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# On the Usefulness of Controlling Individuals: An Economic Analysis of Rehabilitation, Incapacitation, and Deterrence

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While classical economists generally considered deterrence of potential offenders the sole function of criminal sanctions and the principal instrument of crime control, the emphasis in modern criminological thought has shifted from deterrence toward the rehabilitation and incapacitation of convicted offenders.[1] The emphasis on direct control of the behavior of identified offenders, occasionally mislabeled "specific deterrence," reflects, in part, the growing interest among modern criminologists in individual causes of crime as well as in offenders as individuals: The promise of successful rehabilitation and control of known offenders, many of whom are poor and uneducated, has a strong humanitarian and moral appeal. It has implications for the behavior and future income, if not the actual welfare, of these individuals. The direct control of individual offenders has been conceived of, however, not just as a means of providing private relief, but as an effective check on the total incidence of crime. The restraining, retraining, counseling, and direct guidance offered to convicted offenders have been viewed as forms of social engineering aimed at effecting a reallocation of human resources away from crime toward socially more useful endeavors.

Several evaluation studies have been conducted in recent years to assess the effectiveness of rehabilitation and other methods of individual control as means of crime prevention.[2] All seem to share a similar methodological approach in that they attempt to estimate or predict analytically the impact of these methods on individual recidivism (i.e., the rate of offenders' reentry into crime). They then implicitly equate the observed or anticipated outcomes at the individual level with those in the aggregate. The point of departure of this paper is the distinction between effectiveness of means of crime control at the aggregate or *market* level as opposed to the individual level. If the flow of offenses of specific types reflects, by and large, not the capricious outcome of biological or social idiosyncracies, but the equilibrating interplay of systematic "supply and demand" forces, then the effectiveness of individual control programs must be evaluated not by their anticipated initial effect on the supply of offenders, but by their ultimate effect on the equilibrium volume of offenses. Indeed, recognition of the existence and the role of equilibrium in the "market for offenses" is shown to lead to important modifications in previous conclusions concerning the relative efficacy and efficiency not only of methods of control of individual offenders, but of means of deterrence as well.

The plan of the paper is as follows: the general components of the market for offenses are presented in Section I, and the basic equilibrium analysis concerning the effectiveness of public intervention in that market is developed in Section II. Sections III and IV present more specific implications concerning crime control via rehabilitation and incapacitation and examine some related empirical evidence. In Section V the analysis is used to derive additional implications for

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[1]See Leon Radzinowitz, chs. 2 and 3.

[2]See the references provided in Sections III and IV of this paper.

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the choice of optimal criminal sanctions. A number of general implications concerning the treatment of individual offenders and specific types of crime are then illustrated in Section VI.

## I. The Market for Offenses

Essential to a comprehensive economic model of crime is the assumption that potential offenders, victims, buyers of illegal goods and services, and the law enforcement authorities all behave according to the fundamental rules of maximizing behavior. It is further postulated that the activities of all agents are coordinated and made mutually consistent at the market level through the effects of explicit or implicit prices (see my 1979 paper). In previous works (for example, the seminal paper by Gary Becker), equilibrium in the market for offenses has been synthesized out of the interplay between only two identified groups: potential offenders, representing the "supply" side of the market; and law enforcement authorities, representing public intervention. Missing in these formulations was a systematic consideration of the roles of potential victims and buyers of illegal goods and services who, by their respective demand for safety or for illegal transactions, dictate the shape of the private "derived demand" for offenses. As is the case in analyses of displacements of equilibria in legitimate markets, a rigorous examination of the effectiveness of public intervention in the market for offenses requires an explicit consideration of both private supply and demand forces in determining the equilibrium volume of offenses at any given level of public intervention.

In what follows I shall first introduce the basic components of such a broader, and more relevant, market system, with an emphasis on those segments of the system that have not been adequately considered before.

### A. *Supply of Offenses*

An elaborate analysis of the supply side of the market appears in earlier studies (see, for example, my 1974 paper). For the sake of a simple diagrammatical exposition, and without affecting the generality of the subsequent equilibrium analysis, I shall present here a simple version of the model in which attitudes toward risk are assumed to be neutral. The offender's supply of offenses of any given type $s(\pi)$ is then expected to be, in general, a nondecreasing function of his expected net return per offense $\pi = d - pf$, where $d$ denotes his differential payoff from the illegitimate over an alternative (say, legitimate) activity, net of all the direct costs involved in carrying out the offense,[3] and $pf$ denotes his expected direct or opportunity cost due to the criminal sanction imposed ($f$), with $p$ denoting the probability of apprehension and punishment. Formally, $s'(\pi) \geqslant 0$.[4]

To further simplify the analysis of aggregation of individual supply functions, let the net return per offense be identical to all offenders. Then the aggregate frequency of offenses, $q = S(\pi)$, likewise would be a nondecreasing function of the net return per offense. The proof of the latter proposition follows from the presumed existence of a continuous distribution of individual preferences for participation in illegitimate activities. The latter can be represented by a density function of critical entry returns which are sufficient to induce different individuals' entry to the market for offenses, $\gamma(\pi^*)$.[5]

[3]More specifically, $d = d(w_i, w_l, c)$ is a function of the gross payoff per offense $w_i$, net of the various expected costs of "producing" the offense which depend, in turn, on the effective measures of self-protection by the victim $c$, and the foregone value of the offenders' time in an alternative (legitimate) activity $w_l$. In crimes committed for strictly nonpecuniary objectives, $w_i = 0$, and therefore both $d$ and $\pi$ are negative quantities. The supply of offenses can still be depicted, however, as an increasing function of $d$ or $(-pf)$.

[4]The prediction that individual participation in criminal activity is a nondecreasing function of the monetary net return $\pi$ would in general hold unambiguously, of course, only for compensated changes in $\pi$ that left the offender's relevant real income unchanged. It holds generally, however, in connection with an offender's incentive to first enter the criminal market, and also for the choice to intensify illegal activity on the assumption that the income effect of a change in any of the relevant components of $\pi$, whatever its direction, is not sufficiently strong to offset the corresponding substitution effects on time allocation in favor of crime.

[5]More generally, if individuals faced identical criminal payoffs but differed with respect to the legitimate

Let the corresponding density of additional offenses supplied at these critical net returns be given by $g(\pi^*)$. Clearly, $g(\pi^*)$ would be a continuous and positive function even if $s'(\pi)=0$. Since the mean supply-of-offenses function is the cumulative density function $S(\pi)=\int_{-\infty}^{\pi} g(\pi^*)\,d\pi^*$, it would then be necessarily nondecreasing in $\pi$. In general, the more condensed the frequency distribution of critical entry returns about particular values of $\pi$, the more elastic will be the aggregate supply of offenses about these values. Only in the case where offenders constituted a "noncompeting group" totally irresponsive to incentives would the aggregate supply of offenses schedule be completely inelastic at a fixed supply of offenses.

### B. *The Private Derived Demand for Offenses*

The concept "demand for offenses" may, on first glance, seem paradoxical in reference to those offenses which impose negative externalities on all relevant parties. Some criminal activities, especially those labeled "victimless crimes," do take place, however, under the patronizing influence of second parties. There are, in fact, explicit markets for voluntary exchanges in all illicit goods and services, including goods that are acquired through the commission of crimes against property and person. The willful, direct or derived, demand for offenses—whether desired for their own sake or as a means of satisfying the demand for stolen goods—forms at least one fragment of the private demand for these offenses, which is expected to obey all the fundamental laws of demand theory.[6]

There does exist an implicit private demand schedule for offenses of all types, however, including those that harm second parties. Such a schedule is *derived* from the private demand for safety. As a formal construct, the demand schedule for offenses represents the average potential payoff per offense at alternative frequencies of offenses $d(q)$. Measured as the differential value of the loot (if any) over the direct and opportunity cost of "production" incurred by the offender, the potential payoff $d$ is in large measure a function of the level of vulnerable nonhuman and human assets possessed by potential victims. In addition, it is dictated by the amount of self-protection and self-insurance ($c$) they provide to protect these assets.[7] Burglar alarm systems, guards, locks, safe deposit boxes, selected places of residence, and restricted travel all serve the similar purpose of decreasing the gross loot per offense, or increasing the cost and effort to the offender of committing the offense. Optimal expenditure on protection, especially if combined with an optimal purchase of market insurance at actuarially fair terms, can be shown in turn to be a continuous and increasing function of the rate of offenses (i.e., the objective risk of victimization), or $c'(q)\geq 0$.[8] Since the potential payoff per offense is a decreasing function of private protection, all other determinants of illegitimate and legitimate opportunities held constant, it would therefore be a decreasing function of the crime rate itself.

wages available to them, $\gamma(\pi^*)$ would be determined by the joint-probability distribution of individuals' preferences for crime and their alternative earning opportunities.

[6]For an attempt to implement this idea empirically in a study of auto theft, see Walter Vandaele.

[7]Self-protection by victims may also contribute to the probability that an offender is apprehended and punished, which would further reduce his expected net return $\pi$. For simplicity, this source of interaction between private and public protection will not be considered here.

[8]This result can be proved unambiguously for the decision to provide self-insurance (activities which reduce the potential size of the loot), and even self-protection (activities which reduce the personal risk of victimization), provided that protection is combined with full market insurance, and that the marginal benefits from protection increase as the average risk of victimization $q$ (the general crime rate) rises. (For a general analysis see my paper with Gary Becker.) Indeed, since expected income is assumed to be continuous, differentiable, and *strictly concave* in the real outlays on self-insurance and protection, $c$, the theorem of the maximum (see, for example, Hal Varian) guarantees that the optimal expenditure on protection per capita $c^*(q)$ also will be a continuous, differentiable, and increasing function of $q$. Furthermore, by assumption, $d=d(w_i, w_l, c)$ is a continuous and decreasing function of $c$. Thus, $d$ itself is expected to be a continuous and decreasing (indirect) function of $q$.



Finally, the shape of the market derived demand for offenses involving material gains must also exhibit "diminishing marginal returns" from the stock of available targets. With opportunities for gains from property crimes unevenly distributed in the population, optimal selection of criminal targets by cost-minimizing offenders implies that, as the aggregate volume of offenses increases, the marginal targets selected would be associated with greater costs of production per dollar gained. For this reason alone, the differential return per offense is expected to be a decreasing function of the aggregate frequency of offenses.

Since all the components of the private derived demand for offenses are expected to be negatively related to the frequency of offenses (all prices of protective devices, wealth, legitimate earning, and productivity parameters held constant), their vertical sum is also expected to be a continuous and decreasing function of the rate of offenses. Formally, $d=D(q)$ with $D'(q)\leq 0$.

### C. *Public Enforcement*

Since criminal activities by definition create external diseconomies, and since private self-protection or private enforcement of criminal laws are themselves associated with various externalities and some properties of a nonexclusionary public good, there is a generally recognized incentive for public intervention in the market for offenses.

If social optimality is presumed to be founded on the principle of maximizing the efficiency of overall resource allocation rather than on any measure of vengence, moral "justice," or equality in the distributive outcomes of law enforcement, then the target of public enforcement and protection can be stated in terms of minimizing the aggregate, or per capita losses from crime. The relevant social loss function in this formulation is generally comprised of three principal cost functions: the direct social damage from offenses $\Delta$, defined as the overall loss to society from crime over the private gains to offenders; the *direct* cost of interference in the market for offenses $C$; and the social costs resulting from the subsequent treatment imposed on convicted offenders. Note that, since criminals cannot collect as earnings all the damage they impose on victims (for example, the value of life and property destroyed, the real cost of insurance and protection against victimization, and the value of resources used to commit offenses), the net social damage from crime $\Delta$ is expected to be positive in connection with "simple" theft and fraud, as well as serious felonies. For the case of intervention via conventional law enforcement activity (see Becker), $C$ summarizes the costs of apprehending and convicting offenders, and the costs of subsequent treatment are those resulting from imposition of criminal sanctions. Formally,

$$(1)\quad L(q)=\Delta(q)+C(q,p)+b(t)pfq$$

where $p$ and $f$ denote the probability and severity of the specific criminal sanctions imposed, and $b$ is a "social cost multiplier" which transforms the private cost of punishment to the offender into social cost terms, and which depends on the form of punishment used ($t$).

Equation (1) represents a public welfare criterion for determining an optimal policy of crime control. To determine the expected criminal sanction $pf$, for example, equation (1) must be minimized subject to a) the crime-response function, summarizing the effectiveness of the sanction (whatever its form) in reducing the actual volume of offenses, and b) the production function of direct law enforcement activity which determines the properties of $C(q,p)$.

Numerous behavioral propositions emanating from this formulation have been discussed at length by Becker and in my 1977 paper. One implication that is of particular relevance here concerns the optimal social response to changes in the frequency of offenses due to specific exogenous factors. Note, first, that such societal response function does not constitute an independent derived-demand-for-offenses schedule, since public enforcement is a monopolized state activity which is therefore dependent on both the private supply and demand schedules. Rather, the law enforcement authority sets its optimal enforcement policy after taking account of the parameters (elasticities) of these schedules, as well as the parameters controlling all cost terms included in equation (1). Given the vector of these parameters $\phi$, however, it can be shown under fairly general conditions that the optimal values of the enforcement instrument $pf$ will be adjusted upward whenever the frequency of offenses rises due to changes in other exogenous or random factors.[9] This pattern of societal response helps guarantee, of course, the stability of equilibrium in the general market for offenses.

The market system introduced in the preceding discussion can be illustrated most simply by assuming that public intervention assumes the form of enforcement of purely deterring sanctions such as fines. In that case, law enforcement does not affect the private demand and supply relationships directly, but operates like an excise tax or tariff in the amount of $\tau=pf$. Equilibrium in the market for offenses would then be the solution of the simplified system[10]

(2) $q^s=S(\pi)$ with $S'(\pi)>0$

(3) $d=D(q^d)$ with $D'(q)\leqslant 0$

(4) $pf=\tau(q^d|\phi)$ with $\tau'(q)\geqslant 0$

(5) $\pi\equiv d-pf$

(6) $q^s=q^d$

The supply, demand, and "tax" schedules given in equations (2)–(4) are depicted

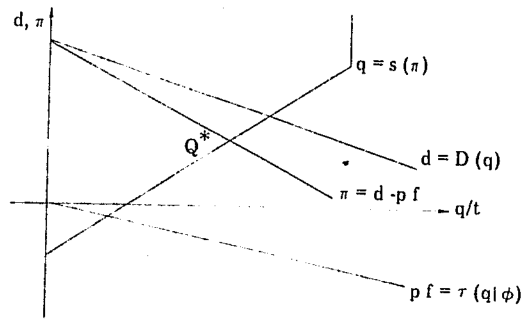


FIGURE 1

graphically in Figure 1, with $q^s$ and $q^d$ denoting the quantities of offenses "supplied" and "demanded," respectively. Equation (5) expresses the necessary condition for equilibrium, with the solution at point $Q$ in Figure 1 seen to be stable by virtue of the properties of equations (2)–(4).

### II. Individual Control and Deterrence: An Equilibrium Analysis

The three basic measures of crime control most frequently discussed in the criminological literature are deterrence, incapacitation, and rehabilitation. Deterrence essentially aims at modifying the "price of crime" for all offenders, potential and actual. It is analogous to any method of public intervention that seeks to modify the market net return from crime, $\pi$, through either punishment, an improvement in employment opportunities in legitimate labor markets (hence a reduction in $d$), or related efforts. Rehabilitation and incapacitation, in contrast, seek to remove a subset of convicted offenders from the market for offenses either by relocating them in legitimate labor markets, or by excluding them from the social scene for prescribed periods of time. Typical means of incapacitation such as imprisonment exert, of course, both incapacitative and deterrent effects. For obvious methodological purposes, however, the term incapacitation will be used in this analysis to convey the distinct role of physical removal as means of reducing individual recidivism at any given level of net punishment.

[9]This result, subject to assumptions required for fulfillment of second-order conditions, is discussed in my paper with Joel Gibbons in Proposition 1, p. 49.

[10]The simplified market system expressed in equations (3) and (4) abstracts from any *direct* (technical) interdependencies between private protection and public enforcement. Thus, a change in $\tau$ is not assumed to cause a shift in the private demand schedule $D(q)$. Note, however, that equations (3.) and (4) do express *indirect* interdependence between private and public protection because the former is shown to be an increasing function of $q(D'(q)\leqslant 0)$. Thus, for example, a decrease in public law enforcement due to an exogenous factor (say, a police strike) is clearly expected to bring about an increase in the amount of private self-protection provided, because of the resulting increase in the crime rate.



The effectiveness of rehabilitation and incapacitation in curbing individual recidivism and their overall potential quantitative significance will be considered in subsequent sections. In this section, I shall try to determine the efficacy of individual control methods relative to deterrence at the market level under any assumed level of their efficacy at the individual level. Effective control of convicted offenders with positive probabilities of recidivism would then amount, in a steady state of the market, to a leftward shift in the aggregate supply-of-offenses schedule from the initial equilibrium position. For illustration, suppose that the market supply curve had the linear shape of the cumulative uniform probability distribution of entry net returns, $\pi^*$, sufficient to induce members of the population at large to enter the market for offenses, all individual supply curves being inelastic about an arbitrary number of offenses. Let the subset of individual offenders apprehended and removed from the market be randomly drawn from the full set of active offenders at the initial equilibrium net return, $\pi_0$. Then the initial supply curves $S_0S_0$ would be reshaped into $S_0A_0S_1$ if individual control were via incapacitation, or into $S_0A_0S_2S_0$ if control were via rehabilitation, provided that the latter resulted in an equal absolute increase in the entry net returns the subset of rehabilitated offenders would now require before reentering the market for offenses. As Figure 2 shows, the change in the equilibrium frequency of offenses can differ drastically from the potential aggregate change corresponding to the total number of offenders removed under incapacitation or rehabilitation. The difference between the actual and anticipated effects of individual control methods is indicated by the distance $A_0A_1$ in the case of incapacitation and by the distance $A_0A_2$ in the case of rehabilitation.

The source of the difference between any successful rehabilitative or incapacitative effects at the individual and the market levels is the replacement of individual offenders who are successfully removed from the market for offenses by veteran offenders or new entrants who are induced by the prevailing opportunities for illegitimate rewards to fill the vacancies created by the departing

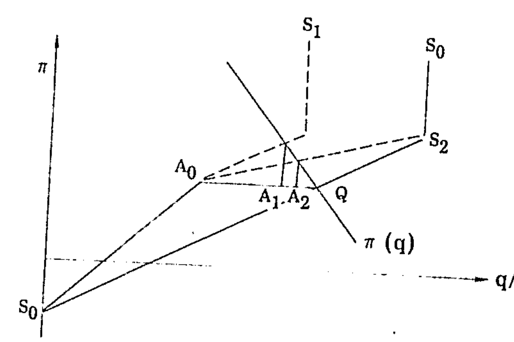


FIGURE 2

offenders. Since control of the behavior of convicted offenders per se does not involve changes in expected criminal sanctions or in the private derived-demand-for-offenses schedule, the departure of individual offenders and the accompanying reduction in the frequency of offenses will temporarily increase the market net return from offenses. The increased rewards due, say, to higher demand prices for illegal goods or to a lower amount of private protection, in turn would operate as a signal to potential participants to enter or reenter the market, as the case may be, and would induce active offenders to adjust their participation in illegitimate activities upward. This replacement effect, offsetting the initial removal effect exerted by methods of individual control, would be inevitable as long as supply elasticities were greater than zero, private demand elasticities less than infinite, and alternative law enforcement activities unchanged.

These conclusions can be expressed more rigorously through the following formal analysis. Assume, for convenience, that individual supply-of-offenses schedules were all of a constant elasticity variety, differing only in individual constant terms. Then the mean supply-of-offenses function would have the same constant elasticity as the individual functions regardless of the mix of offenders operating.[11] Similarly, assume that the implicit market demand schedule for offenses,

[11]That is, if $q_j=A_j\pi^{\alpha}$, all $j$, then

$$\frac{1}{N}\sum_j q_j=\frac{1}{N}A_j\pi^{\alpha}=q$$

incorporating a fixed expected sanction imposed through public law enforcement, is also of a constant elasticity variety. Market equilibrium would then be the solution of the three equation system

$$q^s = A_0\pi^\alpha \tag{7}$$

$$q^d = B_0\pi^{-\beta} \tag{8}$$

$$q^d = q^s \tag{9}$$

If individual control methods could effectively reduce the recidivism rate of controlled offenders, effective control would be tantamount, in the context of the present model, to a finite reduction in the value of the coefficient $A_0$ in equation (7) with no change in the coefficients $\alpha$, $\beta$, or $B_0$. Let the percentage change in $A_0$ corresponding to a given program of individual control ($J$) be given by $\tilde{A}_0 = \partial\, ln\, A_0/\partial J$. The effect of the program on the equilibrium frequency of offenses will then be given by

$$-\frac{\partial\, ln\, q^*}{\partial J} = \frac{\beta}{\alpha+\beta}\tilde{A}_0 \tag{10}$$

where $q^*$ is the solution to equations (7), (8), and (9). The term $\beta/(\alpha+\beta)$ indicates the extent to which the removal effect is offset by the equilibrium replacement effect. Clearly,

$$\frac{\beta}{\alpha+\beta} = \begin{cases} 0 & \text{if } \alpha=\infty \quad \text{or } \beta=0 \\ 1 & \text{if } \alpha=0 \quad \text{or} \rightarrow 0 \text{ as } \beta\rightarrow\infty \\ <1 & \text{if } \alpha>0, \quad 0<\beta<\infty \end{cases} \tag{11}$$

The replacement effect would then be complete if the supply-of-offenses schedule was infinitely elastic and the market demand elasticity was zero about the initial equilibrium position. It would be nil only if the supply elasticity was zero and the demand elasticity was infinite. In all other cases the actual efficacy of individual control programs would be moderated by the multiplier $\beta/(\alpha+\beta)$.

And what about deterrence? If the extent of public control via law enforcement activity were confined to setting the expected punitive tax, or fine $pf$, with no direct control over the parameters of the differential payoff schedule $d=D(q)$, then, in the context of the present model, the effect of such control would be tantamount to a reduction only in the initial equilibrium rate of criminal return $\pi^0$ with no change in $\alpha$, $\beta$, or $A_0$. The effect of a percentage change in $\pi^0$ via the deterrence program $\tau$ on the equilibrium rate of offenses is then given by[12]

$$-\frac{\partial\, ln\, q^*}{\partial \tau} = \frac{\beta\alpha}{\alpha+\beta}\tilde{\pi}^0 \tag{12}$$

where $\tilde{\pi}^0 \equiv -\partial\, ln\, \pi^0/\partial\tau$. Clearly then,

$$\frac{\beta\alpha}{\alpha+\beta} \begin{cases} \rightarrow\alpha & \text{as } \beta\rightarrow\alpha \\ \rightarrow\beta & \text{as } \alpha\rightarrow\infty \\ <\alpha\geqslant 0 & \text{if } 0<\alpha<\infty,\ \beta\geqslant 0 \end{cases} \tag{13}$$

Unlike the efficacy of methods of individual control in reducing the aggregate rate of offenses, which is shown in equation (11) to be a decreasing function of the elasticity of the market supply-of-offenses schedule $\alpha$, the efficacy of general deterrence is an increasing function of the latter elasticity essentially because deterrence operates like a change in the initial market price. The equilibrium analysis further indicates, however, that the efficacy of both deterrence and methods of individual control of offenders are increasing functions of the elasticity of the market demand curve for offenses.

or $q = A_0\pi^\alpha$ where $A_0 = \frac{1}{N}\sum A_j$

and $N$ denotes the population at large.

[12] By equation (8), given the initial market equilibrium $q=q^0$ and $\pi=\pi^0$, $B_0=(\pi^0)^\beta q^0$. The equilibrium frequency of offenses, as solved from equations (7)–(9) is given by

$$q^* = A_0^{\beta/(\alpha+\beta)}B_0^{\alpha/(\alpha+\beta)}$$

Since the deterrence program affects directly $\pi^0$, rather than $B_0$, the effect of a change in $\pi^0$ on $q^*$ is then easily found to be

$$\frac{\partial\, ln\, q^*}{\partial\, ln\, \pi^0} = \frac{\beta\alpha}{\alpha+\beta}$$



## III. To What Extent Can Rehabilitation Reduce Crime?

The term rehabilitation, as used in connection with criminal behavior, has come to denote various methods of treatment of convicted offenders aimed at reducing individual recidivism through imposition of specific positive incentives. In the last few decades a variety of rehabilitative methods ranging from therapy to vocational training programs have been tried in the United States and elsewhere, in some cases on a significant scale.[13]

The effectiveness of these programs has been assessed exclusively in terms of their success at the individual level. The evidence for effectiveness even at that level has been rather meager. Numerous studies indicate little success, if not outright failure, of most programs in bringing about any enduring rehabilitative outcomes for treated offenders.

It is possible that the degree of actual success has been greater than what many studies estimate, or that the incentives provided through training and related programs have been insufficient. Pursuing the economic approach developed here, one can say only that while successful rehabilitation may be quite costly to achieve, it is in principle a function of the quantity and quality of resources invested in, or the implicit subsidy provided to, individual offenders toward acquisition of various legitimate skills. What has been entirely missing in studies of the rehabilitation experience is the realization that whatever its effect on treated offenders, its role at the market level would be hampered by three additional constraints: a) the typically small proportion of the potential offender population that can be subjected to treatment; b) equilibrating forces at the market level;[14] and c) counterincentives arising from benefits conferred on convicted offenders. These considerations can be spelled out formally as follows.

Denote the total number of persons wishing to enter and participate in the market for offenses at a given rate of criminal returns $\pi_0$ by $S^e(\pi_0)$, and assume that on average offenders commit $k(\pi_0)$ offenses per period. Each period a fraction $p$ of all participants in the illegal market is apprehended and convicted, and a fraction $r$ of these offenders is ultimately rehabilitated after fully serving the criminal sanctions imposed. Successful rehabilitation implies in turn that, on average, rehabilitated offenders are removed from the market for offenses for $L$ periods, where $L$ may coincide, at most, with the offender's remaining labor market horizon. The market for offenses is assumed to be free of secular growth.[15]

Under these assumptions it can be shown that, as long as $\pi_0$ remained unchanged, an increase of 1 percent in the fraction of successfully rehabilitated convicts would lead in a steady state to a decline in the frequency of offenses committed in the amount

$$\sigma_r^{max} = -\frac{\partial\, ln\, q(\pi_0)}{\partial\, ln\, r} = \frac{rpL}{1+rpL} \tag{14}$$

where $-\partial\, ln\, q(\pi_0)/\partial\, ln\, r$ is analogous to the term $\tilde{A}_0$ in equation (10). Clearly, in view of the small magnitude of $r$ in practice, $\sigma_r^{max}$ is expected to be quite small.

Moreover, the equilibrium flow of offenses would be modified by the change in the market net return from crime accompanying the process of rehabilitation: In terms of the simplified market model given by equations (7)–(9), if rehabilitation does not affect any of the parameters of the supply and demand schedules other than $A_0$, then, by equation (10),[16]

$$\left.\frac{\partial\, ln\, q^*}{\partial\, ln\, r}\right|_{\substack{B_0,\alpha,\beta \\ pf\ constant}} = \frac{\partial\, ln\, A_0}{\partial\, ln\, r}\frac{\beta}{\alpha+\beta} = \frac{rpL}{1+rpL}\cdot\frac{\beta}{\alpha+\beta} \tag{15}$$

[13] An extensive survey of these programs is included in Douglas Lipton, Robert Martinson, and Judith Wilks. See also Leslie Wilkins, James Robison and Gerald Smith; Roger Hood; Walter Baily; Phillip Cook; James Wilson.

[14] The following analysis is based on the implicit assumption that the increased supply of graduates of rehabilitation programs in the legitimate sector of the economy is sufficiently small in relative terms so as not to cause any perceptible reduction in legitimate wages available to offenders.

[15] But see the analysis in the Appendix. Positive population growth is shown to reduce the magnitude of $\sigma_r^{max}$ in equation (14).

[16] Note that the process of replacement due to the vacancies created by successfully rehabilitated offenders would be operative not only at the market level, but

where $\beta/(\alpha+\beta)$ expresses the replacement effect at the market level.

But the effect of rehabilitation on the equilibrium frequency of offenses is even more complex. The reason is that successful rehabilitation confers an implicit *subsidy* on potential offenders by offering training and employment benefits at public expense. Even if the rehabilitation programs were not carried out at the expense of the criminal sanctions, but rather in addition to them, the provision of rehabilitative net benefits—to the extent that they are positive—necessarily enhances the anticipated net return from crime to the potential offender ($\pi_0$) by the magnitude of the rehabilitation subsidy per offense, $g$. Put differently, the rehabilitation benefits provided to actual offenders *ex post* produce a counterdeterrent effect on potential offenders *ex ante*. By equation (12) the total effect of the rehabilitation subsidy is given by

$$(16)\quad \varepsilon_r \equiv -\frac{\partial \ln q^*}{\partial g}\bigg|_{\substack{\alpha,\beta\\ pf\ constant}} = \frac{\beta}{\alpha+\beta} \times \left[\frac{\partial \ln r}{\partial g}\frac{rpL}{1+rpL} - \alpha\frac{\partial \ln \pi_0}{\partial g}\right]$$

Clearly, if the subsidization effect $(\partial \ln \pi_0/\partial g) \equiv \tilde{\pi}$ were sufficiently high, rehabilitation may increase rather than lower the actual frequency of crime in the population.[17] If the rehabilitative subsidy were negative, however ($g<0$), its effect on crime would be analogous to that of a criminal sanction.

## IV. The Preventive Effect of Imprisonment: Deterrence or Incapacitation?

Imprisonment produces an incapacitative as well as a deterrent effect. The argument that it derives its efficacy and efficiency mainly from its incapacitative value[18] is deficient, however, on several important grounds. First, although imprisonment temporarily eliminates participation in criminal activity outside of prison walls, it does not stop it inside. Moreover, since imprisonment is likely to result in the relative depreciation of legitimate knowledge and skills, it may lead to an increase in the rate of recidivism of imprisoned offenders in their postrelease period. Part of the incapacitative value of temporary incarceration, then, may be offset by its "hardening" effect on the same offenders.

Even if hardening effects are ignored, the maximum incapacitative value of imprisonment, measured in elasticity terms, can be found to be rather modest in practice in view of the small magnitudes of both the probability that a potential offender at large be apprehended and imprisoned $p$, and the typical length of his actual incarceration $T$. By a direct application of the preceding analysis of the removal effect associated with rehabilitation (see the Appendix) a 1 percent change in either $p$ or $T$ would generate a maximum incapacitative effect on the crime rate equal to

$$(17)\quad \sigma_I^{max} \equiv -\frac{\partial \ln q(\pi_0)}{\partial \ln pT} = \frac{pT}{1+pT}$$

As the analysis in the following section will show, it is the elasticity of the crime rate with respect to incapacitative measures, rather than the absolute "marginal product" of the latter, which determines the marginal social "revenue" from the allocation of resources to

among offenders participating in the rehabilitation program as well. In particular, the knowledge of illegitimate openings created by rehabilitated offenders, and sometimes cooperation among offenders in the treatment group, would induce greater participation in illegitimate activity on the part of those in the group with greater comparative advantage in crime. This is one reason why the average rate of recidivism among graduates of rehabilitation programs may not differ markedly from that among offenders outside the program, as some evaluation studies report (see fn. 13).

[17]Again, this counterdeterrent effect may operate at the individual as well as at the market level, as long as recidivism on the part of graduates of rehabilitation programs would not foreclose their opportunities for obtaining future rehabilitation benefits. Since offenders undergoing rehabilitation are in a position to assess the rehabilitation benefits with greater certainty than other offenders, their average rate of recidivism may even rise relative to that of other convicts.

[18]See, for example, Shlomo Shinnar and Reuel Shinnar, and Jan Chaiken, Michael Lawless, and Keith Stevenson.



the production of incapacitative instruments. Thus, the argument that the marginal social value of incapacitation is high because the majority of offenses are committed by a small number of offenders (i.e., that the number of offenses committed by a typical offender $k$ is high), turns out to be irrelevant for the determination of optimal policy vis-à-vis incapacitative instruments on the margin, because $k$ itself does not influence the magnitude of $\sigma_I^{max}$.

Again, the maximal incapacitative effect of imprisonment is necessarily an overstatement of the actual effect because it fails to account for the replacement effect caused by the displacement in market equilibrium. However, changes in $p$ and $T$ produce shifts in both the market demand-for-offenses schedule (reflecting deterrence) and in the supply-of-offenses schedule (reflecting incapacitation). In the Appendix it is shown that the steady-state supply-of-offenses schedule can be written generally as

$$(18)\quad q = A_0(pT)S(\pi)$$

where, in a steady state with no growth, $A_0 = 1/(1+pT)$. Thus, in terms of the market model given in equations (7)–(9), the total effect of equal percentage changes in either $p$, $T$, or their product $pT$ on the equilibrium rate of offenses is given by

$$(19)\quad \varepsilon_p = \varepsilon_T \equiv -\frac{\partial \ln q^*}{\partial \ln pT}\bigg|_{\alpha,\beta\ constant} = \frac{\beta}{\alpha+\beta}\frac{pT}{1+pT} + \frac{\beta\alpha}{\alpha+\beta}\frac{\partial \ln \pi_0}{\partial \ln pT}$$

Equation (19) points to a serious overstatement of the pure incapacitative effect of imprisonment, or its share in the total preventive effect of imprisonment as addressed analytically and empirically in many recent studies, because of failure to assess incapacitation effects within the context of equilibrium analysis.[19] As equation (19) shows, the higher the elasticity of the supply schedule $\alpha$, the lower the actual incapacitative effect of imprisonment, and the higher the fraction of the overall preventive effect of imprisonment attributable to deterrence. Although the potential hardening effect of incapacitation that counteracts its potential removal effect has not been added as a third argument in equation (19), it is apparent that both the incapacitation and the hardening effects of imprisonment would be minor in practice if $\alpha$ were sufficiently high.

An illustration of the potential empirical importance of the incapacitative effect of imprisonment can be provided by evaluating the relevant components of equation (19) on the basis of empirical data. In my 1974 paper, estimates of the overall elasticity of "all felony offenses" with respect to probability and severity of imprisonment for these felonies, derived through a cross-state regression analysis using 1960 data for the United States, show the latter to be about unity. Even exaggerated estimates of the actual incapacitative effect of imprisonment, based on the assumption that $p=1/3$ (i.e., one of every three offenders at large is apprehended and imprisoned every year), and, say, $\alpha=\beta$, show that incapacitation cannot explain even 25 percent of the observed elasticity. More realistic estimates would place the latter proportion for most crimes well under 10 percent (see the Appendix). It appears therefore that in practice the overwhelming portion of the total preventive effect of imprisonment is attributable to its pure deterrent effect.

## V. On the Choice of Optimal Sanctions

The optimal deployment of alternative means of crime control cannot be based merely on their relative efficacy in reducing offenses, but must involve consideration of their relative costs. The analysis here will focus on the optimal choice among alternative sanctions, using the model of optimal public enforcement outlined in Section I.

Fines and related monetary exchanges exert a purely deterrent effect. In contrast, imprisonment, detention, and probation render both incapacitative and deterrent services. By equation (19) the latter sanctions

[19]See, for example, Shinnar and Shinnar; David Greenberg.

must exert a total preventive effect that is either equal to or greater than the purely deterrent effect of a fine of equal cost to the offender.

Imprisonment and fines are associated, however, with different social costs as well—a point which is central to Becker's important analysis of the case for fines. Whenever feasible, an optimal fine would amount to a transfer payment made by the offender to compensate the rest of society for the external costs inflicted through his criminal conduct. The net resource costs to society from fines are then the costs of the "collection agency." In contrast, imprisonment is a nontransferrable, noncompensating payment made by the offender in the form of foregone earnings and other restrictions on personal freedoms during the period of incarceration. The part of an offender's foregone income that is derived from legitimate activities is, of course, a genuine social cost as well. In addition, the administration and maintenance of a prison system involves considerable expenditures of resources. In equation (1) the cost to society imparted by any sanction imposed on the offender is formally captured by the multiplier $b$. As long as fines are feasible $b(m)>b(f)\geqslant 0$, where $m$ and $f$ stand for the monetary equivalents of imprisonment and fines, respectively.

If imprisonment and fines were constrained to be mutually exclusive, the choice of the optimal value of either sanction would be determined through minimization of equation (1), generally expressed

$$L(p,t)=\Delta(q)+C(q,p)+b(t)ptq,$$
$$t=m,f$$

with respect to $m$ and $f$ separately. For any given value of $p$, the optimality conditions relating to $f$ and $m$ are given by

$$\Delta_q+C_q=b(m)pm(E_m-1) \tag{20}$$

and

$$\Delta_q+C_q=b(f)pf(E_f-1) \tag{21}$$

where $E_t\equiv 1/\varepsilon_t$, and $\varepsilon_t\equiv -\partial \ln q^*/\partial \ln t$ denotes the elasticity of the *equilibrium* crime rate with respect to $t$, $t=m,f$. The determinants of $\varepsilon_m$ and $\varepsilon_f$ can be inferred from equation (19): While $\varepsilon_m$ would include both terms on the right-hand side of equation (19), $\varepsilon_f$ would be represented by the second term alone. Note that in this specification of the social loss function, where $t$ is not an argument in the cost function of direct law enforcement activity, $C(q,p)$, and where no distributive effects of enforcement are considered as part of the social target function, equations (20) and (21) can be satisfied only if both $\varepsilon_m$ and $\varepsilon_f$ are less than unity. This restriction does not apply, however, to the magnitude of the elasticities of the supply-of-offenses function $S(\pi)$ ($\alpha$ in equation (7)), which by equation (19) is free to vary between zero and infinity. Put differently, the restriction $\varepsilon_m<1$ does not imply that in equilibrium *offenders* cannot be highly responsive to incentives, as previous analyses seem to suggest.

Equations (20) and (21) imply that, when forced to invoke either $f$ or $m$, the law enforcement authority would make its choice according to whether

$$\frac{(E_m-1)}{(E_f-1)} \gtreqless \frac{b(f)f}{b(m)m} \tag{22}$$

This result can be interpreted as follows: for any target level of offenses $q^0$, given the value of $p$, a fine would dominate imprisonment as an optimal sanction, provided that its potentially lower overall preventive effect is more than offset by its relatively lower social cost. More generally, if imprisonment and fines could be imposed jointly, their values would be chosen so as to minimize

$$L(p,f,m)=\Delta(q)+C(q,p)+\left[b(m)m+b(f)f\right]pq \tag{23}$$

and the optimal combination of $f$ and $m$, given $p$, would be required to satisfy

$$\frac{m}{f}=\frac{b(f)\varepsilon_m}{b(m)\varepsilon_f} \tag{24}$$

Both equations (22) and (24) point to the superiority of fines in those cases where fines do not exhaust an offender's financial constraint, and $b(f)\approx 0$. The superiority of fines is further apparent in the particular case where the elasticity of the market demand-for-offenses schedule ($\beta$ in equation (8)) is nil. As equation (19) indicates, the elasticity of the equilibrium crime rate with respect to *any* means of crime control would be zero in this case. The superiority of monetary fines would then be unqualified because only compensation to victims could internalize the external costs of crime.



These specific illustrations underscore the dual role of monetary fines, both as a means of crime prevention and as a Pigouvian tax. The general analysis at the same time modifies Becker's assertion that maximization of social welfare requires the exclusive use of fines whenever they are feasible. Since, in general, $b(f)>0$, the analysis shows that even when feasible, fines should be replaced by, or used in conjunction with, an incapacitating penalty if $\varepsilon_m$ were sufficiently greater than $\varepsilon_f$. By equation (19), the difference between the two is proportional to $[pT/(1+pT)]\cdot[\beta/(\alpha+\beta)]$.

## VI. Some Illustrations

### A. *Discriminating Penalties*

Since public law enforcement is carried out under state monopoly, it would be optimal for law enforcement authorities to impose different penalties on different groups of offenders if the marginal social return from enforcement differed systematically across these groups. Equation (20) indicates, for example, that the optimal severity of imprisonment would be higher, the higher is $\varepsilon_m$. Becker has argued on the basis of this condition that insane and young offenders, or perpetrators of unpremeditated crimes whose responsiveness to incentives is presumed to be low, should receive lighter penalties than other, more responsive offenders. The analysis of Section V changes this conclusion, because the magnitude of $\varepsilon_{mj}$ associated with different groups of offenders $j$ is determined by three distinct effects: a) a deterrent effect; b) an incapacitative effect; and c) the interplay of supply and demand forces. While the pure deterrent effect of imprisonment is an increasing function of a group's responsiveness to incentives $\alpha_j$, its pure incapacitative effect under a segmented market structure is a decreasing function of $\alpha_j$. It is thus possible, at least in principle, that $\varepsilon_{mj}$ and $\alpha_j$ would not be positively correlated.

The conclusion that insane, nonpremeditating, and "hardened" offenders should be given relatively lighter penalties holds unqualifiably only under the constraint that all offenders are to be punished through purely deterring sanctions. An optimal policy would not exempt unresponsive offenders from punishment, but punish them through incapacitative penalties. Moreover, it might even pay to punish them relatively *more* severely. Little responsiveness to incentives, then, is no justification for little punishment, but rather for punishment of a different kind.

### B. *The Control of Crimes Against Persons*

It is frequently asserted, although not systematically documented, that perpetrators of crimes of passion are less responsive to incentives than other offenders. While undoubtedly valid in particular cases, this assertion need not hold in general.[20] It is, however, possible that the distribution of individual preferences for such crimes is subject to marked discontinuities which can contribute to an inelastic shape of the aggregate supply-of-offenses schedule about typical equilibria positions. In addition, it is possible that the market derived-demand schedule for such crimes is quite elastic. By these considerations the efficacy of rehabilitation and incapacitation may indeed be higher in connection with crimes against persons.

Note, however, that a prerequisite for any method of individual control to be efficacious at both the individual and the aggregate levels is that there be a positive and

[20]Samuel Yochelson and Stanton Samenow report evidence, based on psychological observations during treatment, that a majority of crimes of passion are in fact nonspontaneous and deterrable. Also see the analyses and evidence reported in my 1975 and 1977 papers and in Kenneth Wolpin.

significant probability of individual *recidivism*. Many crimes against persons, especially murders and assaults, are committed as a result of personal frictions under unique personal circumstances that have low probabilities of recurrence once the crime is committed. Methods of individual control would then inherently be productive only in connection with those perpetrators of crimes against persons whose probability of recidivism is high.

### C. *Victimless Crimes*

The supply elasticities $\alpha_i$ of "victimless crimes," such as gambling, loan sharking, prostitution, and the sale of all illicit goods, are likely to be particularly high as these criminal enterprises share many of the characteristics of business endeavors in legitimate markets. No one would suggest that the act of shutting off a gasoline station because of violation of safety or health codes, or its conversion to a bicycle shop, can per se result in a comparable reduction in the aggregate amount of gasoline sold in the relevant local market. The reduced supply by the obstructed station will almost surely be replaced by increased production by competitors and jobbers. The same goes for prostitution and transactions in drugs. And because the consumers patronizing these businesses may have relatively inelastic demands, any law enforcement crackdown on these businesses would mainly hike the prices of the commodities involved without affecting markedly the volume of transactions. Monetary fines or taxes would produce both the maximum amount of crime prevention via deterrence, and compensation for members of society who, in various personal ways, may be victimized by the activities in question.

### D. *A Parallel between Rehabilitation and Retraining Programs*

The equilibrium analysis developed in this paper is applicable in explaining not only the evidence concerning the efficacy of rehabilitation programs for offenders, but also the evidence emerging from evaluation studies of retraining programs of adult workers in specific legitimate industries (see, for example, Charles Perry et al., pp. 183–200). Public retraining of workers for superior jobs or skills in specific industries subject to high degrees of technological innovations amount to an attempt to reshape the shifting supply schedules of workers to these jobs. The latter reflect the minimum wage differentials required by individual workers to enter (or reenter) the submarkets for the relatively higher skills, in view of the additional investments necessary. If subsidized retraining is successful in imparting the required knowledge, it will enable the retrained workers to compete with newly trained workers for the skilled positions available at the going market wages. However, since the retraining programs do not affect the industries' derived demand schedules for the specific skills involved, the total employment of these skills (hence the actual integration of retrained workers) would not be markedly affected if the supply schedules of the specific skills were sufficiently elastic, and those of the derived demand schedules were low.

## VII. A Concluding Remark

I do not mean to suggest that methods of individual control should be abolished; rehabilitation may serve a variety of social objectives, not all of which include crime prevention. Incapacitation would be necessary for specific types of offenses or offenders where the extent of individual responsiveness to incentives is low and the rate of recidivism is high. My analysis shows, however, that, in a large class of cases, efficient crime control requires only the imposition of deterring punishments or the promotion of general legitimate earning opportunities, without any attempt at individual control.

## Appendix: A General Analysis of Maximum Removal Effects

The following analysis is based on the original model of the incapacitative effect of imprisonment developed in my 1974 paper. Let the total population in a given community be represented by $N$, with $N$ growing over time at the geometrical rate $g$. Given an equilibrium rate of criminal returns $\pi^*=\pi_0$ and other determinants of participation in criminal activity, a fraction $s^e(\pi_0)$ of the total population would be attracted to the market for offenses in any given period. The stock of offenders in $t$ is thus given by

$$\text{(A1)}\qquad S_t^e(\pi_0)=s^e(\pi_0)N_t$$
$$=s^e(\pi_0)N_0(1+g)^t$$

With individual methods of crime control effectively used, the stock of offenders at large is given by

$$\text{(A2)}\qquad \theta_t=S_t^e(\pi_0)-R_t$$

where $R_t$ denotes the number of offenders actually removed.

Assume that a fraction $p<1$ of $\theta_t$ is apprehended and effectively removed each period for a duration of $T$ periods. Then, by application of the analysis in my 1974 paper, the steady-state effective stock of offenders at large (per capita) can be easily derived:

$$\text{(A3)}\qquad \bar{\theta}=\frac{1}{1+p\sum_{\tau=1}^{T}(1+g)^{-\tau}}s^e(\pi_0)$$

If an average offender at large commits $k(\pi_0)$ offenses per period when $\pi=\pi_0$, the (per capita) supply-of-offenses function can now be specified as

$$\text{(A4)}\qquad q=\frac{k(\pi_0)}{1+p\sum_{\tau=1}^{T}(1+g)^{-\tau}}s^e(\pi_0)$$
$$=A_0(pT)s(\pi_0)$$

where $$A_0=\frac{1}{1+p\sum_{\tau=1}^{T}(1+g)^{-\tau}}$$

and $s(\pi_0)\equiv k(\pi_0)\cdot s^e(\pi_0)$. Clearly, equation (A4) is of the format of the supply-of-offenses function analyzed in the text, with $s(\pi_0)=\pi^{\alpha}$, and with $A_0$ reducing to $1/(1+pT)$ if $g=0$. The effect of a percentage increase in the fraction of offenders removed from the market in a given period on the steady-state value of $q$ will therefore be given by

$$\text{(A5)}\qquad \sigma^{max}\equiv-\left.\frac{\partial\, ln\, q}{\partial\, ln\, p}\right|_{\pi^*=\pi_0}$$
$$=\frac{p\sum_{\tau=1}^{T}(1+g)^{-\tau}}{1+p\sum_{\tau=1}^{T}(1+g)^{-\tau}}=\left.\frac{\partial\, ln\, q}{\partial\, ln\, T}\right|_{\pi^*=\pi_0}$$

which reduces to $\sigma^{max}=pT/(1+pT)$ if $g=0$ (see equation (17)). By substituting *rp* and $L$, as defined in section III, for $p$ and $T$ in equation (A5) and setting $g\approx0$, equation (14) is also immediately derived. Note that the assumption $g=0$ overstates the value of $\sigma^{max}$ whenever $g>0$.

*Illustration*: According to *Characteristics of State Prisoners, 1960*, the average length of time spent in state prisons by offenders upon their first release from prison in 1960 for all index crimes is estimated at 30.75 months or 2.56 years.[21] A measure of the probability that an offender at large be apprehended and imprisoned for these crimes in 1960, calculated as the ratio of offenders committed to state prisons $C^0$ to the total number of offenses known to police $Q^0$, sets $p$ at 0.028.[22] The values of $\sigma^{max}$ based on these values of $p$ and $T$ is 0.066. In contrast, the estimated elasticities of the same offenses with respect to $p$ and $T$, based on a 1960 cross-state regression analysis, are found to average about unity in absolute magnitude (see my 1974 paper, Table 5). Clearly, an estimate of

[21] This is the weighted average of the actual times served for the specific index-crime categories, weighted by the data on releases. The index crimes include murder, rape, aggravated assault, robbery, burglary, larceny, and auto theft.

[22] The value of $C^0$ is calculated from *Characteristics of State Prisoners, 1960*, Table A1, and $Q^0$ from *Uniform Crime Reports* (*UCR*), Table 2.

TABLE 1—ESTIMATES OF THE INCAPACITATIVE AND DETERRENT EFFECTS OF IMPRISONMENT BASED ON 1960 DATA

| Category | $p$ (1) | $T$ (2) | $\sigma^{max}=\frac{pT}{1+pT}$ (3) | $\theta=\frac{\beta}{\alpha+\beta}\sigma^{max}$ (4) | $\varepsilon_p$ (5) | $s=1-\theta/\varepsilon_p$ (6) |
|---|---|---|---|---|---|---|
| All Offenses | .028 | 2.56 | .066 | .033 | .991 | .967 |
| | .10[a] | 2.56 | .20 | .10 | .991 | .90[a] |
| | .20[a] | 2.56 | .33 | .17 | .991 | .83[a] |
| | .33[a] | 2.56 | .46 | .23 | .991 | .77[a] |
| Specific Crimes: | | | | | | |
| Murder | .398 | 10.12 | .801 | .400 | .852 | .531 |
| Rape | .227 | 3.73 | .458 | .229 | .896 | .744 |
| Aggravated Assault | .030 | 2.08 | .059 | .029 | .724 | .960 |
| Robbery | .084 | 3.53 | .229 | .114 | 1.303 | .913 |
| Burglary | .024 | 2.05 | .047 | .023 | .724 | .968 |
| Larceny | .022 | 1.65 | .035 | .017 | .371 | .954 |
| Auto Theft | .021 | 1.78 | .036 | .018 | .407 | .936 |

*Sources*: Data for columns (1) and (2) are given in fnn. 21 and 22. In column (4), I set $\alpha=\beta$. Column (5) lists empirical estimates of the elasticity of specified offenses with respect to the probability of imprisonment $\varepsilon_p$ as reported in my 1974 paper, Tables 4 and 5. Column (6) represents estimates of the share of deterrence in $\varepsilon_p$.

[a]Hypothetical estimates based on arbitrary values of $p$.

$p$ based on $C^0/Q^0$ may be seriously biased in both an upward and a downward direction. The desired measure of the probability $p$ may be approximated by $C^0/\theta$, where $\theta$ is the number of offenders at large, or $K/Q=kC^0/K\theta$, where $k$ is the average number of offenses committed by an offender at large (see my 1974 paper, p. 124). Clearly, while $C^0<K$, if $k>1, Q>Q^0$ because the number of offenses reported is substantially lower than the true number of offenses committed.[23]

Alternative estimates of $\sigma^{max}$ and the actual incapacitative effect of imprisonment can be obtained (see Table 1) by placing arbitrary values on the magnitude of $p$. If one were willing to assume that as much as one in ten offenders at large is actually apprehended and imprisoned in a given year, $\sigma^{max}$ will be 0.20 and the actual incapacitation effect $\sigma^{max}(\beta/\alpha+\beta)$, with $\alpha=\beta$, would be 0.10, or just about 10 percent of the actually estimated elasticity. It is clear that any reasonable estimate of $p$ implies that the bulk of the empirically estimated effect of imprisonment on crime (represented in Table 1 by $\varepsilon_p$) is due to deterrence, especially if $\alpha$ were high.

Note that the share of deterrence in $\varepsilon_p$ as estimated by $s$ in Table 1 may be understated both because $\sigma^{max}$ is estimated under an assumed zero population growth, and because no attempt is made to deduct from the calculated incapacitative effect of imprisonment its hardening effect on released offenders. Also note that the estimate of $s$ may be understated especially in the case of murder because my measure of the relevant $p$ for murder is biased upward: it is calculated on the assumption that any potential murderer at large commits one murder every year both before and after his imprisonment (see fn. 23 and Section VI, Part B).

[23]FBI data from 1960, which provide estimates of the probability of arrest relying on both an offense-based measure (percentage of offenses cleared by arrest) and an offender-based measure (persons charged relative to offenses known) show the latter estimate to be 24 percent lower than the former. (See *UCR*, Table 9.) In contrast, some estimates of the extent of underreported crime show reported index crimes to be 50 to 75 percent lower than the "true" number of crimes in 1964. (See President's Commission on Law Enforcement and Administration of Justice, pp. 17, 18.) Note that in the case of murder $k$ may be substantially less than unity for "offenders at large" (see Section VI, Part B.). Hence my estimate of $p$ for murder might be seriously overstated.



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