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# Does Incapacitation Reduce Crime?

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**Abstract** Questions and answers about incapacitation abound in all discussions about criminal justice policy. They are among the most pressing of all research issues, yet estimates about the incapacitation effect on crime vary considerably, and most are based on very old and incomplete estimates of the longitudinal pattern of criminal careers. This paper provides an overview of the incapacitation issue, highlights information on recent estimates of criminal careers that are useful to the incapacitation model, and outlines an ambitious research agenda for continued and expanded work on incapacitation and crime that centers on developing better estimates of the characteristics of criminal careers and their relevance to policy choices.

**Keywords** Incapacitation · Criminal careers · Criminal justice policy · Criminal offending

## Introduction

There is no doubt that the major crime-reduction strategy since the 1980s has been to increase the use of punishment, especially incarceration, under the assumption that offenders incarcerated will be prevented by incapacitation from committing further crimes (Marvell and Moody 1994, p. 109; Zimring and Hawkins 1995). Incapacitation strategies seek to reduce crime by interruption, or "taking a slice out of" an individual career (Blumstein 1983, p. 874; Visher 1987). In developing an incapacitation strategy, there is a

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need to focus on the offenders who would be committing crimes at very high rates while free, the rates at which they would be committing those crimes, and over what duration they would be likely to continue.

Traditionally, there have been two main approaches to developing estimates of the effect of incarceration on crime (Donohue and Siegelman 1998). The first, popular among criminologists, focuses on examining individual offending rates. By removing a convicted criminal from the street and placing him in prison, researchers can estimate the crime he would have otherwise committed in the community. This approach involves the use of criminal career information on rates of offending and desistance. After early research using this approach (Avi-Itzhak and Shinnar 1973; Shinnar and Shinnar 1975; Greenberg 1975), the most recent and authoritative estimates of these rates comes from the RAND Second Inmate Survey, a three-state survey (in California, Michigan, and Texas) of 2,190 prisoners. One problem with this survey is that the inmate sample is not necessarily representative of any known population and the estimates are based on site-specific offending data obtained over 30 years ago in the 1970's. Spelman (1994) used these data to develop aggregate crime-reduction estimates through incapacitation; however, he did not estimate the marginal impact of an increase or decrease in sentence length for a particular group of offenders.

The second approach to estimating the effect of incarceration, centered in economics, involves the use of cross-sectional data at the nation, state, or county level to capture the impact of incarceration on aggregate crime rates. This method captures the joint impact of incapacitation and deterrence (Levitt 1996; Marvell and Moody 1994), and tries to estimate the total crime reduction associated with increased incarceration without distinguishing between incapacitation and deterrent effects (Donohue and Siegelman 1998, p. 7). The focus here is usually on changes in policies that lead to increases or decreases in the number of people who are incarcerated. The outcome under investigation is an estimate of the effect of changes in the imprisonment rates on changes in the aggregate crime rates, or the "elasticity" of crime rates with respect to changes in imprisonment rates. This approach confounds the effects of deterrence and incapacitation and cannot obtain a separate measure of incapacitation. It is limited by its use of aggregate crime statistics and the concern over omitted-variable bias (i.e., imprisonment ends up acting as a proxy for many other factors that influence crime but which have not been included in the analysis and one can only crudely identify all the other variables that should be included in the econometric estimates; Spelman 2000a, p. 440).[1]

There has been considerable discussion regarding the incapacitation effect, and there is little doubt that there is a sizable incapacitation effect with over 2 million people incarcerated, but it is still uncertain how much that affects the crime rate and how it is distributed among individual offenders (Spelman 2000a, p. 419). The knowledge base has been stagnant largely because of the lack of new data needed to assess individual offending rates. Questions about incapacitation are central to the discussion about criminal justice policy and are intellectually and politically challenging (Zimring and Hawkins 1995, vi), and so this seems like a good time to re-invigorate the incapacitation discussion by identifying the information needed to generate more useful estimates of incapacitation effects.

This paper has three principal aims. The first is to present a brief overview of the main issues regarding the incapacitation literature that is concerned with estimation of individual

[1] Because neither approach inherently dominates the other, the combined use of both approaches is likely to be more useful (Zimring and Hawkins 1995).

offending rates from the criminological perspective; this builds on more comprehensive reviews that are available elsewhere (Cohen 1983; Spelman 1994, 2000a; Visher 1987). The second aim is to highlight some recent criminal-career findings that illuminate the importance of such information and its relevance for generating incapacitation estimates. Lastly, the paper presents an argument for the criminological approach and sets an agenda for future research that seeks to further the knowledge base about the incapacitation effect. A prominent call here will be for more in-depth, descriptive research into the longitudinal patterning of criminal careers (and in particular its separate dimensions) as well as a renewed call for more current data sources that contain the necessary information to assess contemporary incapacitation effects.

## What Do We Know

### Avi-Itzhak and Shinnar Incapacitation Model

Avi-Itzhak and Shinnar's (1973; also Shinnar and Shinnar 1975) steady-state model assumes that there is a finite population of offenders who, when free in the community, commit crimes at a certain rate and remain involved in crime over a certain period of time (i.e., the duration of their criminal careers). The model assumes that the larger the fraction of an offender's criminal career spent in prison, the fewer crimes they can accumulate in the community. The amount of crime prevented by incapacitation depends on five inputs: (1) the rate at which offenders commit crime when free; (2) the likelihood of an offender being caught and convicted; (3) the likelihood, if convicted, that an offender will receive a prison sentence; (4) the average time spent in prison, and (5) the average time offenders will be involved in crime (i.e., the duration of a criminal career). The equation that estimates the fraction of crimes avoided as a result of incapacitation (and these five factors) is given by:

$$I = \lambda qJS\{T_r/(T_r + S)\}/[1 + \lambda qJS\{T_r/(T_r + S)\}],$$

where $I$ = the fraction of potential crimes avoided as a result of incapacitation, $\lambda$ is the rate at which offenders commit crimes, $q$ is the probability of being apprehended and convicted for a crime, $J$ is the probability of being sentenced to prison if convicted, $S$ is the average time served in custody, and $T_r$ is the average time offenders will remain involved in crime.[2]

The Avi-Itzhak and Shinnar model can also be used to derive an equation for the percentage change in the annual custodial population required to achieve a 1% change in the level of crime, i.e., the elasticity of crime in relation to prison.[3] This change is given by:

$$\mathrm{E} = \{1 + \lambda qJS^2T_r \big/ (T_r + S)^2\} \big/ \{-\lambda qJST_r^2 \big/ (T_r + S)^2\}],$$

[2] $I$ can be thought of as the percentage increase in crime that would result if all offenders (or all offenders of a certain type) were released. Also, $I$ must be adjusted downwards to account for the fact that, when co-offenders commit a crime, imprisoning both will only save one offense (Weatherburn et al. 2006, p. 3).

[3] $E$ also has to be adjusted for co-offending.

where $E$ is the elasticity of crime in relation to prison. Their analysis showed that increasing sentence severity $S$ results in a relatively small reduction in crime rates. When combined with information about the length of the typical career, it is possible to estimate the proportion of that career that the typical offender spends incarcerated. This proportion represents the reduction in the crime rate due to incapacitation. By inserting different estimates of the parameters into the model, researchers can estimate the effect of incapacitation on crime (Spelman 2000b, p. 99). This strategy also sidesteps the problem of having to work out what exogenous factors to control for when estimating the effect of prison on crime using the econometric model.

As with any model, the incapacitation model rests on several assumptions—many of which have either not been confirmed by empirical research or have not been carefully studied. First, accurate estimates of the model parameters have to be obtained. Second, all offenders are assumed to run the same risk of being arrested and incarcerated. Third, there are a fixed number of offenders in the population, so that as more offenders are imprisoned, there are fewer left in the general population. Fourth, the experience of imprisonment does not change the expected length of a criminal career ($T_r$) or the rate at which the individual offenders commit crime (denoted by the Greek letter lambda, $\lambda$) when free. Fifth, the duration of criminal careers are assumed to be exponentially distributed. Sixth, the intensity of offending frequency ($\lambda$) is assumed to be constant over age and homogeneous across all offenders. The model has since been subsequently expanded and improved to include a distribution of offense rates (Greenwood 1982; Canela-Cacho et al. 1997) and information on co-offending (Reiss 1980).

Estimates of the crime-reduction potential of incapacitation are both numerous and diverse, reflecting different assumptions made by different researchers (Cohen 1983; Visher 1987). Most incapacitation studies suggest that prison exerts a significant suppression effect on crime; however, the estimated effects vary markedly from study to study depending on the extent of incapacitation, how much the prison population is increased, and the values of the model parameters used (Spelman 2000a; Weatherburn et al. 2006). In an early review, Cohen (1978, pp. 219–221) estimated elasticities of −0.05 to −0.70, while Spelman's (1994, p. 220) estimates ranged from −0.12 to −0.20, with a best guess estimate of −0.16. DiIulio and Piehl (1991), using Wisconsin prisoner data from 1989, report an elasticity estimate of −0.22, while Piehl and DiIulio's (1995) analysis of New Jersey offender data indicates an elasticity estimate of −0.26. Likewise, Weatherburn and colleagues (2006) carried out an analysis of burglary offenders from New South Wales and obtained an adjusted elasticity of burglary with respect to imprisonment of −0.3. These various estimates cover a reasonable range of elasticity of about −0.2, or a requirement for a 5% increase in the prison population to achieve a 1% reduction in crime.

In short, high-end elasticity estimates suggest a greater opportunity for crime reduction through increasing prison population, whereas moderate to low-end estimates suggest that prison growth should be curtailed with the saved resources channeled to social programs. Generating more precise estimates of the elasticity of crime with respect to incarceration under a variety of circumstances would certainly be important for policy (Donohue and Siegelman 1998, p. 2).

The magnitude of the incapacitation effect is strongly dependent on the estimates of $\lambda$, the average crime rate while free; thus, the incapacitation effect is greater with higher individual crime rates (Cohen 1978, p. 210). The key is not necessarily to focus on the actual estimate per se, largely because such estimates are uncertain due to the input quantities being so different and context-specific (Spelman 1994). In fact, Spelman (2000a) suggests that researchers should not look for a single best estimate of the incapacitation effect; instead, it may be more beneficial to consider the ranges and their bounding generally, and to specifically understand the populations on which those estimates are based.

## Estimates of Lambda ($\lambda$)

The primary documentation for a number of criminological estimates of incapacitation is the Rand Second Inmate Survey (Petersilia et al. 1978, 1980, 1981; Chaiken and Chaiken 1982; Greenwood 1982) of 2,190 incarcerated prisoners who were asked to describe the kind and amount of crime they committed during the three-year period prior to their current incarceration. The Rand surveys from the 1970s are the dominant source of data for estimates of individual crime rates and the volume of crimes avoided by imprisonment.[4] The problems with such surveys are the accuracy of the estimates provided, the projections of rates to the target group of a policy, and the uncertainty about the relationship between individual and community prevention (Zimring and Hawkins 1995, p. 81).

Estimates of average $\lambda$'s range from three crimes per person per year to 14 crimes per person per year, to Zedlewski's (1985) average of 187 non-drug crimes per person per year. Cohen (1983, pp. 20–21) suggests an upper limit of 12 index crimes per year, but of course, such estimates depend on which crime types are included in the summary calculation. For example, in the Rand surveys, the average number of burglaries committed per active burglar was between 76 and 118, for robbery it was between 41 and 61, for other theft it was between 142 and 209, for fraud it was between 174 and 238, and for drug dealing it was between 880 and 1300, and all of these varied by whether the sample was drawn from California prisons or jail, Michigan prisons or jails, or Texas prisons. When summed across appropriate categories, Chaiken and Chaiken (1982) found that inmates averaged between 187 and 287 crimes per year exclusive of drug deals.[5] The estimates form a highly skewed distribution where the median (half of the population) committed very few crimes per year, but a much smaller percentage commit many crimes annually and that tail raises the mean of the group sharply.[6]

As could be expected given the small number of high-rate offenders, claims were made about identifying those offenders and incapacitating them selectively. If that could be done, it could be a most efficient way to avert crimes. Using an average of 187 offenses committed per offender per year, and assuming that all such identified convicted persons not yet imprisoned also commit 187 felonies per year, Zedlewski (1985, 1987) found that imprisonment (and expansion of the prison population) would yield considerable crime-reduction benefits. Specifically, he concluded that incarceration has a benefit–cost ratio of just over 17: putting 1,000 felons in prison costs society \$25 million (1,000 felons X \$25,000 each per year of confinement), but not putting these same felons in prison costs

[4] To be sure, criminologists have spent considerable effort tracking individual patterns of offending by many other offenders over the life course, using a number of recent and important methodological advances. We return to this point later.

[5] The high and low estimates of the average resulted from applying two different consistency standards to classify unreliable estimates.

[6] Texas had a much higher rate of imprisonment so that high-rate offenders made up a larger proportion of the California prison population than of the Texas prison population. California's estimates are so high because they are a function of the relatively low level of imprisonment; Texas mixes in a greater number of low-rate offenders; but there is a phenomenon of diminishing marginal returns: as long as most high-rate offenders are already in prison, then offenders at the margin of imprisonment will have much lower average crime rates than those already in prison (Zimring and Hawkins 1988, p. 432).

society about $430 million per year (187,000 crimes X $2,300 per crime) (B/C Ratio = $430,000,000/$25,000,000, or 17). Not surprisingly, Zimring and Hawkins (1988) argued that Zedlewski's analyses were fatally flawed.

Their first concern was that Zedlewski had overestimated the numerator and deflated the denominator, with the most important flaw being the use of the average of 187 crimes committed per prisoner instead of using the median, which would have reduced the benefit/cost ratio considerably because of the skewness of the offending distribution. Their second concern was that Zedlewski's analysis presented several aggregation problems. He pooled together several different crime types, which exhibited a wide array of offending estimates and costs per crime and various jurisdictions (states as well as both jails and prisons), thus obscuring many important distinctions.[7]

Perhaps of broader import was the widespread concern over the concept of selective incapacitation. Any classification of an individual as a high- or low-$\lambda$ person was fraught with error. And any such attempt at identifying would introduce an inequity that was widely seen as unacceptable. Analyses by Canela-Cacho et al. (1997) highlighted the fact that people in prison inevitably were higher-$\lambda$ people because the fact that they rolled the dice more often led them to be disproportionately represented in prison, a process characterized as "stochastic selectivity", thereby avoiding any need to make individual estimates of $\lambda$, but achieving the same purpose.

Differences in the $\lambda$ estimates result from differences in the samples taken, especially if they are prisoners, new arrivals at prison, or street offenders. In some cases, there have been differences between estimates based on self-reports and official records, but official-record estimates have to be calibrated upwards to account for arrest probabilities.[8] For example, the Rand surveys of prisoners were replicated in Nebraska (Horney and Marshall 1991) and Colorado (English and Mande 1992) by sampling incoming prisoners. A New Orleans study (Miranne and Geerken 1991) sampled resident jail inmates, but some 75% had prison sentences and were being held in jail waiting for transfer to prison because of prison overcrowding. Here, there were differences in the survey instruments and in criminal justice operations and selection procedures across the states, all of which could have led to the variation in the various estimates.

Estimates of $\lambda$ certainly vary by crime type as well. For example, burglary $\lambda$'s range from a low of 17.1 in Nebraska to a high of 62.9 in California. Similarly, even the total across a variety of crime types varies from a high of 176.2 in California to a low of 55.6 in New Orleans. Weatherburn et al.'s (2006) recent analysis of the $\lambda$'s of juvenile burglars indicated an average of 68, with one offender reporting 700 burglaries in the preceding 6 months. Truncation at the 90th percentile as recommended (Blumstein et al. 1986, p. 66; Visher 1986) lowers the average $\lambda$ to 38 burglaries per year.

[7] Greenberg (1990) also noted that Zedlewski overestimated the benefits of imprisonment because he assumed the estimate of 187 crimes was true for everyone, when in fact, it should have pertained only to that fraction of the subject population that reported committing the particular felonies under consideration. Yet, 53.3% of the prison inmates said that they had not committed any of those crimes (these inmates had committed crimes that were not among those listed). Thus, according to Greenberg, the appropriate mean offense rate for the prison sample is not 187 offenses per year, but (187)(0.467) = 87.3 property offenses per year (see also Rolph and Chaiken 1987).

[8] Using official arrest rates, Blumstein and Cohen (1979, p. 582) found $\lambda$ for index crimes to be 13.2, while Cohen (1983) provided an estimate of 8.7 and Greenberg an estimate of 3. Shinnar and Shinnar reported a $\lambda$ between 6 and 14 for reported crimes. These estimates are smaller than those from self-reports because of the survey instrument used, the assumptions underlying calculations of arrest probabilities, and the sample differences.

It is important to point out that the Rand survey chose three states with crime rates higher than the national average, and the higher aggregate crime rates could stem from a higher proportion of the population engaging in crime or from higher values of $\lambda$ among those who offend. Also, the population that is just sentenced to prison is likely to be unrepresentative of the population that is just convicted but not incarcerated because offense frequency is highest right before the arrest that led to the incarceration, indicating that when the offender is picked up and the period of time the offender reports about his/her criminal activity will likely distort the $\lambda$ estimates. According to Greenberg (1990, pp. 57–58), this may be due to several factors: (1) among those who violate the law, the distribution of the frequency of violation is highly skewed; with a small number of offenders committing offenses at a high frequency, (2) the offender population at large is extremely heterogeneous; (3) selection from this heterogeneous population of offenders is unlikely to be totally random (the more often people violate the law, the greater the likelihood that they will be arrested); thereby requiring statistical analysis to project the measured distribution from the observed population to the other populations of interest, particularly, prisoners, new admissions to prison, and general street offenders; (4) after conviction, even further selection occurs, since factors related to the imprisonment decision often reflect a judge's estimates of factors related to the level of offending; (5) some models fail to take account of the reality that most criminal careers come to an end; (6) models do not include co-offending, at least in part because the data on co-offending is so limited; and (7) models do not deal with replacement effects, a concern that is particularly relevant to drug offending (Blumstein 1993), but much less so with most predatory offending.

Other concerns are relevant. For example, crimes averted by prison population growth tend to be less serious than crimes reported in inmate surveys. Estimate of $\lambda$ for jail inmates are typically lower than for prison inmates, and when prison populations expand they typically will draw individuals with lower $\lambda$'s on average than those that would be committed if prison populations remain steady (Marvell and Moody 1994, p. 116). Further, $\lambda$'s overstate the incapacitation effect because many crimes have multiple offenders. This concern is occasionally accommodated by assuming two offenders per crime (based on estimates from Reiss 1980), but that may be too large an accommodation because co-offending is most common among juveniles and young adults, who are less likely than older offenders to receive prison sentences. When all of these concerns are dealt with, Marvell and Moody's re-calculated $\lambda$'s are reduced by 20% for exaggerated high-end $\lambda$'s, 17% for career termination, 2% for non-street time, 22% for diminished marginal returns, and 38% for co-offending. The combined reduction is 77%, which lowers the mean $\lambda$ of 108 for prisoners in CA, MI, CO, TX, NE, and NO to 25 index crimes, and if truncated at the 90th percentile, it would be reduced to 12 crimes (Marvell and Moody 1994, p. 117). In sum, the arrest rate and self-reported $\lambda$'s give rough lower and upper estimates for a range of 16–25 fewer index crimes committed per year per additional prisoner on average (Marvell and Moody 1994, p. 118). More generally, Marvell and Moody's work shows that many problems can be calibrated and researchers can end up with some reasonable estimates.

Measuring the distribution of the frequency of offending among active offenders is a key need in estimating the incapacitative implications of various incarceration policies. That measurement is complicated by the selection biases introduced when the samples are drawn from criminal justice populations that have passed through the filter of arrest. The problem of selection effects is particularly important in studies that focus on the effectiveness of incapacitation. Differential selection of offenders arising stochastically from variation in individual offending frequencies will result in measurement bias if one applies this biased estimate of offending frequency to all offenders and not just those offenders processed through the same stage of the system; the bias is larger the further into the system the samples are drawn (Canela-Cacho et al. 1997, p. 135).[9] Given the importance of this ''stochastic selectivity'' issue, we discuss it in greater detail in the next section.

## Stochastic Selectivity

Canela-Cacho et al. (1997) propose and apply methods for estimating the offending frequency in the total offending population partitioned into three groups: free offenders in the community, arriving prisoners, and resident inmate offenders in prison. This partition is based on measurements obtained from a population that has been filtered by the criminal justice system. In contrast to a single rate applied to all offenders, these very different estimates are much more appropriate indications of the distributions of offending frequency by these three groups, and especially by the general population of offenders. Their proposed model explicitly accounts for the selection effects that result from interactions of offender heterogeneity, i.e., the overrepresentation of high-$\lambda$ offenders among prison inmates as a function of variability in individual offending frequencies, with system sanction policies, which include an offender's risk of incarceration following a crime, and the expected length of confinement when an offender is committed to prison.

The form of selectivity reflected in their model occurs as a natural consequence of heterogeneity in offenders' $\lambda$ and the random aspects of the filtering process. Most important, it does not involve explicit selection of individuals based on individual characteristics. This is particularly attractive because it avoids the most objectionable features of the explicit selection rules proposed to attain selectivity in the early selective incapacitation approaches. Instead, selectivity occurs naturally as high-$\lambda$ offenders provide increased opportunities for incarceration through the greater number of crimes they commit.

Using data from the Rand Surveys, Canela-Cacho et al. found that (1) free offenders average 1–3 robberies and 2–4 burglaries per year, while resident inmates have $\lambda$ values 10–50 times higher, and (2) the imprisonment risk of offenders increases substantially as $\lambda$ increases (even when offenders face the same imprisonment risk per crime, the risk of incarceration for any offender in any year is strongly related to that offender's $\lambda$). In short, a highly heterogeneous distribution of offending frequency in the total population of offenders combines with relatively low imprisonment levels to lead to substantial selectivity of high-$\lambda$ offenders among resident inmates and a low mean $\lambda$ among those offenders who remain free (Canela-Cacho et al. 1997). These results have important implications for estimating the incapacitative effect of an increase in incarceration. For example, compared to inmates, free offenders are predominantly low-$\lambda$ offenders, and even though stochastic selectivity will continue to draw new inmates disproportionately from the high end of the distribution of free offenders, those new inmates will average lower $\lambda$'s than current

[9] The problem is that a sample of inmates arriving in prison is likely to display a higher mean frequency of offending than is the population of all offenders. Zedlewski used the $\lambda$ estimates derived from prisoner samples to represent offending by unincarcerated offenders without recognition of the potentially severe distortion that introduces. Especially in light of the high skewness of the $\lambda$ distribution, high-$\lambda$ offenders distort the mean considerably, and since these individuals are a much smaller fraction of the total population of offenders, it is misleading to use the mean $\lambda$ of prisoners to represent the mean for the total population of offenders.

inmates and their incarceration will reduce fewer crimes than the average current inmate. The returns to further crime reduction that can be achieved by expanding incarceration thus declines because of the large share of crimes that are committed by low-$\lambda$ offenders who remain free.[10]

In sum, questions about which population provides the most appropriate estimate of mean-$\lambda$ and whether that estimate is applicable to the policy under consideration are crucial. Applying mean-$\lambda$ derived from prison inmates and applying it indiscriminately to all related populations is inappropriate (Canela-Cacho et al. 1997, p. 164). The distinction between prison inmates and free offenders is important in the discussion of incarceration policy, where analysts attribute the $\lambda$ for prison inmates to the additional inmates who would be found in prison as a result of a shift in the sanction policy, such as the increases in the imprisonment risk per crime or in the time to be served (Canela-Cacho et al. 1997, p. 165). Current inmates have a higher $\lambda$ than free offenders, though free offenders, especially those with the highest $\lambda$ among those free, will always be drawn into incarceration.

### Where Things Stand

From this line of research, four summary conclusions can be reached. First, the estimates of elasticities vary widely depending on estimates of average offending frequency or $\lambda$ (and those estimates can vary widely because of errors in applying the appropriate estimate to the appropriate population of interest), the number of offenders who participate in committing the typical offense, and the length of the typical criminal career (Spelman 2000a, p. 423). Second, the modeling approach is also limited because it only shows the effect of incapacitation on crimes committed by adults not juveniles. Because juveniles are responsible for almost a quarter of all Part I crimes, and relatively little is known about the stability of offending frequency among juveniles (Loeber and Snyder 1990), their arrest probabilities (Brame et al. 2004), and their desistance (Mulvey et al. 2004), the incapacitation model does not provide a complete picture of the amount of crime reduction via incapacitation for juveniles. Third, this approach focuses specifically on crime reduction through incapacitation only; to the extent that the threat of prison succeeds in deterring offenders or prisons succeed in rehabilitating offenders (net of criminalizing them), the incapacitation elasticities understate the full effects of imprisonment (Spelman 2000a, p. 425). Fourth, since the use of incarcerated samples likely overstates the incapacitative benefit because inmates have higher $\lambda$'s, analyses using mean $\lambda$'s of prison inmates overstate the likely crime reduction to be derived from expanding imprisonment because most high-$\lambda$ offenders are already incapacitated, so any further increases in imprisonment will largely affect lower-$\lambda$ offenders (Canela-Cacho et al. 1997, p. 157).

## Criminal Career Research & its Relevance for Incapacitation

Since publication of the Rand estimates, a burgeoning literature has emerged that has tracked the longitudinal patterning of criminal careers (Blumstein et al. 1986; Piquero et al.

[10] This is a specific example where knowledge about individual offending careers can help understand the potential impact of incarceration policies.

2003). Much of this information has yielded important insight into estimates of $\lambda$, co-offending, and career length, key input quantities for the incapacitation model.[11]

With regard to individual offense frequency estimates, Laub and Sampson's (2003) recent analysis of the criminal careers of former delinquents showed that the large majority of offenders desisted by age 70. Additionally, Laub and Sampson were unable to find a group of individuals whose $\lambda$ estimates were high and stable over time. Other studies also show that $\lambda$ is not high and stable using serious offender samples from California (Haapanen 1990) and Nebraska (Horney and Marshall 1991), and only one study shows a stable $\lambda$, but for a very small number of individuals (Blokland et al. 2005).

With regard to co-offending estimates, Piquero et al. (2007) examined patterns of co-offending using longitudinal data for 411 South London boys followed to age 40. Their results indicated that: (1) co-offending peaks in the late teenage years; (2) the incidence of co-offending decreases with age primarily because individual offenders change and become less likely to offend with others rather than because of selective attrition of co-offenders or persistence of those who offend primarily alone; and (3) co-offending appears more common for some crimes (burglary, robbery) than others. The data indicate a similar peak and shape (much like the traditional age–crime curve) for the total number of offenders, offenses, and co-offenders at each age.

With regard to career length estimates, and also using the Glueck delinquent sample that provided observations over the longest period yet available, Laub and Sampson (2003, p. 90) estimated the average career length to be 25.6 years for all crimes, lower for violence (9.2 years) and higher for property (13.6 years). Individual career lengths varied from a low of one year to a high of 57 years for total crime, 47 years for violence, and 51 for property (Laub 2006, personal communication).

## Where do we Go from Here? Data Needs

Improved estimates of incapacitation will come about only through greater knowledge about individual crime-committing behavior (cf. Cohen 1978, p. 228). In that spirit, knowledge of the longitudinal patterning of criminal careers is deemed central for better estimating the number of crimes avoided by removing an offender from society (Blumstein et al. 1986, p. 122; Piquero et al. 2003, 2007).

First, more work is needed on the assumptions underlying the Avi-Itzhak and Shinnar model. Their model assumed the various input quantities did not change over time; that incapacitating one group of offenders eliminated all offenses that would have been committed by those offenders; that all offenders share common risks of arrest following a crime and of incarceration following arrest, and that all offenders committed crimes at virtually similar rates. Since every model is as good as the assumptions on which it relies, these assumptions need to be assessed and relaxed where possible.

Evidence on the assumption of homogeneity of risks of criminal-justice actions is scant. A few studies suggest that offenders run different risks of being arrested per offense committed (Cohen 1986; Brame et al. 2004), and some evidence indicates that the risk of

[11] The incapacitation model also has a number of other important input quantities including the probability of being apprehended and convicted, the probability of receiving a prison sentence, and the average time spent in prison. While information on incarceration given arrest is likely easier to obtain, information on individual estimates of risk of arrest per offense committed does not exist, within offenders, over time, and by crime type. Longitudinal studies with data on both self-reports of crime and of arrest are needed for such an assessment.

being arrested and incarcerated is not the same within individual offenders over the course of their careers (Spelman 1994). Just as batters learn to hit pitchers better over the course of a baseball game (Smith 2006), Spelman notes that offenders ''learn'' over time to engage in the sorts of crimes that they can commit effectively with low risk of apprehension (cf Piquero et al. 1999). Information comparing the ratio of arrests to offenses, within individuals, over long periods of time among both general populations and experienced offenders using self-report and official offending information is needed. Potentially important is knowledge about q, or the probability of arrest given an offense. There is a need particularly for information on differences in the likelihood of arrest between high- and low-rate offenders (it seems most likely that high-rate offenders should have an appreciably lower value of q), and for offenders at different stages of their criminal careers (Blumstein et al., 2006, unpublished manuscript). On this point, Cook (1986) suggests that an individual's offending rates respond to changes in his expected value of punishment given a crime (see also Pogarsky and Piquero 2003; Pogarsky et al. 2004).

There is also very little evidence regarding the assumption that the more offenders imprisoned the fewer there are in the general population. Only a few studies have estimated the size of the criminal population (Blumstein et al. 1986; Greene and Stollmack 1981; Tillman 1987; Rossmo and Routledge 1990). The most limiting issue with these studies concerns replacement and substitution effects. No information exists concerning how groups deal with imprisoned members, and whether this varies across crime types. We certainly know that drug markets recruit replacements for imprisoned participants (Blumstein 1993), and so few transactions are averted through incarceration. Some burglars operating in the service of a fence might be replaced by the fence, but it is likely that most predatory crimes do not see much in the way of replacement.

The final assumption made by the Avi-Itzhak and Shinnar model is that the experience of imprisonment does not change the expected length of a criminal career or the rate at which the individual offends. In a longitudinal study of six-hundred offenders paroled from the California Youth Authority, Haapanen (1990) found that the offending rates of offenders decreased from the period before to the period after confinement. Replication and extension of this study is necessary.

Second, the effectiveness of any incapacitation strategy depends to a large extent not only on $\lambda$, but also on the residual length of offenders' careers compared to their total time served. If the total time remaining in the career is less than the total time served, the time served after the career would have terminated represents a waste of prison space from an incapacitation perspective (Blumstein et al. 1986, p. 128; Piquero et al. 2003, 2004). With a few exceptions (Blumstein et al. 1982; Kazemian and Farrington 2006), there has been minimal work on career length generally, and residual career length in particular.[12] Further, because some careers will terminate during incarceration, there is a need to consider dropout and termination rates as they respond to incapacitation (Blumstein 2005).

Third, there is a pressing need to update the co-offending values of Reiss (1980) that were based on data from the 1970s. There exists little knowledge of co-offending and whether its nature has changed over time (Piquero et al. 2007). There is also a need for knowledge about levels of persistence and desistance among criminal groups to determine the net reduction produced by imprisonment of certain offenders (Zimring and Hawkins 1995, p. 85). Also, there is a need for research on group substitution (someone takes the

[12] A related point concerns the assumption that career length is exponentially distributed. There has been only very limited work concerning the extent to which career lengths do in fact follow an exponential distribution.

place of the incapacitated offender), and extinction effects (removal of the offender from the community prevents the behavior from occurring, even by remaining members of his group). Researchers have dealt with these issues by assuming particular discounts to estimate group-process and substitution effects based on offending information from the 1970s (Spelman 1994, pp. 58–61; Weatherburn et al. 2006).

Fourth, there is a need to update the 30-year-old $\lambda$ estimates of the Rand studies, especially given the historical increases in prison populations as well as the drug incarceration binge of the 1980s and 1990s. If the expected declines in $\lambda$ have not occurred, this may suggest two alternative scenarios of important changes in the nature of offending: an increase in the underlying $\lambda$'s within the offending population or a large increase in the size of the offending population, or some combination of both. Also, the estimates gathered from retrospective arrest histories should include prospective validation using future arrest experiences to assure that estimated career patterns do persist into the future (Cohen 1983, p. 76).

Fifth, one avenue that researchers have pursued with regard to obtaining estimates of $\lambda$ over the life course has been to use existing longitudinal data sets and apply new methodological techniques (developmental trajectories, growth curves) to them. Much longitudinal data exists for known samples with both official and self-report data, including individuals who are not incarcerated. There also exist heterogeneous estimates of $\lambda$ that are allowed to change over time. Generally however, researchers have not used these samples and methods to study the effect of incapacitation on crime, but they clearly should.

Sixth, since much of the research has been conducted on prison samples, there is no information on the incapacitative effects of jails, primarily because jail data are so rare and that which exists is not very good, largely because of all the movement and transfer among jailed offenders. Yet, jail populations have been increasing at about the same rate as prison populations since the 1980s and it is important to assess how these changes relate to crime rates.

Seventh, no study has used the model to examine the variation in the incapacitation effect across race and gender. Given that blacks have higher arrest and incarceration rates than whites (Mauer 1999; Tonry 1995) and women's rates are growing faster than men's (Kruttschnitt and Gartner 2005, p. 2), some estimates on the variation in incapacitation across demographic groups would be valuable.

Eighth, we know that incarceration rates have grown appreciably since 1980, predominantly because of increases in commitments per arrest and in time served (Blumstein and Beck 2000, 2005) and because of the growth of drug offenders in prison. These changes could have major effects on incapacitation effects, and yet there have been no estimates of the effects of those changes.

Ninth, information about differences in offending rates between inmates and free offenders will be important in developing much more appropriate estimates of the incapacitative effect of incarceration. This should address the amount of crime that is averted through current incarceration as well as the marginal incapacitative effect achieved by a shift in sanctioning policy. Since many politicians desire an upward shift (hence more incapacitation, but at a decreasing rate), it is important to estimate the degree of improvement achieved by marginal increases from current policy (Canela-Cacho et al. 1997, p. 167).

## Where do we Go from Here? Research Needs

An issue that has long been of concern to criminal justice policymakers is the effect of incarceration on crime rates. This effect largely shows itself as two very different effects:

general deterrence and incapacitation. General deterrence is a measure of the broad effect of punishment on offending rates more generally; the connection between the two—punishment and crime—is very loose, almost ethereal, in that both are measured very broadly as rates across some broadly defined jurisdiction, usually states. In contrast to this very loose connection, incapacitation tries to link various specific aspects of offenders' criminal career parameters—specifically individual offending frequency and career duration—with specific punishment policies.

Both aspects of crime-control measurement are of interest for policy purposes, not so much because one wants to derive explicit numeric values of crime reduction, but rather to have some broad sense of the costs and benefits of various policy choices, and also to draw attention to the relative influence of various policy parameters in affecting crime rates. For example, as one examines the choice between long sentences of few offenders or shorter sentences of more offenders (in the context of some limited punishment capacity), then knowledge of the duration of criminal careers should limit the length of the sentences in order to avoid the "wastage" of prison capacity if offenders are kept incarcerated well after their careers would have ended (Blumstein et al. 1982; Piquero et al. 2003). This is precisely where knowledge about individual career parameters is salient for policymakers.

## Measuring Deterrence

The basic approach to measuring the general deterrent effect is quite technical—measuring both crime rates and incarceration rates in multiple places, finding that places with higher incarceration rates have lower crime rates, and using econometric analysis to assess the "elasticity" of crime rates to changes in incarceration rates. Of course, it is important to "control" for differences across the different places that could account for differences in crime rates that had nothing to do with incarceration, e.g., socioeconomic differences and demographic differences, as well as factors that affect incarceration rates that had nothing to do with crime rates, e.g., state budgets, all of which likely vary across jurisdictions. As usual with such econometric analyses, these "controls" are achieved, atheoretically, simply by adding variables linearly to the crime-incarceration equation, and is typically done without any particular knowledge of how each of these factors contributes, possibly in some non-linear fashion or interacting with another factor. The results are taken on faith because of the widespread belief that price affects demand (i.e., sanctions affect crime) and because of the long history of econometrics in analyzing economic phenomena, which are rarely as complex as criminological phenomena.

The issue is then complicated by the fact that there may be a simultaneous relationship between crime and incarceration, where not only does incarceration influence crime, but crime may also influence incarceration rates (e.g., higher crime rates may inhibit incarceration rates because of saturation of the punishment system), and then one needs to identify factors that contribute to crime but not incarceration and others that contribute to incarceration but not crime, and these factors are often difficult to identify cleanly. All of this must leave one with some concerns about the validity of the computed elasticity because of the many explicit and implicit assumptions on which it is based, about which Miles and Ludwig (this issue) are virtually silent in their challenges to incapacitation research.

## Measuring Incapacitation

In marked contrast, there is a satisfying directness about the challenge of estimating incapacitation effects at the micro level. A number of prisoners occupy their cells and the principal question is how many crimes they would be committing if they were free on the outside. That is obviously not a trivial question to answer, but its formulation is quite straightforward and that sets us down a path to develop estimates of prisoners' $\lambda$. That is a much more direct approach for getting an estimate than the enormous array of explicit and implicit assumptions necessary to generate an aggregate deterrence elasticity estimate.

We would not anticipate that anyone concerned with estimating $\lambda$ for a particular prison population would feel it necessary to go out and measure the $\lambda$ value for the particular set of prisoners then resident. Values have been estimated in a wide variety of contexts. While there is a continuing need to make and update these estimates in different contexts and settings, the estimates can reasonably be applied in a variety of settings. Contrast this, for example, with the single elasticity estimate from deterrence research that presumably applies to the nation as a whole (because it was derived from estimates using data from each of the 50 states).[13]

It is fair to estimate that if we know that an individual prisoner has a $\lambda$ of 10 robberies per year and he spends 2 years in prison, then his incarceration will avert 20 robberies. Obviously, this estimate depends on a number of assumptions that can be examined explicitly. First, he would have been active offending at that rate, $\lambda$, throughout his two-year period of confinement (Spelman 1994, p. 206). This provokes thinking about the expected duration of criminal careers, and specifically the residual career following the intervention of the criminal justice system, to calibrate how much of the sentence would be "wasted" by having the offender occupy a cell that was no longer serving an incapacitative function. Thus, one of the important roles of pursuing incapacitation estimates is the attention it draws to the different dimensions of a criminal career. Second, the time incarcerated did not affect his offending frequency after release. If he were at least partially rehabilitated, then he would have a lower $\lambda$ and the effect of incarceration would be greater than 20 robberies averted. Or there could be a criminogenic effect, which would counteract the incapacitative effect. Since much of the rehabilitation research suggests that neither of these effects is very large, they need not be major factors of concern. Third, there is no replacement of the crimes on the street. We can be confident that incarceration of drug sellers achieves negligible incapacitative effects because they are most likely to be replaced by other sellers (Blumstein 1993). Also, to a much lesser extent, burglars operating through a fence may be replaced by a new recruit brought in by the fence. But replacement is largely irrelevant to the large majority of predatory, person-oriented crimes that concern society. Thus, the concern about replacement is largely a very secondary issue aside from its primary role in drug markets and perhaps less so in the markets for other vice or market-related offenses.

If one could develop a $\lambda$ estimate for each individual offender, then one would be tempted to pursue a policy of selective incapacitation, so that individuals with high $\lambda$'s would be incarcerated and individuals with low $\lambda$'s would be put on probation. This

[13] This raises another caution about using aggregate data to arrive at incapacitation estimates because the probability of arrest varies across crime type and jurisdictions (and over time) as does the probability of incarceration which is constrained by local jail and prison conditions (Cohen 1986, p. 409). For example, Spelman (2000a, pp. 473–476) shows that states differ considerably in the strategies they pursue. Some states incarcerate a small proportion of their offenders but do so for long terms, while other states incarcerate more offenders for shorter terms (Spelman 2000a, p. 473). Moreover, states may alter these strategies and decisions over time, by making selections to give prison sentences differentially according to crime type. As Blumstein et al. (1986, pp. 148–149) show, not only do crime rates and prison use vary by states and over time, but so too does the probability of prison given crime, and the median time served in prison. These, of course, influence the cost/benefit ratios from incapacitation and yield different elasticity estimates.

concept met with strong opposition because of the inequality of treatment for similar offenses implied and because of the errors inherent in measuring individual values of $\lambda$. Dealing with such estimates in individual cases is actually unnecessary because of "stochastic selectivity", which as noted earlier, recognizes that the goals of selective incapacitation are achieved just by chance alone because the higher $\lambda$ offenders are more likely to be arrested, convicted, and incarcerated because they "roll the dice" more often such that their higher offending frequency puts them at a greater annual risk of experiencing the variety of criminal justice interventions leading to incarceration.

Rather than focusing on individual-level measurement of $\lambda$, it is more reasonable to direct attention to the distribution of $\lambda$ among various populations: the general population of offenders, the population admitted to prison, and of greatest interest for measuring incapacitation—the population of prisoners. The effort to measure the last of these was undertaken by Rand in the 1970s, and certainly calls for a current replication, when prison populations have changed so much, both in total numbers and in composition, with such large populations of drug offenders. The Rand studies used both self-reports by the prisoners of their offending patterns in the three years prior to their current incarceration and their arrest histories. The most striking result was the impressive skewness of the $\lambda$ distributions measured, with, for example, median values of those who did robbery of 3.8 per year, but with the 90th percentile being 72; similarly, for burglary the median was 4.7 and the 90th percentile was 195 (Visher 1986, p. 183, Table 11). In distributions with this degree of skewness, it may be seen as problematic how to represent the crime-reduction implications of such distributions. The obvious parameter is the mean, because that represents the average number of offenses of a particular crime type averted by the people in prison. This analysis simply requires careful accounting of the distribution over the population in prison.

The data from the Rand Survey provided the opportunity for Canela-Cacho et al. (1997) to generate estimates for the $\lambda$ distribution of the other two populations of interest. The skewness of the $\lambda$ distribution was so extreme that it required a mixture of three exponential components. For the distribution in the general offending population, the distribution was a mixture with means of 1, 10, and 100 with associated weights of 0.90, 0.095, and 0.005, respectively, whereas in the prison population the weights were much more heavily on the side of the high-frequency offenders, with weights of about 1/3, 1/3, and 1/3, reflecting the influence of stochastic selectivity. Thus, even though the initial data were collected from prisoners, the analysis permitted developing estimates for a variety of offender groups, including street offenders who were not at the time candidates for incarceration. Miles and Ludwig simply do not take account of this analytic potential.[14]

Measurement of $\lambda$ is ideally done through self-reports of an appropriate population of active offenders. But self-report measurement is expensive and not always seen as reliable, especially with people who have made a career of misrepresentation. But there are other approaches that side-step these and other shortcomings. Perhaps the most useful is the analysis of official records of arrests (Blumstein and Cohen 1979). These are widely available in state and federal repositories, almost always in computer-readable form, and so inexpensive to analyze. Of course, the frequency of arrest ($\mu$) is appreciably lower than the

[14] It should also be recognized that $\lambda$ is not merely a scalar value, but a vector representing the offending frequency over a mixture of crime types. If one took it over six crime types (murder, robbery, rape, assault, burglary, and larceny), one would cover over three quarters of the non-drug offenders in US prisons. We have omitted drug offenses here because we recognize that their incapacitation effect is likely to be nullified through the recruitment of replacements in the community.

frequency of offending ($\lambda$) by the probability of arrest given a crime commission (q), so one must calibrate an estimate of $\mu$ upward by dividing by q to get an estimate of $\lambda$.

## Policy Relevance

All of these considerations of criminal careers are obviously more complex than running the simple regression equations needed to estimate the deterrent effects of incarceration. But they are inherently more appropriate. They bring to the analysis all of the relevant considerations that should be taken into account in measuring the effects of incarceration on crime rates. It does so explicitly, and it establishes a program of research on the key parameters—offending frequency, career length and residual career length, participation rate in crime, arrest, and commitment probability—that are relevant to developing improved estimates of the effect of incapacitation. It avoids hiding all these relevant consideration in an elasticity estimate that takes none of these factors into account and that "controls" in a very weak and limited way for the complex effects of all the other factors in society that affect crime and incarceration rates.

It is unlikely that any specific policymaker is going to use the crime-reduction estimates derived from either deterrence or incapacitation research directly in setting incarceration policy.[15] Rather, it is important that any such analyses provide insight into the implications for crime reduction that might be associated with various policy choices. Consideration of incapacitation is certainly the richer approach in the sense that it highlights the various dimensions of the criminal career—particularly $\lambda$, career length, and crime type mix—and their relation to the various dimensions of sentencing policy—particularly the probability

[15] In their critique of the incapacitation approach, the main issue raised by Miles and Ludwig is that it offers no useful information to policymakers because of "insurmountable" practical and conceptual problems. They argue that the primary policy implication of the measurement of $\lambda$ is selective incapacitation, and that even if estimates of $\lambda$ accurately identified the highest risk offenders with sufficient speed to permit the justice system to prevent the commission of crimes, $\lambda$ estimates would still have limited use to decision-makers because few criminal justice policies have selective incapacitation as their goal. They fail to acknowledge that incapacitation research is focused largely on "collective incapacitation" and has largely ignored selective incapacitation, recognizing that "stochastic selectivity" achieves many of the same goals without incurring the problems. Noting that criminal justice policies include deterrence and replacement in addition to incapacitation, they conclude that micro-parameter estimates are unlikely to provide useful guides about the combined effects of deterrence, incapacitation, and replacement effects from a particular change, since the bundle of effects produced is likely to be specific to the policy change in question. A single estimate of $\lambda$ would provide incomplete and potentially even misleading information for policymakers forced to choose among these different policy options. Policy is not typically driven by any single value of $\lambda$, but rather a range and by the insights derived from the various relevant parameters. Additionally, Miles and Ludwig write as if policymakers are more likely to consider and adopt information from the aggregate approach. They claim that the aggregate approach is straightforward and ultimately more useful to criminal justice policymakers because it encourages lawmakers to consider changes in sanction policy to look for rigorous evaluations of the net effects of similar policy changes implemented in other jurisdictions. But experience with policymakers makes it clear that they do not want "take-it-or-leave-it" parameter estimates; rather, they need the insights that derive from a complex area of research. Further, Miles and Ludwig make it seem as if a policymaker would adopt the econometric approach and resultant estimates because they are based on a single policy experiment, but they do not fully appreciate that what may work in one jurisdiction may not work in another. On this score, recall that results from the original domestic experiment in Minneapolis showed that arrest deterred subsequent domestic violence. In the six replications that followed however, arrest deterred in certain jurisdictions but backfired in others, and the effect of arrest was contingent on particular offender characteristics. Given that policy experiments of the sort advocated by Miles and Ludwig are likely to have particular effects in particular jurisdictions, because each jurisdiction has a unique makeup of crime types and offender characteristics, it is unclear how the aggregate level information will be any more influential or better than micro-level information.

of commitment given conviction, sentence length, and whatever insight might be available on a particular offender's offending frequency. The pity is that the national research agenda has paid so little attention to this issue. In his final comments on leaving the Directorship of the National Institute of Justice, Jeremy Travis noted this as a disappointment (National Institute of Justice, 2000, p. 24):

> "I will identify this as a major regret. We wanted to be able to update the lambda estimates, in part because they provide the basis for so much policy debate and discussion and because they have been critiqued by scholars as being inadequate or limited. I think that in the next 5 years, the Institute will be able to mount a major initiative to reestimate the rates of offending."

In contrast, deterrence research typically leaves one with a single elasticity that combines some mixture of deterrence and incapacitation effects (since it measures the association between the punishment rate and crime rate, its elasticity typically reflects the virtually impossible-to-separate combination of deterrence and incapacitation effects). For example, one particular insight that derives from incapacitation research is the realization that the more selective the incarceration (i.e., the lower the probability of commitment given conviction), the higher the incapacitation effect per prisoner. This array of policy insights is not possible from deterrence research, where the focus is on the gross level of incarceration, and it is not clear whatever other policy insights might emerge.

Moving forward, it is instructive to return to a statement made some years ago by Piehl and DiIulio (1995, p. 25), who reminded us that the "path to intellectual consensus…can be paved not by disagreeing about the implications of what is known or how people have estimated their models, but by agreeing more fully about the gaps in knowledge and how to best fill them." It is hoped that the listing of the data and research needs above keeps criminologists thinking broadly and carefully about how incapacitation influences crime. It would be well for economists to bring their particular mix of analytic skills and policy insights to join them.

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