Imprisonment and Crime: Evidence, Policy Implications, & Future Research Directions

Prospectus

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From the 1920s through the mid-1970s rates of incarceration in US state and federal prisons fluctuated without trend around a mean of about 100 per 100000. Beginning in the mid-1970s this pattern of stability changed abruptly. From that time to the present the imprisonment rate has risen without interruption. By 2008 the rate had reached 509 per 100000. Including persons incarcerated in local jails, the per capita incarceration rate in 2008 stood at 764 per 100000.

Such a dramatic increase in imprisonment naturally leads to the question whether the crime rate was reduced from what it would have otherwise been without the increase. The answer to this question is unequivocally yes. As will be reviewed below, nearly all studies find an inverse relationship between imprisonment rates and crime rates. In this paper, however, we address a much more difficult question: On the margin what do we know about the effect of more or less incarceration on crime rates? This question is inherently more difficult to address because it involves assessing changes on the margin and because the relationship between crime rates and incarceration rates depends upon the specific form of the change in sanction policy.

This essay will be organized as follows: Section 1 will introduce and summarize the essay's primary conclusions. Section II will discuss the theoretical perspectives from economics and other disciplines on the effect of imprisonment on crime rates. Sections III will review and critique the evidence on the preventive effect of imprisonment. Section IV will discuss policy implications and directions for future research. Section V will conclude.

Below are our current thoughts on the content of each section.

I. Introduction

This section will begin by introducing the paper's purpose along the lines described above and will summarize its key conclusions. Tentatively these conclusions are:
1. Studies of the relationship between particular policy changes and crime rates consistently find a preventive effect of increased penalties through some combination of deterrence and incapacitation. Studies by Helland and Tabarrok (2007), Kessler and Levitt (1999), and Drago, Galbiati, and Vertova (2009) as well as other indirect evidence suggest that the preventive effect is not entirely due to incapacitation.

2. Estimates of the magnitude of the relationship between aggregate imprisonment rates and crime rates vary so substantially that there is little to be concluded. Low-end estimates suggest that on the margin imprisonment rates are too high relative to a cost benefit analysis and the high-end estimates suggesting even larger prison populations are warranted (Donohue, 2007). Systematic technical deficiencies make it difficult to identify especially good studies within the large literature.
One issue we wish to explore is the relationship between current approaches to cost-benefit analysis, which focus on marginal cost/marginal benefit calculations, and comparisons of different regimes, i.e. high versus low incarceration. We draw this difference for two reasons. First, as our brief recitation of incarceration facts suggests, US policy falls into distinct regimes. Second, the policy relevant empirical question is not so much whether the current regime meets some first order condition but rather whether it is dominated by a feasible (which includes readily identifiable) alternative. We further intend to develop comparisons of incarceration policy regimes that consider issues of robustness, i.e. our comparisons will account for policymaker ignorance about key behavioral parameters.

A second issue we believe is important is that aggregate analyses of the relationship of crime rate to imprisonment rates are typically not well posed. Prison population is not a policy variable rather it is an outcome of a vector sanction policies dictating who goes to prison and for how long. Further, all incentive-based theories of criminal behavior are posed in terms of the certainty and severity of punishment not in terms of the imprisonment rate. Thus, to evaluate incremental costs and benefits of imprisonment the question must be reframed in terms of sanction policies dictating the certainty and severity of punishment. Extant research provides only limited evidence on the effects of certainty and severity of punishment on crime rates.

3. We will argue that the bulk of imprisonment studies should move to a richer conception of the effects of policy regimes. Future research on sanction effects will be most useful for policy evaluation if it moves closer to a medical model. Medical research is not organized around the theme of whether medical care cures diseases, the analog to the issue of whether prisons prevent crime. Instead its addresses far more specific questions: Is a specific drug or procedure effective in treating a specific disease? Does the drug or procedure have adverse side effects for certain types of people? Further most such research is comparative—is the specific drug or procedure more effective than the status quo alternative?-which relates to the concern expressed above that too much attention is paid to marginal benefit versus marginal cost calculations and too little to incarceration regimes per se.

Our medical model analogy highlights an additional limit of many studies. Medical treatments are heterogeneous so are sanctions. Medicines and procedures will not be effective in treating all conditions and some treatments may be ineffective or even counterproductive in treating the condition that they were intended to remedy. This premise applies equally to sanction effects on crime. There are good reasons for predicting heterogeneity in the crime reduction effects of sanctions. Obvious sources of heterogeneity include factors such as prior contact with criminal justices system, demographic characteristics, and the mechanism by which sanction threats are communicated to their intended audience. Further, from the perspective of empirical work, it is evident that a number of factors that generate heterogeneity are unobservable to the analyst. To be clear, this perspective is now standard in the treatment effect literature, see Abbring and Heckman (2007) for a comprehensive overview. Hence an important theme in our work will be the recasting of imprisonment assessments using modern treatment effect methods.

4. Despite the limitations of the existing evidence, there are sound reasons for concluding that for a number of specific contexts the current sanction regime includes long sentences that do not pass a crime prevention benefit-cost test and which can be reduced in a straightforward fashion, i.e. an alternative regime is easy to formulate. (Note: Lengthy sentences may still be justifiable on retributive grounds.) One of the most direct pieces of evidence for this conclusion is the Helland and Tabarrok (2007) study of the deterrent effect of California's "three-strike" law. They find sound evidence that the threat of the third strike does deter offenders with 2 strikes. However, their cost-benefit analysis shows that the cost of the very lengthy incarceration mandated by the third strike, 20 years or more of imprisonment, is unlikely to be socially beneficial compared to a sentence of about 5 years, the term of incarceration for the comparison group that formed the counterfactual in the statistical analysis of deterrent effects.

The specific findings of the Helland and Tabarrok study may be confirmed with from a different and more general vantage point. There is much well established evidence on the decline in offending rate with age. This would suggest that part of California's third strike policy amounts to turning its prisons into a retirement homes for aged criminal who no longer pose a threat to society. Of course, one could argue that this ex post inefficiency is ex ante efficient because of deterrent effects and so this argument will need to be fleshed out The argument raises interesting issues of the time consistency of sentencing rules which we may explore as well.

5. We further believe that insights from behavioral and social economics have implications of assessing imprisonment policy[1]. In doing this, we are cognizant of the danger of developing "just so" stories that can rationalize any conclusions on the comparative effectiveness of punishment regimes.[2] Nevertheless, we believe that one can interpret a number of quantitative

[1] Machina (2009) gives a useful recent review of decision theory that moves beyond the expected utility framework; full treatments include Kreps (1988) and Gilboa (2009). Social interactions work is reviewed in Brock and Durlauf (2001) and Durlauf (2004). Empirical evidence of social influences on crime is developed in Glaeser, Sacerdote, and Scheinkman (1996), Morenoff, Sampson, and Raudenbush (2001) and Sirakaya (2006).

[2] For example, if criminals do not know the probabilities of various punishments for a given crime, one could use the recent literature on decisionmaking under ambiguity to argue that this

and qualitative findings on criminal decisionmaking processes using various advances in decision theory.

For example, in the context of criminal penalties, there are also good reasons for suspecting that on the margin, the certainty rather the severity of punishment is the more effective deterrent.[3] These include the well documented present orientation of would-be offenders. We conjecture the present orientation may be interpreted using models with hyperbolic discounting.

Moving from psychological to social determinants of decisionmaking, one can develop new additional insights in the certainty/severity tradeoff. Policies that increase certainty may also erode the basis for their effectiveness by reducing stigma and also exposing individuals to the criminogenic influences of prison, Thus, increased certainty policies are more likely to have an enduring crime prevention effect if they are implemented in a way that the deterrent effect is sufficiently large that, in equilibrium, less rather than more imprisonment is actually meted out. This might be achieved by implementation of the types of policies advocated by David Kennedy in *Deterrence and Crime Prevention* and by Mark Kleiman in *When Brute Force Fails.* Notice as well that that stigma effects create the potential for multiple equilibria in offending rates for a given punishment regime

Prison may in fact produce distinct deterrent and criminogenic effects. The threat of imprisonment may deter but the actual experience of imprisonment may be criminogenic (Nagin, Cullen, and Jonson, in press). Because most people are not on the margin of criminality, there is a large overlap between the population for whom the deterrent threat is relevant and the population who have actually experienced punishment. Theories of deterrence need to be integrated with theories of the effect of imprisonment on the imprisoned.

II. Theoretical Perspectives on the Deterrent Effect of Imprisonment

Economics and the so-called rational choice tradition in criminology views criminal decision making as a weighing of the benefits and costs of offending. Among the costs is the risk of imprisonment and or other sanctions. Economic theory on criminal decision-making is posed in terms of an expected utility model in which in the cost of imprisonment equals the probability of imprisonment given crime commission times the expected disutility of a prison sentence of specified length.

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ignorance leads them to follow a maximin decision criterion and assume certain punishment, which we think is empirically nonsensical.

[3]This idea is of course classic in criminology and goes back to Beccaria. We use the phrase on the margin to emphasize the fact that certainty and severity interact in the crime decision problem, so that the effects of marginal changes in them are not constant. We note as well that the desirability of certain versus severe sentences may hold even without appeal to psychological features of criminals. Suppose that the expected sentence length is kept constant, and one is considering marginal shifts between longer sentences and a higher probability of being punished. These have different effects decision to commit a crime.

Noneconomists have challenged this model on many grounds. Some of this criticism is poorly developed and motivated by a longstanding hostility to the institution of imprisonment rather than to well formed model of individual behavior or good empirical evidence. However, two lines of criticism of the economic model have real merit for our purposes here:

Sanction risk perceptions are often chaotic and poorly informed and have little basis. Nagin's (1998) review of the deterrence literature argues: "Even if crime decisions are influenced by sanction risk perceptions, as the perceptual deterrence literature strongly suggests, absent some linkage between policy and perceptions, however imperfect, behavior is immune to policy manipulation." There is a large literature in criminology showing that sanction risk perceptions are badly distorted. One cogent response to this literature is that sanction risk perceptions among the general public are largely irrelevant because most people are so far from the margin of criminality that they have no reason to be informed about sanction risks. There are, however, studies of sanction risk perceptions among active criminals. Kennedy nicely summarizes them in his book *Deterrence and Crime Prevention.* While the evidence on sanction risk perceptions of active offenders is all anecdotal, it is very clear that even among this group for whom sanctions do matter, sanction risk perceptions are not well informed. Note this same anecdotal evidence also makes clear that active criminals do concern themselves with sanctions. Indeed many of Kennedy's recommendations in *Deterrence and Crime Control* are based on clarifying and focusing attention on sanction risks among a targeted group of active offenders. Social scientists would do well to formalize Kennedy's arguments on effective strategies for "educating" targeted criminal groups on the sanction consequences for targeted criminal behaviors.

Second, the prison experience may be criminogenic. In Langen and Levin (2002) the characteristics of nearly 300,000 individuals released from prison in 1994 are analyzed. Prior to their imprisonment 93.1% had been previously arrested (ave.=6.6 arrests), 81.4% had been previously convicted (ave.=3.8 convictions) and 43.6% had been previously imprisoned. Recidivism was also the norm--67.5% of the releases were rearrested within 3 years. These statistics demonstrate two important points. First, recidivism rates are very high among those sent to prison. While this fact does not imply that the prison experience does not have a chastening effect, it does demonstrate that for most individuals it is not sufficiently chastening to deter reoffending altogether. Second, they imply an important and under- appreciated linkage between general and specific deterrence. General deterrence refers to the effect of sanction threats on the population writ large and specific deterrence to the effect of punishment on the person actually punished. If one accepts the proposition that most people are not close to the margin of criminality, the statistics from the Langen and Levin study make clear that is there is a lot of overlap in the populations for which general and specific deterrence pertain.

One of us has recently completed a review of the literature on the effect of imprisonment on reoffending (Nagin, Cullen, and Jonson, in press) and was struck by how little thought has been given to what the concept of special deterrence actually means. A well articulated theory integrating the concepts of general and specific deterrence is important because there is, in fact, good reason for theorizing that the experience of imprisonment exacerbates future criminality. The logic for distinguishing specific deterrence from general deterrence is that the experience of punishment may have a deterrent value in itself. At its core deterrence is a theory about the effect of expectations on behavior, namely how expectations about the adverse consequences of

state sanctioned punishment may discourage criminal behavior. Thus, for there to be a specific deterrent effect the experience of punishment must cause individuals to revise upward their expectations about the certainty or severity of punishment for future criminality. One possibility is that individuals who actually experience punishment conclude that it is an experience not to be repeated. Implicit in this argument is an assumption that prior to actually experiencing punishment, individuals systematically under-estimate its onerousness. The structure of the law itself may also cause previously convicted individuals to revise upward their estimates of the likelihood and/or severity of punishment for future lawbreaking. The criminal law commonly prescribes more severe penalties for recidivists. For example, sentencing guidelines routinely dictate more severe sentences for individuals with prior convictions. Prosecutors may also be more likely to prosecute individuals with criminal histories.

There are, however, many plausible arguments for why the experience of imprisonment might increase offending rate upon release. Some individuals might conclude that the experience was not as adverse as anticipated with the result that they revise downward rather than upward their expected utility loss from a future experience with punishment. Pogarsky and Piquero (2003) advance a related argument from behavioral economics that the experience of apprehension may actually reduce rather than increase the perceived risk of apprehension.

The experience of punishment may also trigger other social forces that increase the likelihood of reoffending. There are three main variants of this argument. The first contends that prison is criminogenic because it provides an environment which reinforces deviant values and which is conducive to the acquisition of new criminal skills (Clemmer 1940; Sykes 1958). The second contends that prison is criminogenic because it stigmatizes offenders. Social stigmatization, it is argued, prompts those who are stigmatized to adopt the label of criminal and behave in ways that are consistent with this label (Becker 1963; Braithwaite 1988; Lemert 1951). The third contends that prison increases the risk of re-offending because it reduces the offender's capacity (on release) to obtain income by legitimate means (Fagan and Freeman 1999). For all of these reasons, there may be diminishing crime reduction benefits as the scale of imprisonment increases.

III. Literature Review

This section will review the literature on the preventive effect of incarceration. Our tentative plan is to divide it into four sections: (1) Statistical studies of the association of imprisonment rates and crime rates, (2) other studies of the deterrent effect of imprisonment, (3) studies related to the deterrent effect of the certainty and severity of punishment, and (4) incapacitation studies.

1. Statistical studies of the association of imprisonment rates and crime rates. This section will begin with a brief review of the Ehrlich-era studies and their shortcomings and then quickly move to the more recent studies of the linkage between state-level crime rates and state level per capita imprisonment rates. These studies represent the latest literature on the preventive effects of imprisonment. We use the term preventive because the studies are measuring some unknown combination of incapacitation and deterrence effects. A review by Donohue (2007) identified 6 such studies. All find statistically significant associations between imprisonment rates and crimes

rates but the elasticity estimates vary widely from nil for a study that allows for the possibility of diminishing returns (Liedke, Piehl, and Useem (2006)) to -.6 (Levitt (1996)).

These studies clearly make the case that, except possibility for recent rates of imprisonment, increases in the size of the prison population reduce crime, at least in the short-run. For several reasons, however, these studies are of limited value in addressing the question whether and how it might make sense to scale back on the use of imprisonment:

a. Donohue (2007) shows that the small elasticity estimates imply that the current imprisonment rate is too large and the high-end estimates imply the rate is way too small. He goes on to list a variety of technical shortcomings of these studies that in our view make it impossible to distinguish among the widely varying effect size estimates. These deficiencies will be detailed.

b. This literature suffers from more than just technical shortcomings that one might strive to correct. It also suffers from two important conceptual flaws that limit its usefulness in devising crime control policy. Prison population is not a policy variable rather it is an outcome of sanction policies dictating who goes to prison and for how long. Changes in the size of prison populations can only be achieves by changing policies affecting the prison in/out decision or the length of incarcerations for those sent to prison. In the deterrence literature the former relates to the probability of imprisonment P, sometimes referred to as the certainty of punishment, and latter concerns the severity of punishment S. Let C and I, respectively, denote the crime rate and the per capita imprisonment rate. In equilibrium $I = C \times P \times S$. All incentive based theories of criminal behavior are posed in terms of the certainty and severity of punishment not in terms of the imprisonment rate. Thus, more generally $I = C(P,S) \times P \times S$ Therefore to answer the question of how changes in P or S might affect I requires knowledge of $C(P,S)$ which is not provided by the imprisonment rate-crime rate literature, although one can glean evidence of its properties from various studies.[4]

This is not a minor conceptual quibble if, as we have argued above, it is plausibly and perhaps likely that potential criminals respond differently to changes in P than changes in S and the effects may depend upon offender characteristics such as prior record. Relatedly, there is also no unique relationship between $P \times S$ the expected sanction cost per crime, and imprisonment rate, I. The lack of such a unique relationship which was first demonstrated in Blumstein and Nagin (1976) extends to the theoretical indeterminacy of even the sign of the change in I with respect to a change in P or S. If the elasticity of C with respect to P or S is less than 1, an increase in either of these variables would result in an increased in prison population whereas if the elasticity is greater than 1 an increase would result in a reduced prison population; (This is analogous to the J-curve effect in international trade.)

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[4]To understand the determination of the crime rate, for the basic rational crimainl model, individual i commits a crime if $(1 - P)u_i(A,NS) + Pu_i(A,S) > u_i(NA)$ where u_i is the utility of the individual, A means the criminal act is committed, NA means the act is not committed, NS means no sentence received and as before S denotes the sentence. The crime rate equals the percentage of the population where the inequality holds (indifference is ignored for simplicity).

The indeterminancy in the sign of the relationship P , S and I implies the possibility of a Laffer curve-style relationship between sanction variables and the imprisonment rate. If there were no sanction threat there would be no one in prison even though crime rates would be very high. Alternatively, if sanctions could in practice be made sufficiently severe and certain, there would again be nobody in prison because everyone would be deterred.

2. Other studies focus deterrent effect of imprisonment. At the moment, we regard three studies as especially noteworthy: Helland and Taborrok (2007) on the deterrent of California's third strike, Drago, Galbiati, and Vertova (2009) on the effects of an Italian prison clemency, and a randomized field trial conducted by Weisburd et al. (2008) on the use of imprisonment to enforce fine payment.

Weisburd, Einat, and Kowalski (2008): This study reports on a randomized field trial of alternative strategies for incenting the payment of court ordered fines. The most salient finding involves the "miracle of the cells," namely, that the imminent threat of incarceration is a powerful incentive for paying delinquent fines. The miracle of the cells, we believe, provides a valuable vantage point for considering the oft repeated conclusion of the deterrence literature that the certainty rather the severity of punishment is the more powerful deterrent. Consistent with the "certainty" principle the common feature of treatment conditions involving incarceration was a high certainty of incarceration for failure to pay the fine. However, that Weisburd et al. label the response the "miracle of the cells" not the "miracle of certainty" is telling. Their choice of label is a reminder that certainty must result in a distasteful consequence, namely in this case incarceration, for it to be a deterrent. The consequences needn't be draconian just sufficiently costly to deter the behavior.

Helland and Tabarrok (2007). This study examines whether California's "Three Strikes" law deters offending among individuals previously convicted of strike-eligible offenses. The future offending of individuals convicted of two strikeable offenses was compared with that of individuals who had been convicted of only one strikeable offense but who, in addition, had been tried for a second strikeable offense but were ultimately convicted of a non-strike eligible offense. The study demonstrates that these two groups of individuals were comparable on many characteristics such as age, race, and time in prison. Even so, it finds that arrest rates were about 20 percent lower for the group with convictions for two strikeable offenses. The authors attribute this reduction to the greatly enhanced sentence that would have accompanied conviction on a third strikeable offense.

Drago, Galbiati, and Vertova (2009). In May of 2006, Italy's Collective Clemency Bill resulted in the release of more than 20,000 inmates from Italian prisons. The release came with the condition that individuals convicted of another crime within five years of their release would have to serve the residual of the sentence that was suspended in addition to the sentence for the new crime. The residual sentence length varied between 1 and 36 months. This analysis examines whether the natural experiment created by the early release of these individuals had an effect on reoffending rate. One key finding was that each month of residual sentence was associated with 1.24 percent reduction in the propensity to recommit crime. The second key finding was that individuals who spent more time in prison for their clemency offense were less

responsive to the incentive not to reoffend created by their having to serve out the residual sentence for that offense. This suggests that time served in prison reduces responsiveness to future punishment.

The Drago, Galbiati, and Vertova (2009) and Helland and Tabarrok (2007) studies, we believe, have important substantive implications because they provide a perspective on why it might be that the experience of punishment may be both criminogenic and a deterrent. As discussed previously, there are many mechanisms by which the experience of punishment might be criminogenic. Similarly there are many mechanisms by which the experience may have an ameliorative effect on criminality. Among the most compelling arguments for a preventive effect involves expectations about punishment for future offending—namely that future offending will be sanctioned even more harshly than prior offending. The Drago, Galbiati, and Vertova (2009) and Helland and Tabarrok (2007) findings are supportive of this expectations-based mechanism but in a specific sort of way. Most sanctioning systems punish repeat offenders more harshly yet when Helland and Tabarrok replicated their analysis in states without three-strike laws, they found no differences in the recidivism of offenders with one and two strikeable offenses by California standards. This suggests that expectations-based deterrence among repeat offenders requires a very tangible, "in your face" disincentive to reoffending that is hard to neglect. In the case of the Drago, Galbiati, and Vertova study, the disincentive was the residual sentence to be added to the penalty for any new offense. In the case of the California Three-Strikes sentencing regime, it was the threat of imprisonment for life for a third strike. Other evidence on the importance of tangible incentives to affect the behavior of active offenders is the Weisburd et al (2008) finding that the imminent threat of incarceration was an effective incentive for getting convicted offenders to make payment on delinquent fines.

The second notable finding from the Drago, Galbiati, and Vertova study was that the deterrent effect of residual sentence diminished with length of incarceration for the offense that received clemency. This finding is consistent with the finding of much of the literature reviewed in Nagin et al. (in press) that points to a criminogenic effect of the experience of imprisonment. As was noted in the Section 2 synopsis, criminogenic and preventive effects are not mutually exclusive; they both can be operating in unison with the net effect either in a criminogenic or preventive direction depending on the summation of the combined criminogenic and preventive influences. The Drago, Galbiati, and Vertova findings suggest the criminogenic influences may mount with time in prison.

c. Certainty and severity studies

One of the key conclusions that emerged from the 1970's era deterrence literature was that the certainty of punishment was a more powerful deterrent than the severity of punishment. The analyses of this era generally used cross-sectional data on states and involved regressions of the statewide crime rate on two sanction variables and other demographic and SES related variables. The sanction variables were certainty of punishment as measured by the ratio of prison admissions to number of reported crimes and severity of punishment as measured by time served of recent prison releases. The basis for the "certainty not severity" deterrence conclusion was that the certainty measure was consistently found to have a negative and significant association with the crime rate whereas the severity measure generally had no significant association.

This conclusion was likely based on faulty statistical inference. Two primary criticisms were leveled. The first was that the negative association between the certainty measure and crime rate was an artifact of measurement error in number of crimes, the denominator of the certainty measure and the numerator of the crime rate. The second involved the use of theoretically indefensible identification restrictions in endogenous formulations of the crime rate and sanction levels (Nagin, 1978). However, subsequent findings from the so-called perceptual deterrence literature and economics studies of the effects of contact with the criminal justice system on access to legal labor markets provide a far firmer empirical and theoretical basis for the "certainty" contention.

Both literatures also suggest that there is a substantial informal sanction or stigma cost associated with such contact. We will briefly review this literature and then go on to discuss how growing prison populations may be eroding the stigma effect by making a prison record far more commonplace and thereby inherently less stigmatizing. In a nutshell the argument is this: if fear of stigma is a key component of the deterrence mechanism, such fear will depend on how the punishment is meted out. If stigma is monotonically decreasing in the percentage of the population that has received the punishment, then it can be diminished when punishment is commonplace. Prison sanction policies that are effective in the short term may erode the very basis for their effectiveness over the long run if they increase the proportion of the population who are stigmatized with a prison record.

We note that for some formulations of stigma, the implications of increased incarceration are more complicated. If stigma arises from imprisonment because of the way that it affects inferences of an individual's underlying type, the increased imprisonment can increase or decrease stigma according to how it affects these inferences. Our belief is that large increases in imprisonment in the last several decades have reduced stigma as it has decreased the tightness of the relationship between one being fundamentally anti-social (for example) and having been imprisoned; intuitively, a pool of exconvicts which is a mix of nonviolent drug offenders and violent criminals means that the informational content of having been incarcerated is different from the case when nonviolent drug offenders are not typically imprisoned. An obvious response to this argument is that communities will form separate levels of stigma according to the reason for incarceration, but this implies that sufficient information is available to do so, which is far from obvious when one considers informal social interactions as opposed to job applications and interviews.[5]

d. Incapacitation

The discussion of incapacitation will be abbreviated. We make two key points: (1) Individual rates of offending are highly skewed and that due to what Blumstein, Canela-Cacho, and Cohen (1993) call stochastic selectivity, high rate offenders in the upper tail of the offending distribution are likely to be quickly "recaptured." Thus, changes in the certainty and/or severity of punishment will have a more muted incapacitation effect than suggested by average offending rates. (2) Offending rates are very age dependent. This implies that except for most the

[5] See Besley and Coate (1992) for a similar set of arguments in the context of welfare stigma.

dangerous offenders, lengthy prison sentences are not an effective strategy for reducing crime through incapacitation.

IV. Policy Implications

This section is the least well developed beyond the summaries provided in the introduction.

1. Certainty enhancing strategies

As argued above there are good theoretical reasons for predicting that the certainty of punishment is a more effective deterrent than the severity of punishment. A more precise statement of this prediction is: let $E(S|C)$ denote the expected sentence given crime and recall that P=probability of prison given crime and S=sentence given imprisonment. Thus, $E(S|C) = P \times S$. The "certainty prediction" is that a 1% increase in P will have a larger deterrent effect than a 1% increase in S even though both such changes will result in equal changes in $E(S|C)$.

2. Coarse policy comparisons

We will argue that some aspects of currently policy are clearly not cost beneficial. For, example, even if the certainty principle is correct, as noted earlier, an in increase in P will only decrease both the crime rate and the imprisonment rate if the elasticity of the crime rate with respect to P is greater than 1. The fact that rising, not falling, imprisonment rates have accompanied the tougher sanctioning regimes enacted over the past 3 decades suggests that, in general, this elasticity is less than 1. However, the types of strategies that Kennedy advocates in his aforementioned book might suggest enforcement strategies where the elasticity is greater than 1. In essence, these strategies involve targeting a select group of offenders with highly certain and severe sanctions. The goal is make the threat sufficiently credible that won't have to be delivered on. This is another issue we intend to think more carefully about.

3. Penalty structure and heterogeneity

A third area we are exploring concerns the structuring of sentencing when one recognizes the heterogeneity of potential criminals. As we see it, sentencing structure should distinguish between that subset of the population for which deterrence is most efficacious and that for which incapacitation is needed in order to minimize crime rates. This dichotomy is somewhat different from what one sees in policies such as three strikes laws, in which marginal deterrence is emphasized. Put differently, we feel that one should think of a policymaker as facing a signal extraction problem for a convicted criminal as to the criminals "type." Imprisonment of those whose type renders them relatively likely to recidivate obviously has an incapacitation effect which does not apply to those whose type means they are unlikely to do so.A policymaker does not know an individual criminal's type, but past convictions provide information that is relevant to drawing inferences about type. Even if there are no deterrent effects, increasing sentence

length with the number of prior convictions can be justified as policymakers tailor sentence length to type. . This signal extraction problem coexists, of course, with the problem of structuring sentences given the distribution of deterrence effects across the population for a given sentencing structure.. We conjecture that this signal extraction approach will provide support for increased sentence given past convictions but will not justify extremely long sentences in light of the age/crime profile we have described above.[6]

4. What new research is needed?

Finally we will elaborate upon the types of research that needs to be done to produce findings that advance sciences and are policy relevant. As described in the synopsis of the Introduction under (2), research needs to follow an analog to the medical research model in which much more targeted questions about sanction effects on crime are addressed. The research should also focus on the theoretically relevant variables of certainty and severity. One approach is to try to take advantages of so-called "natural experiments." Examples of "natural experiments" are sentencing variations that results from random assignment of case to judges and regression discontinuity designs. Various randomized experiments would, of course, also be very desirable. At the same time, we are sympathetic to arguments raised in Heckman and Urzua (2009) and so will also be very concerned with developing suggestions onhow observational studies may be improved. In this respect, we will consider how to conduct empirical analyses of the effects of incarceration using decision-theoretic approaches inspired by Heckman and Vytlacil (2001).

[6]Of course, since Becker (1968), the question of optimal sentence structure has been widely studied; Shavell (2004) provides an overview. Our signal extraction argument may be understood as arguing that sentence structure should be thought of from the perspective of information revelation about a criminal's latent characteristics, which does not appear to have been studied before. Polinsky and Shavell (1998), for example, develop a model in which penalities increase with prior convictions in order to enhance deterrence effects for earlier in life. Our argument is different: increasing penalties are justified because of increased information on criminal type. We see analogies between this approach and the use of trajectories to study delinquency (see Nagin (2005) for an overview) in the sense that just as the delinquency literature attempts to identify different delinquency trajectories for different adolescent types, the justice system ideally will assign sentences based on criminal trajectory, which are also heterogeneous.

References

Abbring, J. and J. Heckman, (2007), "Econometric Evaluation of Social Programs, Part III: Distributional Treatment Effects, Dynamic Treatment Effects, Dynamic Discrete Choice, and General Equilibrium Policy Evaluation, in *Handbook of Econometrics*, vol. 6, J. Heckman and E. Leamer, eds., Amsterdam: North Holland, 5145-5303.

Becker, G., (1968), "Crime and Punishment: An Economic Approach," *Journal of Political Economy*, 76, 169-217.

Besley, T. and S. Coate, (1992), "Understanding Welfare Stigma: Taxpayer Resentment and Statistical Discrimination," *Journal of Urban Economics*, 48, 165-183.

Blumstein, Alfred, Josè A. Canela-Cacho and Jacqueline Cohen,"Filtered Sampling from Populations with Heterogeneous Event Frequencies" (1993), Management Science, Vol. 39, No.7, pp. 886-899.

Brock, W. and S. Durlauf, (2001), "Interactions-Based Models," in *Handbook of Econometrics* 5, J. Heckman and E. Leamer eds., Amsterdam: North Holland.

Durlauf, S., (2004), "Neighborhood Effects," in J. V. Henderson and J.-F. Thisse, eds., *Handbook of Regional and Urban Economics 4*, Amsterdam: North Holland.

Gilboa, I., (2009), *Theory of Decision Under Uncertainty*, New York: Cambridge University Press.

Glaeser, E., B. Sacerdote, and J. Scheinkman, (1996), "Crime and Social Interactions," *Quarterly Journal of Economics*, 111, 2, 507-548.

Heckman, J. and S. Urzua, (2009), "Comparing IV with Structural Models: What Simple IV Can and Cannot Identify," *IZA Working Paper* no. 3980.

Heckman, J. and E. Vytlacil (2001), "Policy Relevant Treatment Effects," American Economic Review, 91, 2, 107-111.

Helland, E. and A. Tabarrok, (2007), "Does Three Strikes Deter? A Nonparametric Investigation," *Journal of Human Resources*, XLII, 2, 309-330.

Kreps, D., (1988), *Notes on the Theory of Choice*, Boulder: Westview Press.

Levitt. S., (1996) "The Effect of Prison Population Size on Crime Rates: Evidence from Prison Overcrowding Litigation." *Quarterly Journal of Economics*. 111, 2, 319-351.

Liedka, R., A. Piehl, and B. Useem, (2006), "The Crime-Control Effect of Incarceration: Does Scale Matter?" *Criminology and Public Policy*, 5, 2, 245-276.

Machina, M., (2008), "Non-Expected Utility Theory," in New Palgrave Dictionary of Economics, S. Durlauf and L Blume, eds., London: MacMillan.

Morenoff, J., R. Sampson, and S. Raudenbush, (2001), "Neighborhood Inequality, Collective Efficacy, and the Spatial Dynamics of Urban Violence," *Criminology,* 39, 3, 517-560.

Nagin, D.S. 1978. "General Deterrence: A Review and Critique of the Empirical Evidence." In *Deterrence and Incapacitation: Estimating the Effects of Criminal Sanctions on Crime Rates.* Washington, D.C.: National Academy of Sciences.

Nagin, D., (2005), *Group-Based Modeling of Development*, Cambridge: Harvard University Press,

Polinsky, M. and S. Shavell, (1998), "On Offense History and the Theory of Deterrence." *International Review of Law and Economics*, 18, 3, 305-324.

Shavell, S., (2004), *Foundations of Economic Analysis of Law*, Cambridge: Harvard University Press.

Sirakaya, S. (2006), "Recidivism and Social Interactions," *Journal of the American Statistical Association*, 101, 475, 863-877.