Deterrence: A Review of the Evidence by a Criminologist for Economists

Daniel S. Nagin

Heinz College, Carnegie Mellon University, Pittsburgh, Pennsylvania 15213; email:
dn03@andrew.cmu.edu

Keywords

police, imprisonment, capital punishment, sanction risk perceptions

Abstract

This article reviews the evidence on the deterrent effect of police, imprisonment, and capital punishment and additionally summarizes knowledge of sanction risk perceptions. Studies of changes in police presence, whether achieved by changes in police numbers or in their strategic deployment, consistently find evidence of deterrent effects. Studies of the deterrent effect of increases in already long prison sentences find at most a modest deterrent effect. Studies of the deterrent effect of capital punishment provide no useful information on the topic. Four high-priority areas for future research are identified: developing and testing an integrated model of the effects of the threat and experience of punishment, measuring perceptions of sanction regimes, developing and testing a theory of criminal opportunities, and estimating the deterrent effect of shorter prison sentences and identifying high-deterrence policies.

1. INTRODUCTION

The criminal justice system dispenses justice by apprehending, prosecuting, and punishing individuals who break the law. These activities may also prevent crime by three distinct mechanisms. One is incapacitation. Convicted offenders are often punished with imprisonment. Incapacitation refers to the crimes averted by the offenders' physical isolation during the period of their incarceration. The two other mechanisms involve possible behavioral responses. The threat of punishment may discourage criminal acts. In economics, this effect is called deterrence, whereas in criminology it is referred to as general deterrence. However labeled, the subject of this review is the preventative effect of the threat of punishment, which I refer to as deterrence. The other behavioral mechanism concerns the effect of the experience of punishment on reoffending. In criminology, this effect is termed specific deterrence. I note, however, that there are many sound reasons for suspecting that the experience of punishment might increase, not decrease, future offending. I return to this observation in my discussion of directions for future research. Readers are referred to Nagin et al. (2009) for a review of the evidence on the effect of the experience of punishment on reoffending and to Spelman (1994) for a review of the evidence on incapacitation effects (see the sidebar, Incapacitation).

The distinction between incapacitation and deterrence is also important for policy. Crime prevention by incapacitation necessarily requires higher imprisonment rates and the attendant social costs. By contrast, if crime can be deterred from occurring in the first place, there is no perpetrator to punish. As a consequence, crime prevention by deterrence does not necessarily involve a trade-off between crime rates and imprisonment rates (Blumstein & Nagin 1978, Durlauf & Nagin 2011a).

Going back at least to the Enlightenment-era legal philosophers Cesare Beccaria and Jeremy Bentham, scholars have speculated on the deterrent effect of official sanctions, but sustained efforts to empirically verify their effects did not begin until the 1960s. Since that time, hundreds of studies have tested for deterrent effects. There is also a large theoretical literature on deterrence both within and outside economics. Becker's (1968) seminal article "Crime and Punishment: An

INCAPACITATION

Imprisonment rates in the United States rose unabated from 1973 to 2011. Recent work by Johnson & Raphael (2013) on the crime-prevention effect of imprisonment suggests that the size of the effect diminishes with the scale of imprisonment. They find substantial declines in the number of crimes averted per prisoner over the period 1991–2004 compared with 1978–1990. If the crime-reduction effect of incarceration primarily stems from incapacitation, this finding is consistent with the concept of stochastic selectivity (Canela-Cacho et al. 1997), whereby high-rate offenders are more likely to be apprehended and incarcerated than low-rate offenders. Thus, as the scale of imprisonment increases, higher-rate offenders will be less likely to be at large committing crimes, and as a result, new admissions will tend to be lower-rate offenders. Johnson & Raphael's finding is replicated by Vollaard (2013) in an analysis of the Netherlands' habitual offender law and is consistent with an earlier analysis by Useem & Piehl (2008) that similarly concludes that crime-reduction benefits decline with the scale of imprisonment. It also noteworthy that Owens (2009) finds modest incapacitation effects in her analysis of 2003 data from Maryland. Note, however, that because of the substantial aging of the prison population in recent decades, the seeming decline in the incapacitative effectiveness of prison with scale may be reflecting only the aging of the prison population, which coincides with rising imprisonment rates.

Economic Approach" forms the foundation for much of the theoretical and empirical research in economics that followed its publication.

This review is not intended to be encyclopedic of either the empirical or theoretical literature on deterrence. Its objective is to highlight findings and conclusions that are particularly important and to lay out areas of research that, in my judgment, have high potential payoff and are especially amenable to economic analysis. For extended reviews of the theoretical and empirical literature both within and outside economics, readers are referred to Durlauf & Nagin (2011b) and Nagin (1998, 2013).

2. KEY THEORETICAL IDEAS

Since Bentham and Beccaria, three key concepts underlay theorizing about deterrence—the certainty, severity, and immediacy (celerity) of punishment. Certainty refers to the probability of legal sanction given commission of crime; severity refers to the onerousness of the legal consequences given a sanction is imposed; and celerity refers to the lapse in time between commission of the crime and its punishment. Becker's model and most of its progeny in economics focus only on certainty and severity (for exceptions, see Polinsky & Shavell 1999, Lee & McCrary 2009). Let p denote the probability of sanction given commission of a crime and $U(S)$ measure the (dis)utility of a sanction of severity S. In Becker's model, $pU(S)$ measures the expected sanction cost of committing a crime. This quantity is embedded in a larger choice theoretic model of crime and punishment, which is beyond the scope of this review, but it suffices to say that similar to all models of deterrence, ceteris paribus, increases in either p or S are disincentives to criminal behavior.

Most economic models of crime do not include celerity of punishment as a theoretical component. Perhaps the reason is that even in theory, the swiftness of punishment, except for the payment of a monetary fine, has an ambiguous incentive effect. Whereas it is always advantageous to delay payment of a monetary fine, there is nothing irrational about a desire to get nonmonetary punishment over with. Further complicating matters is that most nonmonetary legal sanctions (e.g., imprisonment) are themselves experienced over time.

As discussed below, there is far more empirical support for the deterrent effect of changes in the certainty of punishment than changes in the severity of punishment. One explanation for what I call the certainty effect comes from criminological theory, which places at least as much emphasis on the deterrent effect of informal sanction costs as formal sanction costs (Zimring & Hawkins 1973, Williams & Hawkins 1986, Klepper & Nagin 1989). Informal sanction costs include costs that are separate from those that attend the imposition of formal sanctions, such as loss of freedom or fines, and include censure by friends and family and loss of social and economic standing. Importantly, the magnitude of informal costs may be largely independent of the severity of legal consequences. Merely being arrested for committing a crime may trigger the imposition of informal sanctions. Williams & Hawkins (1986) use the term "fear of arrest" to label the deterrent effect of informal sanction costs.

The concept of the fear of arrest is a reminder that p is itself a product of a series of conditional probabilities associated with various stages of the criminal justice system—the probability of apprehension, the probability of conviction given apprehension, and so on. Each of these conditional probabilities has costs associated with it. A simple two-stage model in which p is the product of the probability of apprehension, p_a, and the probability of sanction given apprehension, $p_{s|a}$, demonstrates how informal sanction costs may be the source of the certainty effect. Let ISC denote the fixed informal sanction costs that attend apprehension. In this model, the expected sanction cost of committing a crime is

$$E\left(S, ISC, p_a, p_{s|a}\right) = p_a ISC + p_a p_{s|a} U(S). \qquad (1)$$

Under this formalization, unless $U(^*)$ is highly convex in S, $\dfrac{\partial E}{\partial p_a} > \dfrac{\partial E}{\partial S}$. Thus the informal sanction costs that attend arrest alone are one explanation for the certainty effect. Another, which was first suggested by Becker (1968), is that criminals are risk takers. Although there is evidence from psychology that crime-prone individuals enjoy engaging in risky behaviors, I know of no evidence that their risk preference for nonmonetary punishments such as imprisonment can be characterized as convex in the severity of punishment.

3. THE DETERRENT EFFECT OF IMPRISONMENT

There have been two distinct waves of studies of the deterrent effect of imprisonment. Studies in the 1960s and 1970s, which were primarily cross-sectional analyses of states, examined the relationship of the state's crime rate to the certainty of punishment, measured by the ratio of prison admissions to reported crimes, and the severity of punishment measured by median time served in prison. These studies suffered from a number of serious statistical flaws that are detailed in National Research Council (1978). One was that they conflate deterrent and in-capacitation effects. The second was more fundamental. There are many good reasons for believing that crime rates and sanction levels are endogenously determined. Indeed Becker's theory is predicated on their endogenous determination. Most studies did not even attempt to deal with the endogeneity issue, and those that did invoked identification restrictions that were not credible.

In response to these deficiencies, a second generation of studies emerged in the 1990s. Unlike the first-generation studies, which primarily involved cross-sectional analyses of states, the second-generation studies had a longitudinal component in which data were analyzed not only across states, but also over time. Another important difference is that the second-generation studies did not attempt to estimate certainty and severity effects separately. Instead they examined the re-lationship between the crime rate and rate of imprisonment (prisoners per capita).

Durlauf & Nagin (2011a,b) discuss at length the reasons why these studies provide little useful information on deterrence. One is that, similar to the earlier studies, they conflate deterrent and incapacitation effects. Also similar to the earlier studies, with the possible exception of Levitt (1998) and Johnson & Raphael (2013), they do not resolve the identi-fication problem resulting from the endogenous determination of crime rates and impris-onment rates. Third, all these studies suffer from an important theoretical flaw: Prison population is not a policy variable; rather, it is an outcome of sanction policies dictating who goes to prison and for how long—namely, p and S. In all incentive-based theories of criminal behavior in the tradition of Bentham and Beccaria, including most importantly Becker's, the deterrence response to sanction threats is posed in terms of the certainty and severity of punishment, not the imprisonment rate. Therefore, predicting how changes in certainty and severity might affect the crime rate requires knowledge of the relationship of the crime rate to certainty and severity as separate entities, which is not provided by the literature relating the crime rate to the imprisonment rate.

I turn now to six studies that, in my judgment, report convincing evidence of the deterrent effect of incarceration. They also nicely illustrate heterogeneity in the deterrence response to the threat of imprisonment. Weisburd et al. (2008) and Hawken & Kleiman (2009) study the use of imprisonment to enforce fine payment and conditions of probation, respectively, and

find substantial deterrent effects. Helland & Tabarrok (2007) analyze the deterrent effect of California's third-strike provision and find a moderate deterrent effect. Raphael & Ludwig (2003) examine the deterrent effect of prison sentence enhancements for gun crimes and find no effect. Lee & McCrary (2009) and Hjalmarsson (2009) examine the heightened threat of imprisonment that attends coming under the jurisdiction of the adult courts at the age of majority and find no deterrent effect.

Weisburd et al. (2008) report on a randomized field trial of alternative strategies for incentivizing the payment of court-ordered fines. The most salient finding is that the imminent threat of incarceration provides a powerful incentive to pay delinquent fines, even when the incarceration is only for a short period. They call this effect "the miracle of the cells." The miracle of the cells provides valuable perspective on the conclusion that the certainty rather than the severity of punishment is the more powerful deterrent. Consistent with the certainty principle, the common feature of treatment conditions involving incarceration is a high certainty of imprisonment for failure to pay the fine. However, that Weisburd et al. label the response the miracle of the cells rather than the miracle of certainty is telling. Their choice of label is a reminder that certainty must result in a distasteful consequence for it to be a deterrent. The consequences need not be draconian, just sufficiently costly, to deter the proscribed behavior.

The deterrence strategy of certain but nondraconian sanctions has been applied with apparently great success in Project HOPE, an intervention heralded in Kleiman (2009) and Hawken & Kleiman (2009). Project HOPE is a Hawaii-based probation enforcement program. In a randomized experiment, probationers assigned to Project HOPE had much lower rates of positive drug tests and missed appointments and—most importantly—were significantly less likely to be arrested and imprisoned. The cornerstone of the HOPE intervention was regular drug testing, including random tests, and certain, but short, punishment periods of confinement (i.e., 1–2 days) for positive drug tests or other violations of probation conditions. Thus both the fine experiment and Project HOPE showed that highly certain punishment can be an effective deterrent for persons for whom deterrence has previously been ineffective in averting crime.

Helland & Tabarrok (2007) examine whether California's "Three Strikes and You're Out" law deters offending among individuals previously convicted of strike-eligible offenses. The authors compare the future offending of individuals convicted of two previous strikeable offenses with that of individuals who had been convicted of only one strikeable offense but who additionally had been tried for a second strikeable offense but were ultimately convicted of a nonstrikeable offense. The study demonstrates that these two groups of individuals were comparable on many characteristics, such as age, race, and time in prison. Even so, Helland & Tabarrok find that arrest rates were approximately 20% lower for the group with convictions for two strikeable offenses. The authors attribute this reduction to the greatly enhanced sentence that would have accompanied conviction for a third strikeable offense. Note, however, that their cost-benefit analysis found that the cost of 25 years or more of imprisonment of the third-strike threat likely far exceeded the crime-reduction benefits.

Raphael & Ludwig (2003) examine the deterrent effect of sentence enhancements for gun crimes that formed the basis for a Richmond, Virginia, intervention called Project Exile. Perpetrators of gun crimes, with a particular emphasis on those with a felony record, were targets of federal prosecution, which provided for far more severe prison sentences for weapon use than Virginia state law did. Based on an analysis involving comparisons of adult homicide arrest rates with juvenile homicide arrest rates within Richmond and comparisons of Richmond's gun homicide rate with other cities that had comparable pre-intervention homicide rate trends, Raphael & Ludwig conclude that the threat of an enhanced sentence had no apparent deterrent effect.

For most crimes, the certainty and severity of punishment increase discontinuously upon reaching the age of majority, when jurisdiction for criminal wrongdoing shifts from the juvenile to the adult court. In an extraordinarily careful analysis of individual-level crime histories from Florida, Lee & McCrary (2009) attempt to identify a discontinuous decline in offending at age 18, the age of majority in Florida. Their point estimate of the discontinuous change is negative as predicted, but minute in magnitude and not even remotely close to statistical significance.

Another analysis of the effect of moving from the jurisdiction of the juvenile to adult courts by Hjalmarsson (2009) uses the 1997 National Longitudinal Survey of Youth to examine whether young males' perception of incarceration risk changed at the age of criminal majority. She finds that on average subjective probabilities of being sent to jail for auto theft increased discontinuously by 5.2 percentage points when youth reached the age of majority in their state of residence. Although youth perceived an increase in incarceration risk, she finds no convincing evidence of an effect on their self-reported criminal behavior.

4. THE DETERRENT EFFECT OF POLICING

The police may prevent crime through many possible mechanisms. The apprehension of active offenders is a necessary first step for their conviction and punishment. If the sanction involves imprisonment, crime may be prevented by the incapacitation of the apprehended offender. Many police tactics, such as rapid response to calls for service or postcrime investigation, are intended not only to capture the offender but to deter others by projecting a tangible threat of apprehension. Police, however, may deter without actually apprehending criminals—their very presence may deter a motivated offender from carrying out a contemplated criminal act.

Research on the deterrent effect of the police has evolved in two distinct literatures. One has focused on the deterrent effect of the level of police numbers. The other has focused on the crime-prevention effectiveness of different strategies for deploying police. These two literatures are reviewed separately below.

4.1. Studies of Levels of Police Numbers and Resources

Studies of the effect of police numbers and resources come in two forms. One is an analog of the imprisonment-rate and crime-rate studies described in the prior section. These studies are based on panel data sets, usually of US cities over the period from approximately 1970 to 2000. They relate FBI index crime rates to the resources committed to policing as measured by police per capita or police expenditures per capita. Examples of this form of study include Levitt (1997) and Evans & Owens (2007). The second form is more targeted and analyzes the impact on crime that results from abrupt changes in the level of policing owing, for example, to terror alerts. Both types of studies consistently find that greater police presence reduces crime.

In my view the most convincing evidence comes from the abrupt-change type of study focusing on cases in which the regime change is clearly attributable to an event unrelated to the crime rate. For example, in September 1944, German soldiers occupying Denmark arrested the entire Danish police force. According to an account by Andenaes (1974), crime rates rose immediately but not uniformly. The frequency of street crimes such as robbery, whose control depends heavily on visible police presence, rose sharply. By contrast, crimes such as fraud were less affected. Readers are referred to Sherman & Eck (2002) for other examples of increases in crime following a collapse of police presence.

Contemporary tests of the police-crime relationship based on abrupt decreases in police presence investigate the impact on crime of reductions in police presence and productivity as

a result of large budget cuts or lawsuits following racial-profiling scandals. Such studies have examined the Cincinnati Police Department (Shi 2009), the New Jersey State Police (Heaton 2010), and the Oregon State Police (DeAngelo & Hansen 2008). Each of these studies concludes that decreases in police presence and activity substantially increase crime. Shi (2009), for example, studies the fallout from an incident in Cincinnati in which a white police officer shot and killed an unarmed African American suspect. The incident was followed by rioting, heavy media attention, a federal civil rights investigation, and the indictment of the officer in question. These events created an unofficial incentive for officers from the Cincinnati Police Department to curtail their use of arrest for misdemeanor crimes. Shi demonstrates measurable declines in police productivity in the aftermath of the riot and also documents a substantial increase in criminal activity. She estimates elasticities of crime to police presence of –0.5 for violent crime and –0.3 for property crime.

The ongoing threat of terrorism has also provided a number of unique opportunities to study the impact of police resource allocation in cities around the world, including the District of Columbia (Klick & Tabarrok 2005), Buenos Aires (Di Tella & Schargrodsky 2004), Stockholm (Poutvaara & Priks 2006), and London (Draca et al. 2011). Klick & Tabarrok (2005) examine the effect of the color-coded alert system implemented in the aftermath of the September 11, 2001, terrorist attack on crime in the National Mall area of Washington, D.C. The purpose of the alerts is to signal federal, state, and local law enforcement agencies to occasions when it might be prudent to divert resources to sensitive locations, such as the National Mall. Klick & Tabarrok (2005) use daily police reports of crime for the period from March 2002 to July 2003, during which time the terrorism alert level rose from elevated (yellow) to high (orange) and back down to elevated on four occasions. During high alerts, anecdotal evidence suggested that police presence increased by 50%. They estimate a police-to-crime elasticity of 0.3.

To summarize, studies of police presence consistently find that putting more police officers on the street has a substantial deterrent effect on serious crime. Yet these police manpower studies speak only to the number and allocation of police officers and not to what police officers actually do on the street beyond making arrests.

4.2. Police Deployment and Crime

Much research has examined the crime-prevention effectiveness of alternative strategies for deploying police resources. This research has largely been conducted by criminologists. Among this group of researchers, the preferred research designs are interrupted time-series studies of the effect of targeted interventions and true randomized experiments. The discussion that follows draws heavily on two excellent reviews of this research by Weisburd & Eck (2004) and Braga (2008).

For the most part, deployment strategies affect the certainty of punishment through their impact on the probability of apprehension. One way to increase apprehension risk is to mobilize police in a fashion that increases the probability that an offender is arrested after committing a crime. In Nagin (2013), I describe police acting in this role as apprehension agents. There is limited strong evidence of a deterrent as opposed to an incapacitation effect resulting from the apprehension of criminals. Studies of the effect of rapid response to calls for service do not directly test for deterrence but find no evidence of improved apprehension effectiveness (Kansas City Police Dep. 1977, Spelman & Brown 1981). This may be because most calls for service occur well after the crime event, with the result that the perpetrator has fled the scene. Similarly, apprehension risk is probably not materially increased by improved investigations (Greenwood et al. 1977, Eck 1992, Braga et al. 2011).

The second source of deterrence from police activities involves averting crime in the first place. In this circumstance, there is no apprehension because there is no offense. In Nagin (2013), I describe police acting in this role as sentinels. In my view, the sentinel role played by the police force is its primary source of deterrence. Thus measures of apprehension risk based only on enforcement actions in response to crimes that actually occur, such as arrests per reported crime, are not valid measures of the apprehension risk represented by criminal opportunities not acted on because the risk was deemed too high (Cook 1979).

One example of sentinel-like police-deployment strategies that have been shown to be effective in averting crime in the first place is hot-spots policing. Another example is problem-oriented policing. However, evidence of its effectiveness is less clear-cut.

The idea of hot-spot policing stems from a striking empirical regularity uncovered by Sherman et al. (1989), who find that only 3% of addresses and intersections ("places") in Minneapolis produced 50% of all calls to the police. Twenty-five years later in a study in Seattle, Washington, Weisburd et al. (2004) report that between 4% and 5% of street segments in the city accounted for 50% of crime incidents for each year over a 14-year period.

The first test of the efficacy of concentrating police resources on crime hot spots was conducted by Sherman & Weisburd (1995). In this randomized experiment, hot spots in the experimental group were subjected to, on average, a doubling of police patrol intensity compared with hot spots in the control group. Declines in total crime calls ranged from 6% to 13%. In another randomized experiment, Weisburd & Green (1995) find that hot-spot policing was similarly effective in suppressing drug markets.

Braga's (2008) informative review of hot-spot policing summarizes the findings from nine experimental or quasi-experimental evaluations. The targets of the police actions varied. Some hot spots were generally high-crime locations, whereas others were characterized by specific crime problems such as drug trafficking. All but two of the studies found evidence of significant reductions in crime. Furthermore, no evidence was found of material crime displacement to immediately surrounding locations. On the contrary, some studies found evidence of crime reductions, not increases, in the surrounding locations. Note also that the findings from the previously described econometric studies of focused police actions—for example, in response to the terror alert level—buttress the conclusion that the strategic targeting of police resources can be quite effective in reducing crime.

A second example of a sentinel-like policing strategy is problem-oriented policing. Problem-oriented policing involves organizing residents and property owners to help police identify the sources of violent and property crime and then targeting these problems with focused deterrence-based warnings to repeat offenders; increased police, citizen, and technological monitoring; and better control of physical and social disorders. It also involves orchestrated efforts between police and prosecutors to increase sanction costs.

One of the most highly publicized instances of problem-oriented policing is Boston's Operation Ceasefire (Kennedy et al. 2001). The objective of the operation was to prevent intergang gun violence using two deterrence-based strategies. The first strategy was to target enforcement against suppliers of weapons to Boston's violent youth gangs. The second involved a more novel approach. The youth gangs themselves were assembled by the police on multiple occasions to send the message that the response to any instance of serious violence would be "pulling every lever" legally available to punish gang members collectively. This included a salient severity-related dimension—vigorous prosecution for unrelated, nonviolent crimes such as drug dealing. Thus the aim of Operation Ceasefire was to deter violent crime by increasing the certainty and severity of punishment, but only in targeted circumstances—specifically, if the gang members committed a violent crime.

Since Operation Ceasefire, the strategy of pulling every lever has been the centerpiece of field interventions in many large and small US cities, including Richmond, Virginia; Chicago, Illinois; Stockton, California; High Point, North Carolina; and Pittsburgh, Pennsylvania. Readers are referred to Kennedy (2009), one of the architects of this strategy, for an extended description of these interventions and the philosophy behind them. Independent evaluations have also been conducted of some of these interventions: e.g., Boston (see Cook & Ludwig 2006), Richmond (see Raphael & Ludwig 2003), Chicago (see Papachristos et al. 2007), Pittsburgh (see Wilson & Chermak 2011), and High Point (see Corsaro et al. 2012).

The conclusions of the independent evaluations are varied, but Cook's (2012) characterization of the much publicized High Point drug-market intervention seems apt: Initial conclusions of eye-catchingly large effects have been replaced with far more modest assessments of effect sizes and cautions about the generalizability of the results. Reuter & Pollack (2012) wonder whether a successful intervention in a small urban area such as High Point can be replicated in a large city such as Chicago. Ferrier & Ludwig (2011) point out the difficulty in understanding the mechanism that underlies a seemingly successful intervention that pulls many levers. Despite concerns, these interventions illustrate the potential for combining elements of both certainty and severity enhancement to generate a targeted deterrent effect.

5. THE DETERRENT EFFECT OF CAPITAL PUNISHMENT

Studies of the deterrent effect of capital punishment have been and continue to be a source of bitter contention. Ehrlich's (1975) study, in which he concludes that each execution averts seven to eight homicides, is undoubtedly the most cited study of this kind. A National Research Council (1978) report lays out a lengthy list of criticisms of Ehrlich's analysis. The report concludes, "available studies [including Ehrlich's] provide no useful evidence on the deterrent effect of capital punishment" (National Research Council 1978, p. 9).

Coincidentally, that report was issued shortly after the 1976 Supreme Court decision *Gregg v. Georgia* ended a four-year legal moratorium on execution in the United States. In the 35 years since the publication of the 1978 report, and more especially in recent years, a considerable number of post-*Gregg* studies have attempted to estimate the effect of the legal status or the actual implementation of the death penalty on homicide rates. These studies have reached widely varying conclusions that have resulted in often bitter disagreement about their interpretation.

This more recent literature has been the subject of another National Research Council (2012) report, titled *Deterrence and the Death Penalty*, which I coedited, as well as two reviews of the literature commissioned for the report (Chalfin et al. 2013, Durlauf & Charles 2013) and two previously completed reviews by Donohue & Wolfers (2005, 2009). The 2012 report reached a conclusion similar to the 1978 report: "Research to date on the effect of capital punishment on homicide is not informative about whether capital punishment decreases, increases, or has no effect on homicide rates" (National Research Council 2012, p. 2).

The 2012 National Research Council report levels three key criticisms of the post-*Gregg* capital-punishment-deterrence research that transcend the high profile but still narrow the issue of the deterrent effect of capital punishment. They also apply to studies of the deterrent effect of other forms of sanction—prison, fines, and community control—that form the backbone of contemporary sanction policy in the United States and most other countries throughout the world.

One criticism concerns the incomplete specification of the sanction regime for homicide. Even for capital-eligible convictions for homicide, only a minority result in a sentence of death, let alone an actual execution. This is true even for states such as Texas and Virginia, which make the most intense use of capital punishment. Instead, most homicides result in a lengthy prison sentence,

sometimes life without parole. A study by Cook (2009) illustrates this point. Of 274 cases prosecuted as capital cases, only 11 resulted in a death sentence. Another 42 resulted in dismissal or a verdict of not guilty, which left 221 cases that resulted in conviction and sentences to a noncapital sanction.

None of the post-*Gregg* studies take into account the noncapital component of the sanction regime. There are sound reasons for expecting that the severity of the noncapital sanctions for homicide vary systematically with the availability and the intensity of use of capital punishment. For example, the political culture of a state may affect the frequency of use of capital punishment and also the severity of noncapital sanctions for homicide. Thus any effect that these noncapital sanctions have on homicide may contaminate the estimated effect of capital punishment on homicide. In capital-punishment studies, the potential for such bias is particularly strong because noncapital sanctions remain the dominant sanction response to capital-eligible murders.

Homicide is not the only criminal offense punishable by a range of qualitatively different sanction alternatives. Indeed the sanction regimes for most other criminal offenses, even felonies, include more than one sanction option for their punishment. I return to this point in the discussion of future research directions below.

A second key criticism elaborated in the 2012 National Research Council report concerns the specification of perceptions of the capital-punishment component of the sanction regime. Studies typically suppose that people who are contemplating murder perceive sanctions risks as subjective probabilities of arrest, conviction, and execution. Lacking data on these subjective probabilities, researchers presume that they are somehow based on the observable frequencies of arrest, conviction, and execution.

The report concludes that several factors make the attempts by the panel studies to specify the capital component of state sanction regimes uninterpretable. First, the findings are very sensitive to the way the risk of execution is specified. For example, because of delays between the imposition of a death sentence and it being carried out, if ever, researchers routinely computed ratios in which the numerator was the number of executions in a given state and year divided by the number of death sentences imposed in that state in some prior year. Results are very sensitive to how that ratio is computed, and there is no logical basis for resolving disagreements about how the true risk of execution should be measured. Another difficulty is that only 15% of those sentenced to death in the United States since 1977 have been executed, with close to 40% leaving death row for other reasons (vacated sentences or convictions, commutations, a successful appeal, or death by other causes) and 45% still awaiting execution (Snell 2010). Available information for calculating the risk depends on the size of the state—for large states such as Texas and California, there are far more data for calibrating risk than for small states such as Delaware and Montana. Further complicating matters, policies can change owing to court decisions and administrative decrees of elected officials. This unpredictability calls into question the usefulness of prior data on the death penalty when calculating present and future risk. Because none of the measures used has any clear relationship with the correct measure, there is no reasoned basis for arbitrating competing claims about which study provides the better estimate of the deterrent effect of the death penalty.

Even if it were possible to judge which measure more closely corresponds to true risk, there is no evidence that the perceptions of potential murders correspond to this risk. The above discussion concerns only one aspect of the sanction regime: the risk of execution given conviction. Other relevant dimensions of the sanction regime are the risk of conviction given commission of a murder and the certainty and severity of the noncapital alternatives to the death penalty. The assumption that potential murderers have accurate perceptions of these risks and consequences is not credible: Indeed it is preposterous.

The third key criticism of the capital-punishment literature is that much of the research is based on linear-in-parameters, fixed-effect panel data models that make exceedingly strong assumptions that are not credible. Among these are that the deterrent effect of capital punishment is additive to the rest of the model, and homogeneous, and that the legal status and administration of capital punishment are random across states. The report recommended that future research use methods that identify deterrent effects using models that make less strong assumptions or that make clear the sensitivity of findings to modeling assumptions. Because the panel regression models are also routinely used in deterrence research outside of capital punishment, this recommendation also applies to the wider body of noncapital-punishment research. Readers are referred to Manski & Pepper (2013) and Durlauf et al. (2013) for two methodological alternatives to standard practice (partial identification and model averaging, respectively).

6. SANCTION RISK PERCEPTIONS

This section selectively reviews studies of sanction risk perceptions. For an exhaustive and thoughtful review, on which this discussion draws heavily, readers are referred to Apel (2013). Studies of sanction risk perception come in three primary forms: surveys of the general public's knowledge of the sanction regime, studies of the effect of apprehension (or nonapprehension) on risk perceptions and subsequent behavior, and scenario-based studies in which respondents are questioned about their perceptions of the risk of apprehension and punishment in specific circumstances.

6.1. General Population Surveys

Apel (2013) identifies only two surveys of the general public's knowledge of the statutory penalties for the types of crime that compose the FBI's crime index (e.g., murder, robbery). Both are dated. A survey conducted in the 1970s of residents in Tucson, Arizona, suggests generally good knowledge of the types of sanctions (e.g., fine, prison) available for the punishment of the 14 types of crime surveyed (Williams et al. 1980). Erickson & Gibbs (1979) also find that respondents were reasonably well calibrated on the relative severity of punishments across types of crime (e.g., punishment for robbery is generally more severe than for larceny). However, a study in the 1960s commissioned by the California Assembly found that the general public's knowledge of the statutorily prescribed level of punishment was poor (Assem. Comm. Crim. Proced. 1968). Only about one-quarter of the sample correctly identified the maximum prison sentence available for the punishment of the various crimes included in the survey. However, 62% of incarcerated adults correctly identified the maximum. I return to the large difference in knowledge between the incarcerated and not-incarcerated samples below.

There have also been general population surveys of sanction perceptions for two types of crimes—marijuana use and drunk driving—that are far more prevalent in the general population than crimes such as robbery or burglary. The surveys suggest far better, although hardly perfect, knowledge of the legally available sanctions for these two offenses. MacCoun et al. (2009) report that in states that decriminalized possession between 1976 and 1980, the percentage of student respondents to the Monitoring the Future survey reporting a possible jail sentence declined from 58% to 18%. Corresponding changes for students living in states that did not decriminalize were not as large. This finding suggests that for populations in which there is greater need to know the sanction risk, knowledge of the risk is better. Note, however, that MacCoun et al. also report that, as in the California survey, knowledge of the maximum

penalties for marijuana use was not good. Surveys of knowledge among adults of drunk-driving penalties by Ross (1973) suggest greater awareness of the drunk-driving sanctions and available enforcement tools (e.g., breathalyzers) than corresponding knowledge for street-type crimes.

An important finding of the early panel perceptual deterrence studies in which participants were surveyed on their sanction risk perception and self-reported delinquency over time was that there is considerable instability in sanction risk perceptions and that nonoffenders and novice offenders had higher sanction risk perceptions relative to experienced offenders. Paternoster et al. (1982) call this an experiential effect whereby delinquent youths learned that sanction risks were lower than initially anticipated.

A large number of studies have used longitudinal data to analyze whether the effect of success or failure in avoiding apprehension influences sanction risk perceptions. The analytical strategy involves relating experience with success or failure in prior survey waves with perceptions of apprehension risk in later survey waves. Studies by criminologists of this type were prompted by an influential article by Stafford & Warr (1993), who distinguish between two sources of information on sanction risk: one's own experience and the experience of peers. A parallel literature has also appeared in economics based on Bayesian updating that began with Lochner (2007). The Bayesian updating model and the arguments of Stafford & Warr are complementary. In fact, Bayesian updating formalizes their arguments.

Among the predictions of a Bayesian updating model is that people generally do not entirely abandon prior beliefs based on new information. Instead they will only incrementally adjust them. In the case of the perception of apprehension risk, this implies that the experience of apprehension will result in an incremental upward shift in risk perception, and the experience of what Stafford & Warr (1993) call "apprehension avoidance" will result in an incremental reduction in risk. A second prediction of the Bayesian updating model is that the magnitude of the change will depend on the depth of prior knowledge. Individuals with more prior knowledge tend to adjust less to new information than individuals with less prior knowledge. In the context of sanction risk perceptions, this implies that individuals with more experience with offending will make smaller adjustments in their risk perceptions based on current experience with apprehension than individuals with less experience. Concerning the first prediction, a long list of studies find that increases (decreases) in perceived apprehension risk are associated with the failure (success) in avoiding apprehension (Pogarsky et al. 2005, Matsueda et al. 2006, Lochner 2007, Hjalmarsson 2009, Anwar & Loughran 2011).

Evidence consistent with the second prediction is reported by Pogarsky et al. (2004), Matuseda et al. (2006), and Anwar & Loughran (2011). Anwar & Loughran (2011) conduct a particularly thorough test of this prediction. They analyze a sample comprising approximately 1,300 adjudicated/convicted youth from Arizona and Pennsylvania enrolled in the Pathways to Desistance study (Mulvey 2011) who were interviewed eight times in five years. They find that that being arrested significantly increased subjective probabilities (prediction 1) but that the magnitude of the change was less for more experienced offenders (prediction 2). Specifically, they show that experienced offenders placed relatively more weight on their prior subjective probabilities and therefore updated less in response to new arrests. Inexperienced offenders, by contrast, updated more by placing more weight on their current arrest ratios and less weight on their prior subjective probabilities. It is also noteworthy that the authors conclude that the impact of arrest on subjective probabilities was specific within classes of criminal behaviors—youth arrested for aggressive crimes did not update their subjective probabilities concerning income-generating crimes. This finding implies that there are not spillover effects across classes of crime.

6.2. Studies of Situational Factors on Risk Perceptions

This grouping of studies examines the effect of situational factors on risk perceptions. Particularly important in this regard are situational factors that can be manipulated by policy, such as official sanctions and police presence.

As discussed above, knowledge of official sanctions seems to be strongly affected by the need-to-know principle. Knowledge is better, but hardly perfect, among populations with the greatest involvement in the illegal activity. Based on the California Assembly study, for example, knowledge of the maximum penalty for various FBI index–type crimes was far better for incarcerated sample members than for the not-incarcerated sample members.

Other interesting evidence of the awareness of official sanctions is reported in the previously referenced study by Hjalmarsson (2009), who finds that upon reaching the age of majority, male respondents to the 1997 National Longitudinal Survey of Youth on average increased their perceived risk of incarceration for auto theft by 5.2 percentage points.

Evidence on how police presence affects perceptions of apprehension risk is scant. In my own work with Paternoster, we constructed scenarios and examined how respondent perceptions of sanction risks were affected by scenario conditions. In Nagin & Paternoster (1993) we find that respondent perceptions of sanction costs in a drunk-driving scenario were higher in the scenario condition involving a police crackdown on drunk driving versus a scenario condition described as involving state police cutbacks. In addition, perceptions of sanction costs were lower if surveillance could be avoided by driving on back roads. In scenarios concerning peer provocation, Wikström et al. (2012) find that adolescents reported a lower likelihood of violent response in scenario conditions in which adult monitors were present. Evidence from ethnographic studies suggests that offenders are quite conscious of police presence when selecting targets. Wright & Decker (1994) report that burglars avoid neighborhoods with a heavy police presence and that robbers prefer to target individuals unlikely to report the crime to the police.

7. FOUR TOPICS FOR FUTURE RESEARCH

7.1. Developing and Testing an Integrated Model of the Effects of the Threat and Experience of Punishment

At the outset of this review I distinguish between what criminologists call specific deterrence and general deterrence. The former is the response to the experience of punishment, whereas the latter is the response to the threat of punishment. There is no logical contradiction between the conclusions that the experience of punishment actually increases the propensity for offending, even as the threat of punishment deters it. Indeed in a review by Nagin et al. (2009) of the effect of the experience of imprisonment on recidivism, a key conclusion is that the great majority of studies point to a criminogenic effect of the prison experience on subsequent offending, but Nagin & Snodgrass (2012) and Loeffler (2011) find no such effect.

Although there are statistical shortcomings in the literature suggesting that the experience of imprisonment increases offending, making this conclusion far from definitive, serious attention should be devoted to extending and testing the economic model of crime to account for the possibly of a criminogenic effect of the experience of punishment. Langan & Levin (2002), who analyze data on 272,111 individuals released from prison in 1993, find that within three years, 68% had been arrested, 46.9% had been convicted, and 25.4% had been reimprisoned. According to a Bureau of Justice Statistics (2006) study of felony defendants in the 75 largest cities, at the time of arrest 32% of defendants had an active criminal justice status, such as probation (15%), release

pending disposition of a prior case (10%), or parole (5%). Furthermore, 76% of all defendants had been arrested previously, with 50% having at least five prior arrest charges.

There are two very different interpretations of these statistics. One is that the high concentration of recidivists in the criminal justice system represents the ongoing failure of deterrence to suppress the criminal behavior of a small minority of the population. The other is that the experience of contact with the criminal justice system, most specifically in the form of imprisonment, is criminogenic. These two diametrically opposing interpretations of the data lay at the core of much academic and public policy debate about the role of imprisonment in crime control. The difficulties in disentangling them may be seen in a recent study by Drago et al. (2009) of Italy's Collective Clemency Bill. In May 2006, this bill resulted in the release of more than 20,000 inmates from Italian prisons. The release came with the condition that individuals convicted of another crime within five years of their release would have to serve the residual of the sentence that was suspended in addition to the sentence for the new crime. The residual sentence length varied between 1 and 36 months. Drago et al. (2009) find that each month of residual sentence was associated with a 1.24% reduction in the propensity to recommit crime. The authors interpret this finding as a deterrent effect, but an alternative and equally valid interpretation is that each additional month of imprisonment increases the propensity to offend by 1.2%.[1] The respective roles of these distinct explanations cannot be identified.

The logic of specific deterrence is grounded in the idea that if the experience of imprisonment is sufficiently distasteful, some of the punished may conclude that it is an experience not to be repeated. The structure of the law itself may also cause previously convicted individuals to revise upward their estimates of the likelihood and/or severity of punishment for future lawbreaking. Criminal law commonly prescribes more severe penalties for recidivists. The experience of punishment may also affect the likelihood of future crime by decreasing the attractiveness of crime itself or by expanding alternatives to crime through participation in rehabilitation programs.

There are, however, a number of reasons for theorizing that the experience of punishment might increase an individual's future proclivity for crime. One argument relates to the effect of the experience of crime on expectations about the prison experience. Whereas some individuals might conclude imprisonment is not an experience to be repeated, others might conclude that the experience was not as adverse as anticipated. Other reasons have to do with the social interactions resulting from imprisonment. Prisons might be so-called schools for crime in which inmates learn new crime skills even as their noncrime human capital depreciates. Associating with other more experienced inmates could lead new inmates to adopt the older inmate's deviant value systems. Being punished may also elevate an offender's feelings of resentment against society.

The experience of imprisonment may also increase future criminality by stigmatizing the individual socially and economically. A substantial body of research finds that arrest and conviction adversely affect various forms of conventional attainment, such as access to legal labor markets (for reviews, see Sampson & Laub 1993; Waldfogel 1993; Nagin & Waldfogel 1995, 1998; Freeman 1996).

I see two major tasks related to developing an integrated model of the response to both the threat and experience of legal sanctions. One involves extending Becker's model to account for how the proclivity for crime is affected by the experience of punishment. This will require at a minimum consideration of the effect of the experience of punishment on sanction risk

---

[1]I thank Philip Cook for this important insight on the alternative interpretation.

perceptions and the limiting of legal alternatives to crime owing to factors such as stigma and erosion of human capital. More ambitious efforts might also consider issues related to social interaction that occur in prison that may affect the utility of crime itself.

Because, by construction, this model will recast Becker's model in a dynamic framework, it will also require consideration of the degree to which potential offenders anticipate and discount future consequences of crime and noncrime. There is a vast literature outside of economics that documents the present orientation of criminals (for reviews, see Jolliffe & Farrington 2009, Wilson & Herrnstein 1985). This raises difficult issues of how best to model this present orientation in the context of the rational calculator that typifies economic models. For an extended discussion of these issues, readers are referred to Durlauf & Nagin (2011b).

Empirical testing of the model will require longitudinal data. The specific form of the data that will be required of course depends on the specific form of the model that is developed. There are two promising publicly available data sets. One is the National Longitudinal Survey of Youth, which collects considerable crime-related data. A disadvantage of this data source is that, because it samples the general population, it includes few serious criminals. Another is from the Pathways to Desistance project (Mulvey 2011), which, as indicated above, comprises a sample of youth with felony criminal records. This data source has extraordinarily rich crime-related data.

7.2. Measuring Perceptions of Sanction Regimes

A sanction regime defines the sanctions that are legally available for the punishment of various types of crime and the way that legal authority is actually administered. Depending on the crime and characteristics of the offenders, such as age or prior record, available sanctions range in severity from verbal reprimand to fines and different forms of community service to lengthy terms of imprisonment and execution. The way that the legal authority is actually administered determines the relative frequency with which the available sanction options are used and also the swiftness of their application. Thus both dimensions of the sanction regime—the legal authority for different types of sanctions and the way that authority is administered—combine to determine the certainty, severity, and celerity of sanction options available for the punishment of a specific type of crime.

A major theoretical and empirical gap involves how active criminals and people on the margin of criminality perceive the sanction regime. Deterrence is the behavioral response to perceptions of sanction threats. Establishing the linkage between risk perceptions and actual sanction regimes is imperative. Unless perceptions adjust, however crudely, to changes in the sanction regime, the desired deterrent effect will not be achieved. The Bayesian updating research and the survey evidence showing better knowledge of sanctions among active offenders suggest that there is a linkage. However, many fundamental questions remain unanswered. For example, sanction regimes are multifaceted, their administration is complex, and data measuring that administration have many gaps and are not widely publicized. The above-mentioned report on the deterrent effect of the death penalty (National Research Council 2012) discusses this problem in detail, particularly as it relates to the assumption of many economic studies of the death penalty that subjective perceptions of risk correspond to objective risk. The report observes that this assumption "hardly seems credible" (National Research Council 2012, p. 106). Thus the question is, how are sanction regimes actually perceived? Moreover, there is much evidence that most criminals do not specialize—burglars also tend to commit robberies, engage in other types of violence, and deal drugs. Each of these specific crimes has its own sanction regime. It seems unlikely that criminals have well-formed perceptions of the sanction regimes for specific crimes. How then do they form their subjective perceptions over the types of

crimes that they actually commit or are on the margin of committing? Finally, how do perceptions of the sanction regime evolve over time as a function of one's own experience, the experience of peers, and information from other sources such as the media?

The death penalty report goes on to lay out a research program for assembling data on sanction-regime perceptions not only for murder but also for other serious crimes. I summarize the program here. Readers should refer to the report and associated references for detail (National Research Council 2012).

The essential task is to measure the perceptions of sanction risks that potential criminals actually hold. How might this be done? Researchers have developed considerable experience measuring beliefs probabilistically in broad population surveys. Manski (2004) reviews the history in several disciplines, describes the emergence of the modern literature, summarizes applications, and discusses open issues. Among the major US platforms for the collection of such data are the Health and Retirement Study, which has periodically elicited probabilistic expectations of retirement, bequests, and mortality from multiple cohorts of older Americans; the Survey of Economic Expectations, which has asked repeated population cross sections to state the percent chance that they will lose their jobs, have health insurance, or be victims of crime in the year ahead; and the National Longitudinal Survey of Youth 1997, which has periodically asked young people about the chance that they will become a parent, be arrested, or complete schooling.

However, success in measuring beliefs probabilistically among the general public does not imply that survey research could similarly measure the sanction risk perceptions of potential criminals. A major issue for studies of this type is obtaining data from the relevant population, in this case, the population of potential criminals. Theoretically, most adolescents and adults are physically capable of committing a serious crime. The reality, however, is that the probability of most people doing so is so small that as a practical matter it can be treated as zero.

Thus the first step, and an important prerequisite, for a program of research on sanction risk perceptions is to define the relevant population of potential criminals. Such a definition will be required to devise cost-effective sampling strategies for interviewing people with nontrivial risks of committing crimes. We expect that one important segment of the relevant population is people with criminal records. The correlation between past and future offending is among the best-documented empirical regularities in criminology (National Research Council 1986).

Some may question the feasibility of collecting data on the sanction risk perceptions and criminal behavior of individuals with prior histories of serious crimes, especially if subjects are repeatedly interviewed for the purpose of obtaining longitudinal data. Longitudinal data are useful to study how offending experience and external events, such as police crackdowns or policy changes, affect sanction risk perceptions. However, as noted above, the Pathways to Desistance project demonstrates that, with sufficient diligence, it is feasible to collect longitudinal data on highly crime-prone people.

7.3. Developing and Testing a Theory of Criminal Opportunities

At the outset of this review I point out that the certainty of punishment is determined by the product of conditional probabilities corresponding to stages of the criminal justice system—probability apprehension, probability conviction given apprehension, and so on. In turn, the levels of these probabilities are determined by the decisions and effectiveness of various actors in the criminal justice system and statutory and legal requirements.

One such set of actors who are especially important in affecting certainty includes the police through their influence on the probability of apprehension, which I denote above by p_a. For several reasons, p_a is probably the most important of the certainty-related probabilities in the deterrence

process. First, absent apprehension, the process leading to sanctions cannot be initiated. Second, conditional on apprehension, the probability of sanctions is high for a serious crime. Sixty-eight percent of felony prosecutions result in conviction and imposition of some type of sanction, usually incarceration (Bureau of Justice Statistics 2006). Third, as discussed in Section 2, the informal sanction costs triggered by arrest are likely a major contributor to total sanction costs. Fourth, the well-documented present orientation of most criminals likely makes their perception of p_a a salient factor in their decision calculus.

In Section 4, I indicate that police could affect p_a in two distinct ways. One was through their effectiveness in apprehending criminals after they had committed crimes. The other was by their effectiveness in deterring crime from happening in the first place by tactics such as hot-spot policing. In Nagin (2013), I describe police in the former role as apprehension agents and the latter role as sentinels. Also in Nagin (2013), as here, I conclude that the evidence suggests that the deterrent effect of the police stems primarily from their role as sentinels.

This brings me to the concept of a criminal opportunity. In criminology, there is a large literature devoted to the subject of situational crime prevention (for a good review, see Clarke 1995). This literature has a decidedly practical orientation—it focuses on ways to make potential targets of crime, whether people, objects, or places, more difficult to successfully victimize. Approaches to reducing vulnerability include installation of alarm systems, improved lighting, surveillance systems, fencing, and electronic tagging of property. It also includes human surveillance in the form of community watch groups and security guards. Cohen & Felson (1979) describe human surveillance as "guardianship." The police in their role as sentinels also act as guardians—a liquor store with a police car idling outside is not an attractive criminal target.

A useful metric for measuring the desirability of a criminal opportunity from the would-be offender's perspective is p_a. Viewed from this perspective, p_a is not a homogeneous quantity; it clearly depends on characteristics of the target and level of its protection—p_a equals 1 for anyone foolish enough to try to rob the President of the United States and is close to 0 for a robbery of a feeble elderly person in a deserted location. **Figure 1** shows a hypothetical distribution of criminal opportunities, which is depicted as leftward skewed. Assume that in this population of opportunities, the expected gain from victimization and the expected punishment conditional on
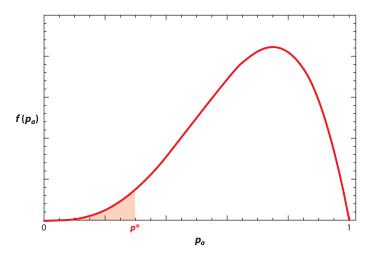

Figure 1

Hypothetical distribution of criminal opportunities.

apprehension are constant. Also assume that would-be offenders have homogeneous preferences. Let p^* denote the maximum probability of apprehension for an acceptable target. Under these assumptions, only opportunities in which $p_a < p^*$ would be victimized. Interesting questions that might be addressed under this set up include the following: How can this model of target choice be imbedded into a Beckerian-type model of the decision to engage in crime? How does policing, as well as other situational crime-prevention tactics, shift this distribution? How do such shifts affect the crime rate and the probability of apprehension for targets that are victimized? How do changes in other aspects of target attractiveness, such as expected sanctions if apprehended, affect crime rates, and how can the sizes of these effects be compared with changes in the distribution of p_a? How can a model of this sort be empirically calibrated? Answers to all these questions should be high-priority research topics.

7.4. Estimating the Deterrent Effect of Shorter Prison Sentences and Identification of High-Deterrence Policies

In Section 1 I point out that crime prevention by incapacitation necessarily requires higher imprisonment rates and the attendant social costs. By contrast, if crime can be deterred from occurring in the first place, there is no perpetrator to punish. As a consequence, crime prevention by deterrence does not necessarily involve a trade-off between crime rates and imprisonment rates (Durlauf & Nagin 2011a). It is thus important for crime-control policy to identify policies that on the margin have large incremental deterrent effects, not only because of their crime-prevention benefits, but also because of their possible reduction of imprisonment rates.

I preface the remainder of this discussion with an important caveat from Durlauf & Nagin (2011a) concerning the identification of high-deterrence sanction policies. Ultimately, a criminal justice policy, assuming it passes a priori justice considerations, should be judged on whether its benefits exceed its costs, including broad social conceptions of the costs of imprisonment. Policies with small or no deterrent effects might pass a benefit-cost test even though they increase prison population. Similarly, high-deterrence policies that are costly to implement might fail the benefit-cost test even though they reduce prison populations. Still, in terms of policy evaluation, the message that these theoretical conditions are meant to convey is that high-deterrence policies are, other things being equal, more desirable than low-deterrence policies and that in principle no logical requirement exists that lower crime means higher imprisonment. The latter is important because of widespread concerns about the social costs of mass incarceration. Therefore, in conjunction with the evaluation of policy effects on crime and imprisonment, clear delineation is needed of the overall costs of the policy.

In Durlauf & Nagin (2011a), we express skepticism that there are large numbers of policies involving increases in sentence length that produce substantial deterrent effects. The one exception may involve short prison sentences. The fine-payment experiment conducted by Weisburd et al. (2008) and the Project HOPE experiment make it clear that the imminent threat of incarceration is a powerful incentive for paying delinquent fines or for conforming with conditions of probation, even for populations who have not been deterred previously by the threat of punishment. These experiments suggest that there is a concave relationship between the magnitude of deterrent effects and sentence lengths. Sentence lengths in Western European countries tend to be far shorter than in the United States. For example, more than 90% of sentences in the Netherlands are less than 1 year (Nieuwbeerta et al. 2009). Research based on European data on the deterrent effect of shorter sentence length should be a priority.

In Durlauf & Nagin (2011a), we also express optimism that viable police-deployment strategies based on the sentinel role of policing hold promise for having large deterrent

effects. Specifically, we speculate that strategies that result in large and visible shifts in apprehension risk are the most likely to have deterrent effects that are large enough to reduce imprisonment as well. Hot-spot policing might have this characteristic. More generally, the types of problem-oriented policing strategies described and championed by Kennedy (2009) and by Kleiman (2009) have the common feature of targeting enforcement resources on selected high-crime people or places. Also, the multimodal approach to preventing crime among high-risk groups that combines deterrent and reintegration tactics described by Papachristos et al. (2007) is a creative example of a carrot-and-stick approach to crime prevention. Although the effectiveness of these strategies for focusing police and other criminal justice resources has yet to be demonstrated, priority attention should be given to their continued evaluation, particularly as they relate to the carrot component of the intervention. The effectiveness of positive incentives is an understudied topic.

8. CLOSING COMMENTS

The aim of this review was to provide a noneconomist's perspective to economists on important findings about the deterrent effect of legal sanctions and on fruitful research opportunities. In my view, research on deterrence in criminology and economics has been too insular, and each discipline would benefit from a better understanding of the perspectives and findings from the other discipline. In this article I attempt to inform economists about relevant research from criminology. In Nagin (2013), I attempt to do the reverse intellectual cross-pollination.

SUMMARY POINTS

1. Studies of changes in police presence, whether achieved by changes in police numbers or in their strategic deployment, consistently find evidence of deterrent effects. Although improvements in the effectiveness of police in apprehending the perpetrators of crimes that are committed may prevent crime by the subsequent incarceration of the perpetrator, there is no good evidence that such activities have a material deterrent effect on other potential criminals.
2. Studies of the deterrent effect of increases in already long prison sentences find at most a modest deterrent effect. However, there is evidence suggesting a concave relationship between the magnitude of deterrent effects and sentence length, which implies decreasing marginal deterrence returns to increases in sentence length.
3. Studies of the deterrent effect of capital punishment provide no useful information on the topic.
4. Four high-priority areas for future research are identified: developing and testing an integrated model of the effects of the threat and experience of punishment, measuring perceptions of sanction regimes, developing and testing a theory of criminal opportunities, and estimating the deterrent effect of shorter prison sentences and identifying high-deterrence policies.

DISCLOSURE STATEMENT

The author is not aware of any affiliations, memberships, funding, or financial holdings that might be perceived as affecting the objectivity of this review.

ACKNOWLEDGMENT

LITERATURE CITED

Andenaes J. 1974. *Punishment and Deterrence*. Ann Arbor: Univ. Michigan Press

Anwar S, Loughran TA. 2011. Testing a Bayesian learning theory of deterrence among serious juvenile offenders. *Criminology* 49:667–98

Apel R. 2013. Sanctions, perceptions and crime: implications for criminal deterrence. *J. Quant. Criminol.* 28: In press

Assem. Comm. Crim. Proced. 1968. Deterrent effects of criminal sanctions: progress report of the Assembly Committee on Criminal Procedure. *Rep.*, Assembly State Calif.

Becker GS. 1968. Crime and punishment: an economic approach. *J. Polit. Econ.* 79:169–217

Blumstein A, Nagin DS. 1978. On the optimal use of incarceration. *Oper. Res.* 26:381–405

Braga AA. 2008. *Police Enforcement Strategies to Prevent Crime in Hot Spot Areas*. Washington, DC: US Dep. Justice, Off. Commun. Oriented Polic. Serv.

Braga AA, Flynn EA, Kelling GL, Cole CM. 2011. Moving the work of criminal investigators towards crime control: new perspectives in policing. *New Perspect. Policing Pap.*, Kennedy School, Harvard Univ., Cambridge, MA

Bureau of Justice Statistics. 2006. *Felony Defendants in Large Urban Counties, 2006*. Washington, DC: Off. Justice Programs

Canela-Cacho JA, Blumstein A, Cohen J. 1997. Relationship between the offending frequency (λ) of imprisoned and free offenders. *Criminology* 35:133–76

Chalfin A, Haviland AM, Raphael S. 2013. What do panel studies tell us about a deterrent effect of capital punishment? A critique of the literature. *J. Quant. Criminol.* In press

Clarke RV. 1995. Situational crime prevention. *Crime Justice* 91:91–150

Cohen LE, Felson M. 1979. Social change and crime rate trends: a routine activity approach. *Am. Sociol. Rev.* 44:588–608

Cook PJ. 1979. The clearance rate as a measure of criminal justice system effectiveness. *J. Public Econ.* 11:135–42

Cook PJ. 2009. Potential savings from abolition of the death penalty in North Carolina. *Am. Law Econ. Rev.* 11:498–529

Cook PJ. 2012. The impact of drug market pulling levers policing on neighborhood violence: an evaluation of the High Point drug market intervention. *Criminol. Public Policy* 11:161–64

Cook PJ, Ludwig J. 2006. Aiming for evidence-based gun policy. *J. Policy Anal. Manag.* 48:691–735

Corsaro N, Hunt ED, Hipple NK, McGarrell EF. 2012. The impact of drug market pulling levers policing on neighborhood violence: an evaluation of the High Point drug market intervention. *Criminol. Public Policy* 11:167–99

DeAngelo G, Hansen B. 2008. *Life and death in the fast lane: police enforcement and roadway safety*. Work. Pap., Univ. Calif., Santa Barbara

Di Tella R, Schargrodsky E. 2004. Do police reduce crime? Estimates using the allocation of police forces after a terrorist attack. *Am. Econ. Rev.* 94:115–33

Donohue JJ, Wolfers J. 2005. Uses and abuses of empirical evidence in the death penalty debate. *Stanford Law Rev.* 58:791–846

Donohue JJ, Wolfers J. 2009. Estimating the impact of the death penalty on murder. *Am. Law Econ. Rev.* 11:249–309

Draca M, Machin S, Witt R. 2011. Panic on the streets of London: police, crime and the July 2005 terror attacks. *Am. Econ. Rev.* 101:2157–81

Drago F, Galbiati R, Vertova P. 2009. The deterrent effects of prison: evidence from a natural experiment. *J. Polit. Econ.* 117:257–80

Durlauf SN, Charles K. 2013. Pitfalls in the use of time series methods to study deterrence and capital punishment. *J. Quant. Criminol.* In press

Durlauf S, Fu C, Navarro S. 2013. Capital punishment and deterrence: understanding disparate results. *J. Quant. Criminol.* In press

Durlauf SN, Nagin DS. 2011a. Imprisonment and crime: Can both be reduced? *Criminol. Public Policy* 10:9–54

Durlauf SN, Nagin DS. 2011b. The deterrent effect of imprisonment. In *Controlling Crime: Strategies and Tradeoffs*, ed. PJ Cook, J Ludwig, J McCrary, pp. 43–94. Chicago: Univ. Chicago Press

Eck JE. 1992. Helpful hints for the tradition-bound chief. *Fresh Perspect. Pap.*, Police Exec. Res. Forum, Washington, DC

Ehrlich I. 1975. The deterrent effect of capital punishment: a question of life and death. *Am. Econ. Rev.* 65:397–417

Erickson ML, Gibbs JP. 1979. On the perceived severity of legal penalties. *J. Crim. Law Criminol. Police Sci.* 70:102–16

Evans WN, Owens EG. 2007. COPS and crime. *J. Public Econ.* 91:181–201

Ferrier M, Ludwig J. 2011. Crime policy and informal social control. *Criminol. Public Policy* 10:1029–36

Freeman RB. 1996. Why do so many young American men commit crimes and what might we do about it? *J. Econ. Perspect.* 10:25–42

Greenwood P, Chaiken J, Petersilla J. 1977. *The Criminal Investigation Process*. Lexington, MA: Lexington Books

Hawken A, Kleiman M. 2009. Managing drug-involved probationers with swift and certain sanctions: evaluating Hawaii's HOPE. *Rep. 230444*, Natl. Inst. Justice, Washington, DC

Heaton P. 2010. Understanding the effects of anti-profiling policies. *J. Law Econ.* 53:29–64

Helland E, Tabarrok A. 2007. Does three strikes deter? A nonparametric estimation. *J. Hum. Resour.* 42:309–30

Hjalmarsson R. 2009. Crime and expected punishment: changes in perceptions at the age of criminal majority. *Am. Law Econ. Rev.* 7:209–48

Johnson R, Raphael S. 2013. How much crime reduction does the marginal prisoner buy? *J. Law Econ.* In press

Jolliffe D, Farrington DP. 2009. A systematic review of the relationship between childhood impulsiveness and later violence. In *Personality, Personality Disorder, and Violence*, ed. M McMurran, RC Howard, pp. 41–61. New York: Wiley

Kansas City Police Dep. 1977. Response time analysis: executive summary. *Rep.*, Kansas City, Mo.

Kennedy DM. 2009. *Deterrence and Crime Prevention: Reconsidering the Prospect of Sanction*. New York: Routledge

Kennedy DM, Braga AA, Piehl AM, Waring EJ. 2001. Reducing gun violence: the Boston Gun Project's Operation Ceasefire. *Res. Rep.*, US Natl. Inst. Justice, Washington, DC

Kleiman M. 2009. *When Brute Force Fails: How to Have Less Crime and Less Punishment*. Princeton, NJ: Princeton Univ. Press

Klepper S, Nagin D. 1989. The deterrent effect of perceived certainty and severity of punishment revisited. *Criminology* 27:721–46

Klick J, Tabarrok A. 2005. Using terror alert levels to estimate the effect of police on crime. *J. Law Econ.* 46:267–79

Langan PA, Levin DJ. 2002. Recidivism of prisoners released in 1994. *Spec. Rep.*, Bur. Justice Stat., US Dep. Justice, Washington, DC

Lee DS, McCrary J. 2009. *The deterrent effect of prison: dynamic theory and evidence*. Work. Pap., Princeton Univ., Princeton, NJ

Levitt SD. 1997. Using electoral cycles in police hiring to estimate the effect of police on crime. *Am. Econ. Rev.* 87:270–90

Levitt SD. 1998. Juvenile crime and punishment. *J. Polit. Econ.* 106:1156–85

Lochner L. 2007. Individual perceptions of the criminal justice system. *Am. Econ. Rev.* 97:444–60

Loeffler CE. 2011. *Estimating the effects of imprisonment on the life-course*. PhD diss., Harvard Univ., Cambridge, MA

MacCoun R, Pacula RL, Chriqui JF, Harris KM, Reuter PH. 2009. Do citizens know whether their state has decriminalized marijuana? Assessing the perceptual component of deterrence theory. *Rev. Law Econ.* 5:347–71

Manski CF. 2004. Measuring expectations. *Econometrica* 72:1329–76

Manski C, Pepper J. 2013. Deterrence and the death penalty: partial identification analysis using repeated cross sections. *J. Quant. Criminol.* In press

Matsueda RL, Kreager DA, Huizinga D. 2006. Deterring delinquents: a rational choice model of theft and violence. *Am. Sociol. Rev.* 71:95–122

Mulvey EP. 2011. Highlights from Pathways to Desistance: a longitudinal study of serious adolescent offenders. *Juv. Justice Fact Sheet*, US Dep. Justice, Washington, DC

Nagin DS. 1998. Criminal deterrence research at the outset of the twenty-first century. In *Crime and Justice: An Annual Review of Research*, Vol. 23, ed. M Tonry, pp. 1–42. Chicago: Univ. Chicago Press

Nagin DS. 2013. Deterrence. In *Crime and Justice: An Annual Review of Research*, Vol. 41, ed. M Tonry. Chicago: Univ. Chicago Press. In press

Nagin DS, Cullen FT, Jonson CL. 2009. Imprisonment and reoffending. In *Crime and Justice: A Review of Research*, Vol. 38, ed. M Tonry, pp. 115–200. Chicago: Univ. Chicago Press

Nagin DS, Paternoster R. 1993. Enduring individual differences and rational choice theories of crime. *Law Soc. Rev.* 27:467–99

Nagin DS, Snodgrass GM. 2012. *The effect of incarceration on re-offending: evidence from a natural experiment in Pennsylvania*. Work. Pap., Heinz Coll., Carnegie Mellon Univ., Pittsburgh

Nagin DS, Waldfogel J. 1995. The effects of criminality and conviction on the labor market status of young British offenders. *Int. Rev. Law Econ.* 15:109–26

Nagin DS, Waldfogel J. 1998. The effect of conviction on income through the life cycle. *Int. Rev. Law Econ.* 18:25–40

National Research Council. 1978. *Deterrence and Incapacitation: Estimating the Effects of Criminal Sanctions on Crime Rates*. Washington, DC: Natl. Acad.

National Research Council. 1986. *Criminal Careers and "Career Criminals": Panel on Research on Criminal Careers*, ed. A Blumstein, J Cohen, JA Roth, CA Visher. Washington, DC: Natl. Acad.

National Research Council. 2012. *Deterrence and the Death Penalty*, ed. DS Nagin, JV Pepper. Washington, DC: National Acad.

Nieuwbeerta P, Nagin DS, Blokland A. 2009. The relationship between first imprisonment and criminal career development: a matched samples comparison. *J. Quant. Criminol.* 25:227–57

Owens EG. 2009. More times, less crime? Estimating the incapacitative effects of sentence enhancements. *J. Labor Econ.* 53:551–79

Papachristos AV, Meares TL, Fagan J. 2007. Attention felons: evaluating Project Safe Neighborhoods in Chicago. *J. Empir. Legal Stud.* 4:223–72

Paternoster R, Saltzman LE, Chiricos TG, Waldo GP. 1982. Perceived risk and deterrence: methodological artifacts in perceptual deterrence research. *J. Crim. Law Criminol.* 73:1238–58

Pogarsky G, Kim K, Paternoster R. 2005. Perceptual change in the National Youth Survey: lessons for deterrence theory and offender decision-making. *Justice Q.* 22:1–29

Pogarsky G, Piquero AR, Paternoster. 2004. Modeling change in perceptions about sanction threats: the neglected linkage in deterrence theory. *J. Quant. Criminol.* 20:343–69

Polinsky AM, Shavell S. 1999. On the disutility and discounting of imprisonment and the theory of deterrence. *J. Legal Stud.* 28:1–16

Poutvaara P, Priks M. 2006. *Hooliganism in the shadow of a terrorist attack and the tsunami: Do police reduce group violence?* Work. Pap., Univ. Helsinki

Raphael S, Ludwig J. 2003. Prison sentence enhancements: the case of Project Exile. In *Evaluating Gun Policy: Effects on Crime and Violence*, ed. J Ludwig, PJ Cook, pp. 251–86. Washington, DC: Brookings Inst.

Reuter P, Pollack H. 2012. Good markets make bad neighbors: regulating open-air drug markets. *Criminol. Public Policy* 11:211–20

Ross HL. 1973. Law, science, and accidents: the British Road Safety Act of 1967. *J. Legal Stud.* 2:1–78

Sampson RJ, Laub JH. 1993. *Crime in the Making: Pathways and Turning Points Through Life*. Cambridge, MA: Harvard Univ. Press

Sherman LW, Eck JE. 2002. Policing for prevention. In *Evidence Based Crime Prevention*, ed. LW Sherman, D Farrington, B Welsh, pp. 295–329. New York: Routledge

Sherman LW, Gartin P, Buerger ME. 1989. Hot spots of predatory crime: routine activities and the criminology of place. *Criminology* 27:27–55

Sherman LW, Weisburd D. 1995. General deterrent effects of police patrol in crime 'hot spots': a randomized study. *Justice Q.* 12:625–48

Shi L. 2009. The limits of oversight in policing: evidence from the 2001 Cincinnati riot. *J. Public Econ.* 93:99–113

Snell TL. 2010. *Capital Punishment 2009: Statistical Tables*. Washington, DC: US Dep. Justice

Spelman W. 1994. *Criminal Incapacitation*. New York: Plenum

Spelman W, Brown DK. 1981. Calling the police: a replication of the citizen reporting component of the Kansas City response time analysis. *Rep.*, Police Exec. Res. Forum, Washington, DC

Stafford MC, Warr M. 1993. A reconceptualization of general and specific deterrence. *J. Res. Crime Delinq.* 30:123–35

Useem B, Piehl AM. 2008. *Prison State: The Challenge of Mass Incarceration*. Cambridge, UK: Cambridge Univ. Press

Vollaard B. 2013. Preventing crime through selective incapacitation. *Econ. J.* In press

Waldfogel J. 1993. The effect of criminal conviction on income and the trust "reposed in the workmen." *J. Hum. Resour.* 24:62–81

Weisburd D, Bushway S, Lum C, Yang S-M. 2004. Trajectories of crime at places: a longitudinal study of street segments in the city of Seattle. *Criminology* 42:238–320

Weisburd D, Eck J. 2004. What can police do to reduce crime, disorder, and fear? *Ann. Am. Acad. Pol. Soc. Sci.* 593:42–65

Weisburd D, Einat T, Kowalski M. 2008. The miracle of the cells: an experimental study of interventions to increase payment of court-ordered financial obligations. *Criminol. Public Policy* 7:9–36

Weisburd D, Green L. 1995. Policing drug hot spots: the Jersey City Drug Market Analysis Experiment. *Justice Q.* 12:711–35

Wikström P-OH, Oberwittler D, Treiber K, Hardie B. 2012. *Breaking Rules: The Social and Situational Dynamics of Young People's Urban Crime*. New York: Oxford Univ. Press

Williams KR, Gibbs JP, Erickson ML. 1980. Public knowledge of statutory penalties: the extent and basis of accurate perception. *Pac. Sociol. Rev.* 23:105–28

Williams KR, Hawkins R. 1986. Perceptual research on general deterrence: a critical overview. *Law Soc. Rev.* 20:545–72

Wilson JM, Chermak S. 2011. Community-driven violence reduction programs. *Criminol. Public Policy* 10:993–1027

Wilson JQ, Herrnstein R. 1985. *Crime and Human Nature: The Definitive Study of Causes of Crime*. New York: Simon & Shuster

Wright RT, Decker SH. 1994. *Burglars on the Job: Streetlife and Residential Break-Ins*. Boston: Northeastern Univ. Press

Zimring F, Hawkins G. 1973. *Deterrence: The Legal Threat in Crime Control*. Chicago: Univ. Chicago Press

RELATED RESOURCES

Paternoster R. 2010. How much do we really know about criminal deterrence? *J. Crim. Law Criminol.* 10:765–823

Piquero A, Paternoster R, Pogarsky G, Loughran T. 2011. Elaborating the individual difference component in deterrence theory. *Annu. Rev. Law Soc. Sci.* 7:355–60

Contents

Indexes

Errata

An online log of corrections to *Annual Review of Economics* articles may be found
at http://econ.annualreviews.org

ANNUAL REVIEWS

It's about time. Your time. It's time well spent.

New From Annual Reviews:

Annual Review of Statistics and Its Application

Volume 1 • Online January 2014 • http://statistics.annualreviews.org

Editor: **Stephen E. Fienberg,** *Carnegie Mellon University*

Associate Editors: **Nancy Reid,** *University of Toronto*

Stephen M. Stigler, *University of Chicago*

The *Annual Review of Statistics and Its Application* aims to inform statisticians and quantitative methodologists, as well as all scientists and users of statistics about major methodological advances and the computational tools that allow for their implementation. It will include developments in the field of statistics, including theoretical statistical underpinnings of new methodology, as well as developments in specific application domains such as biostatistics and bioinformatics, economics, machine learning, psychology, sociology, and aspects of the physical sciences.

Complimentary online access to the first volume will be available until January 2015.

Access this and all other Annual Reviews journals via your institution at www.annualreviews.org.