally Jolls, Sunstein & Thaler, *supra* note 4.

Professor Polinsky and others—a literature that pushes beyond the simple idea described in the excerpt from Polinsky’s introductory text—bounded rationality is most sensibly understood, I want to suggest in this chapter, as a complement rather than a challenge to traditional economic analysis of public law enforcement.

Section 1 below sketches the basic conception of bounded rationality used in this chapter. Section 2 offers an account of public law enforcement with boundedly rational agents and relates this account to traditional economic analysis of public law enforcement. Section 3 briefly applies the bounded rationality analysis offered here to the specific area of public enforcement of employment discrimination laws.

A definitional comment is important at the outset. The relationship between the concept of bounded rationality emphasized in this chapter and the basic idea of “irrationality”—the term that appears in the title of the book containing this chapter—is a difficult and contested one. The goal of this chapter is not to weigh in on that definitional issue, but instead to explore the implications of some empirically important forms of human behavior (however they are termed, but I refer to them here as “bounded rationality”) for the structure of public law enforcement. In invoking the idea of bounded rationality in this chapter, I mean to draw on the relatively well-established meaning of the term in the existing behavioral economics literature.⁸

1. A Brief Account of Bounded Rationality

According to Gary Becker, “[A]ll human behavior can be viewed as involving participants who maximize their utility from a stable set of preferences and accumulate an optimal amount of information and other inputs in a variety of markets.”⁹ Bounded rationality, in sharp contrast to this formulation, refers to “the obvious fact that human cognitive abilities are not infinite.”¹⁰ Human behavior exhibits a variety of errors or inconsistencies. While such errors or inconsistencies may often be adaptive, they nonetheless mean that behavior will deviate systematically from that predicted by the standard economic model of unbounded rationality.¹¹

⁸ Cf. Christine Jolls, Cass R. Sunstein & Richard Thaler, *Theories and Tropes: A Reply to Posner and Kelman*, 50 *Stan. L. Rev.* 1593, 1594 (1998) (suggesting an emphasis on “bounded rationality” over “irrationality”).

⁹ Gary S. Becker, *The Economic Approach to Human Behavior* 14 (1976).

¹⁰ Jolls, Sunstein & Thaler, *supra* note 4, at 1477.

¹¹ See *id.* at 1477-78.

One central aspect of bounded rationality involves what are often called judgment errors. Many (though not all) judgment errors concern biases in the estimation of probabilities; these are a major emphasis of this chapter.

A widely-studied example of a judgment error is optimism bias.¹² As documented in over 250 studies, people exhibit a strong tendency to underestimate the probability that negative events will happen to them as opposed to others.¹³ (Elsewhere I discuss the important question of the distinction between estimates that are below the average person's probability of a negative event and estimates that are below the average probability of that event; a majority of people could in fact correctly estimate that their probability is below the average probability of an event, but the usual benchmark for comparison is the average person's probability of an event.¹⁴) Examples of optimism bias range from estimates of the probability of getting a particular disease to estimates of the likelihood of getting fired from a job.¹⁵ At least in some contexts, the empirical evidence makes clear that optimism bias reflects not only underestimation of the probability of a negative event relative to the average person's probability of that event, but also underestimation of the probability of a negative event relative to the actual probability of that event.¹⁶

Like other forms of bounded rationality, optimism bias may often be adaptive (even though it may harm people in particular instances) because by thinking that things will turn out well for them, people may increase the chance that things actually will turn out well for them. Indeed, there is evidence that optimism bias tends to correlate with happiness, contentment, and the ability to engage in productive, creative work.¹⁷

A second well-known example of a judgment error is the way in which availability, or the ease with which a given event comes to individuals' minds, may affect probability estimates. In one experiment, for instance, individuals asked how many words in a four-page section of a novel end in "ing" gave much

¹² This paragraph draws on Christine Jolls, Behavioral Economic Analysis of Redistributive Legal Rules, 51 Vand. L. Rev. 1653, 1659-61 (1998).

¹³ See Neil D. Weinstein, Unrealistic Optimism About Future Life Events, 39 J. Personality & Soc. Psychol. 806 (1980); Neil D. Weinstein, Bibliography of Unrealistic Optimism Studies (unpublished, on file with the author).

¹⁴ See Jolls, *supra* note 12, at 1659 n.24.

¹⁵ See John P. Kirscht, Don P. Haefner, S. Stephen Kegeles, & Irwin M. Rosenstock, A National Study of Health Beliefs, 7 J. Health & Hum. Behav. 248, 250-51 (1966); Weinstein, Unrealistic Optimism About Future Life Events, *supra* note 13, at 809-12.

¹⁶ See Jolls, *supra* note 12, at 1660 (discussing studies).

¹⁷ See Shelley E. Taylor & Jonathan D. Brown, Illusion and Well-Being: A Social Psychological Perspective on Mental Health, 103 Psychol. Bull. 193 (1988).

larger estimates than individuals asked how many words have “n” as the second-to-last letter, despite the fact that obviously there are as a logical and factual matter more words satisfying the latter criterion than the former.¹⁸ More generally, the perceptions of boundedly rational actors about probabilities of uncertain events are heavily influenced by how available other instances of the event in question are. Parallel to the case of optimism bias, availability is likely to be adaptive (here because it will often reflect optimizing behavior for people with limited information), but it can lead to systematic errors in probability assessment.¹⁹

While the first major component of bounded rationality involves judgment errors, the second major component involves departures of decision making behavior from the precepts of expected utility theory. “[T]he axioms of expected utility theory characterize rational choice, [but] actual choices diverge in important ways from this model, as has been known since the early experiments by Allais and Ellsberg.”²⁰ In response to the limits of expected utility theory, more than two decades ago Daniel Kahneman and Amos Tversky pioneered an alternative decision making model known as prospect theory.²¹ According to prospect theory, people evaluate outcomes based on the change they represent from an initial reference point rather than based on the nature of the outcome itself.²² Moreover, a given change produces less reaction the further a decision maker already is from the decision maker’s reference point. Thus, for example, according to prospect theory the difference in value between losing \$100 and losing \$200 is greater than the difference in value between losing \$1100 and losing \$1200 (assuming a reference point of \$0)²³; this is precisely the opposite of what is implied by the concavity assumption routinely employed in expected utility theory.²⁴

Bounded rationality—embracing judgment errors and departures from expected utility theory—is an enormously rich topic, one that could be approached and described in many different ways. The conception offered here is offered for its usefulness in analyzing the structure of public law enforcement, the focus of this chapter.²⁵ The next section puts the conception of bounded

¹⁸ Amos Tversky & Daniel Kahneman, *Extensional Versus Intuitive Reasoning: The Conjunction Fallacy in Probability Judgment*, 90 *Psychol. Rev.* 293, 295 (1983).

¹⁹ See Jolls, Sunstein & Thaler, *supra* note 4, at 1518.

²⁰ *Id.* at 1478 (citations omitted).

²¹ Daniel Kahneman & Amos Tversky, *Prospect Theory: An Analysis of Decision Under Risk*, 47 *Econometrica* 263 (1979).

²² *Id.* at 273.

²³ *Id.* at 278.

²⁴ The concavity assumption implies that utility declines rapidly as losses mount.

²⁵ Cf. Jolls, Sunstein & Thaler, *supra* note 4, at 1480-81 (emphasizing aspects of bounded rationality that are useful for analysis of particular legal issues).

rationality just described to work in analyzing the question of public law enforcement from a behavioral economics perspective.

2. Bounded Rationality and Public Law Enforcement

In traditional economic analysis of law, the essential problem of public law enforcement revolves around how to compel sometimes-recalcitrant actors to conform their behavior to legal rules at the lowest possible cost to the public fisc. Public agents in this picture should choose both efforts at detection and punishments imposed upon detected offenders with an eye toward inducing desired behavior at the lowest possible cost.

In the traditional economic model, potential offenders are assumed to compare the costs and benefits of a given behavior and to refrain from the behavior when costs exceed benefits.²⁶ It will not be surprising that, moving to a behavioral economics framework, both judgment errors and departures from expected utility theory can affect how potential offenders perform this cost-benefit comparison. Below I consider three specific ways that bounded rationality, in the form of both judgment errors and departures from expected utility theory, may come into play in actors' behavior, and the resulting implications for the structure of public law enforcement.

Before proceeding further, it is important to emphasize that I am not suggesting here that an approach to public law enforcement based upon the conception of bounded rationality described above captures everything or even close to everything that is relevant to how the law should be enforced by investigators, inspectors, prosecutors, and other public agents—any more than an approach based on the assumption of *unbounded* rationality would capture everything of relevance to that question. The behavior of potential offenders is likely to be strongly related to social factors that are not captured by bounded rationality.²⁷ In addition, psychological phenomena not emphasized by bounded rationality or other aspects of behavioral economics may play a role; this may be especially true in the case of public enforcement of laws regulating serious criminal conduct.²⁸ My goal here is simply to suggest how bounded rationality as conceived above can complement traditional economic analysis of public law enforcement.

²⁶ See, e.g., A. Mitchell Polinsky & Steven Shavell, *The Economic Theory of Public Enforcement of Law*, 38 *J. Econ. Lit.* 45, 47 (2000).

²⁷ The discussion in section 3 below of the work by Lauren Edelman and her coauthors is a suggestive example. See *infra* notes 61-62 and accompanying text.

²⁸ See, e.g., William T. Dickins, *Crime and Punishment Again: The Economic Approach with a Psychological Twist*, 30 *J. Pub. Econ.* 97 (1986).

As just suggested, public enforcement of laws regulating serious criminal conduct may raise important issues distinct from those raised by public enforcement of other laws (such as the double parking prohibition from the opening Polinsky excerpt). At the most basic level, the empirical evidence derived from the noncriminal population—the usual subjects in the experimental work on which behavioral economics is based—may fail to carry over to the criminal population; some tentative evidence to this effect is discussed at various points below. Because public enforcement of laws regulating serious criminal conduct seems to raise distinct and important issues, the public enforcement of such laws is not a focus of the analysis below.

2.1 Optimism Bias

As noted earlier, a highly robust feature of human behavior is that people underestimate the probability that negative events will happen to them as opposed to others. Given that detection of unlawful behavior by public agents is generally an undesirable event, an immediate implication of optimism bias in the public law enforcement context is that people will often underestimate the probability that their—as opposed to others’—unlawful behavior will be detected.

A study of drivers who consumed alcohol at least occasionally provides interesting empirical support for optimism bias in the public law enforcement context.²⁹ (One might view laws prohibiting drunk driving as instances of laws prohibiting serious criminal behavior—which, as noted above, are not the laws on which I focus. Drunk driving obviously is an extremely serious offense, but, at the same time, the demographic group at issue for drunk driving seems likely—by comparison to the demographic group at issue for crimes like homicide and armed robbery—to be relatively similar to the general population.) These drivers who consumed alcohol at least occasionally were found to attach a significantly lower probability to their being apprehended for drunk driving when driving with blood-alcohol levels over the legal limit than to the average driver’s being apprehended for drunk driving when driving with a blood-alcohol level over the legal limit.³⁰ This was true not only for drivers who reported that they sometimes drove with blood-alcohol levels they believed to be over the legal limit, but also for drivers who said they did not engage in such behavior (although the magnitude of the optimism bias effect was smaller for the latter group).³¹ Thus, the results—suggesting significant optimism bias on the part of drivers—cannot be explained on the ground that some drivers (those who drive with blood-alcohol levels above the legal limit) underestimate the probability of apprehension while others overestimate it. Most alcohol-consuming drivers, whether or not they sometimes

²⁹ See Andrew Guppy, Subjective Probability of Accident and Apprehension in Relation to Self-Other Bias, Age, and Reported Behavior, 25 *Accident Analysis & Prevention* 375 (1993).

³⁰ *Id.* at 377, 378 & Table 1, 379-80.

³¹ *Id.* at 378.

drove with blood-alcohol levels over the legal limit, said that their probability of being apprehended for drunk driving was below average; but this of course cannot be true.

If potential offenders not only underestimate their probability of detection relative to that of others but also underestimate their probability of detection relative to the actual probability, then a simple policy-relevant conclusion follows immediately for the public law enforcement context. Given any particular combination of a probability of detection and a sanction—in Professor Polinsky’s example from the beginning of this chapter, a .001 probability of detection and a \$10,000 fine—actors will tend to be less deterred from the behavior sought to be deterred than they would be in the absence of optimism bias; the bias leads them to underestimate in a systematic way the probability that they will be detected. If, to continue with the numbers from the Polinsky example, the actual probability of detection is .001 for each individual, but in fact people systematically think that their own probability is lower—say .0005—then deterrence obviously will suffer.

Of course, people may have no idea that the actual probability of detection is .001 (whatever they think it is for them personally); indeed, this point provides the jumping-off point for my discussion below of the role of availability in actors’ estimation of the general probability of an uncertain event such as the detection of unlawful behavior. However, unless for some reason—contrary to the tenor of the discussion below as well as the evidence noted above³²—people systematically *overestimate* the actual probability of detection, optimism bias will, as suggested above, lead to less deterrence than traditional economic analysis of public law enforcement would suggest.

As noted earlier, an important exception to the general discussion of optimism bias and public law enforcement may involve actors who contemplate engaging in serious criminal behavior (particularly violent crime). This is so because empirical evidence obtained from noncriminal subject populations may not carry over to the population at issue for serious criminal behavior. Indeed, there is empirical evidence that, among young males who have previously engaged in criminal behavior, the estimated probability of arrest for various crimes is *higher* than the actual probability observed in official arrest rates.³³ This finding suggests that within the stated population actors do *not* underestimate the probability of detection.

Even in contexts in which optimism bias *does* lead actors to underestimate the probability of detection, it is important to note that optimism bias generally should not by itself alter the conclusion from the simple version of traditional economic analysis of public law enforcement—as reflected in the Polinsky

³² See supra note 16 and accompanying text.

³³ See Lance Lochner, A Theoretical and Empirical Study of Individual Perceptions of the Criminal Justice System (working draft, June 2001).

excerpt at the beginning of this chapter—that minimizing the probability of detection and maximizing the punishment for offenders who are detected is the most cost-effective strategy for publicly enforcing the law.³⁴ Before noting how optimism bias generally should not alter this basic conclusion, it is useful to understand more fully the reasoning behind that conclusion within traditional economic analysis of public law enforcement.³⁵

Within traditional economic analysis of public law enforcement, the prescription of minimal enforcement expenditures (meaning a low probability of detection) and large penalties for detected offenders stems from the tradeoff between the benefits and costs to the enforcer of deterring unlawful behavior. As a first approximation, minimizing expenditures on enforcement and maximizing penalties on detected offenders allows society to achieve a desired level of deterrence at a lower cost than would the combination of higher enforcement expenditures and lower penalties. Thus, for instance, as between a .001 probability of detection and a \$10,000 punishment, and a .002 probability of detection and a \$5,000 punishment, the former course should be chosen, as both produce the same expected punishment, while the latter entails greater expenditures on enforcement. Taking the argument to its logical extreme, society should make expenditures on detection as low as possible and penalties for detected offenders as high as possible.

As discussed in section 2.4 below, relaxing various assumptions made in the simple model of public law enforcement avoids—while remaining within the framework of traditional economic analysis of public law enforcement—the conclusion favoring \$10,000 parking tickets. For now the important point is that an account emphasizing optimism bias among boundedly rational actors generally should not alter the basic prescription in favor of relatively small enforcement expenditures and large penalties for detected offenders. (As already noted, though, optimism bias may suggest that enforcement expenditures will need to increase (without any reduction in the penalties for detected offenders) if the level of deterrence anticipated under traditional economic analysis is to be achieved.) The basic reason that the simple prescription generally should not change with optimism bias is that even if potential offenders systematically underestimate the probability that they will be detected, the logic of achieving as much deterrence as possible through heavy punishment of detected offenders rather than through a

³⁴ The statement in the text about the effect of optimism bias assumes a model that is similar in all respects—except optimism bias—to the simple model of traditional economic analysis of public law enforcement discussed in the Polinsky excerpt quoted at the beginning of this chapter. In particular, for simplicity the analysis assumes monetary penalties and risk neutrality. See *infra* section 2.4 for discussion of more nuanced versions of the traditional economic analysis of public law enforcement.

³⁵ For the basic explanation, see Polinsky, *supra* note 1, at 77-78. The text in the paragraph following this note summarizes his account.

higher probability of detection remains. As before, achieving deterrence through increasing the probability of detection is more costly for the enforcement agency than achieving deterrence through increasing the severity of the punishment. Although (assuming it is infeasible to raise the punishment further) the probability of detection may need to rise in response to optimism bias, in general there is no particular reason for the desired punishment level to decline. (A formal model, which I do not provide here, would be necessary to test the limits of this argument, but in simple algebraic terms, if p is the actual probability of detection, $P(p)$ is the perceived probability of detection, and S is the punishment, then under the assumptions stated above and as long as $P(p)$ is increasing in p , S ought to be at its maximum, for otherwise S could be raised and p lowered so as to maintain the same level of deterrence at a lower cost for the enforcement agency.) Thus, at this juncture the prescription of \$10,000 fines for those caught double-parking remains essentially intact despite the introduction of optimism bias among boundedly rational actors.

2.2 Availability

Apart from optimism bias on the part of potential offenders regarding whether public law enforcement efforts will detect *their* unlawful behavior, there is the question of how potential offenders go about estimating the probability that *anyone* will be caught. Although traditional economic analysis of public law enforcement examines the possibility of mistaken predictions by potential offenders about the probability of detection, it focuses on the case in which, while individual actors may make mistakes, the group of actors covered by the enforcement activity is not wrong on average.³⁶ But for boundedly rational actors there may be a different and more systematic relationship between the perceived and actual probabilities of detection, given what bounded rationality teaches us about the way in which individuals perceive probabilistic events.

As described earlier, the perceptions of boundedly rational actors about probabilities of uncertain events are heavily influenced by the availability of the event in question, or how readily other instances of this event come to actors' minds. In the public law enforcement context, availability is likely to influence potential offenders' perceptions of the probability of detection through two central channels. The first concerns the salience of observed instances of detection, or how vivid and striking these instances are. The second concerns the actual frequency with which detection occurs.

³⁶ See Lucian Ayre Bebchuk & Louis Kaplow, Optimal Sanctions When Individuals Are Imperfectly Informed About the Probability of Apprehension, 21 J. Legal Stud. 365, 366 (1992).

2.2.1. The Role of Salience

An interesting context in which to consider salience in the public law enforcement setting is the context of parking enforcement discussed by Professor Polinsky in the passage quoted at the beginning of this chapter. Imagine two distinct methods of administering parking tickets: placing beige (unobtrusive) tickets under the windshield wiper on the curb side of the street (convenient for the parking officer to reach); and sticking large, bright orange tickets that read “VIOLATION” in oversize letters on the drivers’ side window where they are clearly visible to other drivers passing by. In prior work, Cass Sunstein, Richard Thaler and I suggested that the latter method (common in many cities) may be more likely to deter potential parking violators—holding constant the actual probability of getting a ticket—by making the risk of receiving a parking ticket more salient to potential offenders.³⁷

Salience suggests, more generally, that the effects of public law enforcement activity will depend not merely on how frequently offenses are detected (the focus under traditional economic analysis of public law enforcement) but also on *how* they are detected—on the vividness of the enforcement activity. While the use of salient methods of detection, as in the example given in the previous paragraph, would not play a role in traditional economic analysis of public law enforcement, an analysis of public law enforcement with boundedly rational actors suggests the importance of salience in shaping potential offenders’ estimates of the probability of detection. Under traditional economic analysis of public law enforcement, by contrast, the costs of making enforcement activity more salient—for instance, by printing parking tickets on colorful, presumably more costly, paper—will be wasted because they do not change the actual probability of detection.

2.2.2. The Role of the Actual Probability of Detection

The ease with which events come to mind—how available they are—may be heavily influenced not only by their salience, but also by the actual frequency with which they occur and are observed. Events that are very rare—such as receipt of a parking ticket in the Polinsky excerpt from the beginning of this chapter—may not come easily to mind simply because of their infrequency, and thus the perceived probability of such events’ occurrence for boundedly rational actors may tend to be less than their actual probability.

With regard to the effect of actual frequency of an event on boundedly rational actors’ estimation of the probability of the event, the empirical evidence is mixed, with some evidence suggesting underestimation of the probability of infrequent events and other evidence suggesting overestimation of the probability

³⁷ See Jolls, Sunstein & Thaler, *supra* note 4, at 1538.

of infrequent events.³⁸ Surely the salience of the event in question (holding constant its actual frequency) is likely to be a major factor, consistent with the discussion just above. At least in some cases, however, it is possible that the probability of infrequent events will be underestimated purely as a function of their infrequency; for instance, Howard Kunreuther has explored how people regularly fail to buy insurance against negative events such as floods and earthquakes despite massive federal subsidies and large-scale marketing efforts by insurers, and underestimation of the probability of these relatively infrequent (though fairly salient) events may result simply from the lack of a friend, neighbor, or other contact who has experienced such an event in recent memory.³⁹ Interestingly, there is again some evidence that the basic finding here does not carry over to the population of actors who contemplate engaging in serious criminal behavior; it appears that young males, many of whom have engaged in past criminal behavior, are not much influenced by the arrests of others in coming up with their own estimates of the probability of arrest—although it bears noting that the measure used for arrests of others in the study is quite noisy.⁴⁰ Moving back now to the context of offenders not engaged in serious criminal behavior, in Professor Polinsky’s parking enforcement example at the beginning of this chapter, if the probability of getting a ticket is below some “critical threshold,”⁴¹ it is possible that it will simply not show up on the radar screen of potential offenders. In cases such as this, potential offenders will systematically underestimate the probability of detection merely because that probability is below some threshold level.

Availability, then, differs from optimism bias in suggesting—albeit quite tentatively and with a need for further empirical inquiry—that bounded rationality may provide a systematic reason for questioning the simple prescription from traditional economic analysis that public law enforcement should involve minimal enforcement expenditures (meaning a small probability of detection) and large penalties for detected offenders. If, in a given context, the probability of detection is too small to make it out to the radar screens of potential offenders, then the

³⁸ See, e.g., Howard Kunreuther, *The Economics of Protection Against Low Probability Events*, in *Decision Making: An Interdisciplinary Inquiry* 195, 209 (Gerardo R. Ungson & Daniel N. Braunstein eds., 1982); W. Kip Viscusi, *Fatal Tradeoffs: Public and Private Responsibilities for Risk* 150 (1992).

³⁹ See Kunreuther, *supra* note 38, at 209; Howard Kunreuther, *Limited Knowledge and Insurance Protection*, 24 *Pub. Pol’y* 227, 231-39 (1976).

⁴⁰ See *Lochner*, *supra* note 33. *Lochner*’s evidence contradicts the idea that in the context of criminal law “increasing the frequency of punishment is likely to be more efficient [than increasing the severity of punishment], under the assumption that if a criminal knows or knows of someone who has been imprisoned for a particular crime, this information is likely to be available and to cause him to overestimate the likelihood that he will be arrested and convicted if he commits the same crime,” see Korobkin & Ulen, *supra* note 3, at 1089.

⁴¹ Kunreuther, *supra* note 38, at 209.

large penalty specified for detected offenders will fail to achieve its intended deterrent effect. The case of optimism bias differs from the case of availability because optimism bias suggests people may underestimate the probability of detection *whatever* its actual level; by contrast, availability suggests—again, tentatively—that in certain contexts people will underestimate the probability of detection *if* that probability is below some critical level.

As already suggested, it is ultimately an empirical question whether there are important public law enforcement contexts in which the infrequent occurrence of detection may produce underestimation of the probability of detection. The basic empirical difficulty, however, is disentangling underestimation that results from the infrequency of actual incidents of detection from underestimation that results from optimism bias (which would span various levels of the actual detection frequency). More nuanced empirical designs would be necessary to shed light on the degree to which the infrequency of actual incidents of detection may, through the operation of availability, contribute to underestimation of the probability of detection.

2.3. Prospect Theory

As described in section 1, bounded rationality results from both judgment errors—the focus of the discussion above of optimism bias and availability—and departures from expected utility theory. Prospect theory is the alternative to expected utility theory offered by behavioral economics. Prospect theory is concerned with how people process or evaluate the probability estimates they come up with (whatever those may be and whatever particular biases may shape them); the way in which people engage in this task has important implications for public law enforcement.

A first observation about prospect theory is that, under this theory, agents exaggerate the difference between a small probability of a particular event and a zero probability of that event.⁴² This “certainty effect” reflects the Allais paradox noted in the earlier discussion of departures from expected utility theory. Under the Allais paradox—repeatedly confirmed across a range of studies—eliminating a given prospect for gain (say, a fifty percent chance of winning a given sum of money) has a greater effect when it alters what was previously a sure thing than when both the original and the revised situations involve some risk.⁴³

The certainty effect under prospect theory might imply—at odds with Professor Kunreuther’s suggestion from above with regard to flood and earthquake insurance—that people overweigh small probabilities; alternatively, it could imply that people weigh small probabilities accurately and a zero probability inaccurately. All we know from the empirical evidence is that they

⁴² See Kahneman & Tversky, *supra* note 21, at 265-67.

⁴³ *Id.*

overweigh the difference between the two.⁴⁴ In the former but not the latter case, the certainty effect would mitigate the underestimation resulting from availability—if in fact there is underestimation resulting from availability—of the probability of relatively infrequent events.

More straightforward implications of prospect theory for public law enforcement arise from the fact that, under that theory, changes far from an individual's reference point matter relatively little. For instance, as noted above, the value difference between \$100 and \$200 is greater than the value difference between \$1100 and \$1200, assuming a reference point of \$0. Also as noted above, prospect theory suggests that this is true both for gains and for losses, which in turn means that the value function will be convex rather than, as under the usual assumption, concave in losses.⁴⁵ Prospect theory thus implies that the deterrent effect of increasing the magnitude of penalties will have a strongly diminishing effect—the opposite of the case under the concavity assumption. Thus, for instance, the difference between a fine of \$8,000 and a fine of \$10,000 for a parking offender will be far less than the difference between a fine of \$0 and a fine of \$2,000—and the former difference may indeed be negligible.

2.4. Notes on Public Law Enforcement with Unboundedly Rational Actors

As described, several points about public law enforcement with boundedly rational actors point away from the basic prescription offered in Professor Polinsky's parking enforcement example described at the beginning of this chapter. In a very simple model, traditional economic analysis of public law enforcement suggested (in the context of that example) detecting only one out of every thousand parking offenders, but then imposing a fine of \$10,000 on the detected offender. In suggesting reasons to question this prescription, bounded rationality complements, rather than challenges, traditional economic analysis because that analysis in its more refined form also rejects the broad prescription of minimal enforcement expenditures (meaning a small probability of detection) and large penalties for detected offenders.

The scholarly literature on traditional economic analysis of public law enforcement is sufficiently large and rich to prevent a full discussion of it here.⁴⁶ It is easy, however, to pinpoint from that literature several explanations for why very small probabilities of detection and very large penalties for detected offenders may be undesirable. Most obviously, risk aversion of potential offenders points away from this approach.⁴⁷ A second important argument

⁴⁴ For a description of Kahneman and Tversky's modeling approach with regard to the nature of the certainty effect, see Jolls, *supra* note 12, at 1667 n.50.

⁴⁵ Kahneman & Tversky, *supra* note 21, at 278.

⁴⁶ For a definitive survey of this literature, see Polinsky & Shavell, *supra* note 26.

⁴⁷ See, e.g., Polinsky, *supra* note 1, at 82-84; Louis Kaplow, *The Optimal Probability and Magnitude of Fines for Acts That Definitely Are Undesirable*, 12

against setting very small probabilities of detection and very large penalties for detected offenders is that if penalties were made as high as possible for all offenses, then marginal deterrence—the incentive to substitute less serious for more serious offenses—would be eliminated: “If robbery is punished as severely as murder, the robber might as well kill his victim to eliminate a witness.”⁴⁸ A third argument against very small probabilities of detection and very large penalties for detected offenders relies on the idea that individuals may be correct about the probability of detection only on average, rather than in individual cases; this makes the combination of small probabilities of detection and large penalties for detected offenders less desirable *if* (an important assumption) the degree of error in estimating the probability of detection falls with the actual magnitude of that probability.⁴⁹ (The degree of error would not fall with the actual magnitude of the probability of detection if, for instance, individuals’ estimates were always off by ten percent of the actual probability of detection.) Finally, a fourth argument in the same vein incorporates “general” as well as “specific” enforcement and again points away from the simple prescription of very small probabilities of detection and very large penalties for detected offenders.⁵⁰

These arguments (and others) suggest ways in which traditional economic analysis, like behavioral economic analysis, can go beyond the simple, stylized model and produce predictions that seem more plausible than \$10,000 parking ticket fines for rarely-sanctioned double parkers. Thus, the public law enforcement context is one in which bounded rationality seems more to complement than to challenge traditional law and economics. Of course, as the discussion in the previous paragraph makes clear, going beyond the simple, stylized model—whether through traditional economic analysis or through bounded rationality—comes at the expense of spareness and parsimony; without any foray into bounded rationality, it seems fair to say that the substantial literature on traditional economic analysis of public law enforcement suggests that models can point in many different directions depending on the assumptions made. Thus, lack of parsimony, at least in the context of public law enforcement, does not seem to be a criticism specific to work in behavioral, as opposed to traditional, law and economics.⁵¹

Int’l Rev. L. & Econ. 3 (1992); A. Mitchell Polinsky & Steven Shavell, The Optimal Tradeoff Between the Probability and Magnitude of Fines, 69 Am. Econ. Rev. 880 (1979).

⁴⁸ Richard A. Posner, An Economic Theory of the Criminal Law, 85 Colum. L. Rev. 1193, 1207 (1985).

⁴⁹ See Bebchuk & Kaplow, *supra* note 36, at 366-67.

⁵⁰ See Steven Shavell, Specific Versus General Enforcement of Law, 99 J. Pol. Econ. 1088 (1991).

⁵¹ For a general discussion of the parsimony issue, see Jolls, Sunstein & Thaler, *supra* note 4, at 1487-89.

3. Public Enforcement of Employment Discrimination Laws

This section briefly notes some applications of the ideas about bounded rationality and public law enforcement discussed above to the particular context of public enforcement of employment discrimination laws. (The usual rationale for public enforcement—the inability of victims to identify with ease the actor who caused their harm⁵²—is not present in this context, but, nonetheless, employment discrimination laws in the U.S. are enforced by public as well as private actors.)

The analysis starts from a central empirical point—the persistence of significant discrimination in labor markets nearly forty years after the enactment of the Title VII of Civil Rights Act of 1964. It asks: Might bounded rationality play a partial role in explaining the apparent limits on the effect of employment discrimination laws on the existence and persistence of employment discrimination?

As just noted, the basic empirical fact is that, notwithstanding the passage of nearly four decades since the enactment of the Title VII, discrimination appears to be alive and well in employment markets. As I have discussed in some detail elsewhere, several recent studies published in leading economics journals provide strong evidence of continued sex discrimination in labor markets.⁵³ To take just one example, Claudia Goldin and Cecelia Rouse have shown that female musicians auditioning for major symphony orchestras fare substantially better when auditions are conducted behind screens—so that the sex of the musician is not known to those making the selections—than when those doing the evaluations know the performer’s sex.⁵⁴

Recent evidence suggests similar concerns with race discrimination. In “Are Emily and Brendan More Employable than Lakisha and Jamal? A Field Experiment on Labor Market Discrimination,” Marianne Bertrand and Sendhil Mullainathan examine what happens when otherwise identical resumes are sent out either under a typically “white” name (such as Emily or Brendan) or under a typically “black” name (such as Lakisha or Jamal).⁵⁵ They find that resumes with “white” names produced employer interview requests at a rate of one per ten resumes, while resumes with “black” names produced employer interview requests at a rate of one per fifteen resumes. Thus, “black” sounding applicants

⁵² See Polinsky & Shavell, *supra* note 26, at 46.

⁵³ Christine Jolls, *Is There a Glass Ceiling?* 25 *Harv. Women’s L.J.* 1, 3-11 (2002).

⁵⁴ See Claudia Goldin & Cecilia Rouse, *Orchestrating Impartiality: The Impact of “Blind” Auditions on Female Musicians*, 90 *Am. Econ. Rev.* 715, 716 (2000).

⁵⁵ Marianne Bertrand & Sendhil Mullainathan, *Are Emily and Brendan More Employable than Lakisha and Jamal? A Field Experiment on Labor Market Discrimination* (working paper, Nov. 2002).

had to send out about fifty percent more resumes for each interview than “white” sounding applicants. This evidence complements earlier evidence from tester studies showing that black and Hispanic testers enjoyed significant less success in getting interviews and jobs than otherwise-comparable white testers.⁵⁶

A simple aspect of bounded rationality that may provide part of the explanation for the persistence of employment discrimination, despite longstanding laws prohibiting such behavior, is optimism bias on the part of the potential offenders (employers). As discussed above, optimism bias suggests that, under any specified enforcement scheme, actors will tend to be less deterred from the prohibited behavior than they would be in the absence of optimism bias.⁵⁷ This optimism bias account may usefully complement other important reasons—such as the unconscious nature of much modern employment discrimination⁵⁸—for the limits Title VII faces in eradicating discrimination in labor markets.

An important qualification to the potential role of optimism bias in the persistence of employment discrimination is that the actors in question here are firms (although typically run by agents) rather than individuals acting in their personal capacities. Optimism bias may be less pronounced for firms because they may face competitive disadvantages if they make systematic errors.⁵⁹ Evidence on the failure of market pressures to curtail optimism bias in the context of entry into new industry,⁶⁰ however, provides some support for the view that optimism bias may be important even for firms (perhaps in part because of agency issues).

To the extent that optimism bias leads to a systematic reduction in the effectiveness of employment discrimination laws, other aspects of bounded rationality from the discussion above may provide hints of helpful responses the law might adopt. Most obviously, a high degree of salience in the enforcement of employment discrimination laws could harness availability and thereby increase the grip of public law enforcement. Intriguing suggestive evidence from the

⁵⁶ See Harry Cross, *Employer Hiring Practices: Differential Treatment of Hispanic and Anglo Job Seekers*, Urb. Inst. Rep. 90-4 (1990); Margery Austin Turner, Michael Fix & Raymond J. Struyk, *Opportunities Denied, Opportunities Diminished: Racial Discrimination in Hiring*, Urb. Inst. Rep. 91-9 (1991); Genevieve M. Kenney & Douglas A. Wissoker, *An Analysis of the Correlates of Discrimination Facing Young Hispanic Job-Seekers*, 84 *Am. Econ. Rev.* 674 (1994).

⁵⁷ See *supra* page 8.

⁵⁸ See generally Linda Hamilton Krieger, *The Content of Our Categories: A Cognitive Bias Approach to Discrimination and Equal Employment Opportunity*, 47 *Stan. L. Rev.* 1161 (1995).

⁵⁹ See Jolls, Sunstein & Thaler, *supra* note 4, at 1525.

⁶⁰ See Avishalom Tor, *The Fable of Entry: Bounded Rationality, Market Discipline, and Legal Policy*, 101 *Mich. L. Rev.* 482 (2002).

context of employment laws, although not employment discrimination laws, comes from the well-known work of Lauren Edelman, Steven E. Abraham and Howard S. Erlanger, who have suggested that personnel professionals significantly exaggerate the risk of liability under state wrongful discharge laws.⁶¹ Although Edelman, Abraham and Erlanger primarily emphasize the role of status-seeking by personnel professionals in producing these exaggerated estimates, they also note the grip of “horror stories” that “arouse . . . emotion.”⁶² Such “horror stories” may be nothing other than a method of harnessing, through salience, the availability phenomenon, and it might be helpful to employ similar strategies—or employ them to a greater degree than at present—in the context of public enforcement of employment discrimination laws.

4. Conclusion

Economic analysis of public law enforcement has been a central subfield of traditional economic analysis of law. It is also an area in which bounded rationality is best seen, I have suggested in this chapter, as a complement rather than a challenge to traditional economic analysis of law. As Professors Polinsky and Steven Shavell—who have in general approached the public law enforcement topic from a traditional economic perspective—recently wrote: “The psychology and learning process . . . by which individuals assimilate and formulate perceived probabilities of sanctions and their magnitude are important . . . to determining how deterrence works and what optimal policy is.”⁶³ In other words, psychologically informed analysis both of how individuals estimate the probability of detection and of how they evaluate the consequences of detection is obviously important to the sensible structuring of public law enforcement. An important issue for bounded rationality—as well as other aspects of behavioral economics—going forward is the degree to which, in areas of legal analysis outside of public law enforcement, behavioral economics is best seen as complementing rather than challenging traditional economic analysis.

⁶¹ Lauren Edelman, Steven E. Abraham & Howard S. Erlanger, *Professional Construction of Law: The Inflated Threat of Wrongful Discharge*, 26 *L. & Soc. Rev.* 47 (1992).

⁶² *Id.* at 66, 74-78.

⁶³ A. Mitchell Polinsky & Steven Shavell, *Public Enforcement of Law*, in *The New Palgrave Dictionary of Economics and Law* 178, 186 (Peter Newman ed., 1998).