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THE ECONOMICS OF PRISONS

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Abstract

This chapter scans the English language research on prisons published since Becker's (1968) seminal paper. After first describing the economic nature of prison and parole, issues concerning comparative institutional analysis and organizational design are discussed, including the role of private prisons. Empirical evidence on production functions for prisons, recidivism and offender rehabilitation programs is reviewed. A brief overview of policy issues and suggestions for future research concludes the survey.
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1. Introduction

From a public policy perspective, the normative theory of the economics of crime may be interpreted in terms of the following questions: (1) How many resources should be devoted to the criminal justice system? (2) How should those resources be allocated between the various branches of the system (police, courts, and so on)? (3) How should each branch allocate its resources amongst competing uses? Conceptually these questions are addressed by simultaneously choosing values of policy control variables to minimize the overall social cost of crime, defined as the (net) direct harm from offenses plus the cost of operating the criminal justice system, subject to the various subsystem production functions and the supply of offenses functions (Becker, 1968). This chapter highlights the third question in the efficiency hierarchy as applied to prisons (correctional institutions), with explicit consideration given to the institutional framework within which the question is posed.

Alternatives exist to the model alluded to in the previous paragraph. Ehrlich (1982) permits goals such as retribution to be reflected in the social cost function, with the degree of retribution related to the number of unpunished offenders and to the severity of their crimes (also see Miceli, 1991). Other economists (notably Shoup, 1964 and Thurow, 1970) emphasize conflicts between efficiency and equity in the provision of protection services. The optimization framework itself is inconsistent with the classical retributive

justification of punishment. Adam Smith ([1791] 1976, pp. 79, 87-91) suggestively remarks that the private demand for punishment is independent of any consideration of social advantage. In contrast to economic models, Kantian inspired retributive ('just desert') models and their cousins (for example, the 'restorative' theory of Cragg, 1992; the Rawlsian-inspired 'rectification' theory of Adler, 1991; the 'restitutive' theory of Barnett, 1977, 1998, Ch. 8, 10, 11) generally argue that punishment can and must be justified independent of the consequences as measured in a social cost function (Duff, 1986, 1996). Economic and retributive models each have difficulty rationalizing certain policies adopted or at least acknowledged by most modern penal systems: economic prescriptions appear inconsistent with constitutional constraints on cruel and unusual punishments; classical retributive models specify punishments which may be insufficient for deterrence. Constitutional contractarian models applied to punishment can rationalize independent constraints on social cost minimization (Avio, 1993b), and will be implicitly assumed in what follows.

A seemingly natural way to organize this survey is in accordance with the individual purposes of imprisonment: incapacitation, rehabilitation, specific deterrence (the deterrent effect on released offenders of having served an imprisonment term), general deterrence and retribution. The problem is that the literature cannot be easily sorted in this way (consider, for example, how the topic of prison privatization might fit within such a framework). The alternative adopted here is to organize the survey in terms of the 'operational' topics treated in the literature, beginning with the economic nature of prisons and parole. Issues concerning comparative institutional analysis and organizational design are then discussed, followed by various empirical topics including production functions for correctional institutions, recidivism (a variously defined measure related to the criminal activity of released inmates), offender rehabilitation programs, and labor markets for former prison inmates. An overview of policy issues concludes the survey. Discussion is limited for the most part to research by economists and/or to authors taking a law and economic perspective. The reader is forewarned that general deterrence is not systematically covered here, as this would entail surveying the vast theoretical and empirical literature on offender supply functions, and undertaking that would greatly increase the lenght and scope of this chapter.

2. Prisons Conceptualized

Prisons provide protection services to society. In principle, these services could be replaced or supplemented by a less resource absorbing system of monetary penalties and/or corporal punishments, the sanctions of choice throughout most of human history. But constitutional constraints in modern democracies limit

corporal punishments, and the wealth constraints of most offenders relative to the social value of the harm they create renders sole reliance on fines inefficient (Polinsky and Shavell, 1984; Shavell, 1985, 1987a, 1987b; Garoupa, 1997). Moreover, Levitt (1997) notes that the authorities may not even know the wealth level of offenders, and may be unable to distinguish between individuals with different subjective disutilities of prison terms. This latter fact is important because the threat of imprisonment must ultimately lie behind any fine. Since the typical criminal has a relatively low disutility of prison term, 'the fine must be low relative to the jail sentence to be incentive compatible' (ibid., 1997, p. 181). But relatively low fines will induce other types of agents to become offenders. Nevertheless, a case can be made that fines are underutilized in Western societies, although less so in Europe than in the US. Benson (1996) favors a system of fines as restitution for victims. He argues that the coerced supply of offender labor services may overcome the wealth constraint (at a cost), while the incentive for victims to cooperate in the prosecution of offenders increases the effectiveness of the police and courts. Conversely, convicted offenders may be induced to commit more crimes to pay off their initial fine, and the promise of fines as restitution may lead to overzealous prosecution by victims. For the remainder of this essay, the relative efficiency of incarceration as a criminal sanction is assumed.

Modern prisons may be viewed as multi-product firms providing incarceration days and rehabilitation opportunities (Avio, 1973). The threat of incarceration has a putative general deterrent effect on prospective offenders (Lewis, 1986) whereas incarceration prevents inmates from committing crimes against those outside the prison walls. This incapacitation effect may be partly offset by an increased number of 'new' criminals if the returns to crime increase as incarcerated offenders are temporarily removed from the criminal market (Cook, 1977; Ehrlich, 1981). The rehabilitation effect acknowledges that a convicted offender's proclivity for crime may decrease as a result of the incarceration experience, as well as by virtue of the fact that age has an independent effect upon criminality. The school for crime syndrome, criminal stigmatization and the natural depreciation of human capital while offenders are incarcerated all pull in the opposite direction. Thus the rehabilitation effect may more properly be labelled a 'training' effect, which from a social standpoint may be either positive or negative. Insofar as this is forecasted by potential offenders, the actual discounted expected costs of engaging in current crime may increase or decrease. This result is tempered by the widely held belief that offenders as a whole tend to discount the future more heavily than non-offenders (Herrnstein, 1983; Wilson, 1983, pp. 223-249; Wilson and Herrnstein, 1985, pp. 166-172, 416-422; Gill, 1994).

3. Parole

Miceli (1994) presents a model of the prison where the optimal lengths of the incarceration and parole periods for individual offenders are chosen by a central authority. The goal is to minimize the cost of a given level of deterrence, conditional upon a predetermined probability of conviction. Parole reduces social costs by prompting prison inmates to behave and by decreasing the number of person-days of incarceration supplied. On the other hand, a system utilizing parole and/or probation reduces the costs of crime to potential offenders and reduces the incapacitation effect. The efficient punishment balances these costs and benefits, and typically requires a period of imprisonment followed by supervised release, as opposed to either probation (immediate release) or unconditional release following incarceration. Miceli demonstrates that the socially optimal policy varies across individual offenders. Garoupa (1996) generalizes these results in a model which includes the net gains to offenders in the social welfare calculation.

The information and coordination requirements in the Miceli model are substantial. This point is brought home in the recognition that the model may be understood in terms of either a determinate or an indeterminate sentencing regime. (In the latter, the trial judge sentences offenders to prison for an indefinite period; parole authorities determine when the inmate is to be released.) The behavior of all agents is invariant to the institutional framework given the rational expectations assumption: potential offenders know *prior to committing offenses* the incarceration/parole mix they will receive if convicted, and the effort they will exert to comply with prison rules. Introducing informational imperfections in the form of a failure on the part of the authorities to correctly perceive the good behaviour efforts of confined inmates does not change the basic results of the Miceli model (Garoupa, 1996, p. 26). An analysis assuming a random component in the relationship between good behavior effort and subsequent proclivity to recidivate would presumably yield similar qualitative implications.

Miceli concludes that a grid-style sentencing scheme such as that promulgated by the US Sentencing Commission, which leaves little room for consideration of the full range of offender-specific characteristics, increases the cost of providing a given level of deterrence. These costs are defined to exclude consideration of retribution and disparities in punishment, factors which in part motivate grid-type sentencing systems (Parker and Block, 1989; Parker, 1989; see Easterbrook, 1983, for a market-analogy argument favoring discretion in sentencing). In a somewhat different context, Garoupa's (1996) model is used to examine the effects of the UK Criminal Justice Act, 1991, which raised the upper and lower bounds for the proportion of the sentence that may be served on parole. The social welfare effects of the law are found to be ambiguous.

Lewis (1979, 1983), in an attempt to provide an empirically feasible guide to parole officials, seeks to establish the optimal parole period given exogenously determined conviction rates *and* original sentence lengths. The maximand consists of 'the expected cost to society ... during the period of the original sentence as a function of the number of months served prior to parole' (Lewis, 1979, p. 382). The model is simulated under a range of assumptions concerning the impact of time served in prison on the rate at which released offenders return to crime (the recidivism rate) while on parole.

Neither Lewis (1979, 1983), Miceli (1994) nor Garoupa (1996) account for the impact and effects of inmate training on the rate at which released offenders return to crime. This consideration requires abandoning Becker's (1968) static framework, and including social investments in inmate training as a new choice variable (Avio, 1975). Limited progress has been made with highly stylized two-period models of punishment (Rubenstein, 1980; Davis, 1988; Polinsky and Rubinfeld, 1991; Nash, 1991; Burnovski and Safra, 1994). These papers explicitly or implicitly assume that punishment is by fine, and ignore recidivistic behaviour. The theme of dynamic efficiency and recidivism is taken up in Flinn (1986) and Leung (1995), but in-prison investments in human capital and their impact on recidivism remain unanalyzed. A dynamic general equilibrium model has yet to be developed.

4. Organizational Design

Several commentators note that the current decentralized criminal justice system is not expected to be efficient. Insofar as the decision variables at issue (overall prison budget, sentence lengths, training opportunities, parole release) are chosen by different decision centers, each with a different mandate, it is unlikely that the resulting product mix would be efficient. With the legislature setting the overall prison budget and the courts and parole authorities determining the level of confinement days, prisons are left with zero degrees of freedom in selecting the level of support that affects post-release behavior. The product mix could be efficient if the courts and parole authorities were to select appropriate sentence lengths for the given budget. But since the mandate of the courts is weighted more toward the provision of retribution (indeed, in some regimes judges are determined by popular vote), and the parole authorities have limited flexibility in determining the actual length of stay of prisoners, the decreed sentence lengths and consequent level of rehabilitation services would not in general be expected to be efficient for any given budget.

A system of indeterminate sentences alleviates the coordination and informational problems inherent in a decentralized penal system (Avio, 1973), while remaining consistent with the efficiency thrust of the Miceli (1994)

model. The confinement and training decisions become centralized, and maximum incentives for offenders to avail themselves of rehabilitation opportunities are provided. The general rejection of such programs for all but repeat violent offenders is based upon several factors: the difficulties with protecting the civil rights of inmates under such a regime; the frustrations arising from several decades of inconclusive research on inmate rehabilitation; a perceived lack of success in predicting recidivism on an individual offender basis; and an increased emphasis on retribution as the primary goal of punishment.

Former UK Home Secretary Howard (1996) proposed a hybrid determinate/indeterminate sentencing scheme reminiscent of 'three strikes and you're out' regimes while retaining the benefits of 'marginal deterrence' (Stigler, 1970). Under this scheme, repeat violent offenders would automatically receive life sentences, while the trial judge sets a minimum period intended to satisfy the need for retribution and deterrence. Once that period is served, penal authorities would determine whether and when the inmate is released. Upon release, offenders would be subject to recall for the rest of their lives.

An earlier proposal for a two-part penalty scheme was proposed by Tabasz (1974) to alleviate the retribution-rehabilitation conflict. The first part of the sentence targets retribution. It would be determinate, independent of offender characteristics, of relatively short duration and served in an environment devoid of amenities. The offender would then pass on to a different environment to serve out the second, indeterminate stage directed to the rehabilitation goal. Again the purpose of the indeterminate sentence is to align the incentives of the offender with society's goal of minimizing the overall time-discounted social costs of crime. Tabasz suggests that the condition for release be some readily visible sign of achievement on the part of the offender such as the attainment of a definable educational or vocational training goal.

One difficulty with two-part penalty schemes is that the various penal functions (retribution, rehabilitation, deterrence) do not map separately into the determinate and indeterminate portions of the sentence. Any 'hardening' of the inmate during the first stage would presumably have to be rectified during the second, and since loss of liberty represents an important component of incarcerative punishment, the retributive function is in play during both phases. If the first phase is thought to fulfill the offender's debt to society, then imposition of the second may be constitutionally impermissible. Of course, this latter objection may apply to any sentencing scheme that incorporates goals other than retribution, a term (like 'debt to society') of art.

Roper (1986) proposes a different solution to the decentralization-coordination problem. He conceptualizes prison output as the delivery of a crime-free offender over the period of the court-rendered sentence. Taking this period as a constraint, Roper's prison decides whether to keep the offender in custody over the entire sentence or to release him early. As Roper

puts it, 'the essence of the [prison's] role [is] to assess the risks uniquely associated with the probability of a given offender reoffending' (ibid., p. 91). The author goes on to suggest that the prison enter into contracts with prospective parolees; the prisoner agrees to desist from criminal activities for the duration of the sentence, while the authorities provide financial support, rehabilitation services, employment assistance, and so on, and release the inmate on parole. If the released offender violates a contract term, then he or she is liable not only for the new criminal charge, if any, but also for a civil contracts suit. The argument is presented in terms of a private (for-profit) prison, but a state operated prison could function in the same manner.

While Roper's proposal represents an interesting attempt to correct the principal-agent problem between the state and the offender, as well as the decentralization problem, substantial difficulties remain. First, since most prisoners are judgement proof, the contract remedy must stipulate a return to prison. This penalty would be independent of any sentence levied for the crime causing the contract violation. But it is unlikely that the courts would permit such a remedy. As an alternative, the contract could promise a financial reward subject to forfeit. This avoids the dubious remedy of confinement, but may serve to entice prospective offenders into committing crime in the first place. Second, independent of remedy, the courts may not recognize the validity of such contracts; what economists define as a *voluntary* transaction may not fall within the range recognized by the courts, given that the offender is bargaining for his freedom and *ipso facto* is under duress.

Nardulli (1984) and Giertz and Nardulli (1985) take up the decentralization issue from the perspective of the fiscal federalism literature (also see Benson and Wollan (1989) and Benson (1990, 1994a), where the common pool/property rights nature of the decentralization problem is identified). These authors view judges as rendering inefficiently severe sentences as the result of a free-rider problem emanating from a misalignment of incentives and cost-bearing. Citizens of the local government derive benefits (protection and retribution) from longer sentences, which happen to be specified by local authorities. However, the costs of providing prison services may be partly shifted from one sentencing jurisdiction onto another via prison financing by a senior level of government. Thus the local demand for confinement is not fully constrained by the cost of delivery. The tendency to prison overcrowding in the federal part of the system, and underbuilding in the local part, follows directly.

The short-run solution proposed by Giertz and Nardulli (1985) is to allocate total available prison space to individual sentencing jurisdictions, while continuing with the current division of cost and sentencing responsibilities. This would to an extent defuse free-riding behavior, but one could imagine disagreeable (and constitutionally questionable) inequities in sentencing arising from the constraint. For example, suppose only shoplifters are predicted to

appear before a court during some period, so that relatively harsh sentences are compatible with the given space allocation. Then if an armed robber unexpectedly appears in court, he will either receive a comparatively light sentence or else one of the previously convicted shoplifters must be released earlier than expected. Unless judges accurately forecast the distribution of upcoming cases, a shortage or surplus of prison space would develop, leading to disparities in sentences actually served for offenders committing the same crime. This argument could apply to a senior administrative jurisdiction as well, but the greater number of cases reduces the risk of prediction errors. The *long-run* solution offered by Giertz and Nardulli is to hold local jurisdictions responsible for their full share of the cost of incarceration. An alternative is for the senior fiscal authority to impose a mandatory grid sentencing scheme upon all courts within its jurisdiction, thus to some extent negating the free-rider problem.

Gillespie (1983) proposes a market for prison space administered by a centralized correctional authority. This market would facilitate the efficient transfer of prison space from local jurisdictions with excess supply to those with excess demand. Jurisdictions comprised of citizens with relatively heavy demand for long-term sentences backed by a willingness to pay would purchase access to penal space from other jurisdictions. Not only would the pricing mechanism overcome the short-run deficits or surpluses but the market-determined price would signal the social value of new prison space, and hence rationalize the construction of new correctional facilities. Gillespie argues that equity concerns can be addressed by altering the initial allocation according to whatever equity criterion is adopted. With appropriately identified prices and initial allocations, this system appears similar to one giving local authorities a portion of the state budget to be spent by them as they desire: on penal space at the state institution, on space at the local level, or on some other public expenditure (Nardulli, 1984).

Would the Gillespie proposal lead to the same results as a centralized sentencing and prison-supply agency? Probably not, simply because income distribution across the local political units would affect the demands for prison space. For given sentences, the various market-oriented systems should cost less than the standard first-come, first-served, free-rider system. But regardless of the efficiency implications, introducing a market for prison space would predictably exacerbate inequities in sentencing across jurisdictions. Other things equal, low-income sub-units would presumably impose relatively short sentences and sell their space allocations to high-income sub-units, which would impose relatively severe sentences. A general equilibrium formulation of Gillespie's model would also have to consider the possibility that offenders might change their geographical areas of operation in response to differential expected punishments.

5. Privatization

A more fundamental argument for the inefficiency of publicly-operated prisons stems directly from the theory of bureaucracy/public choice literature. Profit-maximization, and its concomitant for non-market production, cost minimization, may not be adopted as the operational goal of the public entity. Some models of bureaucratic behavior assume or imply cost efficiency, whereas other do not. Niskanen (1971) argues that bureaus seek to maximize bureau size, and hence overproduce; but whatever output they provide will be at least cost if the bureau is budget-constrained. Other models (for example, Williamson, 1964) posit that bureau heads will optimize with respect to private objectives, and therefore cost minimization cannot be expected. The debate over private prisons typically draws on the latter genre of models, deemphasizing decentralization and informational difficulties. Privatization and the profit motive, it is argued, removes the wedge between output and returns for public employees, thus reducing agency costs.

The standard private prison contract bases remuneration for the corporate prison upon the number of person-days of confinement supplied, subject to the provision of some standard level of amenities. Thus the corporate prison has no incentive to provide rehabilitation opportunities, except insofar as the latter act to decrease the current cost of confinement (Schmidt and Witte, 1984, pp. 345-346). If rehabilitation activities affect post-release criminality, then regardless of market structure the standard per-diem contract is inferior to one that pays the private prison in accordance with the recidivism success of its releasees (Avio, 1993a). Appropriately designed remuneration schemes harness the power of the market to stimulate the discovery of imprisonment methods that minimize long-run social costs.

The argument has been extended to incorporate the possibility that the corporate prison operating under the traditional remuneration scheme might perversely seek to stimulate recidivism (Gentry, 1986; Avio, 1991). Under the standard contract provisions, the value of the prison corporation depends to an extent upon the continued influx of inmates, which could be enhanced by (clandestinely) providing negative training. A flow of new offenders sufficient to keep individual prisons operating at the minimum of their average cost curves, while simultaneously requiring the construction of new facilities, would maximize profit opportunities. This argument is conditional upon the exercise of market power. Established prison firms would seem to be in an advantageous position to capture managerial and construction contracts for new prisons. Of course, the incentive structure embedded in the public prison system may be equally inimical to social welfare.

Whether the weak or the strong form of the argument against per-diem contracts is applied, the debate over private prisons exhibits a kind of

symmetry: private prisons are socially superior to public prisons because the former seek efficiencies in the drive to maximize profits; public prisons are superior to private prisons because they are *not* driven by the profit motive. Some privatization advocates recognize the difficulty with the standard prison contract, but attempts to explain away this quasi-paradox are unsatisfactory and reveal the inconsistency: Logan (1987, p. 39) argues that rather than maximizing profits, private prisons really seek to maximize convenience subject to some minimal profit constraint; Brakel (1988, p. 34, n.92) argues that line employees of the private prison, whose actions have the greatest potential to affect post-release behavior, are too distant from profit centers to act in accordance with the profit motive. But in the same breath, adherence to the profit motive with the attendant efficiencies is given as the overarching rationale for prison privatization.

The increasing popularity of private prisons in policy circles is attributable to more than the general privatization fashion alone. The modern conceptualization of prisons as a benign warehouse has replaced the 'corrections' model in professional circles. This follows the retrenchment on treatment oriented programs in the 1980s. The prison-as-warehouse conceptualization is consistent with both the static neoclassical and the Kantian-inspired retributive models discussed earlier. In the former, prisons are simply the institutions society employs to effect the restriction of liberty necessary to attain the efficient amount of crime through deterrence and incapacitation. In Kantian retributive models, justice requires punishment in a rights-respecting environment; the moral autonomy of the individual demands that no attempt be made to 'force' rehabilitation. The underlying function of prisons remains the same, a function that could equally well be provided by an institution operating under market incentives.

Non-economic arguments may ultimately decide the scope that private prisons are allowed to play. A feeling of unease accompanies the thought of government delegating to private individuals the authority to punish (Dilulio, 1988, 1990). Regulations such as those included in the American Bar Association's Model Code and Model Statute for Private Incarceration may be necessary to protect the civil liberties of offenders (Robbins, 1989). Benson (1990, 1994b) extends the argument. The potential for success with prison privatization in terms of technological efficiency is so great, that once bureaucratic resistance and other obstacles to private prisons are overcome, society may increasingly come to rely on incarceration as a means of social control. For example, special interest groups may press for the expanded imprisonnment of illegal aliens to control labor supply (Benson, 1994b, pp. 66-72). Prison privatization then poses a threat to both overall allocative efficiency and to individual liberty.

To date, the empirical evidence comparing private and public management of adult secure facilities has been scant and somewhat unsatisfactory. The

number of surveys of these studies (McDonald, 1990; Thomas and Logan, 1993; Sellers, 1993, Ch. 4; Sichor, 1995, Ch. 9; USGAO, 1991, 1996) nearly equals the number of studies, simultaneously reflecting the youthfulness of the private prison industry (the first modern adult secure facility went under private management in 1983), the difficulty of the research, and interest in the topic. The studies typically consist of cost and quality comparisons of matched institutions (see, for example, Edwards, 1996). Thomas (1996) notes that comparisons of similarly designed facilities will not necessarily account for the cost-saving innovations that private prisons should bring, as design is itself a major source of efficiencies. Also, recidivism rates of the various institutions are typically ignored (see Hatry, 1989, for an exception). Econometric work on private prisons has yet to be undertaken. Given the growth of the industry (from fewer than 3,000 [rated capacity] beds under contract in 1983 to over 84,000 in the US, UK and Australia at the end of 1996), the time is ripe for sophisticated quantitative research.

6. Linear Programming Models

The empirical test of propositions relating to correctional institutions requires *a priori* modelling. Although unmodified linear programming imposes severe technology constraints, interesting questions can be addressed using this technique. In the tradition of a systems analysis of prisons (Blumstein and Larson, 1969), Tabasz (1975) constructs a linear programming model of the US Federal Bureau of Prisons. The goal is to allocate different types of offenders to different types of institutions and to different sentence lengths in a manner that maximizes net social benefits subject to the capacity of the prison system and the flow of convicted offenders. In all, 2,700 decision variables are specified. Only benefits to incapacitation and rehabilitation are imputed, and the capital costs of prisons are ignored. The results indicate that prison resources should be concentrated on relatively young and dangerous offenders: inmates over 45 years of age are assigned to 'probation' (immediate release). The model cannot directly indicate how many resources should be allocated to the prison system, but it does give an approximation to the benefit-cost ratio potentially generated by prisons (8.51 in the 'standard' version of the model applying 1973 data (ibid., p. 129)). This estimate, which at face value rationalizes the build-up in prison capacity that began in the US in the 1970s (Blumstein, 1995), should not be taken too seriously. The relatively primitive nature of the data available to Tabasz required strong assumptions, particularly those related to the rates of crime commission, the social costs of crime, and the rehabilitative effects of incarceration. The methodology also imposes an interpretive constraint: the results do not necessarily reflect actual net benefits

attained, but the *potential* benefits if decision variables are chosen optimally. Nonetheless, this study anticipates later attempts to evaluate the prison system as a whole (see Section 12 below).

Linear programming may also be used to identify the relative efficiency levels of individual prisons. The operations research tool known as Data Envelopment Analysis, a non-stochastic frontier methodology, is applied by Ganley and Cubbin (1992, Ch. 5) for this purpose. The underlying linear program is constructed to embody a varying returns to scale technology. Analysis of 33 UK local prisons and remand centers for the financial year 1984-85 suggests that 13 of the establishments were 'technically inefficient relative to the peer prisons on the cost frontier' (ibid., p. 66). On average the operating costs of the inefficient institutions could be reduced by about 12 percent. Prison cost studies comparing this method with the econometric methods discussed below would be helpful.

7. Econometric Models of Prisons

A major policy issue illuminated by economic theory concerns the appropriate size of prisons. For example, in Canada in the 1960s new prisons were built to accommodate about 450 inmates. In the next decade several government reports advocated even smaller institutions. Since little was known about the cost-effectiveness of prisons, this debate occurred in what was largely an empirical vacuum. Conceptualizing the prison as an economic entity leads to traditional cost and production analysis with the potential to systematically address questions such as returns to scale in the provision of prison services.

Block and Ulen (1979) estimate long- and short-run prison cost functions for the state of California using elementary functional forms. The short-run results (using time-series data for each of two maximum security institutions) suggest that average costs are minimized at surprisingly large inmate populations (for example, 5,700 for San Quentin, as estimated over the years 1948-1964 (Block and Ulen, 1979, p. 200)). A 1971-1972 cross-section of jails yields a long-run cost curve indicating approximately constant returns to scale. Both the short- and long-run analyses abstract from the rehabilitative dimension of prison output; expenditures specifically earmarked for rehabilitation are eliminated from the cost data.

Schmidt and Witte (1984) (also see McGuire and Witte, 1978; Trumball and Witte, 1981-82a,1981-82b; Kritzer, 1981-82) present a comprehensive econometric analysis of US federal and California prison systems from the mid- to late-1970s. Short- and long-run average cost functions are derived. The short-run results for each of 22 federal and 8 California prisons are derived from estimated labor demand equations corresponding to homothetic

generalized Cobb-Douglas production functions. Several of the cost functions are found to be inconsistent with economic theory. The authors ascribe this result to altered operating methods within given institutions over the sample period. For those institutions conforming to economic theory, the majority are found to have short-run average costs which decrease as inmate populations increase. This finding is particularly robust for older, fortress-type institutions. While economies of scale are indicated, it would be imprudent to draw policy implications concerning the crowded conditions in many institutions today as crowding was not a widespread phenomenon during the sample period. The impact of rehabilitation activities on costs is diverse, and 'may depend critically on the nature of the particular institution being studied' (Schmidt and Witte, 1984, p. 335). The authors summarize their results for the entire sample of federal and California institutions: 'costs generally increase until a certain level of rehabilitative activities is provided and then decline thereafter' (ibid., p. 345). Anecdotal evidence suggests that prison work experience uniquely reduces the level of violence within prisons, probably by fostering a prisoner sub-culture that rewards co-operative behavior (Fleisher, 1989, pp. 26-27; 1995, pp. 262-270). Unfortunately Schmidt and Witte lump prison work experience with educational programs and counselling services in constructing the rehabilitation activities variable (Schmidt and Witte, 1984, p. 305).

A long-run cost function is estimated using pooled quarterly data over the mid-1970s for a subset of six federal institutions found to possess similar technologies. Estimated average costs are asymmetrically U-shaped, with a higher penalty on institutions housing fewer than the efficient capacity of 1075 inmates. In this subset of prisons, rehabilitation activities are found to have no statistically significant impact on long-run average costs. This result is puzzling, especially since all but one of these institutions have short-run cost functions sensitive to this variable. Several service quality variables are found to be significant. The authors conclude that 'the minimum-cost-sized prison will probably house between 700 and 1500 inmates' (Schmidt and Witte, 1984, p. 363) and that 'providing single cells for inmates and rather substantial amounts of living space may actually decrease the cost of operating prisons' (ibid., p. 362).

Taken as a whole, these studies are indicative of the important role that econometric analysis can play in analyzing policy questions related to the management of prisons. Several extensions come easily to mind. Comparison of the costs and technologies of private and public prisons would be helpful in the ongoing privatization debate. Econometric studies of the cost-effectiveness of prison industries should be undertaken. Linking rehabilitation *outcomes* with current costs would enhance the value of the studies. The data requirements for this latter task would be substantial but not impossible, as the next two sections suggest.

8. Statistical Models of Recidivism

Serving time in prison, as well as participating in various prison and post-release programs, may have either a positive or negative effect upon the activities of released prison inmates. Nailing down the specifics of the relationships is clearly an important factor in evaluating overall social policies towards crime as well as in evaluating specific programs for incarcerated and paroled offenders. If, for example, predictions of future behavior of individual convicted offenders prove to be sufficiently reliable, then a program of 'selective incapacitation' becomes feasible, if not ethically acceptable (Greenwood and Turner, 1987). The extensive literature addressing criminal recidivism has for the most part been the preserve of criminologists, sociologists and psychologists. Here the contributions of economists Peter Schmidt and Anne Witte are noted (also see Myers, 1980a, 1983).

In a series of articles (Witte and Schmidt, 1977, 1979; Sickles, Schmidt and Witte, 1979; Schmidt and Witte, 1980, 1989) and books (Schmidt and Witte 1984, 1988), Schmidt and Witte and their associates exhaustively analyze follow-up microdata on releasees from North Carolina prisons. Since the theoretically relevant dependent variables - time devoted to criminal activity and the intensity thereof - cannot be observed, a number of proxy recidivism variables are employed. These include the traditional binary 'success-failure' measure, categories of crimes leading to reconviction, seriousness of crimes leading to reconviction, total length of prison sentences received during the follow-up period, length of time from release to first arrest leading to conviction, and length of time from release to first return to prison. Different statistical models (qualitative variable models, survival time models) are used as appropriate for the different dependent variables studied.

The polytymous logit model is used to analyze a random sample of 641 inmates in North Carolina prisons in 1969 and 1971, with follow-up periods averaging 37 months (Schmidt and Witte, 1984, Ch. 3). The seriousness of criminal activity, as measured by whether the most serious reconviction (if any) was a misdemeanour or a felony, and the type of criminal activity (crime against the person, against property, or 'other', including drug crime) are analyzed with respect to various personal characteristics and histories of individual inmates (excluding, for some unstated reason, time served for the sample sentence). The likelihood of reconviction is found to vary significantly with the number of previous convictions, age at release (older offenders have lower probabilities of reconviction), length of the follow-up period, and alcohol or hard drug use (ibid., p. 45). Surprisingly, none of these same variables are significant predictors of the type and the seriousness of offenses for which reconvictions are obtained. On the other hand, the type and the seriousness of previous offenses are found to be related to the type and seriousness respectively

of subsequent convictions, but not the overall probability of reconviction. Consistent with the criminal career syndrome, some evidence of offenders switching from property crime to personal crime is found.

A more refined indicator of the seriousness of new offenses, the total length of time sentenced for recidivist offenses, is analyzed by the same authors (Schmidt and Witte, 1984, Ch. 5) using two samples: that used in the previously reported research, and a cohort group consisting of all individuals released in North Carolina during the first six months of 1975 (25-31 month follow-up). The censored nature of the dependent variable suggests a Tobit analysis. In both samples, the dependent variable is found to vary in the predicted direction with the youthfulness of the offender, a history of alcohol abuse, the number of previous convictions, unsupervised release, and a sample incarceration for a crime against property (Schmidt and Witte, 1984, p. 73). The estimation sample is used to predict the dependent variable for a validation sample. Separating the samples into various race, gender and age groupings substantially improves the prediction reliability for most subgroups, as there appears to be considerable variability in the significance of different explanatory variables across the subgroups. The predicted total time sentenced for the entire validation sample using the best model for each subgroup is insignificantly different from the actual value of total time sentenced, suggesting an important tool for correctional planning. The overall results show the superiority of the more sophisticated models as compared with binary 'success-failure' models.

The second set of models employed by Schmidt and Witte treat survival time - the length of time from release to recidivism. Not only is this variable of interest in itself, but ignoring information on length of time to recidivism (however defined) is statistically inefficient. The authors' extensive analyses (the present discussion is limited to Schmidt and Witte, 1988) utilize various formulations found in the increasingly sophisticated criminogenic literature. Carr-Hill and Carr-Hill (1972) apparently were the first authors to apply survival models in this context, as well as innovations of their own. The data consist of two cohorts of approximately 9,500 individuals each released from all state prisons in North Carolina in separate 12 month periods, with follow-ups ranging from 46 to 81 months. Data limitations, as well as the needs of the correctional authorities supplying the data, dictated the dependent variable: the length of time from release to return to prison. (The length of time from release to first rearrest leading to conviction is analyzed in Schmidt and Witte, 1984, Ch. 7.) Estimation using distributions with monotonic hazard rates proved inadequate. This is unsurprising since recidivism hazard rates first rise and then rather quickly fall. The best overall results apply individual characteristics as explanatory variables to 'split population' models, thereby permitting the probability of recidivism to follow a generating process distinct from that for recidivist survival times. The best fit is found for 'a logit lognormal model, in which the probability of eventual recidivism follows a logit

model and the timing of return follows a lognormal distribution' (Schmidt and Witte, 1988, p. 19). Those models which utilize individual characteristics as explanatory variables for each of the two recidivism outcomes yield the following results: race and gender affect the probability of eventual recidivism but not its timing, whereas indicators of the nature of the previous offense affect the timing of recidivism but not its probability (ibid., p. vii); age on release, the number of prior convictions and a history of alcohol abuse affect in the predicted direction both the probability of eventual recidivism and the mean time until recidivism; finally, the length of the sample incarceration increases the probability of a return to crime and shortens survival time. These latter results appear consistent with the school for crime theory (see Myers, 1980a, for a qualitatively similar conclusion with a sample of parolee data) but selectivity bias renders this interpretation somewhat problematic.

The authors recommend the use of non-parametric methods (Cox's proportional hazards model) to first identify the appropriate explanatory variables, and then the use of parametric models to yield the best predictions. The predictions are generally superior to those elsewhere in the literature (Schmidt and Witte, 1988, p. 15), although the use of explanatory variables does not improve predictions for random samples of releasees. Moreover, the authors emphasize that their best models (predicting false positive rates of 47 percent and false negatives of 28 percent) are unsatisfactory for implementing a policy of selective incapacitation. One can conclude that there is value in using sophisticated models in predicting recidivism for random samples of released offenders, but that the models are not yet sufficiently refined for application to individuals.

Schmidt and Witte note that further experimentation with non-linear formulations of the explanatory variables will probably lead to explaining a higher degree of the variation in the dependent variables (about 10 percent in the current study), and thus boost prediction accuracy (Schmidt and Witte, 1988, p.150). Another suggestion is to take more seriously the economic model of crime by including explanatory variables measuring the certainty and severity of punishment as well as environmental variables representing legitimate and illegitimate opportunities. Suppose, for example, that during the follow-up period there is variation across the relevant geographic jurisdictions and/or over time in police activity. Further, suppose that this leads to variation in the objective probability of arrest. The economic model suggests that the pattern of criminal behavior of released inmates as well as that of individuals with no previous criminal record would be affected. Prediction accuracy could be impaired (and the model mispecified) if the standard criminal justice control variables are excluded. Data limitations may intrude (ibid., p. 85). But even if the local communities in which released offenders reside are unobserved, risk and punishment variables can probably be constructed on an aggregated

geographical basis for each period during the follow-up. Examples of survival-time recidivism research employing environmental variables are Visher, Lattimore and Linster (1991) studying paroled California youths, and Kim et al., (1993) examining Florida drug offenders. On a more micro level, Schmidt and Witte (1988, pp. 9-11) note that the complexion of their research results could be attributable in part to police and prosecutors targeting offenders with certain personal characteristics, as well as to the characteristics themselves affecting criminal activity. Sorting out the simultaneity problems remains an important part of the research agenda in the economics of prisons.

9. The Evaluation of In-Prison Rehabilitation Programs

Psychologists, criminologists, sociologists and public policy commentators have contributed to the extensive literature on the rehabilitation of convicted offenders. This topic shades into a discussion of the overall causes of crime. No attempt will be made here to address the larger question, nor should the discussion be considered a survey of anything but a select subsample of the rehabilitation literature. The limited number of contributions by economists on the direct evaluation of rehabilitation programs is taken up in this section and the next.

On the important question of research design, laboratory-like experiments comparing outcomes for randomly selected program and control groups are generally not possible in the criminal justice context (some exceptions are discussed below). Researchers typically are forced to resort to quasi-experimental designs, which designate 'a group of individuals (the comparison group) that is as much like the group of program participants studied as possible' (Grizzle and Witte, 1980, p. 259). The difficulty is that subjects in the two groups may differ in some characteristic that affects post-release activities. This dictates that the researcher must have in mind an underlying model of criminal and recidivistic behavior. In this section a quasi-experimental program evaluation is contrasted with one employing a 'predicted-versus-actual' method.

Witte (1977) employs a quasi-experimental design to evaluate a program in which a non-random sample of inmates in North Carolina prisons work on day-passes with various local industries. The sample consists of men on the 'work release' program in 1969 or 1971. The experiences of the evaluation group are compared with those of a nonparticipating group who appear to be equally eligible for the program. Multiple regression techniques are used to correct for differences in personal characteristics across the two samples. The author finds no programmatic impact on the decision to return to crime, but a marked beneficial effect on the seriousness of crimes committed during the follow-up period. This latter result is confirmed by the logit and tobit analyses

of Schmidt and Witte (1984, pp. 34-35, 68) utilizing work release as a binary explanatory variable. The results here further indicate that participation in work release is significantly related to neither the type of post-release criminal activity (crime against the person or against property), nor to survival time.

Schmidt and Witte (1979, 1980, 1984, Ch. 8) use a statistical model estimated from a data set consisting of information on all 4,881 inmates released from North Carolina prisons during the first six months of 1975 to evaluate a comprehensive release program for youthful offenders in North Carolina (the Sandhills Vocational Evaluation and Job/Educational Development program). The estimated model is employed to predict criminality indicators for each of the Sandhills participants (489 participants released over the period February 21, 1975 through February 21, 1977); program evaluation proceeds from a comparison of the predicted effects with the actual criminality indicators for participants. The advantage of this 'predicted versus actual' method is that no matched comparison group is needed. But as the authors stress, the reliability of the evaluation depends crucially on the accuracy of the model and on the implicit assumption that the relevant prison unit does not differ significantly 'from the system norm in a way not controlled for by our models' (Schmidt and Witte, 1984, p. 135). Some weak statistical evidence is found suggesting that the Sandhills program reduces the amount of recidivism during the first six months of the follow-up period. (Using a smaller sample from a different estimation, the authors also find that the program reduces the total time sentenced during the follow-up period, that is, the seriousness of follow-up criminal activity (ibid., pp. 130-133.) This study conveys what can be accomplished by way of program evaluation with suitably specified statistical models. In their later study (Schmidt and Witte, 1988, Ch. 8), however, the view is less optimistic. Here an estimated model is again used to predict survival times for nonrepresentative subsamples, including participants in the previously discussed work-release program. The results significantly underpredict recidivism for this group (ibid., p. 138). The authors attribute this not to program effects, but rather to 'work release participants hav[ing] different characteristics than nonparticipants ... our model does not adequately capture the effects of these characteristics on time until recidivism' (ibid., p. 138).

As Schmidt and Witte note, perhaps the safest and most efficient use of the predicted versus actual models is in conjunction with experiments: such models can be used to justify the initiation of costly experimental studies, as well as to indicate the factors that must be controlled. In the event that true- or quasi-experiments are impractical, the predicted versus actual approach provides a relatively low-cost but not altogether reliable alternative. Research refining and systematizing this method is called for.

Turning from methodological to substantive issues, what kinds of in-prison rehabilitative programs work, if any? The 'Nothing Works' doctrine initiated

in Martinson's well-known paper (Martinson, 1974, previewing Lipton, Martinson and Wilks, 1975) ushered in an era of pessimism in penology. After reviewing the results of 231 papers (the majority dealing with programs of a therapeutic nature) published between 1945 and 1967, Martinson concluded that there was little evidence that rehabilitation programs work. This sweeping generalization was echoed by the Panel of Research on Rehabilitative Techniques of the National Research Council (US), which restated Martinson's conclusion: 'it appears that nothing works or at least that there have not been any consistent and persuasive demonstrations of anything that works' (Sechrest, White and Brown, 1979, p. 27). This conclusion has not gone unchallenged (for example, Halleck and Witte, 1977; Gendreau and Ross, 1987; Mair, 1991), but 'Nothing Works' remains a part of penological lore.

One response follows the lead of the second report of the Panel of Research on Rehabilitative Techniques (Martin, Sechrest and Redner, 1981) in questioning whether the strength and degree of implementation of in-prison programs are sufficient for definitive tests. Lattimore and Witte (1985), responding to Englander (1983) (also see Englander, 1985), note that many vocational programs are poorly designed, rather weak in intervention (for example, a training program of short duration), and poorly and incompletely implemented (for example, inmates dropping in and out of programs). Lattimore, Witte and Baker (1990) attempt to evaluate a vocational rehabilitation program for young property offenders in which care is taken to address these difficulties. The program consists of six integrated in-prison sub-programs (ibid., p. 120, Table 1) any or all of which may have been completed by members of the sample. The sample consists of 591 selected North Carolina male inmates aged 18-22 enrolled in the umbrella project sometime between June 1983 and May 1986. The subjects were randomly partitioned by prison officials into an experimental group and a control group. The two groups differed in their exposure to the various parts of the umbrella project and in their completion records for the various component parts of the project. Only 16 percent of the experimental group began all of the program components, that is, the umbrella program was only weakly implemented. Nevertheless, some programmatic effects were still evident: an examination of survival times indicates that the program reduced post-release arrests by about 10 percentage points for releasees who had been out over about 600 days (ibid., p. 128, Fig. 2). Moreover, the survival history of those who completed a vocational program was significantly better than for those who did not, a result the authors could not account for in terms of their sociodemographic and criminality measures. Unfortunately, doubts were recently cast on these results by one of the co-authors of the original paper: 'unpublished longer-term follow-up results show no significant differences in criminal activities between the experimental and the control groups' (Witte, 1997, p. 226).

10. Manpower Programs for Former Prison Inmates

Perhaps partly in response to the 'Nothing Works' dialogue, the attention of economists has largely shifted from in-prison rehabilitation programs to assistance programs for released prisoners. Cook (1975) (also see Hardin, 1975; Marks and Vining, 1986), after reviewing various labor market studies of parolees, as well as his own study utilizing a data set (collected and analyzed by Evans, 1968) consisting of 327 male parolees from Massachusetts penitentiaries in 1959, notes that (1) 'discrimination is not an important factor in the work experience of parolees' (Cook, 1975, p. 18); (2) the quality of jobs, and not the quantity, is crucial in determining the employment record of released offenders; (3) success in the job market for released offenders leads to lower recidivism rates; and (4) in-prison therapeutic, educational and job-skills programs have little effect upon post-release success. Even though remedial education and vocational training programs 'have demonstrated success in providing prisoners and parolees with measurably increased academic and vocational skill' (ibid., pp. 47-48), they have typically not been successful in reducing recidivism rates. (Witte and Reid, 1980, obtain similarly pessimistic results in examining the labor market performance of a group of ex-inmates not limited to parolees.) The survey by Long and Witte (1981, p. 128) is unequivocal: 'Evaluations of vocational training and remedial education programs in prison, parole, or probation settings have almost uniformly found that such programs have insignificant effects on both labor market performance and criminality.' The hypothesis is that the programs have not improved the job-opportunities of offenders, even though they have improved their skill levels. Released offenders either are unable to find the better jobs or, if found, they cannot keep them because of inadequate preparation for the demands of such work. Cook (echoed by Witte and Reid, 1980) concludes that the evidence suggests job search and on-the-job training programs should be given priority. Whether the prospect of improved legitimate job opportunities would act to reduce the initial deterrent effectiveness of punishment remains a concern. Cook notes that increasing the probability of punishment may be an appropriate offset. Such a substitution would not be costless, however, and again points to an analysis stressing the dynamic and general equilibrium modelling of crime.

Borus, Hardin and Terry (1976) (also see Hardin, 1975) utilize a quasi-experimental design to evaluate a Michigan job-placement program for selected parolees. The authors find that program participants did not fair better in terms of various indicators of job-market success, and in fact 'fared worse, on the average ... as to hours employed, gross earnings, and take-home pay' (Borus, Hardin and Terry, 1976, p. 394). Apparently no attempt was made to directly compare the recidivism experience of program participants with

non-participants. This aspect was addressed in the following study, yielding a similarly pessimistic conclusion.

Mallar and Thornton (1978) report on a program (LIFE - 'Living Insurance for Ex-Offenders') seeking to establish whether transitional aid programs and/or job-placement assistance for ex-prisoners reduce recidivism for theft crimes (also see Myers, 1983). A non-random sample of 432 high-risk prisoners from Maryland's state prisons released into the Baltimore area in the early 1970s was randomly partitioned into four treatment groups: one receiving direct financial aid ($60/week for three months); one receiving job-placement assistance (for up to one year); one receiving both; and a control group receiving no assistance of either type. The authors conclude: 'The provision of financial aid led to a large and statistically significant reduction in theft rearrests, while the provision of job-placement services proved to be singularly ineffective in reducing recidivism' (Mallar and Thornton, 1978, p. 224). Subjects in the financial aid group were less likely to be employed full time, especially during the first quarter after release, and more likely to be enrolled in school or a training program. The authors speculate that this apparent investment in human capital may widen the differential in recidivism response over time. It also appears that the transitional aid group achieved higher paying jobs, leading the authors to suggest that transitional aid permitted subjects to invest more in job search. Finally, the authors demonstrate the benefit/cost viability of the direct aid program.

Broadly similar results with respect to the job-placement component were obtained in an expanded version of the LIFE program (named TARP, 'Transitional Aid Research Project'; see Rossi, Berk and Lenihan, 1980). This program applied a controlled experimental design to all released inmates (not just parolees) from Georgia and Texas state prisons. The transitional aid component also appeared to be unsuccessful, but the authors attribute this to work disincentive effects not in place for the LIFE program (for additional comment see Long and Witte, 1981, pp. 129-130, and Englander, 1983, pp. 28-29). Again, these studies do not address the question whether the prospect of transitional financial aid would eventually reduce the initial deterrent effectiveness of punishment.

The National Supported Work Program (Hollister, Kemper and Maynard, 1984; Couch, 1992) placed subjects in a variety of supportive and subsidized work environments commensurate with their backgrounds. The emphasis was on developing work habits in accordance with a graduated stress concept of job-market preparation. As one author describes it: 'Stress within the working environment increased gradually during the training period until it simulated the workplace norms of the private sector. At that point, not more than 18 months after entry, individuals who received the services ... had to attempt a transition to unsubsidized employment' (Couch, 1992, p. 381). Over the period from March 1975 to July 1977, 2,276 ex-offenders, one of four subject groups,

were randomly assigned to either an experimental group or a control group, with regular nine-month follow-ups extending to three years. All subjects had been incarcerated sometime during the six months preceeding enrollment in the program, and the average length of time served was four years. Less than 10 percent of this group exhausted the allowable time in the program. The results indicate no reduction in recidivism among the ex-offender experimental group as a whole, and no measurable labor market effects (Piliavin and Gartner, 1984). An eight year follow-up (Couch, 1992) indicates no improvement in labor market success for disadvantaged youths (the ex-offender group did not receive the long-term follow-up). Other large-scale studies (for example, the Mathematica Policy Research, Inc. study of the Job Corps (Mallar et al., 1982) and the Abt Associates review of the Job Training Partnership Act (JTPA) programs (Orr et al., 1996)) do not identify an ex-inmate subgroup for analysis.

As the concluding sections of this chapter attest, the rich research possibilities inherent in large longitudinal data sets are ushering in a new era of empirical research on criminal behavior (see, for example, Tauchen, Witte and Griesinger, 1994) and recidivism. At the same time, the research design of experimental studies will continue to improve (Witte, 1993). Weitekamp and Kerner (1994) sensibly call for an integration of longitudinal and experimental studies. This method would seem to have considerable potential for evaluating specific programs for inmates and ex-inmates. Pending the outcome of these hybrid studies, the conflicting results found in even the limited subsample of the literature discussed above suggests that a magic one-size-fits-all rehabilitation bullet does not exist. Offenders differ in their motivations as well as in their abilities, proclivities and backgrounds. Moreover, 'success' itself will only be found by choosing carefully from amongst different outcome measures, and then measured only in small magnitudes. Finally, it bears noting that even if 'Something Works', the corresponding implementation may be globally suboptimal either because of high direct program costs, or because of the implicit added incentive for individuals to enter the criminal market.

11. Criminal and Legitimate Labor Markets for Former Prison Inmates

Results obtained from specific in-prison rehabilitation programs and manpower programs for released offenders have been weak and inconsistent. This, coupled with the substantial increase in the proportion of the US population incarcerated over the last two decades makes the wide-scale implementation of costly rehabilitation programs unlikely. Consequently, recent economic research focuses on the general effects of incarceration, independent of prison programs, on subsequent criminal and legitimate labor market activities of

released offenders. Various kinds of empirical information and estimation strategies are employed.

Grogger (1991) uses panel data on California arrestees to attempt to determine the effect of imprisonment on future criminality as well as to estimate the incapacitative effect of prison. Since estimates of the proportion of all young California males arrested at some point reach as high as one-third, the sample of arrestees offers a more representative picture than data on prison releasees alone (see Witte, 1980 and Myers, 1983). Grogger's empirical results suggest that imprisonment has a criminogenic effect ('each additional month spent in prison increases average arrests by about 2 percent' (Grogger, 1991, p. 304)) which may be attributed to either negative training or negative labor market signalling. Moreover, under the assumption that sanction expectations are formed entirely from one's own historical involvement with the justice system (that is, 'specific' as opposed to 'general' deterrence), 'the criminogenic effect of imprisonment is nearly three times as great as the deterrent effect' (ibid.). Prison is also found to have an incapacitative effect - each month reduces the average individual's criminal activity roughly in proportion to the time spent in prison. As Grogger notes (ibid., p. 299), the interpretation of the results depends crucially upon whether arrests are an appropriate measure of criminal activity. In addition, unobserved fixed characteristics could also bias the results. For example, a penchant for violence could be correlated with both longer sentences for any given crime category as well as with greater post-incarceration criminality. The following studies address this type of complication.

Freeman (1992) employs the National Longitudinal Survey of Youth and other surveys to estimate the long-run impact of incarceration on future legitimate employment of young US males. After standardizing for observed personal characteristics of individuals in the sample, he finds that incarceration in 1980 had a substantial negative impact on whether one was employed in any given subsequent year (to 1988) and on the total number of subsequent weeks worked. 'For the entire eight-year period, incarceration in 1980 reduced subsequent work weeks by 27 percent for blacks and 22 percent for all youth' (ibid., p. 217). Only one-third of the negative employment effect is attributed to the exclusionary impact of current incarceration on currrent employment. Freeman tests whether his results might be due to some unobserved characteristic correlated with both criminality and labor market fitness (such as functional illiteracy) by utilizing data on the pre- and post-incarceration employment experience of individuals. Adapting an omitted variables regression model, Freeman finds that incarceration continues to have a substantial impact on subsequent employment, although the impact is reduced by up to one-half (ibid., p. 225). Freeman cautions that these results do not imply that a random person assigned a criminal record would necessarily have the predicted subsequent employment experience. Rather, the statistics indicate

what happened to those who *chose* crime. In other words, the data remain consistent with rational decision making by far-sighted individuals facing the risk of incarceration and the potential loss of legitimate income.

Freeman's results may be compared with those of Grogger (1995), who again studies a sample of young male California arrestees. All individuals in the sample were arrested at least once between 1973 and early 1987. Grogger seeks to determine the effects of contact with the criminal justice system on subsequent legitimate labor market outcomes. He obtains a comparison sample of non-offenders by partitioning the sample in accordance with the date of first arrest. The treatment sample consists of young California males first arrested prior to 1985, and the comparison sample consists of those first arrested in 1985 or later. Quarterly data on earnings and employment from 1980 through 1984 are merged with each individual's criminal justice history. To eliminate the impact of unobserved variables correlated with arrests, Grogger applies the fixed-effects estimator to a distributed lag model. Unobserved correlated factors are found to have a large effect on labour market outcomes, whereas arrests are found to have a relatively modest and short-lived impact on earnings and employment. ('After six-quarters the effect (of an arrest) is insignificantly different from zero' (ibid. p. 61).) The impact of incarceration is also noted, although the results here are somewhat unreliable because the relatively long prison sentences may lead to regression results that simply reflect a contemporaneous enforced exclusion from the labor market. The results relating to jail sentences are more reliable, as their duration is typically of one year or less. Jail sentences are found to have an impact on subsequent earnings and employment, but again these are characterized as relatively short-lasting when compared with Freeman's results. Grogger notes (ibid., p. 70) that this may be due to the differences in sentence lengths for the two sample: long sentences (Freeman's sample) may have long-lasting effects, whereas short sentences (Grogger's sample) have relatively short-lasting effects. Insofar as the empirical results *do* conflict, different rationalizations of criminal activity would be in order. Freeman's results may be interpreted as indicating a relatively moderate impact of arrests and incarceration on labor market prospects. Studies using empirical measures of actual sentence lengths served would be helpful in determining whether the supply-side argument or the demand-side argument is stronger.

Other papers bearing on the impact of incarceration on earnings and employment stress the independent deterrent effect of criminal stigmatization, a byproduct of contact with the criminal justice system. Rasmussen (1996) presents two models of criminal stigmatization. The moral hazard model has employers unwilling to pay the market wage to ex-offenders because of their lower net productivity (contribution to product less thievery from the firm and other destructive behaviors), whereas in the adverse selection model a criminal record signals exogenously lower *gross* productivity (for example, lower

intelligence). Applied to the economics of prisons, the moral hazard effect reflects the negative training discussed earlier: time spent in prison increases the offender's productivity as a criminal. Any deterrent effect of stigmatization would be expected to be greater for those with the highest education and greatest job market prospects. Lott (1992b) finds for a sample of US federal larceny and theft offenders (typically involving government property or postal offenses) that 'a one-month increase in sentence length causes a 5.5 to 32 percent greater reduction in postconviction income' (ibid., p. 597). Waldfogel (1994a) similarly employs a sample of white-collar criminals to demonstrate that the reduction in job market prospects from imprisonment is due primarily to stigma, and not stalled experience growth or job displacement. Waldfogel cautions that his results may not be generalizable to offenders whose pre-conviction jobs do not involve substantial trust, and whose convictions are for crimes other than fraud and larceny. (For example, Lott (1992a) finds that longer sentences do not affect the post-imprisonment legitimate income of drug offenders.) To the extent that crime becomes more concentrated in an underclass composed of individuals who have little in the way of job market aspirations and opportunities, the deterrent effect of any criminal stigma may become insignificant. As well, the stigma measured by the disapproval of one's friends and neighbours will probably fall as the proportion of the population incarcerated increases, thus decreasing the deterrent effectiveness of punishment (Freeman, 1996, pp. 32-33). Other papers more relevant to the impact of conviction than incarceration include Lott (1990), Freeman (1986), Grogger (1992), Waldfogel (1994b) and Nagin and Waldfogel (1995).

12. Public Policy Broadly Conceived

Is the criminal justice system administering sentence lengths that might be considered efficient? Waldfogel (1993) constructs a static model of optimal sentencing where the planner chooses sentences to minimize the direct social harm from crime and the cost of imposing punishment. Optimal sentences are derived after making strong simplifying assumptions on functional forms and the relationships between variables. The results (corrected to account for an interpretive error noted in Pyle, 1995, p. 13), suggest that actual sentences in the US for 1984 are somewhat shorter than optimal sentences, but nevertheless are closer to the optimum than would be called for by a strictly retributive (proportionate to the harm) sentencing scheme. Alternatively, using relatively weak assumptions one can infer the social values of the harms imposed by crimes as implicit in current sentences. Waldfogel (1993) finds these implicit valuations correspond closely with estimates of actual harms as given by Cohen (1988).

Since Waldfogel (1993) takes the probabilities of punishment as exogenous, his analysis does not reach the question of whether the optimal number of offenders is incarcerated. A more comprehensive analysis is needed to address what is perhaps the most important public policy issue concerning the economics of prisons: Do prisons pay? Piehl and Dilulio (1995) (also see Dilulio and Piehl, 1991) review the literature and present some estimates. The idea is to use self-reports of incarcerated offenders to estimate the amount of crime such offenders would have committed if not incarcerated, and then, after pricing these crimes, to compare the 'saved' social costs attributable to incarceration with the direct costs (capital and operating) of incarceration. The self-reports come from surveys constructed to minimize biased and inaccurate reporting. (The earliest reliable surveys were completed by the Rand Corporation (see the discussion in Visher, 1986).) Since the distribution of offender reports are heavily skewed, the result depends upon whether the experience of the median, mean or whichever other offender's experience is taken as the basis for the estimate. For example, in one recent report (Piehl and Dilulio, 1995, p. 25, Table 3), the benefit-cost ratio for prisons ranges from 64.02 to 0.07, depending upon where in the distribution the sampling is done. Moreover, this method does not impart a social value to retribution, nor does it capture deterrent and replacement effects. It takes as a baseline the unlikely prospect that offenders would simply be released unsupervised if not incarcerated. The omission of replacement effects is particularly troubling since it works in an opposite direction to that of the deterrent, retribution and incapacitation effects. The implication is that the derived benefit-cost ratios are not necessarily a lower bound for whatever part of the distribution is sampled. Limiting the estimates to crime categories with low replacement rates should give more reliable estimates, but identifying these categories is a problem. Whereas incarcerated drug dealers are rapidly replaced on the streets, and intra-familial murderers are not, the situation is not so clear with respect to many other crimes. Moreover, there are undoubtedly differences in prison populations across geographical jurisdictions. The age-distribution of offenders, the crime mix, and so on ... are all affected by numerous variables (legitimate labor market opportunities, the allocation of police resources) not accounted for in the analysis, thus making inferences for jurisdictions other than that from which the sample was obtained, or indeed for the same jurisdiction at a different time, somewhat problematic. Since age markedly affects the proclivity for crime, the criminal career profile should also be taken into account (Blumstein and Cohen, 1987). For example, a sampled offender on the downward slope of the age-criminality curve will report crime figures that, if extrapolated forward, will lead to an upwardly biased estimate of the benefits from incarceration. Finally, all downstream costs related to incarceration are ignored in this type of analysis. If offenders form their expectations of the risk and costs of punishment primarily from their own experiences, then failing to

incarcerate the sampled offender would lower his perception of the riskiness of criminal activity, and lead to increases in the amount of future crime. The training effects (whether positive or negative) of imprisonment and any stigma and job-market effects are also included from considaration. Very few self-report studies attempt to adjust for all present concerns except deterrence and downstreams effects. His 'best guess' point estimate of the incarceration elasticity of aggregate crime is 0.16 (Spelman, 1994, p. 220). That is, a 1 percent increase in the prison population is predicted to reduce the level of crime by about 0.16 percent.

An alternative methodology more in keeping with the economic model is presented in Levitt (1996) (also see Marvell and Moody, 1994). Levitt estimates offense supply functions using (a proxy for) prison population as an explanatory variable. If prison populations were exogenous, in principle the coefficient could be used to capture incapacitation, deterrence and replacement effects. But Levitt rightly notes that prison populations depend to an extent upon the level of offenses, so that simultaneity problems intrude (Hersch and Netter, 1984, and Cameron, 1989, attempt to estimate the impact of offenses on sentence lengths and prison populations). Levitt employs instrumental variables reflecting prison overcrowding legislation, and thus attempts to isolate the one-way impact of incarceration on crime rates. The estimation indicates that 'each additional prisoner leads to a reduction of between five and six reported crimes. Including unreported crimes raises the total to fifteen' (Levitt, 1996, p. 345). This number is very close to the median numbers obtained from self-report surveys, although only incapacitation effects are accounted for in the latter studies. Levitt demonstrates that his estimates lead to a benefit-cost ratio for the marginal prisoner that exceeds unity, and suggests that the current level of imprisonment (in the US) is 'roughly efficient' (ibid., p. 324).

Levitt's paper will undoubtedly excite controversy (see, for example, Donohue and Siegelman, 1998). If the various subsystems of the criminal justice system do not adjust rapidly to exogenous shifts, then lagged offense rates would be expected to have an impact upon the demand for overcrowding litigation. This would call into question a crucial assumption in the model. Levitt presents numbers indicating otherwise (Levitt, 1996, pp. 334-336), and presents econometric tests supporting the overidentifying restrictions (ibid., p. 340). Perhaps an equally important consideration is whether Levitt has faithfully interpreted the model he seeks to implement. For Ehrlich (1973) as for Becker (1968), the supply of offenses function includes offender risk variables. Thus the appropriate imprisonment variable included in the offense supply equations is a measure of the expected cost of punishment, conditional upon conviction. Proxies typically used for this theoretical measure are based upon average sentence lengths received or served, not prison populations *per se*. While not implausible, the argument that potential offenders form their

sanction expectations on the basis of observations of prison populations requires independent justification.

Donohue and Siegelman (1998) employ both the incapacitation and aggregate offense-supply models to calculate cost-benefit ratios from imprisonment in the U.S. The goal is to establish whether a continuation of the huge run-up in the proportion of the population incarcerated over the last quarter century is cost justified. The authors, after reviewing the applicable studies, adopt offense elasticities of approximately 0.15 (also see Wilson, 1994). Attaching cost figures to these estimates suggests that further increases in the proportion incarcerated is unjustified for the US, but recent levels may be justified. These calculations do not take into account the possible criminogenic impact of current incarcerations. If imprisonment increases the criminality of released prisoners, then the US may be incarcerating at excessive rates. Donohue and Siegelman (1998) argue that certain pre-school enrichment programs are a more cost efficient alternative for reducing the level of crime.

13. Additional Topics

This chapter has not attempted to canvass all topics that could be included in a survey of the economics of prisons. Notable exclusions are prison industries (Barnes, 1921; Auerbach et al., 1988), industrial relations in prisons (Staudohar, 1976; Wynne, 1978; Peterson, 1981; Zimmer and Jacobs, 1981), litigation of prisoner suits (Brown, 1992), racial disparities in the prison population and in recidivism (Myers, 1980a, 1980b, 1992; Freeman, 1986, 1988; Myers and Sabol, 1988; Cameron, 1989; Dilulio, 1994; Langan, 1994), class-based models of prison use (Andrews, 1993), various alternatives to imprisonment and to standard methods of incarceration (fines, community-based sanctions, electronic monitoring, bootcamps, corporal punishments (Langbein, 1977; Polinsky and Shavell, 1984; Waldfogel, 1995; Benson and Rasmussen, 1995; Avio, 1995; Kan, 1996)) and economic factors in the origins of prison systems (Langbein, 1976; Conley, 1981; Lewis, 1988, 1990; Nicholas, 1990).

The economics of prisons has come a long way since Becker (1968) regenerated the interest of economists in crime. Further progress will require developments in both theoretical and empirical spheres, including the specification and estimation of dynamic structural models of criminal behaviour. The many simplifying assumptions of existing models must be relaxed, and the relationships between the various crime categories and between criminal and legitimate labour markets better understood. Studies of countries other than the US are necessary for establishing the generality of the empirical findings. 'Protracted prospective' longitudinal data sets (Janson, 1994) must be constructed on representative individuals, with information that

includes sentence lengths actually served and activities undertaken while imprisoned, as well as on the more standard variables.

In general, one could argue that the punishment theories developed by economists and within which the economics of prisons is embedded need to pay more attention to the stylized facts uncovered by longitudinal studies: (i) most crimes are committed by youths; (ii) only a small number of these youths persist in criminal activity as they age; but (iii) these same people are responsible for the bulk of serious crimes (for discussion see Farrington, Ohlin and Wilson, 1986; Moffitt, 1994). The theoretical models developed in economics do not appear to satisfactorily address these facts. One policy implication is that more attention is paid to influencing the lifetime profile of established criminals than attending to the prevention of such careers in the first place. Similarly, the underlying legal and social institutions providing the background environment for criminal activity require careful examination (Witte, 1993). Akerlof and Yellen (1994) provide an illustrative model that points in the right direction (also see Becker, 1996), a model which implicates 'community policing' (Campbell, 1994). Finally, given their comparative advantage, economists have quite naturally confined themselves to the impact of the law and its administration on the incentives implicit in fixed preferences, that is, to short-run 'carrot and stick' approaches to modifying criminal behavior. Perhaps a more complete picture of human nature than that depicted in the economic model of crime is warranted. It may now be time to explore the long-run preference-shaping impact of the law (Dau-Schmidt, 1990; Friedman, 1993; Robinson, 1994) and education (Witte, 1996, 1997; Usher, 1997), along with the role of habituation in that process (Wilson, 1994; Dilulio, 1996). We know little about how and why a shared moral order is developed and maintained (Robinson, 1994). This change in perspective, calling as it does for an examination of the relationship between socialization and individuation, suggests a return to a relatively neglected part of the research program laid out in Adam Smith ([1791] 1976). Analysis of the social institutions that inculcate self-command, and which otherwise function as civilizing forces in our society (Muller, 1993; Wilson, 1993), should be part and parcel of the research strategy adopted by social scientists to help understand and control crime.

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