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Deterrence in the Twenty-first Century: A Review of the Evidence

Daniel S. Nagin

Abstract

The evidence in support of the deterrent effect of the certainty of punishment is far more consistent than that for the severity of punishment. However, the evidence in support of certainty's effect pertains almost exclusively to apprehension probability. Consequently, the more precise statement is that certainty of apprehension, not the severity of the ensuing legal consequence, is the more effective deterrent. This conclusion has important policy implications among which are that lengthy prison sentences and mandatory minimum sentencing cannot be justified on deterrence.

There are four major research gaps. The first concerns the mechanism by which police affect perceptions of the probability of apprehension. The second concerns the inextricable link between the deterrent effect of the threat of punishment and the potentially criminogenic effect of the experience of punishment. The third concerns the concept of a sanction regime defined by the sanctions legally available and how that legal authority is administered. Theories of deterrence conceive of sanctions in the singular not the plural and do not provide a conceptual basis for considering the differential deterrent effects of different components of the sanction regime. The fourth involves sanction risk perceptions. Establishing the link between risk perceptions and sanction regimes is imperative; unless perceptions adjust, however crudely, to changes in the sanction regime, desired deterrent effects will not be achieved.

Three enduring questions have occupied centuries of scholarship on crime and punishment. Does punishment prevent crime? How does punishment prevent crime? And should punishment be used to prevent crime? This essay is concerned with the first two of these questions.

The criminal justice system dispenses justice by apprehending, prosecuting, and punishing individuals who break the law. These activities may prevent crime by three distinct mechanisms—incapacitation, specific deterrence, and general deterrence. Convicted offenders are sometimes punished with imprisonment. Incapacitation concerns crimes averted by their physical isolation during the period of their incarceration. Specific and general deterrence involve possible behavioral responses. General deterrence refers to the crime prevention effects of the threat of punishment. Specific deterrence concerns the aftermath of the failure of general deterrence—the effect on reoffending, if any, that results from the experience of actually being punished.

In this essay, I consider the theoretical and evidentiary basis for general deterrence. In another recent *Crime & Justice* essay (Nagin, Cullen, and Jonson 2009), I surveyed the evidence on the specific deterrence effects of imprisonment. Here, I draw heavily from recent and prior deterrence reviews by myself and others.

My aim is to provide a succinct summary of the current state of theoretical and empirical knowledge about deterrence in support of several interrelated objectives. The first is to provide a selective intellectual history of deterrence research that identifies important recurring themes. I highlight both what has been learned and persistent flaws that should be addressed in future research.

The second objective concerns the framing of discourse on deterrence, which often takes the same pattern, particularly in policy discussions: one group arguing that sanction threats always deter and another group arguing that sanction threats never deter. When deterrence effects are unpacked,

it is clear that sanction threats are not universally efficacious: magnitudes of deterrent effects range from none to seemingly very large. Thus, another primary objective is to move discourse about deterrence away from the equally indefensible positions that deterrence effects are always or never present, to a more nuanced and useful inquiry into the basis for variation in the existence and size of deterrent effects.

The third objective is policy related. Prison populations have been rising in the US for 4 decades. Only recently have there been signs that the increase is abating. In 2009 and 2010 state-level prison population declined but federal-level population continued to increase (BJS 2012). Less well-recognized is that prison populations have risen elsewhere in the world, for example, in the Netherlands since 1975 and more recently in England and Wales, Portugal, Spain, and New Zealand. An incarceration-based sanction policy that reduces crime solely by incapacitation will necessarily increase the rate of imprisonment. In contrast, if the crime control policy also prevents crime by deterrence, it may be possible to reduce both imprisonment and crime—successful prevention by any mechanism, whether by deterrence or otherwise, has the virtue of averting not only crime but also the punishment of perpetrators. Hence, it is important to identify policies that increase imprisonment but have only negligible effects on crime rates.

My main conclusions are as follows: First, there is little evidence that increases in the length of already long prison sentences yield general deterrent effects that are sufficiently large to justify their social and economic costs. Such severity-based deterrence measures include “three strikes, you’re out,” life without the possibility of parole, and other laws that mandate lengthy prison sentence.

Second, based on the earlier noted *Crime and Justice* review (Nagin, Cullen, and Jonson 2009), I have concluded that there is little evidence of a specific deterrent effect arising from the

experience of imprisonment compared with experience of noncustodial sanctions such as probation. Instead, the evidence suggests that that reoffending is either unaffected or increased.

Third, there is substantial evidence that increasing the visibility of the police by hiring more officers and allocating existing officers in ways that materially heighten the perceived risk of apprehension can deter crimes. This evidence is consistent with the perceptual deterrence literature which surveys individuals on sanction risk perceptions and relates these perceptions to their actual or intended offending behavior. This literature finds that perceived certainty of punishment is associated with reduced self-reported or intended offending.

Thus, I conclude, as have many prior reviews of deterrence research, that evidence in support of the deterrent effect of various measures of the certainty of punishment is far more convincing and consistent than for the severity of punishment. However, the certainty of punishment is conceptually and mathematically the product of a series of conditional probabilities—the probability of apprehension given commission of a crime, the probability of prosecution given apprehension, the probability of conviction given prosecution, and the probability of sanction given conviction. The evidence in support of certainty's deterrent effect pertains almost exclusively to apprehension probability. Consequently, the conclusion that certainty not severity is the more effective deterrent is more precisely stated as *certainty of apprehension* and not the severity of the legal consequence ensuing from apprehension is the more effective deterrent. This more precise statement has important policy implications; the empirical evidence from the policing and perceptual deterrence literature is silent on the deterrent effectiveness of policies that mandate incarceration after apprehension. These include policies such as mandatory minimum sentencing laws or sentencing guidelines that mandate incarceration. Thus, this revised conclusion about the

deterrent effect of punishment certainty should not be construed as implying that policies mandating severe legal consequences have been demonstrated to achieve deterrent effects.

Together these conclusions have a range of policy implications, particularly as they relate to the United States (Durlauf and Nagin 2011*a*). First, it is clear that lengthy prison sentences cannot be justified on a deterrence-based, crime-prevention basis. Thus, the case for crime prevention benefits of measures requiring lengthy prison sentences such as California's three-strikes law must rest on incapacitation. Another implication is that crime prevention would be enhanced by shifting resources from imprisonment to policing or, in periods of declining criminal justice system budgets, that policing should get a larger share of a smaller overall budget.

While accumulation of knowledge about deterrence in the past four decades has been impressive, much remains to be learned. There are four major theoretical and related empirical gaps. The first concerns the deterrent effect of the certainty of apprehension. There are two distinct mechanisms by which the police may deter crime. One stems from their effectiveness in apprehending perpetrators of crimes—by definition this activity involves occurrences in which deterrence has failed. Thus, police effectiveness in successfully apprehending criminal perpetrators can have a deterrent effect only on others or on the perpetrator's future behavior. The second mechanism involves the effect of the intensity of police presence in creating a perception that apprehension risk is sufficiently high that no crime is committed in the first place. I speculate that this second mechanism is the primary source of police effectiveness in deterring crime whereas the first role primarily prevents crime by capturing and incapacitating crime-prone individuals. The research gap involves developing rigorous empirical tests of this contention and developing improved theoretical models of how police presence and tactics can reduce the attractiveness of criminal opportunities by increasing the perceived risk of apprehension.

The second gap concerns the distinction between specific and general deterrence. The two are inextricably linked because the experience of punishment is a consequence of the failure of the threat of punishment to deter crime, yet no theory of deterrence explicitly addresses how the experience of punishment influences the deterrent effect of the threat of punishment. Relevant issues include: how the experience of punishment affects the proclivity to commit crime due to potential stigma effects, sustained contacts with criminals in a prison setting, or participation in rehabilitative programs as well as the effect of the experience of punishment on perceptions of the certainty and severity of sanctions. Analysis of these and other related issues will require longitudinal data on individuals who do and do not have the experience of punishment.

The third theoretical gap concerns the concept of a sanction regime. A sanction regime defines the sanctions that are legally available for the punishment of various types of crime and how that legal authority is administered. Depending on the crime and characteristics of the offenders, such as age or prior record, available sanctions range in severity from verbal reprimands to fines and different forms of community service to lengthy terms of imprisonment and execution. How the legal authority is administered determines the relative frequency that 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 how that authority is administered—combine to determine the certainty, severity, and celerity of sanctioning options available for punishment of a specific type of crime.

Theories of deterrence, however, specify sanction threats in the singular, not the plural. For example, a sizable number of studies examine the question whether capital punishment deters murder. Yet properly understood, the relevant question is the differential or marginal

deterrent effect of execution over the deterrent effect of other available or commonly-used penalties. In this case the alternative penalty would be a lengthy prison sentence—sometimes life without the possibility of parole. Yet none of the capital punishment studies take account of differences across states and over time in the severity of non-capital punishments for murder (Nagin and Pepper 2012). Theories of deterrence that conceive of sanctions in the singular do not provide a conceptual basis for considering the differential deterrent effect of different types of sanction options. The empirical companion to this theoretical expansion involves assembling the data required to measure sanction regimes. At least in the US, such data are largely unavailable.

The fourth theoretical and empirical gap involves sanction risk perceptions, an issue that I emphasized in an earlier review of the deterrence literature (Nagin 1998). Deterrence is the behavioral response to the perception of sanction threats. Establishing the link between risk perceptions and sanction regimes is imperative; the conclusion that crime decisions are affected by sanction risk perceptions is not sufficient to conclude that policy can deter crime. Policy cannot directly manipulate perceptions. It can affect only the variety and severity of sanctions legally available in the sanction regime and the manner of their administration. Unless perceptions adjust, however crudely, to changes in the sanction regime the desired deterrent effect will not be achieved.

Since the publication of Nagin (1998), valuable headway has been made in how the experience of apprehension or not following commission of a crime affects sanction risk perceptions. This research is valuable for specification of a theory that combines the concepts of general and specific deterrence. However, it does not address how perceptions are formed about the two key dimensions of a sanction regime—the legal authority for different types of sanctions and how that authority is administered. Numerous surveys have been conducted of the general public’s knowledge of sanction regimes, especially concerning the legal authority for different types of

sanctions (Apel, forthcoming). Not surprisingly, the surveys find that knowledge of sanction regimes is poor. However, the fundamental flaw with these surveys is that knowledge of the potential legal consequences of lawbreaking is unnecessary for most people; their decisions to refrain from crime are based on the mere knowledge that the behavior is legally prohibited, or because of other non-legal considerations such as morality or fear of social censure (Packer 1968; Zimring and Hawkins 1973; Andenaes 1974; Wikström et al. 2012). That said, for individuals for whom sanction threats might affect their behavior, it is preposterous to assume that their perceptions conform to the realities of the legally available sanction options and their administration. More than a decade after my earlier review, it remains the case that little is known about how individuals form perceptions of the sanction regimes they confront.

This essay is organized in the following sections. Key concepts of deterrence are discussed in the first section where I also set out a simplified model of deterrence that is referred to throughout the essay. Section II provides a brief summary of the themes, conclusions, and flaws of research on the deterrent effects of prison and the police up to about 1990. In the third section I summarize the evidence on the deterrent effects of capital punishment. I discuss the capital punishment literature separately because of its distinctive features and salience. I then in section IV examine post-1990 studies of the crime prevention effects of imprisonment and in section V post-1990s studies of the police effects on crime. Section VI discusses the survey-based literature on the accuracy of sanction risk perceptions, their formation, and their relationship to self-reported criminality. Section VII offers conclusions.

I. Key Concepts

Deterrence is a theory of choice in which would-be offenders balance the benefits and costs of crime. Benefits may be pecuniary, as in the case of property crime, but may also involve intangible benefits such as defending one's honor, expressing outrage, demonstrating dominance, cementing a reputation, or seeking a thrill. The potential costs of crime are comparably varied. Crime can entail personal risk if the victim resists. It may also invoke pangs of conscience or shame (Braithwaite 1989). I am mainly concerned with offender responses to the costs that attend the imposition of official sanctions such as arrest, imprisonment, execution, fines, and other restrictions on freedom and liberty such as mandated drug testing or electronic monitoring.

The origins of most modern theories of deterrence can be traced to the work of the Enlightenment-era legal philosophers (Beccaria 1986[1764]; Bentham 1988[1789]). The motivation for their work was their mutual abhorrence of the administration of punishment without constructive purpose. For them the constructive purpose was preventing crime. As Beccaria observed "it is better to prevent crimes than punish them" (1986[1764], p. 93). Beccaria and Bentham argued that there are three key ingredients to the deterrence process—the severity, certainty, and celerity of punishment. These concepts, particularly the certainty and severity of punishment, form the foundation of nearly all contemporary theories of deterrence. The enduring impact of their thinking is remarkable testimony to their innovation.

The theory of deterrence is predicated on the idea that if state-imposed sanction costs are sufficiently severe, criminal activity will be discouraged, at least for some. Thus, one of the key concepts of deterrence is the severity of punishment. Severity alone, however, cannot deter. There must also be some possibility that the sanction will be incurred if the crime is committed. Indeed the argument that the probability of punishment, not severity, is the more potent component of the deterrence process goes back to Beccaria who observed: "One of the greatest

curbs on crime is not the cruelty of punishments, but their infallibility.... The certainty of punishment even if moderate will always make a stronger impression” (1986[1764], p. 58).

In the lifetimes of Beccaria and Bentham there was no criminal justice system as we know it. Punishment for lawbreaking was almost certainly less regular and more haphazard than it is today. Punishment in contemporary society, however, also still remains far from guaranteed. In order for a formal sanction—whether moderate or severe—to be imposed, the offender must first be apprehended, usually by the police.¹ He must next be charged and successfully prosecuted, and finally sentenced by the judge. Successful passage through all of these stages is far from certain. The most important set of actors affecting certainty is the police—absent detection and apprehension, there is no possibility of conviction or punishment. For this reason special attention is given to discussing what is known about the deterrent effect of police activities and presence.

The third conceptual component of the theory of deterrence advanced by Bentham and Beccaria is the swiftness of punishment, which Bentham referred to as celerity. Celerity is the least studied of the conceptual troika underlying deterrence theory. The theoretical basis for its effect on deterrence is ambiguous, as is the empirical evidence on its effectiveness. Even Beccaria seemed to base his case for celerity more on normative considerations of just punishment than on deterrence effectiveness. He observed, “the more promptly and the more closely punishment follows upon the commission of a crime, the more just and useful will it be. I say more just, because the criminal is thereby spared the useless and cruel torments of uncertainty, which increase with the vigor of imagination and with the sense of personal weakness” (Beccaria 1986[1764], p. 36).

¹ Crime may also be sanctioned entirely outside of the criminal justice system through retaliation by the victim or by others on his or her behalf (Jacobs and Wright 2006).

In 1968 economist Gary Becker published the first modern formalization of the Beccaria-Bentham conception of the deterrence process (Becker 1968). Since then, other formalizations have appeared in economics, criminology, law, and sociology—some in the form of mathematical models and others in the form of non-mathematical conceptual theories (Cornish and Clarke 1986).

For the purposes of this essay still another formalization is provided. My purpose is twofold. One is to provide a conceptual structure for framing results that are well established in the literature. The second is more ambitious. I earlier indicated that the seemingly greater deterrent effect of certainty rather than severity of punishment reflected a response to the certainty of apprehension. In this regard, I distinguished two distinct functions of the police—apprehension of the perpetrators of crime and serving in a sentinel function that deters crime from happening in the first place. The second purpose is to formalize this distinction. In so doing I link situational crime prevention theory with deterrence theory.

Bentham's conception of criminal choice involved the would-be offender balancing the potential pains of punishment against the pleasures of the offense. In this spirit the model formalizes the decision of a would-be offender to victimize a potential criminal opportunity, whether that opportunity is a person in the form of a potential robbery victim, or property that might be stolen or vandalized.

The choice model is depicted in figure 1. It distinguishes four possible outcomes if the target is victimized: the criminal act is successfully completed, the act is not successfully completed but the perpetrator is not apprehended, the act is not successfully completed and the perpetrator is apprehended but not convicted, and the act is not successfully completed and the perpetrator is both apprehended and convicted.

The probability of each these outcomes is determined by following probabilities:

Perceived Probability of Successful Completion of the Act. This probability, which is denoted by P_s , measures the would-be offender's perception of the chances the target can be successfully victimized. This perception will be affected by how effectively the opportunity is protected. For property targets, the level of protection is determined by technological safeguards like alarm and surveillance systems and use of physical protection such as locked showcases. For human targets, protection level is affected by the care which valuable property is secured, for example, by keeping it out of sight. Protection may also be provided by what Cohen and Felson (1979) call capable guardians such as security guards, vigilant employees, or onlookers who are willing to intervene. Importantly, the police may also serve as a guardian. I refer to police as acting as sentinels when acting in this role. An idling police car outside a liquor store greatly reduces the chance, probably to zero, that the store can be successfully robbed. This brings me to the risk of apprehension.

Perceived Probability of Apprehension Given Non-Completion. Police perform another crime control function that is distinct from their role as official guardians. They apprehend those offenders who chose to act upon a criminal opportunity. When acting in this role police are described as "apprehension agents." The sentinel and apprehension roles of the police are conceptually linked but distinct. They are conceptually linked because both roles are based on the legal authority of the police to arrest persons suspected of committing a crime. Because a contributing factor to P_s is the risk of apprehension, arrest authority is one source of police influence on P_s in their sentinel role. However, the sentinel role of police is distinct from their apprehension role because the latter comes into play only when deterrence has failed and a would-be offender becomes an actual offender. Thus, at one moment police can be functioning

as a sentinel and in the next moment they can be acting as apprehension agent. The would-be offender's perception of the probability of apprehension given commission of the crime is denoted by p_a .

In this model I assume that the risk of apprehension is limited to acts that are not successfully completed. I make this assumption for several reasons. First, it is useful for clarifying the distinction between police acting as sentinels and police acting as apprehension agents. Second, it conforms to the seeming reality that most offenders are apprehended at the scene of the crime or soon thereafter. I say seeming because I have been able to identify only two studies (Greenwood, Chaiken, and Petersilia 1977; Blake and Coupe 2001) that report relevant data. Data reported in both support this assumption.

Perceived Probability of Conviction Given Apprehension. The offender's perception of the probability that apprehension will actually result in conviction is denoted by $p_{c|a}$.

Under this set-up, the probability of successful completion is P_s , the probability of unsuccessful completion but with apprehension avoidance is $(1-P_s)(1-P_a)$, the probability of unsuccessful completion followed by apprehension but not conviction is $(1-P_s)(P_a)(1-P_{a|c})$, and the probability of unsuccessful completion followed by apprehension and conviction is $(1-P_s)(P_a)(P_{a|c})$.

The benefits and costs of each of these outcomes are assumed to be determined by the following factors:

Rewards. Rewards measures the total benefits of victimizing a target. For a crime with a property motive, the value of the property to the perpetrator likely accounts for all or a major share of the total reward. However, the thrill of offending or—in the case of

violent crimes without a property motive—the satisfaction of humiliating, physically hurting, or killing the victim may also be relevant to the reward value of a target.

Crime Commission Cost. Crime commission cost measures the total cost of committing the crime separate from sanction cost defined below. Commission cost includes time searching for the opportunity, planning time, if any, and the effort required to commit the crime itself. Importantly, it also includes the potential costs to the perpetrator of victim retaliation or resistance. Finally, commission cost includes Raskolnikov-like feelings of guilt or shame that may affect the perpetrator, whether or not he is apprehended and sanctioned.

Perceived Formal Sanction Costs. Perceived sanction cost measures the would-be perpetrator's assessment of the formal sanctions cost that might be imposed if convicted. These costs include the loss of freedom if imprisoned and the unpleasantness of other restrictions on freedom due to conditions of parole or probations, and fines.

Perceived Informal Sanction Cost. The imposition of formal sanctions may also trigger informal sanctions by family, friends, and the community at large, which for some offenders may be even more costly than the formal sanctions. Informal sanction cost may also involve large economic costs due to job loss.

Perceived Cost of Apprehension. Apprehension imposes costs that are distinct from formal and informal sanction cost. These include the unpleasantness of the apprehension

itself, possible loss of liberty due to pre-trial detention, and legal fees. Perceived cost of apprehension also includes the social and economic costs triggered by arrest, even absent conviction, such as disapproval of family, friends, and the community at large, as well as job loss.

At the end of each branch, figure 1 shows the costs that attend the various forms of an unsuccessful attempt or the benefit of a successful attempt. If the individual chooses to act on a criminal opportunity the benefits and costs of the four possible outcomes and their attendant probabilities are as follows:

- 1) The offender successfully completes the criminal act. This occurs with probability P_s and the net benefit to the offender is reward less commission cost. Thus, the expected benefit of victimization is P_s (Reward-Commission Cost) which is denoted as $P_s(R-CC)$.
- 2) The offender is not successful but not apprehended. This occurs with probability $(1-P_s)(1-P_a)$. The cost to the offender is that much, or all, of the commission cost is incurred but with no reward. For simplicity it is assumed that all of the commission cost is incurred. Thus, the contribution of this outcome to expected cost is $(1-P_s)(1-P_a)(\text{Commission Cost})$ which is denoted as $(1-P_s)(1-P_a)CC$.
- 3) The offender is not successful and is apprehended but is not convicted and formally sanctioned. This occurs with probability $(1-P_s)(P_a)(1-P_{a|c})$. In this case the cost to the offender is commission cost plus apprehension cost. Thus the contribution of this outcome to expected cost is $(1-P_s)(P_a)(1-P_{c|a})(\text{Commission Cost} + \text{Apprehension Cost})$ which is denoted as $(1-P_s)(P_a)(1-P_{c|a})(CC + AC)$. Because, as already noted, most

apprehensions occur at the scene of the crime, or shortly thereafter, it is assumed that the perpetrator does not have the opportunity to enjoy the rewards provided by the act.

- 4) The offender is not successful, but is apprehended, convicted and formally sanctioned. This occurs with probability $(1-P_s)(P_a)(P_{c|a})$. In this case the cost to the offender is commission cost plus apprehension cost plus formal and informal sanction cost. Thus, the contribution of this outcome to expected cost, again assuming that the rewards are not enjoyed, is $(1-P_s)(P_a)(P_{c|a})(\text{Commission Cost} + \text{Apprehension Cost} + \text{Formal Sanction} + \text{Informal Sanction Cost})$ which is denoted as $(1-P_s)(P_a)(P_{c|a})(CC + AC + FS + ISC)$.²

An arrow at the top of figure 1 highlights that the possible events depicted occur over time. Success or failure at completion is typically immediate, whereas the down tree events occur later, often months after the criminal event in the case of conviction and sentencing. I return to this observation in the discussion of the celerity of punishment.

It is assumed that the crime will be committed if the expected benefits from a successful completion exceeds the expected cost of an unsuccessful attempt. Namely, if

$$P_s(R-CC) > (1-P_s)(1-P_a)CC + (1-P_s)(P_a)(1-P_{c|a})(CC + AC) + (1-P_s)(P_a)(P_{c|a})(CC + AC + FS + ISC) \quad (1)$$

An equivalent form of this relationship moves P_s on the left-side to the right-side in which case the crime will be committed if:

$$(R-CC) > [(1-P_s) / P_s] [(1-P_a)CC + (P_a)(1-P_{c|a})(CC + AC) + (P_a)(P_{c|a})(CC + AC + FS + ISC)] \quad (2)$$

The left-hand side of equation 2 measures the net benefits of committing the crime and the right-hand side measures the costs. Several observations about this relationship are relevant to the remainder of the discussion.

²This model assumes that success precludes the possibility of subsequent apprehension and the attendant risk of formal sanction.

First, unless the net benefit of crime commission is positive (i.e., $R-C > 0$),³ the offense will not be committed regardless of the formal and informal sanction costs specified on the right-hand side of equation 2. Particularly if commission cost is understood to include the shame of committing an act that involves taking another person's property or doing violence to their person, for most people sanction costs are irrelevant to the decision to refrain from crime. For example, Bachman, Paternoster, and Ward (1992) found in a study of sexual assault that sanction risk perceptions were relevant to self-reported intentions to offend only for the least morally committed. The absence of an effect for those with higher levels of moral commitment, however, should not be construed as their being impervious to incentives but to their moral commitment being a sufficient basis for refraining from sexual assault.⁴ This elementary but fundamental point has been made repeatedly in the discussion about to the degree which sanction threats affect behavior among different individuals. See, for example, Zimring and Hawkins (1973) and more recently Wikström et al. (2012) and Piquero et al. (2011). I return to this point in the discussion of sanction risk perceptions and their influence on behavior in section VI.

Second, the bottom three branches of the tree pertain to the consequences of failure to complete the crime. Commission cost contributes to the total cost of all three of these branches, apprehension cost contributes to two of the three branches—apprehension with and without conviction—and informal and formal sanctions cost contribute only to the final branch, apprehension with conviction. This implies that increases in perceived commission cost will have a greater deterrent effect than equal increases in either perceived apprehension cost or perceived formal and informal sanction cost. In turn the structure of the tree implies that increases in apprehension cost will have a greater deterrent effect than equal increases in either

³ Rewards and commission cost may also be affected by risk preferences.

⁴ Knowledge of potential punishment may also reinforce a normative sense of wrongfulness.

formal or informal sanction cost. This observation helps to explain the longstanding conclusion from the perceptual deterrence literature that shame, a key component of commission cost and apprehension cost, plays a more decisive role in the deterrence process than sanction cost. This issue is discussed further in section III. It also explains the seeming effectiveness of situational crime prevention tactics. A topic I allude to in section V.

Third, the structure of the tree also implies that decreases in P_s will have larger deterrent effects than equal-sized increases in either P_a or $P_{s|a}$ and that increases in P_a will have a bigger deterrent impact than an equal increase in $P_{s|a}$. This observation is consistent with the longstanding belief dating back to Beccaria that the certainty of punishment is a more effective deterrent than the severity of punishment. However, I earlier noted that the evidence suggests that a more precise statement of the certainty conclusion pertains to the certainty of apprehension. The decision model laid out here provides a still more precise statement of that conclusion. Decreases in P_s provide more effective deterrence than equal increases in P_a . Concerning the distinction between police serving as sentinels or as apprehension agents, when serving in their role as sentinels they affect P_s whereas when serving as apprehension agents they affect P_a . This implies the sentinel role of policing is more effective in deterring crime than their apprehension agent role. This observation is relevant to the discussion in section V of the varying findings on police effectiveness in preventing crime.

II. Deterrence Research to the 1990s

Empirically-based deterrence research began in earnest in the late 1960s. There were three major instigators. One was technological—the growing availability of computers and statistical software for analyzing crime data which itself was growing in availability. The second was

social—the steady growth of crime rates during the 1960s. The third was intellectual, especially within economics—with the publication in 1968 of Gary Becker’s seminal article “Crime and Punishment: An Economic Approach.”

Deterrence studies up to the 1990s are usefully grouped into three categories: experimental and quasi-experimental studies, aggregate studies, and perceptual deterrence studies. My 1998 *Crime and Justice* review provided an extended discussion of the three types of studies (Nagin 1998). This section summarizes conclusions of the experimental and quasi-experimental studies and aggregate studies of this research era that are most relevant to this review. Because of the persistence of themes in the pre- and post-1990s perceptual deterrence research and the continuity of the research methods used, I discuss this body of research without reference to era in section VI.

A. Experimental and Quasi-Experimental Studies

This category of studies examines the effect of targeted policy interventions such as police crackdowns or implementation of statutes changing penalties. In the experimental studies the intervention and control treatments are randomly assigned. A classic example is the Minneapolis Domestic Violence Experiment (Sherman and Berk 1984) in which police responded to misdemeanor incidents of domestic violence with one of three randomly chosen responses. The arrest response was found to be most effective in preventing recidivism but as discussed in section V this finding was not consistent across replications of the experiment in other localities.

True experiments, however, compose only a small fraction of the studies in this category. Most are quasi-experiments. The best-designed quasi-experimental studies attempt to incorporate important features of a true experiment—a well-defined treatment regime, measurement of response

before and after treatment, and a control group. Two classic studies of this genre are Ross's studies of the effects on drunk driving of the British Road Safety Act (Ross 1973) and of Scandinavian-style drunk driving laws. Most studies in this group examine the effects of police crackdowns on drug markets, disorderly behavior, and drunk driving. Excellent reviews of these studies are available in Sherman (1990) and Ross (1982). Both Sherman and Ross conclude that the interventions were generally successful in generating an initial deterrent effect. For instance, in drunk-driving interventions this was evidenced by a reduction in fatalities in which the driver was intoxicated or in drug market crackdowns by reduced dealing. However, they also concluded that the effect was generally only transitory: the initial deterrent effect typically began decaying even while the intervention was in effect. One exception to this finding of at least initial deterrent effectiveness concerned studies of increases in sentence severity. Ross (1982) discusses the ineffectiveness of severity enhancements in three very different places—Finland, Chicago, and New South Wales, Australia. Evidence even of an initial effect is less consistent than in studies of interventions that increased the certainty of apprehension.

I take away three important lessons from this literature. First, the generally more consistent findings of initial effectiveness in the apprehension-based interventions, compared to the severity-based interventions, provides more evidence in support for my modified version of the certainty effect, namely that certainty of apprehension is a more effective deterrent than the severity of the ensuing legal consequences, but with an important proviso. Ross (1982) attributed the ineffectiveness of severity-enhancing policies to the fact that they trigger a system response that reduced certainty of punishment. He pointed out that if judges or juries believed the penalties too harsh, they may have responded by refusing to convict guilty defendants. Police and prosecutors may respond similarly. Thus, any potential deterrent effect of the severity enhancement may be

canceled by the reduction in certainty. This result is a reminder not only of the difficulty of enforcing penalties that are deemed unjust but also that certainty and severity do not operate independently—they interact. Tonry (2009) forcefully elaborates upon many of these points.

Second, Sherman (1990) offers useful nomenclature for describing the finding of only transitory effects. He uses the term "initial deterrence decay" to describe the decline in the deterrent response as "potential offenders learn through trial and error that they had overestimated the certainty of getting caught at the beginning of the crackdown," and "residual deterrence" which is a crime suppression effect that extends beyond the intervention until offenders learn by experience or word of mouth that "it is once again 'safe' to offend" (p. 10). Sherman's observations are a reminder that deterrence is a perceptual phenomenon. In Sherman (1990) and Nagin (1998) we both discuss the decay of initial deterrence as a possible response to what behavioral economists call ambiguity aversion. People consistently prefer gambles in which the risks are clearly comprehensible compared to equivalent gambles in which the risks are less transparent. Initial deterrence may be a response to perceptions of uncertainty about true risk rather than to any change in the true risk of apprehension. Thus, unless policy can affect perceptions there will be no behavioral response. It is also a reminder that perceptions may be updated in response to cues from the environment and therefore will not necessarily be stable. I return to this important issue in the discussion of the perceptions studies in section VI.

Third, the findings from these studies have stood the test of time. In my judgment, well conducted experimental and quasi-experimental studies of deterrence provide the most convincing evidence of the circumstances under which deterrence is and is not effective. This holds for both the post-1990s and the pre-1990s literatures.

B. Aggregate Studies

The pre-1990s aggregate studies generally analyzed the association of crime rates across geographic units, usually states, with measures of the certainty and severity of punishment. The most basic form of these analyses involved bivariate correlations across states of crimes rates for the crime categories composing the FBI part I crime index (e.g, murder and non-negligent homicide, robbery, burglary) with certainty of punishment, measured by prison admissions per reported crime, and severity of punishment, measured by median time served. More elaborate analyses were conducted in a regression format. These analyses added various state characteristics known to be correlated with crime (e.g., age and racial composition, urbanization) to the base regression model relating crime rate to the certainty and severity measures. Negative and significant associations were generally found between the crime rate and the certainty of imprisonment ratio. The association of time served with the crime rate was generally insignificant.

Reviews of these studies, including a high-visibility National Research Council (NRC) report (Blumstein, Cohen, and Nagin 1978), concluded that the aggregate studies suffered from such grave flaws that they did not provide a basis for valid inference about deterrent effects. Two flaws are particularly noteworthy because they remain relevant to the interpretation of a successor strand of post-1990 aggregate studies discussed in section IV. The first is that the associations do not distinguish the behavioral response to sanction threats, deterrence, from incapacitation. The second is more fundamental—distinguishing cause from effect. All forms of non-experimental data are vulnerable to the criticism that the outcome of interest, in this case the crime rate, is the cause of the predictor of interest, in this case sanctions, and not vice-versa. High crime rates, for example, might prompt a police crackdown followed by crime rates declining for other reasons. Cross-polity studies of natural variations in crime rates and sanction levels are particularly vulnerable to this concern

because there is generally no basis for assessing whether the variations in sanction levels are the result of factors independent of the crime rate. By contrast, for quasi-experimental studies institutional research can reveal whether the intervention was prompted by rising crime rates.

III. Capital Punishment

Studies of the deterrent effect of capital punishment have been and continue to be the source of bitter contention. Isaac Ehrlich's 1975 study, in which he concluded that each execution averted seven to eight homicides, is undoubtedly the most cited study of this kind. The 1978 National Research Council report (Blumstein, Cohen, and Nagin 1978) and an accompanying commissioned paper (Klein, Forst, and Filatov 1978) laid out a lengthy list of criticisms of the Ehrlich analysis. The NRC report concluded, "available studies [including Ehrlich's] provide no useful evidence on the deterrent effect of capital punishment" (p. 9).

Coincidentally, that report was issued shortly after the 1976 Supreme Court decision *Gregg v. Georgia* ended the moratorium on execution in the United States. In the 35 years since 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 and have resulted in often bitter disagreement about their interpretation.

This more recent literature has been the subject of still another NRC report titled *Deterrence and the Death Penalty*, which I co-edited (Nagin and Pepper 2012), as well as two reviews of the literature commissioned by the NRC committee (Chalfin, Haviland, and Raphael 2012; Durlauf and Charles, forthcoming), and two valuable reviews by Donohue and Wolfers

(2005, 2009). The NRC report and all of the reviews are highly critical of the post-*Gregg* research. The report concluded:

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.

Therefore, the Committee recommends that these studies not be used to inform deliberations requiring judgments about the effect of the death penalty on homicide.

Consequently, claims that research demonstrates that capital punishment decreases or increases the homicide rate by a specified amount or has no effect on the homicide rate should not influence policy judgments about capital punishment. (Nagin and Pepper 2012, p. 3)

The NRC report leveled two key criticisms of the post-*Gregg* capital punishment deterrence research that transcend the high profile but still narrow 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 US and most other countries.

One criticism concerned the incomplete specification of the sanction regime for homicide. Even for capital-eligible convictions for homicide, only a minority of cases result in a sentence of death, let alone an execution (Nagin and Pepper 2012). This is true even for states such as Texas and Virginia that 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 resulting in conviction and sentences to a noncapital sanction.

None of the post-*Gregg* studies take into account the non-capital component of the sanction regime. As discussed in Chalfin, Haviland, and Raphael (2012) and Nagin and Pepper (2012), there are sound reasons for expecting that the severity of the non-capital 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 non-capital sanctions for homicide. Thus, any effect that these non-capital 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, as noted, non-capital sanctions remain the dominant sanction response to capital eligible murders, even in states that make the most intense use of capital punishment.

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. This point is returned to in section IV.

A second key criticism elaborated in the NRC report concerned 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 concluded that several factors made the attempts by the panel studies to specify the capital component of state sanctions 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 its 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 (Chalfin, Haviland, and Raphael 2012) and there is no logical basis for resolving disagreements about how the true risk of execution should be measured. Among the difficulties is that only 15 percent of those sentenced to death in the United States since 1977 have been executed, with close to 40 percent leaving death row for other reasons (vacated sentences or convictions, commutations, a successful appeal, or death by other causes), and 45 percent still awaiting execution (Snell 2010). Available information for calculating the risk depends upon the size of the state—for large states such as Texas and California there is far more data for calibrating risk than for small states such as Delaware and Montana. Further complicating matters, policies can change due 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 murderers correspond to this risk. The above discussion concerns only one aspect of 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 non-capital component alternatives to the death penalty. The assumption that potential murders have accurate perceptions of these

risks and consequences is not credible: indeed it is preposterous. I return to the issue of sanction risk perceptions in section VI.

IV. Imprisonment and Crime

There have been two distinct waves of aggregate studies of the relationship between imprisonment and crime. Studies in the 1960s and 1970s described in section II examined associations of state-level crime rates to state-level certainty of punishment, measured by the ratio of prison admissions to reported crimes, and to state-level severity of punishment as measured by median time served. These studies suffered from fundamental deficiencies laid out in the 1978 NRC report (Blumstein, Cohen, and Nagin 1978) and elsewhere. As a consequence, aggregate-level deterrence research went largely “silent” for more than a decade.

A. Post-1990s Aggregate Studies

By the mid-1990s, a second generation of studies emerged. Unlike the first-generation studies, which primarily involved cross-sectional analyses of states, second-generation studies had a longitudinal component in which data were analyzed across states and over time. Another important difference in the second-generation studies is that they did not attempt to estimate certainty and severity effects separately. Instead they examined the relationship between the crime rate and rate of imprisonment as measured by prisoners per capita.

A review by Donohue (2007) identifies six studies of the relationship of crime rates to imprisonment rates. All find statistically significant negative associations between imprisonment rates and crime rates, implying a crime prevention effect for imprisonment. However, the magnitude of the estimate varied widely; from nil for a study that allowed for the possibility that

prevention effects decline as the scale of imprisonment increases (Liedka, Piehl, and Useem 2006) to -0.4 percent for each 1 percent increase in the imprisonment rate (Spelman 2000).

Apel and Nagin (2009), Durlauf and Nagin (2011*a*, 2011*b*), and Donohue (2007) discuss important flaws in these studies. One is that they are necessarily measuring the combined effect of deterrence and incapacitation on crime rates and thus cannot be interpreted as measuring the deterrent effect of imprisonment. At best they can be said to estimate the upper bound of that effect.

Other shortcomings are even more fundamental. One concerns the same fundamental flaw of the first-generation studies—distinguishing cause from effect. While imprisonment prevents crime through a combination of deterrence and incapacitation, crime also generates the prison population. The object of interest is the effect of the imprisonment rate on the crime rate but data available for estimation of that effect also reflects the effect of the crime rate on the imprisonment rate. Thus, statistical isolation of the crime prevention effect requires properly accounting for the effect of crime on imprisonment.

The shortcomings in the statistical strategies used in these studies to identify the crime prevention effect of imprisonment are discussed at length in Durlauf and Nagin (2011*a*, 2011*b*). To summarize, with the exception of Levitt (1996) and Johnson and Raphael (forthcoming *a*), the conclusions of the studies rest on a form of statistical analysis pioneered by the Nobel Laureate Clive Granger (1969). Granger's method is often mistakenly interpreted as providing estimates with a causal interpretation, which in the context of the aggregate imprisonment studies would be the expected change in the crime rate resulting from a policy that changes the imprisonment rate by a specified amount. In fact, the results are not in general amenable to this interpretation. Instead, application of Granger's method provides only a basis for forecasting

future changes in the crime rate as a function of prior changes in the imprisonment rate and the crime rate. While valid forecasts can be based on correlations alone, valid causal interpretation requires more than establishing correlation.

Figure 2 illustrates the problem. Panel A depicts hypothetical crime and imprisonment functions. The crime function $C(I)$ describes the crime rate as a function of the imprisonment rate, I , and the imprisonment function $I(C)$ measures the imprisonment rate as a function of the crime rate, C . $C(I)$ is shown to be downward sloping in I to reflect the crime reduction effects of imprisonment via some combination of deterrence and incapacitation. Studies of the relationship of the crime rate to the imprisonment rate aim to measure whether this line is in fact downward sloping and if so, by how much. $I(C)$ is depicted as upward sloping because for any fixed set of policies determining the certainty and severity of punishment, imprisonment rates will be a rising function of the crime rate.⁵ The intersection of the $C(I)$ and $I(C)$ functions at I_0 and C_0 measures the observed level of crime and imprisonment.

Crime rates and imprisonment rates are, of course, affected by a multitude of other factors beyond their mutual interaction as depicted in Panel A. The key to estimating $C(I)$ is identifying some factor, called an instrumental variable, that is thought to affect the imprisonment rate but which affects the crime rate only via its effect on shifting the location of imprisonment rate function. Suppose such an instrumental variable (IV) were identified and denoted by z . Panel B demonstrates how changing values of z from z_1 to z_2 to z_3 shifts the $I(C)$ function and in so doing, traces out the $C(I)$ function. Connecting the point (I_1, C_1) , (I_2, C_2) , and (I_3, C_3) estimates $C(I)$. In this fashion IV regression models can be said to identify $C(I)$ and

⁵ Like the entire imprisonment and crime literature, I too assume that sanction policies are unaffected by either the crime rate or the imprisonment rate. This is a not a tenable assumption. However, all the points I make in the ensuing discussion would continue to hold if the model were generalized to allow sanction policy to be affected by crime rates and imprisonment rates.

thereby the crime reduction effect of the imprisonment rate on the crime rate. However, the key to IV regression successfully isolating this effect is that $C(I)$ is not directly affected by z . Panel C illustrates the failure of this assumption. If z also shifts $C(I)$, the changing equilibrium values of the imprisonment rate and crime rate no longer trace out the $C(I)$ function.

Only Levitt (1996) and Johnson and Raphael (forthcoming *b*) use a IV regression approach to identify the causal effect of imprisonment on crime. Levitt (1996) uses court-ordered prison releases to form a set of instrumental variables. He argues that such court orders meet the test for providing a valid estimate of the effect of imprisonment rate on the crime rate—the orders have no direct effect on the crime rate and affect it only insofar as the court orders affect the imprisonment rate, which in turn affects the crime rate.

Even accepting this argument, the estimated effect has only limited policy value. By its construction, it is likely measuring the effect on crime of the early release of selected prisoners, probably those nearing the end of their sentenced terms. It may also be reflecting the effect of diversion of individuals convicted of less serious crime either to local jails or to community supervision. In either case, the estimates are not informative about the crime prevention effects, whether by deterrence or incapacitation, of sentence enhancements related to the manner in which a crime is committed (e.g., weapon use), or the characteristics of the perpetrator (e.g., prior record), or to policies affecting the likelihood of incarceration. More generally, the uncertainty about what is actually being measured inherently limits the value of the estimated effects for both policy and social science.

A more recent study by Johnson and Raphael (forthcoming *a*) is based on a technically complex IV regression model. Identification is based on the assumption that prison populations do not change instantaneously in response to changes in the size of the criminal population.

Similar to the non-IV-based analysis of Liedka, Piehl, and Useem (2006), Johnson and Raphael conclude that the crime prevention effect of imprisonment has diminished with the scale of imprisonment which was rising steadily over the period of their analysis 1978 to 2004.

One explanation for the Johnson and Raphael finding is that the states and the federal government over this period collectively implemented policies with steadily declining average deterrent effectiveness. Given that knowledge of the deterrent effectiveness of alternative sanction policies is so limited, this explanation is not credible. An alternative explanation involving incapacitation is more credible. If the crime reduction effect of incarceration primarily stems from incapacitation, the Johnson and Raphael finding is consistent with the concept of “stochastic selectivity” (Canela-Cacho, Blumstein, and Cohen 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. Johnson and Raphael’s finding is replicated by Vollaard (forthcoming) in an analysis of the Netherland’s Habitual Offender Law. Vollaard attributes the entirety of the crime prevention effect that he estimates to incapacitation. Also of note, Owens (2009) in her analysis of 2003 data from Maryland finds modest incapacitation effects.

The incapacitation interpretation of the Johnson and Raphael finding of decreasing crime prevention returns with the scale of imprisonment is more credible than the deterrence interpretation. This interpretation also implies that the study is not useful for learning about deterrence. However, even the incapacitation interpretation is cast in doubt by the aging of the US prison population. Between 1991 and 2010 the percentage of prisoners in state and federal prisons over 45-years-old has nearly tripled from 10.6 percent to 27.4 percent BJS (1999, 2011). Thus, the seeming decline in the incapacitative effectiveness of prison with scale may only be

reflecting the aging of the prison population which coincides with rising imprisonment rates. Further complicating the decreasing returns interpretation is the changing composition of the prison population in terms of the composition of prisoner conviction offense. Over the past four decades, the percentage of prisoners incarcerated for non-part-I FBI index crimes has increased substantially (Blumstein and Beck 1999, 2005). Thus, the reduction in crime prevention effectiveness may be due to the types of prisoners incarcerated not to scale effects.

All of these studies whether IV-based or not also suffer from an important conceptual flaw that limits their usefulness in understanding deterrence and devising crime-control policy. Prison population is not a policy variable per se; rather, it is an outcome of sanction policies dictating who goes to prison and for how long—namely, the certainty and severity of punishment. In all incentive-based theories of criminal behavior, in the tradition of Bentham and Beccaria, the deterrence response to sanction threats is posed in terms of the certainty and severity of punishment, not in terms of the imprisonment rate. Therefore, to predict 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 that analyzes the relationship of the crime rate to the imprisonment rate.

The studies are also conducted at a too-global level. In Nagin (1998) I describe the two-dimensional taxonomy of sanction policies affecting the scale of imprisonment. One dimension labeled "type" distinguishes three broad categories: policies regulating certainty of punishment such as laws requiring mandatory imprisonment, policies influencing sentence length such as determinate sentencing laws, and policies regulating parole powers. The second dimension of the taxonomy, "scope," distinguishes policies that cast a wide net, such as a general escalation of penalties for

broad categories of crime, compared to policies that focus on targeted offenses (e.g., drug dealing) or offenders (e.g., three-strikes laws).

The nearly 500 percent growth in prison population over the last 2 decades is attributable to a combination of policies belonging to all cells of this matrix. Parole powers have been greatly curtailed, sentence lengths increased, both in general and for particular crimes (e.g., drug dealing), and judicial discretion to impose non-incarcerative sanctions has been reduced (Tonry 1996; Blumstein and Beck 1999, 2005; Raphael and Stoll 2007). Consequently, any effect on the crime rate of the increase in prison population reflects the effects of an amalgam of potentially interacting treatments.

There are good reasons for predicting differences in the crime reduction effects of different types of sanctions (e.g., mandatory minimums for repeat offenders vs. prison diversion programs for first-time offenders). Obvious sources of heterogeneity in offender response include factors such as prior contact with the criminal justice system, demographic characteristics, and the mechanism by which sanction threats are communicated to their intended audience. Indeed, available evidence on the deterrent effect of sentence enhancements, the next topic of discussion, demonstrates such heterogeneity.

B. Policy Evaluation Studies of Sentence Enhancements

There have been comparatively few studies of the deterrent effects of sentence enhancements, judged relative to their importance in contemporary crime control policy. The earliest post-1970s attempts to measure severity effects analyzed the deterrent impact of sentence enhancements for gun crimes. In a series of studies, Loftin, McDowell, and colleagues (Loftin and McDowall 1981; Loftin, Heumann, and McDowall 1983; Loftin and McDowall 1984)

examined whether sentence enhancements for gun use in committing another type of crime such as robbery deter gun use in the commission of crime. While the findings are mixed, this body of research has generally failed to uncover evidence of a deterrent effect (but see McDowall, Loftin, and Wiersema 1992).

However, one important caveat remains with respect to extrapolating these studies to understanding the link between deterrence and severity. The same literature that found that gun penalty enhancements were ineffective also found that these laws generally failed to increase the sentences actually received in gun-related crime prosecutions. Thus, gun-using criminals may not have responded because the real incentives were not changed. This again is a reminder of Tonry's (2009) commentary on the highly inconsistent administration of mandatory minimum sentencing.

Kessler and Levitt (1999) examine the deterrent impact of another California sentence enhancement law, Proposition Eight, passed in 1982. Proposition Eight anticipated the three-strikes laws passed by many states in the 1990s. They estimate a 4 percent decline in crime attributable to deterrence in the first year after enactment. Within 5 to 7 years, the effect grows to a 20 percent reduction. As acknowledged by Kessler and Levitt, the longer term estimate includes incapacitation effects.

Webster, Doob, and Zimring (2006) challenged the basic finding of any preventive effects. Kessler and Levitt examine data from every other year. When all annual data are used, Webster, Doob, and Zimring (2006) find that the decline in crime rates in the affected categories begins before Proposition Eight's enactment, and the slope of this trend remains constant through implementation. But see Levitt (2006) for a response and commentary supporting Webster and colleagues by Raphael (2006) .

One exception to the scarcity of studies on the crime prevention effects of sentence enhancements concerns analyses of the deterrent effect of California's "three strikes, you're out" law, which mandated a minimum sentence of 25 years upon conviction for a third strike offense. Zimring, Hawkins, and Kamin (2001) concluded that the law reduced the felony crime rate by at most 2 percent. They also conclude that only those individuals with two convictions for two offenses qualifying as "strikes" showed any indication of reduced offending. Other studies by Stolzenberg and D'Alessio (1997) and Greenwood and Hawken (2002), who like Zimring, Hawkins, and Kamin (2001) examine before and after trends, conclude that the crime prevention effects were negligible.

I turn now to six studies which in my judgment report particularly convincing evidence on the deterrent effect of incarceration. They also nicely illustrate heterogeneity in the deterrence response to the threat of imprisonment. These studies are: Weisburd, Einat, and Kowalski (2008) and Hawken and Kleiman (2009), who study the use of imprisonment to enforce fine payment and conditions of probation, respectively, and find substantial deterrent effects; Helland and Tabarrok (2007), who analyze the deterrent effect of California's third-strike provision and find a modest deterrent effect; Raphael and Ludwig (2003) who examine the deterrent effect of prison sentence enhancements for gun crimes and find no effect; and Lee and McCrary (2009) and Hjalmarsson (2009), who 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, Einat, and Kowalski (2008) report on a randomized field trial of alternative strategies for incentivizing the payment of court-ordered fines. The most salient finding involves the "miracle of the cells," namely, that the imminent threat of incarceration provides a powerful incentive to pay delinquent fines, even when the incarceration is only for a short period. The

miracle of the cells provides a 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 and colleagues label the response the “miracle of the cells” and not the “miracle of certainty” is telling. Their choice of label is a reminder that certainty must result in a distasteful consequence in order 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 non-draconian sanctions has been applied with apparently great success in Project Hope, an intervention heralded in Hawken and Kleiman (2009), Kleiman (2009), and Hawken (2010). 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, 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 (e.g., 1–2 days) for positive drug tests or other violation of conditions of probation. Thus, both the Weisburd, Einatt, and Kowalski (2008) fine experiment and Project Hope show that highly certain punishment can be an effective deterrent in cases where deterrence has previously been ineffective in averting crime.

Helland and Tabarrok (2007) examine whether California’s “three strikes, you’re out” law deters offending among individuals previously convicted of strike-eligible offenses. The future offending of individuals convicted of two previous eligible offenses was compared with that of individuals who had been convicted of only one eligible offense but who, in addition, had

been tried for a second eligible offense but were ultimately convicted of a noneligible offense. The two groups of individuals were comparable on many characteristics such as age, race, and time in prison. Even so, Helland and Tabarrok find that arrest rates were about 20 percent lower for the group with convictions for two eligible offenses. The authors attribute this to the greatly enhanced sentence that would have accompanied conviction for a third eligible offense.

Raphael and Ludwig (2003) examine the deterrent effect of sentence enhancements for gun crimes that formed the basis for a much publicized Richmond, VA federal program called Project Exile. Perpetrators of gun crimes, with a particular emphasis on those with a felony record, were the targets of federal prosecution which provided for far more severe sanctions for weapon use than were provided by Virginia state law. In a careful and thorough analysis involving comparisons of adult homicide arrest rates with juvenile homicide arrest rates within Richmond and comparisons of gun homicide rate between Richmond and other cities with comparable pre-intervention homicide rates, Raphael and Ludwig conclude that the threat of enhanced sentence had no apparent deterrent effect.

For most crimes, the certainty and severity of punishment increases 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 and 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 achieving statistical significance.⁶

⁶The finding that the young fail to respond to changes in penalties associated with the age of majority is not uniform across studies. An earlier analysis by Levitt (1998) finds a large drop in the offending of young adults when they reach the age of jurisdiction for adult courts. For several reasons, Durlauf and Nagin (2011*a*, 2011*b*) judge the null effect finding of Lee and McCrary more persuasive in terms of understanding deterrence. First, Levitt (1998)

Another analysis of the effect, if any, 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. Youth were asked, "Suppose you were arrested for stealing a car, what is the percent chance that you would serve time in jail?" She found that subjective probabilities of being sent to jail increased discontinuously on average by 5.2 percentage points when youth reached the age of majority in their state of residence. While youth perceived an increase in incarceration risk, she found no convincing evidence of an effect on their self-reported criminal behavior.

C. Summary

In combination, these six studies demonstrate that debates on the effectiveness of deterrence are poorly conceived. Instead, the discussion should be framed in terms argued by Beccaria and Bentham more than two centuries ago: Does the specific sanction deter or not and if it does, are the crime reduction benefits sufficient to justify the costs of imposing the sanction? The Helland and Tabarrok (2007) study is an exemplar of this type of analysis. They conclude that California's third-strike provision does indeed have a deterrent effect, a point even conceded by Zimring, Hawkins, and Kamin (2001). However, Helland and Tabarrok (2007) also conclude, based on a cost-benefit analysis, that the crime-saving benefits are so much smaller than the increased costs of incarceration that the lengthy prison sentences mandated by the third-strike provision cannot be justified based on a cost-benefit criterion.

focuses on differences in age measured at annual frequencies, whereas Lee and McCrary measure age in days or weeks. At annual frequencies, the estimated effect is more likely to reflect both deterrence and incapacitation; hence Levitt's results may be driven by incapacitation effects rather than deterrence per se. Second, the Lee and McCrary analysis is based on individual level data and so avoids problems that can arise because of aggregation (Durlauf, Navarro, and Rivers 2008; Durlauf and Nagin 2011*b*). On its own terms the individual level data studied by Lee and McCrary are unusually informative since they also contain information on the exact age of arrestees, which allows for the calculation of very short run effects of the discontinuity in sentence severity, e.g. effects within 30 days of turning 18.

The six exemplar studies suggest several important sources of the heterogeneity of the deterrent effect of imprisonment. One concerns the length of the sentence itself. Figure 3 depicts two alternative forms of the response function relating crime rate to sentence length. Both are downward sloping, which captures the idea that increases in severity deter crime. At the status quo sentence length, S_1 , the crime rate, C_1 , is the same for both curves. The curves are drawn so that they predict the same crime rate for a zero sanction level. Thus, the absolute deterrent effect of the status quo sanction level is the same for both curves. But because the two curves have different shapes, they also imply different responses to an incremental increase in sentence level to S_2 . The linear curve (A) is meant to depict a response function in which there is a material deterrent effect accompanying the increase to S_2 , whereas the non-linear curve (B) is meant to depict a small crime reduction response due to diminishing deterrent returns to increasing sentence length.

My reading of the evidence on the deterrent effect of sentence length is that it implies that the relationship between crime rate and sentence length more closely conforms to curve B than curve A. Raphael and Ludwig (2003) find no evidence that gun crime enhancement deter, Lee and McCrary (2009) and Hjalmarsson (2009) find no evidence that the greater penalties that attend moving from the juvenile to the adult justice systems deter, and Helland and Tabarrok (2007) find only a small deterrent effect from California's third-strike. As a consequence, the deterrent return to increasing an already long sentence is small, possibly zero. This interpretation forms the basis for my conclusion that mandatory minimum sentencing is unlikely to have a material deterrent effect.

The fine payment and Project Hope experiments also suggest that Curve B, not Curve A, more closely resembles what in medical jargon would be described as the dose-response relationship between crime and sentence length. While neither of these studies is directed at the

deterrence of criminal behavior, both suggest that, unlike increments in long sentences, increments in short sentences do have a material deterrent effect on a crime-prone population.

Notwithstanding their strengths, these six exemplar studies do not address several important aspects of the offender response, if any, to the sanction regime. Except for the most trivial offenses, the question at hand is not the deterrent effect of some particular sanction compared to no sanction whatsoever. Instead, it is the deterrent effectiveness of a specified sanction relative to alternative sanction options. In the case of the death penalty, the alternative is a very lengthy prison sentence. For less serious crimes, sanction options to incarceration include fines and various forms of community supervision, or some combination which may also include a period of incarceration. In 2006, for example, 10 percent of felony defendants were diverted to programs like mandatory drug treatment prior to adjudication. Of those convicted, 29 percent did not receive a jail or prison sentence (BJS 2010) but instead were sentenced to some form of community control, paid a fine, or both.

Theories of deterrence need to be generalized to specify how offenders perceive and respond to the multiplicity of sanction options available for the punishment of most crimes. The theories also need to account for the possibility that offender perceptions of the severity of sanction options may differ. For example, some may view the possibility of life without parole as worse than execution and still others may view strict community supervision as more onerous than a short period of incarceration (Wood and May 2003). The multiplicity of sanction options and heterogeneity in the response to these options greatly complicate the specification of a deterrence model, but both features are essential to the deterrence phenomenon.

I also note that testing such generalized models of deterrence will require a major expansion of the criminal justice data collection infrastructure at least in the US. It is currently not possible to

measure the availability and frequency of use of sanction alternatives at the state level because the required data are not available. Available data include those from the Bureau of Justice Statistics, which publishes nationwide statistics on sentences for prison admissions and time served for prison releases, based on data collected as part of the National Corrections Reporting Program (NCRP) initiated in the early 1980s. More than 40 states now report annual data on sentences for admissions and time served for releases. Individual-level demographic characteristics are also reported. In principle, these data could be used to measure the administration of the legally authorized dimensions of most state sanction regimes by type of crime. The difficulty is that the data are often extremely incomplete. In some years, some states fail to report any data and the data that are sent to BJS are often so incomplete that it is impossible to construct valid state-level measures of the administration of the sanction regime.

V. Police and Crime

The police may prevent crime through many possible mechanisms. 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. The apprehension of active offenders may also deter would-be criminals by increasing their perception of the risk of apprehension. Many police tactics, such as rapid response to calls for service at crime scenes or post-crime investigation, are intended not only to capture the offender but to deter others by projecting a tangible threat of apprehension. Police may, however, 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 police has evolved in two distinct literatures. One has

focused on the deterrent effect of the level of police numbers or resources, for example, by examining the relationship between police per capita and crime rates. The other has focused on the crime prevention effectiveness of different strategies for deploying police.

A. Studies of Levels of Police Numbers and Resources

Studies of the effect of police numbers and resource come in two forms. One is an analogue of the imprisonment rate and crime rate studies described in the preceding section. These studies are based on panel datasets, usually of US cities over the period circa 1970 to 2000. They relate crime rates to the resources committed to policing as measured by police per capita or police expenditures per capita. The second form of study is more targeted. They analyze the effect on crime from abrupt changes in the level of policing due, for example, to terror alerts.

1. *Panel Studies.* Panel studies include Marvell and Moody (1994), Levitt (1997, 2002), McCrary (2002), and Evans and Owens (2007). With the exception of McCrary (2002), these studies consistently find evidence that larger resource commitments to policing are associated with lower crime rates.⁷

The studies use different statistical strategies for estimating the effect of police resource levels on crime. For example, Marvell and Moody (1996) analyze two panel datasets and apply Granger-causality type statistical models to these data. Levitt (1997, 2002) uses instrumental variable-type regression models. In Levitt (1997) election cycles are used as an instrumental variable to untangle the cause-effect relationship between crime rates and police manpower.

⁷McCrary identified an error in the computation of standard errors in Levitt (1997) which when corrected nullified the finding of a crime prevention effect of police numbers. Levitt (2002) argues that McCrary's findings do not overturn his general claim that increased numbers of police reduce crime rates and presents new evidence to that effect.

Levitt (2002) uses the number of firefighters and civil service workers as instrumental variables for the same purpose.

The panel studies consistently find evidence that higher levels of police resources are associated with lower crime rates. Durlauf and Nagin (2011*a*, 2011*b*) discuss important qualifications to the interpretation and validity of this form of analysis. One is that the police panel studies, like the studies of imprisonment and crime, do not distinguish between incapacitation and deterrent effects. The negative associations between police numbers and crime rates identified in these studies may reflect increased effectiveness in apprehending and incarcerating active offenders rather than in deterring crime. More importantly, an underappreciated limitation of these analyses is the assumption that the effect of police levels on crime rates is the same across place and time. As the discussion of studies of the effects of police deployment strategies on crime makes clear, this assumption is not tenable. Nevertheless, the findings of these studies are consistent with studies of abrupt changes in police presence that police numbers do matter.

2. *Abrupt Change Studies.* Studies of this type, which are sometimes called “interrupted time series” or “regression discontinuity” studies, examine the effects of abrupt changes in police presences. If the change in police presence is attributable to an event unrelated to the crime rate, studies of this type can provide particularly convincing evidence of deterrence. 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 like robbery, whose control depends heavily upon visible police presence, rose sharply. By contrast, crimes like fraud were less affected. See Sherman and Eck (2002) and Sherman (in this volume) for other examples of crime increases following a collapse

of police presence.

The Andenaes anecdote illustrates several important points. It provides a useful reminder of the difference between absolute and marginal deterrence. Recalling figure 3, absolute deterrence refers to the difference in the crime rate between the status quo level of sanction threat, S_1 , and a complete (or near) absence of sanction threat, S_0 . The Andenaes anecdote is a compelling demonstration that the absolute deterrent effect is large. However, from a policy perspective, the issue is not the absolute deterrent effect posed by police presence. The question is whether, on the margin, crime can be prevented by incremental increases in police numbers or by changes in the way police are deployed. Also, the anecdote is another useful reminder that deterrent effects are heterogeneous—sanction threats (or the absence thereof) do not uniformly affect all types of crime or more generally all types of people.

Contemporary tests of the police–crime relationship based on abrupt decreases in police presence investigate the effect on the crime rate 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, forthcoming), and the Oregon State Police (DeAngelo and Hansen 2008). Each concludes that decreases in police presence and activity substantially increase crime. Shi (2009) 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 3 days of rioting, heavy media attention, the filing of a class action lawsuit, 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, especially in communities with higher proportional representation of African Americans, out of

concern for allegations of racial profiling. Shi finds measurable declines in police productivity in the aftermath of the riot and also documents a substantial increase in criminal activity. The estimated elasticities of crime to policing based on her approach were -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 effect of police resource allocation in cities around the world, including the District of Columbia (Klick and Tabarrok 2005), Buenos Aires (Di Tella and Schargrotsky 2004), Stockholm (Poutvaara and Priks 2006), and London (Draca, Machin, and Witt 2008). The Klick and Tabarrok (2005) study examines the effect on crime of the color-coded alert system devised by the US Department of Homeland Security in the aftermath of the September 11, 2001 terrorist attack. Its purpose was to signal federal, state, and local law enforcement agencies to occasions when it might be prudent to divert resources to sensitive locations. Klick and Tabarrok (2005) use daily police reports of crime collected by the District's Metropolitan Police Department for the period March 2002 to July 2003, when 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 percent. They estimate that each 1 percent increase in number of police during the terror alert reduced total crime by .3 percent.

To summarize, studies of police presence conducted since the mid-1990s consistently find that putting more police officers on the street—either by hiring new officers or by reallocating existing officers to put them on the street in larger numbers or for longer periods of time—has a substantial deterrent effect on serious crime. There is also consistency with respect to the size of the effect. Most estimates reveal that a 10 percent increase in police presence yields a reduction in total crime of about 3 percent. 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.

B. Police Deployment and Crime

Much research has examined the crime prevention effectiveness of alternative strategies for deploying police resources. This research has mostly been conducted by criminologists and sociologists. Among this group of researchers, the preferred research designs are quasi-experiments involving before-and-after studies of the effect of targeted interventions as well as true randomized experiments. The discussion which follows draws heavily on two excellent reviews of this research by Weisburd and Eck (2004) and Braga (2008).

For the most part, deployment strategies affect the certainty of punishment through their effect 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. Strong evidence of a deterrent as opposed to an incapacitation effect resulting from the apprehension of criminals is limited. Studies of the effect of rapid response to calls for service (Kansas City Police Department 1977; Spelman and Brown 1981) do not directly test for deterrence but found no evidence of improved apprehension effectiveness. This may be because most calls for service occur well after the crime event, with the result that the perpetrator has fled the scene. Thus, it is doubtful that rapid response materially affects crime. Similarly, apprehension risk is probably not materially affected by improved investigations. Eck concluded that “it is unlikely that improvements in the way investigations are conducted or managed have a dramatic effect on crime or criminal justice” (1992, p. 33). This is because most crimes are solved either by the offender being apprehended at the scene or by eyewitness identification of

the perpetrator (Greenwood, Chaiken, and Petersilia 1977). Modern forensic methods may ultimately improve the effectiveness of post-crime investigations, but as Braga et al. (2011) note, clearance rates have remained stubbornly stable over the period 1970 to 2007.

The second source of deterrence from police activities involves averting crime in the first place. In this circumstance, there is no apprehension because there was no offense. In my view, this is the primary source of deterrence from the presence of police. Thus, measures of apprehension risk based only on enforcement actions and crimes that actually occur, such as arrests per reported crime, are not valid measures of the apprehension risk represented by criminal opportunities not acted upon because the risk was deemed too high (Cook 1979).

One example of a police deployment strategy for which there is good evidence of effectiveness is “hot spots” policing. The idea of hot spots policing stems from a striking empirical regularity uncovered by Sherman and colleagues. Sherman, Gartin, and Buerger (1989) found that only 3 percent of addresses and intersections (“places,” as they were called) in Minneapolis produced 50 percent of all calls to the police. Weisburd and Green (1995) found that 20 percent of all disorder crime and 14 percent of crimes against persons in Jersey City, New Jersey arose from 56 drug-related crime hot spots. Twenty-five years later in a study of Seattle, Washington, Weisburd et al. (2004) reported that between 4 and 5 percent of street segments in the city accounted for 50 percent of crime incidents for each year over a 14-year period. Other, more recent studies finding comparable crime concentrations include Brantingham and Brantingham (1999), Eck, Gersh, and Taylor (2000), and Roncek (2000).

The rationale for concentrating police in crime hot spots is to create a prohibitively high risk of apprehension. The first test of the efficacy of concentrating police resources on crime hot spots was conducted by Sherman and 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 percent. In another randomized experiment, Weisburd and Green (1995) found that hot spots policing was similarly effective in suppressing drug markets.

Braga's (2008) informative review of hot spots policing summarizes the findings from nine experimental or quasi-experimental evaluations. The studies were conducted in five large US cities and one suburb of Australia. All but two found evidence of significant reductions in crime. Further, 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—but a “diffusion of crime-control benefits” to non-targeted locales. Note also that the findings from the previously described econometric studies of focused police actions—for example, in response to terror alert level—buttress the conclusion that the strategic targeting of police resources can be very effective in reducing crime.

Another example of a police deployment strategy for which there is credible evidence of effectiveness, albeit less consistent than for hot spots policing, is problem-oriented policing. One of the most visible instances of problem-oriented policing is Boston's Operation Ceasefire (Kennedy et al. 2001). The objective of the collaborative operation was to prevent inter-gang gun violence using two deterrence-based strategies. The first strategy was to target enforcement against weapons traffickers who were supplying 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, in order to send the message that the law enforcement 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, non-violent 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 commit a violent crime.

Since Operation Cease Fire, the strategy of “pulling every lever” has been the centerpiece of field interventions in many large and small US cities including Richmond, VA; Chicago, IL; Stockton, CA; High Point, NC; and Pittsburgh, PA. See Kennedy (2009), one of the architects of the “pulling every lever” strategy, for an extended description of these interventions and the philosophy behind them. Independent evaluations have also been conducted of many of these interventions.⁸ The conclusions of the independent evaluations are varied but Cook’s (2012) characterization of the much publicized High Point 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 and 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 and 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 enhancements to generate a targeted deterrent effect. Additional evaluations of the efficacy of these multi-pronged strategies should be a high priority, with the proviso that any designs implemented be amenable to rigorous evaluation as emphasized by commentators. For a useful discussion of the importance of understanding mechanisms, see Ludwig, Kling, and Mullainathan (2011).

⁸ For Boston see Cook and Ludwig (2006), for Richmond see Raphael and Ludwig (2003), for Chicago see Papachristos, Meares, and Fagan (2007), for Pittsburgh see Wilson and Chermak (2011), and for High Point see Corsaro et al. (2012).

C. Summary

The evidence is clear that large changes in police presence do affect crime rates. The change in presence may be the result of an unplanned event, such a terror alert that triggers a large increase in police officers in public spaces, or it may be a strategic response to a known crime problem, such as in hot spots policing deployments. In either case, crime rates are reduced in places where police presence has been materially increased. While far from the definitive, there is no evidence of displacement of crime to places contiguous to the heightened police presence, at least in the short run. Indeed, there is some evidence of crime reductions in the areas immediately surrounding the heightened presence. By contrast, there is no evidence that the rapidity of the response to crime or the thoroughness of the post-crime investigation has a material influence on crime rates. Combined, these two sets of findings suggest that how police are deployed is as important as the number of police deployed in their influence on crime rates.

Notwithstanding these important findings, some additional issues about police presence remain unresolved. The finding from the hot spots policing evaluations that crime is not displaced to adjacent places may not hold up in the long run. The seeming diffusion of crime control benefits may evaporate as offenders become aware that the heightened patrol activity is not present in adjacent places. More fundamentally, the hot spot itself may be displaced to some new location, for example to a bar that had not previously been a crime hot spot. A longer term perspective on the effectiveness of hot spots policing is required.

While the evaluations of hot spots policing provide important evidence that police presence can be a deterrent, overall crime control policy cannot be built around such a narrowly formulated tactic. Evaluations of problem-oriented policing suggest police effectiveness in a

wider set of circumstances than intensive patrol of high crime micro-places. However, these evaluations do not reveal the mechanism by which prevention is achieved.

The introduction distinguished two distinct crime prevention functions of the police—their role as apprehension agents following the commission of a crime and their role as sentinels. In their sentinel role the police are acting in the parlance of Cohen and Felson (1979) as “capable guardians.” Capable guardians are persons whose presence discourages a motivated offender from victimizing a criminal opportunity. Capable guardians include persons with no official crime control authority who nonetheless are personally willing to intervene or to summon those with the authority to intervene. The police themselves also serve as capable guardians in their conventional patrol and monitoring functions.

For many reasons the apprehension agent role is the most scrutinized and recognized crime control function of the police. The apprehension agent function has been and continues to be glamorized by television in long running programs like *Dragnet* in the 1950s and 1960s, *Hawaii Five-0* in the 1970s, *Hill Street Blues* in the 1980s, *Homicide Life on the Streets* in the 1990s, and *CSI* and *Law and Order* in the present. The apprehension role is also salient because it involves the police response to real victims of sometimes horrendous crime and the ensuing efforts to bring the perpetrators to justice. From a technocratic perspective, police effectiveness in this role can be measured with statistics like the clearance rate. From a crime control perspective, the apprehension agent function protects public safety by capturing and incapacitating sometimes dangerous and repetitive offenders. However, as yet there is no evidence that the apprehension agent role results in a material deterrent effect. By contrast, the evidence on police presence suggests that in their sentinel role police can have a very large deterrent effect. While the differential deterrent effect of the police in their apprehension and

sentinel roles has not been demonstrated, there is sufficient evidence to characterize it as a hypothesis with sufficient empirical support to make it credible.

What then is the explanation for the differential deterrent effectiveness of the sentinel/guardian and apprehension roles of the police? The model of the decision to victimize a criminal opportunity laid out in the introduction, I believe, provides useful perspective on the answer. The model distinguishes two key probabilities—the probability that the opportunity can be successfully completed, P_s , and the probability of apprehension conditional upon the victimization of the target, P_a . In this model, activities that enhance police visibility, like concentration of police at crime hot spots, affect P_s , whereas actions like rapid response to calls for service or improved investigation methods affects P_a . The sentinel role of police is distinct from the apprehension role because the latter comes into play only when deterrence has failed and a would-be offender becomes an actual offender. Thus, at one moment police can function as sentinels and in the next as apprehension agents.

The depiction of the decision to victimize a criminal opportunity in figure 1 provides an explanation for the greater deterrent effectiveness of the police in their sentinel role than in their apprehension role. The police in their sentinel role influence P_s and thereby the probability of all four outcome branches. In particular, improved guardianship reduces the probability that the target can be successfully victimized and increases the probability of the three outcomes that represent failure from the offender's perspective. In contrast, improved effectiveness in the apprehension agent role comes into play only after a crime is committed and can affect only the three branches of the tree related to failure. Thus, innovations that make police more effective sentinels will tend to be more influential in the decision process characterized by this model than innovations in apprehension effectiveness.

The model is also useful in clarifying the basis for the effectiveness of situational crime prevention (Clarke 1995), many forms of which can be construed as reducing P_s . Just as police in their sentinel role reduce the attractiveness of a criminal opportunity, situational crime prevention works by affecting all four branches of the tree.

VI. Perceptual Deterrence and Sanction Risk Perceptions Studies

Analyses of perceptual deterrence examine the association between perceptions of sanction risk, whatever their source, and self-reported illegal behavior or intent to engage in illegal behavior. Analyses of sanction risk perceptions examine the relationship of an individual's perceptions with experience (e.g., being arrested as well as factors external to the individual such as statutorily defined penalties). Some studies address both topics but most emphasize one or the other.

A. Perceptual Deterrence

The perceptual deterrence literature was spawned by a cadre of researchers (Meier and Johnson 1977; Minor 1977; Tittle 1977; Grasmick and Bryjak 1980; Tittle 1980) interested in probing the perceptual underpinnings of the deterrence process.

Perceptual deterrence studies have been based on three types of data: Cross-sectional survey studies, panel survey studies, and scenario-based studies. In cross-sectional survey studies individuals are questioned about their perceptions of the certainty and severity of sanctions and about either their prior offending behavior or their future intentions to offend. For example, Grasmick and Bryjak (1980) queried a sample of city residents about their perceptions of the risk of arrest for offenses such as a petty theft, drunk driving, and tax cheating. They also asked

respondents whether they thought they would commit any of these acts in the future. In panel survey studies the sample is repeatedly surveyed on risk perceptions and criminal behavior. For example, Paternoster et al. (1982) followed a sample of students through their 3 years in high school and surveyed them on the frequency with which they engaged in various delinquent acts and their perceptions of the risks and consequences of being caught. In scenario-based studies individuals are questioned about their perception of the risks of committing a crime that is described to them in detail. They are also asked about their own behavior should they find themselves in that situation. Bachman, Paternoster, and Ward (1992), for instance, constructed a scenario describing the circumstances of a date rape. They then surveyed a sample of college males about their perceptions of the risk of the scenario male being arrested for sexual assault, and what they themselves would do in the same circumstance.

Perceptual deterrence research has been faulted with some justification on a number of grounds. One is that the sampled populations are typically high school or college students who do not, by and large, engage in serious crime and delinquency. Other concerns are related to the veracity of the data collected. How well can respondents actually calibrate sanction risks? Do the ways questions about perceptions of morality and sanction cost are structured prime responses about actual or projected offending? Despite these questions, in my judgment this class of studies has provided enduring contributions to our understanding of deterrence processes.

One contribution is that, with the exception of the early panel studies, perception studies consistently find that actual or projected offending is negatively related to perceptions of sanction certainty. Findings of a deterrence-like relationship of self-reported offending with perceptions of sanction severity are less consistent. When combined, these two findings provide still further support for the “certainty” principal, but with a proviso that certainty result in a negative but not

necessarily draconian consequence. Grasmick and Bryjak (1980) show that when respondents' assessments of the personal costs of the sanction are incorporated into the analysis, perceptions of severity are negatively associated with self-reported behavior.

A second contribution of the perceptual deterrence literature, which may also be its most important, does not involve the evidence it has amassed on deterrence effects per se. Rather it has focused its attention on the links between formal and informal sources of social control. Recognition of this connection pre-dates the perceptual deterrence literature. Zimring and Hawkins (1973) observe, "Official *actions* can set off societal *reactions* that may provide potential offenders with more reason to avoid conviction than the officially imposed unpleasantness of punishment " (p. 174, emphasis in original). See also Andenaes (1974), Gibbs (1975), Blumstein and Nagin (1976), and Williams and Hawkins (1986) for this same argument. Perceptual deterrence research has consistently found that individuals who report higher stakes in conventionality are more deterred by perceived risk of public exposure for lawbreaking.

A salient finding in this regard concerns my own research on tax evasion. Enforcement actions by tax authorities are private matters. Criminal prosecutions, however, are the exception to this rule. They necessarily involve public exposure. Thus, from the taxpayer's perspective civil enforcement actions jeopardize money but not reputation whereas criminal prosecution jeopardizes both. In Klepper and Nagin (1989*a*, 1989*b*) we found that if respondents perceived no risk of criminal prosecution, a majority of respondents reported a material probability of taking advantage of noncompliance opportunities. However, the perception of a non-zero risk of criminal prosecution was sufficient to deter most of the middle class respondents to the survey. Stated differently, if the tax evasion gamble also involved putting reputation and community standing at risk, the middle-class respondents to the survey were less likely to consider taking the gamble.

While my tax evasion research does not pin down the specific sources of these costs, other research on the effects of a criminal record on access to legal labor markets suggests a real basis for the fear of stigmatization (Freeman 1991; Bushway 1996). Freeman estimates that a record of incarceration depresses probability of work by 15 to 30 percent, Waldfogel (1994) estimates that conviction for fraud reduces income by as much as 40 percent, and Bushway (1996) concludes that even an arrest for a minor offense impairs access to legal labor markets, at least in the short run.

The findings from the perceptual deterrence studies directly relate to two of the main themes of this essay. The first concerns the source of the “certainty” effect. In laying out the implications of the model of the decision to victimize a target, it was pointed out that the cost of apprehension appeared in two of the terms on the right hand side of equation 2. This side of the equation measures the potential cost of offending—the term measuring the cost of apprehension without conviction and the term measuring the cost of apprehension with conviction. Formal and informal sanction cost appeared only in the second of these terms. Stated differently, apprehension cost is incurred regardless of whether a conviction ensues, whereas sanction costs can only be incurred if apprehension is followed by conviction. This structure formalizes the argument of Williams and Hawkins (1986) that what they call “fear of arrest” serves as a greater deterrent than formal sanction cost. It is also consistent with the conclusion of my own research with co-authors Raymond Paternoster (Nagin and Paternoster 1993, 1994) and Greg Pogarsky (Nagin and Pogarsky 2001, 2003) that individuals with the greatest stakes in conformity were the most deterred by informal sanction costs.

The fourth branch of figure 3 is the total cost of formal and informal sanctions. The perceptions research combined with the criminal record research suggests that, for people without a criminal record, informal sanction cost makes a large contribution to this total. That contribution

may be substantially reduced once an individual has had contact with the criminal justice system and obtains a criminal record. This observation relates back to a point I emphasized in Nagin (1998). If fear of stigma is a key component of the deterrence mechanism, punishment must be a relatively rare event. Just as the stigma of Hester Prynne's scarlet "A" depended upon adultery being uncommon in Puritan America, a criminal record cannot be socially and economically isolating if it is commonplace. For that reason, policies that work well in the short term may erode their effectiveness over the long run, if they increase the proportion of the population who are stigmatized.

This observation is also germane to the recommendation that future empirical research and theorizing should take account of whether and how the experience of punishment (which in my view is inappropriately referred to as specific deterrence) affects the response to the threat of punishment, or general deterrence. The experience of punishment may affect general deterrence in two distinct ways. First, it may affect perceptions of sanction risks. Second, it may affect the basic proclivity for offending. Proclivity could be reduced, by effective rehabilitation programs or an individual's conclusion that prison is not an experience to be repeated. However, proclivity could also be increased by stigmatization, erosion of human capital during a spell of incarceration, or the social influence of close contact with a mostly crime-prone population. Nagin, Cullen, and Jonson (2009) provide a detailed discussion of this issue.

B. Sanction Risk Perceptions Studies

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 non-apprehension) 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.⁹

1. *General Population Surveys*. Apel (forthcoming) 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 of Tucson, Arizona residents conducted in the 1970s 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, Gibbs, and Erickson 1980). Erickson and 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 1960s study commissioned by the California Assembly (Assembly Committee on Criminal Procedure 1968) found that the general public's knowledge of the statutorily prescribed level of punishment was poor. Only about a quarter of the sample correctly identified the maximum prison sentence available for the punishment of the various crimes included in the survey. However, 62 percent of incarcerated adults correctly identified the maximum. I return to the large difference in knowledge between the incarceration 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 like 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) describe a study by Johnston Lloyd, O'Malley, and Bachman (1981) of student knowledge of punishment for marijuana possession. In states that during decriminalized possession between 1976 and 1980 the percentage reporting a possible jail sentence declined from 58 percent to 18

⁹ For an exhaustive and thoughtful review, on which this discussion draws heavily, see Apel (forthcoming).

percent. 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 of sanction risks, knowledge of the risks is better but still crude. For example, MacCoun et al. (2009) also report that knowledge of the maximum penalties for marijuana use was not good. Surveys of knowledge among adults of drunk driving penalties by Ross (1973) and Grube and Kearney (1983) also suggest greater awareness of the drunk-driving sanctions and available enforcement tools (e.g., breathalyzers) than corresponding knowledge for street-type crimes.

The Tucson-based survey and more recent surveys by Kleck and colleagues (Kleck et al. 2005; Kleck and Barnes, forthcoming) attempt to assess the accuracy of sanction risk perceptions. Kleck et al. (2005), for example, survey adults residing in 54 large urban counties. For crimes such as homicide and robbery they correlate respondent estimates of quantities such as arrests per crime and convictions per crime with ratios based on the actual data. They find that the correlation is close to zero.

The results of the surveys by Kleck and colleagues are not surprising on several counts. First, for the reasons elaborated long ago by Beccaria and Bentham and most recently by Wikstrom et al. (2012) and Apel (forthcoming), most of the general public have no intention to commit the types of crime surveyed in these studies.¹⁰ Thus, there is no reason for them to be aware of the sanction regime for these types of crime. Consequently, their ignorance of the sanction regime is not informative about whether people who have a potential need-to-know of the sanction regime obtain that knowledge, however crudely, and take it into account in the decision whether or not to offend. Second, the ratios calculated by Kleck and colleagues pertain only to criminal opportunities that have actually been acted on. As first pointed out by Cook

¹⁰In the context of the decision model laid out in section I, these are individuals for whom the net reward of committing a crime is negative even without consideration of sanction costs.

(1979), the ratio of arrest per crime is not a valid measure of the risk of apprehension for criminal opportunities that are not acted upon. Third, statistics such as arrest per crime are calculated at the county or city level, and may be very poor indicators of risk at the specific locations where would-be offenders are plying their trade (Apel, forthcoming).

2. *Studies of the Effect of Experience on Perceptions.* Salient findings of the early panel perceptual deterrence studies include considerable instability in sanction risk perceptions and that non-offenders and novice offenders have higher sanction risk perceptions than experienced offenders. Paternoster and colleagues (Paternoster et al. 1982; Paternoster 1983) called this an experiential effect whereby delinquent youths learned that sanction risks were lower than initially anticipated.

An important study by Horney and Marshall (1992) of serious offenders finds that subjects who had higher arrest ratios, that is, self-reported arrests to self-reported crime, reported higher risk perception. Since that time 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 of this type by criminologists were prompted by an influential article by Stafford and Warr (1993), who distinguished 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 the concept of "Bayesian updating."

The Bayesian updating model and the arguments of Stafford and Warr are complementary. Bayesian updating formalizes their arguments. The Bayesian updating model is designed to describe the process by which people update their perceptions of a phenomenon of

interest based on new information about that phenomenon. In this case individuals would update their perceptions of sanction risk with new information regarding success or failure of themselves or their peers in avoiding apprehension. The predictions of the model depend upon the specifics of its mathematical specification, but models of this type make predictions about the updating process that are intuitively sensible. The models predict that people generally do not entirely abandon prior beliefs based on new information. Most commonly, they only incrementally adjust them.¹¹

In the case of perception of apprehension risk, this implies that the experience of apprehension will result in an incremental upward shift in risk perception, and experience of what Stafford and 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 will 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 will individuals with less experience. Both of these predictions are supported by studies of risk perception updating.

Concerning the first prediction, numerous studies find that increases (or decreases) in perceived apprehension risk are associated with failure (success) in avoiding apprehension (Bridges and Stone 1986; Piliavin et al. 1986; Paternoster and Piquero 1995; Pogarsky, Piquero, and Paternoster 2004; Pogarsky, Kim, and Paternoster 2005; Matsueda, Kreager, and Huizinga 2006; Lochner 2007; Hjalmarsson 2008). There are, however, exceptions to this finding.

¹¹Prior history may be ignored if a regime change (e.g., the occupying German army arresting the Danish police force) makes it irrelevant.

Apospori and Alpert (1993) and Pogarsky and Piquero (2003) report evidence that is the reverse of this prediction. Pogarsky and Piquero (2003) attribute this to a variant of what is called the “gambler’s fallacy,” whereby offenders believe that bad luck is not followed by bad luck. This is an interesting possibility but the evidence is overwhelmingly consistent with the Bayesian updating model.

Evidence consistent with the second prediction is reported in Pogarsky, Piquero, and Paternoster (2004), Matsueda, Kreager, and Huizinga (2006), and Anwar and Loughran (2011). Anwar and Loughran (2011) conducted a particularly thorough test of this prediction. They analyzed a sample composed of about 1,300 adjudicated/convicted youth from Arizona and Pennsylvania enrolled in the Pathways to Desistance study who were interviewed eight times in 5 years (Mulvey 2011). Being arrested significantly increased subjective probabilities (prediction 1) but the magnitude of the change was less for more experienced offenders (prediction 2). Specifically, they showed 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 they concluded that the effect 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.

3. *Studies of Situational Effects 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 already noted, 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 maximum penalties for various FBI index type crimes was far better for incarcerated sample members than for not-incarcerated sample members.

Other interesting evidence of awareness of official sanctions is the previously discussed study by Hjalmarsson (2009) of the effect of reaching the age of majority on perceptions of the risk of incarceration for auto theft. She found that male respondents in the 1997 National Longitudinal Survey of Youth increased that risk by 5.2 percentage points upon reaching their age of majority. The increase, however, had no statistically significant effect on behavior.

Evidence on how police presence affects perceptions of apprehension risk is scant. In my own work with Raymond Paternoster we constructed scenarios and examined how respondent perceptions of sanction risks were affected by scenario conditions (Nagin and Paternoster 1993). We found that respondent perceptions of sanction cost in a drunk-driving scenario were higher in the scenario condition involving a police crackdown on drunk driving vs. a scenario condition described as involving state police cutbacks. In addition, perceptions of sanction cost were lower if surveillance could be avoided by driving on back roads. In scenarios concerning peer provocation, Wikstrom et al. (2012) found 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 very conscious of police presence when selecting targets. Wright and 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, such as drug dealers.

C. Summary

Perceptual deterrence research has established that self-reported offending or intention to do so is linked to sanction risk perceptions. The outstanding question is whether those perceptions are grounded in reality. If they are not, behavior is beyond the reach of public policy. The evidence on the sources of sanction risk perceptions suggests that risk perceptions are affected by an individual's own experience with success or failure at averting apprehension. The link between perception and the legally authorized sanctions is less compelling, but does indicate that there is at least a rough awareness among individuals in a need-to-know scenario. The other key component of the sanction regime is the intensity of application of the legally authorized sanctions. Research on this topic is based on general population studies of the correlations of perceptions of quantities of the ratio of arrest to crimes with estimates of these ratios calculated from official statistics. For reasons discussed above, in my judgment these studies are not informative about whether perceptions of intensity among the population with a need-to-know sanction risks are affected by the actual intensity of application of legally authorized sanctions.

Pogarsky (2007) offers a useful taxonomy of responsiveness to legal threats for considering the implications of these summary observations. The taxonomy distinguishes three groups—acute conformists, deterrables, and incorrigibles. In the context of the decision model laid out in section I, conformists are individuals for whom reward minus commission cost is negative. For reasons I have already discussed, they have no need to gain knowledge of sanction risks because there is no profit in crime even absent potential sanction costs. Deterrables are

individuals for whom reward minus commission cost is positive and who are attentive to sanctions threats. For such individuals the issue is whether the net benefit of successful commission exceeds the potential costs attending failure. The incorrigible group is also composed of individuals for whom crime is profitable but who for whatever reason are not attentive to sanction threats. The relative sizes of the incorrigible and deterrable groups and the specific form of the sanction regime will determine the effectiveness of criminal justice public policy in preventing crime via deterrence and thereby avoiding the sanction costs of incapacitation.

Future research on sanction risk perceptions needs to target Pogarsky's deterrables and incorrigibles to gain better knowledge of their awareness of the two key elements of the sanction regime—the legally authorized sanctions and the intensity of their application. For the types of crime in the FBI index this will require abandoning surveys of the general population and instead sampling populations with a large representation of deterrables and incorrigibles. An example of such a survey is the Pathways to Desistance project used in the Anwar and Loughran (2011) analysis, which sampled juveniles adjudicated for felony offenses in Philadelphia and Phoenix.

Surveys targeting deterrables and incorrigibles should also include batteries of questions designed to learn how the actions of the police and other guardians affect perceptions of the probability of success which, for the reasons described in section V, is likely to be particularly decisive in the deterrence process.

VII. Conclusions

Over the past 4 decades, much has been learned about the foundations of deterrence that were laid out more than two centuries ago by Cesare Beccaria and Jeremy Bentham. We now know

that deterrence is ubiquitous but that the effects are heterogeneous, ranging in size from seemingly null to very large. There is little evidence that increasing already long prison sentences has a material deterrence effect. Evidence on the deterrent effect of the certainty of punishment is more consistent but the source of the effect is less clear. In this essay I have argued that the certainty effect stems primarily from police functioning in their official guardian role rather than in their apprehension agent role.

These conclusions have important policy implications that are developed in detail in Durlauf and Nagin (2011*a*). They suggest that lengthy prison sentences cannot be justified on deterrent grounds, but rather must be justified either on crime prevention through incapacitation or on retributive grounds. The crime prevention efficiency of incapacitating aged criminals is dubious and thus the case for lengthy prison sentences must rest on retributive considerations. The conclusions also suggest that crime control effectiveness would be improved by shifting resources from corrections to policing methods that enhance the effectiveness of police in their official guardian role.

While much progress has been made in understanding sources of deterrence and the circumstances in which deterrence is and is not effective, much remains to be learned. Theory needs to be generalized to combine the response to the threat of punishments, known as general deterrence in criminology, and the response to the experience of punishment, which I have argued is inappropriately labeled specific deterrence. A second theoretical and empirical gap concerns the concept of a sanction regime and its two dimensions—the legal authority for different types of sanctions and the way that authority is administered. These two dimensions combine to determine the certainty, severity, and celerity of sanction options available for punishment of a specific type of crime. Theories of deterrence, however, specify sanction threats

in the singular, not the plural. Theories of deterrence that conceive of sanctions in the singular do not provide the conceptual basis for considering the differential deterrent effect of different types of sanction options. The empirical companion to this theoretical expansion involves assembling the data required to measure sanction regimes.

A third theoretical and empirical gap involves sanction risk perceptions. Deterrence is the behavioral response to the perception of sanction threats. Establishing the link between risk perceptions and actual sanction regimes is imperative because policy cannot directly manipulate perceptions. Unless perceptions adjust, however crudely, to changes in the sanction regime, the desired deterrent effect will not be achieved. More research on the sources of sanction risk perceptions in crime prone populations are likely to pay large dividends for theory and policy.

The fourth major gap in theory and empirical knowledge involves a thorough testing of my contention that the guardian role, not the apprehension role, of the police is the most important source of their effectiveness in crime prevention. This theory also needs to be expanded to account for how the police and other guardians effect the distribution of criminal opportunities.

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