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David F. Greenberg

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THE DYNAMICS OF OSCILLATORY PUNISHMENT PROCESSES*

DAVID F. GREENBERG**

In a recent paper, Blumstein, Cohen and Nagin present two homeostatic models of the imprisonment process inspired by Durkheim's conception of society as a normatively integrated self-regulating mechanism.[1] Comparing the imprisonment rates predicted by their models with Canadian data for the period 1925–1960, the researchers found a good agreement for one of their models. It is the purpose of this paper to propose an alternative explanation of the observed imprisonment rates.

In both the models discussed by Blumstein *et al.*, the number of criminals at large in society is regulated by the imprisonment of criminal law violators. When the number of violators in prison declines, the number at large increases. Society then responds to this increase with more incarcerations, thereby reducing the number of criminals (and presumably the amount of crime) present outside the prison system. However, the two models differ in the detailed assumptions made about the imprisonment process.

Both models generate second order autoregressive equations[2] for the per capita imprisonment r_t. These equations have the general form

$$r_t = \phi_1 r_{t-1} + \phi_2 r_{t-2} + \delta' + \epsilon_t, \qquad (1)$$

where ϕ_1, ϕ_2 and δ' are constant coefficients, t is the time, and the disturbance terms ϵ_t are assumed to be independently distributed. When empirical values or plausible estimates of the parameters of the two models are inserted into the expressions derived theoretically for the coefficients, numerical predictions for their values are obtained.

Blumstein, Cohen and Nagin find that the model most consistent with the Canadian data (their model II) yields the coefficients

$$\phi_1 = 1.31, \quad \phi_2 = -0.43, \quad \delta' = 5.0 \times 10^{-5},$$

in rather good agreement with the values

$$\hat{\phi}_1 = 1.23, \quad \hat{\phi}_2 = -0.43, \quad \hat{\delta}' = 9.17 \times 10^{-5}$$

they obtain from a least squares fit to the observed imprisonment rates.

Blumstein, Cohen and Nagin's work has major theoretical and practical implications. First, Durkheim's belief that punitive justice strengthens social cohesion by reinforcing the collective conscience, although influential, has rarely been empirically tested. Durkheim himself argued that it is primarily in societies characterized by mechanical solidarity that punishment serves this function;[3] since he believed that society was evolving toward a division of labor based on organic solidarity, it is unclear that he would expect punishment to play a major role in strengthening norms and preventing crime in the modern world. To be sure, the model proposed by Blumstein *et al.* does not depend entirely on the proposition that collective acts of repression strengthen norms; they allow for the possibility that legal norms themselves may change. Nevertheless, in finding support for the existence of a self-regulating mechanism, they do provide at least partial confirmation of some of Durkheim's ideas and more generally for a functionalist theoretical orientation.

Second, Durkheim's writings on crime are commonly taken as representing a "consensus

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** Assistant Professor, Sociology Department, New York University.

[1] Blumstein, Cohen & Nagin, *The Dynamics of a Homeostatic Punishment Process,* 68 J. CRIM. L. & C. 317 (1976).

[2] An autoregressive equation is one in which the dependent variable is regressed on its own earlier variables.

[3] E. DURKHEIM, THE DIVISION OF LABOR IN SOCIETY (G. Simpson trans. 1933).

theory" approach to crime and law enforcement. It is norms that are widely shared by the community that repression strengthens. Decades ago, George Herbert Mead pointed out[4] that in a pluralistic society characterized by normative dissensus, the enforcement of controversial rules might not have this effect at all. By punishing actions thought by some significant group not to be wrong, the state would tend to evoke resentment and hostility, weakening identification with the collectivity. To the extent that inhibition against crime depends on a sense of identification with rule-makers and with potential victims, the enforcement of some norms might increase rather than decrease the level of violations.

The Blumstein, Cohen and Nagin findings suggest that the "Meadian conflict model" did not operate in Canada during the years of study and thus might be taken as confirming the validity of a consensus perspective; however, the Blumstein, Cohen and Nagin model [hereinafter cited as the BCN model] is capable of accommodating some conflicting elements. Blumstein *et al.* argue that when too large a proportion of the population is imprisoned, norms may change in such a way as to shift the boundary between criminal and non-criminal activities, with lesser offenses being decriminalized. This would reduce the number of criminals through a process of redefinition, rather than repression. Class or interest group conflict could play a role in the social process of redefinition. Blumstein *et al.* also argue that when too few individuals are punished, "the basic identifying values of the society will not be adequately articulated and reinforced, again leading to social instability" creating "pressures for stricter law enforcement and perhaps more severe punishments."[5] This pressure could as easily come from particular groups in the society as from the society as a whole.

Implicit in the above quotation is the view that the punishment of crime is a vital necessity for society; if the number of individuals singled out for punishment falls below some level, "social instability" will result. The BCN model thus seems to legitimate state punishment practices. It does, however, call into question some widely held ideas about the effectiveness of particular punishment practices. In the most successful model, the size of the mean criminal population is extraordinarily insensitive to the recidivism rate, indicating that neither the rehabilitation nor the special deterrence of a prison population roughly as large as is found in Canada would have a substantial impact on the crime rate. The size of the mean criminal population also proves to be insensitive to wide variation in the rate of admissions to and releases from prison, though the prison population is extremely sensitive to variations in these parameters. The model is, however, consistent with the possibility that enforcement makes a contribution to conformity through its general deterrent effect, though it does not provide any information concerning the magnitude of this contribution, if it exists.

Although the BCN model suggests that the mean size of the criminal population is not very responsive to short-run changes in policy concerning prison admissions and releases, it does attribute changes in the size of the criminal population at large to variation in the size of the prison population. In this sense, the model projects an air of complacency. On the one hand, we do not need to be excessively alarmed by increases in crime, because the normal workings of popular pressure will bring about corrective measures just as in the past; extraordinary steps going beyond what has been done in the past are not needed. On the other hand, in the short-run it is primarily through the state's *punishment* policies that the number of criminals in society is regulated. While it is consistent with the BCN model to undertake other programs that might increase the population's motivation to conform, that is probably a long-term proposition, with little immediate impact on either crime rates or punishment levels.

Despite the elegance of the models that Blumstein *et al.* present and the impressive agreement between prediction and observation that they find, final judgment as to the adequacy of their model must be reserved until alternative models of the processes that generate imprisonment rates are examined. Such an examination of one set of alternative models will suggest the need to revise at least some features of the BCN model.

Taken together, a set of assumptions about releases and admissions comprise a model for

[4] Mead, *The Psychology of Punitive Justice*, 23 AM. J. SOC. 577 (1918).

[5] Blumstein, Cohen & Nagin, *supra* note 1, at 320.

changes in the size of the prison population. In examining alternative models, releases from prison will first be considered, and then admissions will be considered.

Releases from Prison

P_t, A_t and R_t represent, respectively, the prison population the number of admissions to prison and the number of releases from prison at time t. Neglecting the small number of inmate deaths, the change in prison population at time t equals the admissions at time t less the releases at time t. Although time is a continuous variable, data concerning prison admissions and releases are available only in aggregated form, as annual rates. This requires that we make use of the discrete-time approximation

$$P_t - P_{t-1} = A_t - R_t, \qquad (2)$$

where we have implicitly assumed that time is measured in years.

The first assumption about releases we consider is that the number of prisoners released is proportional to the prison population in any given year. Thus, when the prison population is high, the number of prisoners released will be correspondingly high as well. This assumption can be expressed through the equation:

$$P_t - P_{t-1} = A_t - bP_t.$$

Lagging the time by one year and taking the difference between the above equation and the lagged equation, we obtain the second order difference equation:

$$P_t - 2P_{t-1} + P_{t-2} = A_t - A_{t-1} - b(P_t - P_{t-1}),$$

or

$$P_t - \frac{(2+b)}{(1+b)} P_{t-1} + \frac{1}{(1+b)} P_{t-2} = \frac{A_t - A_{t-1}}{1+b}. \qquad (3)$$

During the period under study, the mean sentence length was about two years which corresponds to the value $b = 1/2$.

Next we transform equation (3), which relates prison populations and prison admissions, to an equation for the per capita prison population r_t and the per capita prison admission rate a_t. Assuming with Blumstein, Cohen and Nagin that the population T_t grows exponentially at rate g, the transformation can be accomplished using the rules:

$$\begin{aligned} P_t &= r_t T_t \\ P_{t-1} &= (r_{t-1} - g r_t) T_t \\ P_{t-2} &= (r_{t-2} - 2g r_{t-1} + g^2 r_t) T_t \\ A_t &= a_t T_t \\ A_{t-1} &= (a_{t-1} - g a_t) T_t. \end{aligned}$$

These rules are valid to order g. As g for Canada is approximately 0.02, terms of order g^2 can be omitted as negligible. We then find:

$$r_t = \frac{(2+b+2g)}{\{1+b+g(2+b)\}} r_{t-1} - \frac{1}{\{1+b+g(2+b)\}} r_{t-2} + \frac{a_t(1+g) - a_{t-1}}{\{1+b-g(2+b)\}}.$$

Inserting observed values of b and g, we find:

$$\phi_1 = 1.64, \qquad \phi_2 = -0.65.$$

Since the predicted value of ϕ_1 lies outside the ninety-nine percent confidence limits of its observed value, the model is clearly untenable.

As this model has not led to good predictions, the assumption made about releases must be modified. Instead of assuming that the number of releases is proportional to the number of prisoners, we assume that the lengths of the sentences served in prison are geometrically distributed. This means that of a cohort of prisoners admitted at the same time, a fraction α will be released after one year, a fraction α^2 after two years, and a fraction α^n after n years.[6] This approximates the observed distribution of sentences, which is highly skewed. Many prisoners have sentences which are comparatively short, with a small minority serving sentences that are much longer.

With this assumption, equation (2) becomes:

$$P_t - P_{t-1} = A_t - \alpha A_{t-1} - \alpha^2 A_{t-2} \cdots - \alpha^n A_{t-n} \cdots \qquad (3)$$

Because the infinite series in the right hand member is awkward to handle, it is best to

[6] In a continuous time model, the equivalent assumption would be that sentences are exponentially distributed. *See, e.g.*, Shinnar & Shinnar, *The Effects of the Criminal Justice System on the Control of Crime: A Quantitative Approach*, 9 L. & SOC'Y REV. 581 (1975). In a study of prison sentences, a geometric distribution assumption may actually be better than an exponential distribution assumption because prison sentences are usually a year or more in length (in the United States at least) and tend to cluster at the integers (two years, three years etc.).

eliminate it using a trick based on the Koyck transformation for handling problems involving distributed lags in econometrics. The trick consists of rewriting equation (3) with t replaced by $t - 1$, and multiplying the result by the quantity α. This gives us:

$$\alpha(P_{t-1} - P_{t-2}) = \alpha A_{t-1} - \alpha^2 A_{t-2} \cdots - \alpha^n A_{t-n} \cdots \quad (4)$$

Subtracting equation (4) from equation (3), we find:

$$P_t - (1 + \alpha)P_{t-1} + \alpha P_{t-2} = A_t - 2\alpha A_{t-1}. \quad (5)$$

When written in terms of the per capita prison population, this becomes

$$r_t - \frac{(1 + \alpha + 2\alpha g)}{1 + (1 + \alpha)g} r_{t-1} + \frac{\alpha}{1 + (1 + \alpha)g} r_{r-2} = \frac{a_t(1 + 2\alpha g) - 2\alpha a_{t-1}}{1 + (1 + \alpha)g}. \quad (6)$$

The quantity α can be estimated from the mean sentence length S through the equation

$$S = \alpha/(1 - \alpha)^2.$$

During the period under study, the mean sentence length was approximately two years, corresponding to $\alpha = 1/2$. Inserting this value and the empirical value of g in equation (6), we find:

$$\phi_1 = 1.48, \qquad \phi_2 = -0.48.$$

Although the value of ϕ_1 just obtained is about twenty percent higher than the observed value, it does fall within the ninety percent confidence limits for $\hat{\phi}_1$.

It must be emphasized that these predictions for ϕ_1 and ϕ_2 do not depend in any way on assumptions concerning crime rates, recidivism rates, or the rates at which individuals in the population at large initiate or abandon criminal activity. It has simply been assumed that sentence lengths decline geometrically, and that the population grows slowly at an approximately constant rate.

As the Canadian population growth was indeed slow, and as the coefficients are insensitive to the details of the growth pattern, a comparison of the model predictions with observation is primarily a test of the assumption that sentence lengths decline geometrically. A discrepancy between observed and predicted values of ϕ_1 and ϕ_2 might, therefore, indicate little more than a pattern of sentencing that deviates from the pure geometric distribution assumed in the model.[7] In any event, the reasonably good agreement found in this model for the two coefficients ϕ_1 and ϕ_2 demonstrates that the good agreement Blumstein *et al.* find in their model for the same coefficients is not strong evidence in favor of their model.

Any additional dynamic assumptions to be incorporated in our model must take the form of assumptions about the behavior of a_t, the per capita rate of prison admissions. It is to this topic that we turn next.

Commitments to Prison

Perhaps the simplest assumption that might be made about commitments to prison is that the per capita commitment rate fluctuates randomly about a constant level. With this assumption, we can write

$$a_t = a + \nu_t, \quad (7)$$

where the ν_t are independently and identically distributed with zero mean and constant variance, and a is a constant.

With this assumption, the right hand member of equation (6) becomes

$$\frac{a(1 + 2\alpha g - 2\alpha)}{1 + (1 + \alpha)g} + \frac{(1 + 2\alpha g)\nu_t - 2\alpha\nu_{t-1}}{1 + (1 + \alpha)g}.$$

Substituting $\alpha = 1/2$ and $g = 0.02$, we find $\delta' = 0.02a$. The average per capita rate of admissions to prison was approximately twenty per 100,000 per year; consequently the model predicts $\delta' = 0.4 \times 10^{-5}$. This is too small by a factor of more than twenty.

This large discrepancy between predicted

[7] It follows that a better fit for the coefficients ϕ_1 and ϕ_2 can be obtained by slightly modifying the assumptions made about sentences. For example, in making the assumption that sentences are geometrically distributed, it is implicitly assumed that no account is taken of the number of people in prison when decisions are made about release. By assuming that the release rate is increased when the prison population is high, one additional parameter is added to the model, and the fit for both coefficients is improved. Some evidence for a departure from a pure geometric distribution of sentences has been found for a sample of prisoners drawn from five California prisons. *See* J. Chaiken, Distribution of Time Spent in Prison (1977) (unpublished Rand Working Paper).

and observed value of δ' is not as alarming as it appears. The prediction for δ' is quite sensitive to the value of α. For example, if $\alpha = 0.45$ instead of 0.50, we would predict $\delta' = 2.3 \times 10^{-5}$, which, though still too small, lies within the ninety-five percent confidence limit for the observed value. Secondly, the predicted value for δ' depends strongly on the predicted values for ϕ_1 and ϕ_2. Because the values we obtained for these two parameters were slightly too large in magnitude, we expect to find a value for δ' that is somewhat too small.

To see this, we note that the solution to the equation

$$r_t = \phi_1 r_{t-1} + \phi_2 r_{t-2} + \delta'$$

can be written as the sum of any particular solution to this equation, plus the general solution to the reduced equation obtained by setting $\delta' = 0$. We can find a particular solution to the above equation by letting $r_t = C$, a constant. We then find

$$\delta' = C(1 - \phi_1 - \phi_2).$$

C can be found by noting that when the general solution to the reduced equation is oscillatory, as it is in the BCN model II, the mean of the general solution will be zero. Consequently, we must have $C = \bar{r}$, the mean value of the r_t. The prison population is thus predicted to oscillate around a constant value.

Using the values of $\hat{\phi}_1$ and $\hat{\phi}_2$ that Blumstein *et al.* obtained from their least squares analysis, and noting that the mean incarceration rate was roughly forty-six prisoners per 100,000 population, we find $\delta' \simeq 9.2 \times 10^{-5}$. In our "geometric sentences" model, the coefficient $1 - \phi_1 - \phi_2$ vanishes (to within rounding error). Consequently, the least squares value of δ' computed under the constraint that the model's predictions for ϕ_1 and ϕ_2 are correct would lead to the value $\delta' = 0$, which is much closer to the model's prediction for the coefficient.

The assumption that the error terms in equation (7) are statistically independent leads to the prediction that there is first order serial correlation among the error terms ϵ_t in equation (1), with

$$r_{\epsilon_t, \epsilon_{t-1}} = -1/2,$$

and vanishing serial correlations of higher order. This would appear to be a bad prediction, as Blumstein *et al.* report finding no serial correlation among the error terms from their least squares fit.[8]

A consistent treatment of errors in the BCN model, however, also leads to the conclusion that the error terms should be negatively correlated, with a magnitude that depends on the relative accuracy with which the model predicts crime rates and imprisonment rates. As it is not known how accurately their model predicts crime rates, no precise prediction for the magnitude of autocorrelation in the error terms can be made for their model. However, it is possible to establish the limits

$$-6/13 < r_{\epsilon_t, \epsilon_{t-1}} < 0$$

for their model.

A more serious difficulty with the assumption that admissions fluctuate randomly about a constant level is that with coefficients ϕ_1 and ϕ_2 of the magnitude predicted by the "geometric sentence" model, the solution will not be oscillatory. Yet a visual inspection of the annual per capita prison populations suggests random fluctuation about a sinusoidal oscillation. There are two ways such oscillatory behavior can be produced. One is through a self-regulating process of the sort hypothesized by Blumstein, Cohen and Nagin. Another way is for prison admissions to be driven by a variable that is exogenous to the crime-punishment system, and which oscillates sinusoidally.

The distinction between these two possibilities can be clarified through the use of a physical analogy. Suppose I suspend a weight from a spring in the presence of the earth's gravitational field, and let the weight and spring come to equilibrium. If I then displace the weight, stretching or compressing the spring, and release it, the weight will bob up and down without any further intervention on my part. In the absence of friction, the weight will oscillate with a fixed amplitude and fixed frequency indefinitely. Another way I can get the weight to move in an oscillatory manner is by holding it with my hand and moving my hand up and down.

The BCN model is somewhat analogous to the first possibility, though the analogy is im-

[8] It is possible that the stepwise estimation procedure adopted by Blumstein, Cohen and Nagin, in which the autoregressive coefficients of the model were estimated first and the error terms then examined for autocorrelation, led to an underestimation of serial correlation among the error terms.

perfect. Since changes in the criminal population at large are influenced by changes in the prison population, and vice versa, the system actually behaves like two coupled springs. However, the oscillatory movement of each variable in the crime-punishment system arises from the internal dynamics of the self-regulation. The second possibility would constitute a mechanical analogue to the prison population if there is some variable that causes prison admissions to oscillate in the same way that my hand causes the weight to oscillate. To consider this possibility we must see whether there are any variables that might influence prison admissions and which also oscillate with an appropriate frequency.

There are many variables that might be expected to influence the rate of prison admissions, such as a community's demographic composition, the amount of resources it can expend on punishment, the prevailing political sentiment, the crime rate and so on. Most such variables change slowly and not necessarily in a sinusoidal fashion. Whatever contribution they might make to an explanation of the mean level of a community's incarceration rate, they would not cause that rate to oscillate. On the other hand, *those variables that characterize the state of the business cycle do show the required behavior,* because periods of economic expansion alternate with periods of contraction in capitalist economic systems.

Moreover, there are reasons to expect prison admissions to depend strongly on the phase of the business cycle. One reason is suggested by microeconomic theory. When the economy is in a period of contraction, unemployment rises. Persons who are unemployed can be assumed to have a greater incentive to steal than those who are not. In addition, they may risk less when they engage in crime, for they cannot lose their jobs if they are caught.[9] If this reasoning is correct, crime rates will increase during periods of unemployment. Assuming that the probability of arrest, conviction and imprisonment following an offense remain unchanged, more violators will be sentenced to prison during periods of high unemployment. It is also possible that when the crime rate increases, judges will respond to this increase by imposing prison sentences more frequently, in the hope that this will help to reduce the crime rate.

Another reason prison admissions might be expected to vary with the business cycle is suggested by Rusche and Kirchheimer,[10] whose historical survey of punishment practices suggest that long-term changes in the form and intensity of state-imposed punishment reflect the supply and demand of labor. When the supply of labor is high relative to demand, this perspective would suggest that the rate of imprisonment would be increased, with the goal of taking excess labor off the market.

These arguments suggest that of the many indices that might be used to measure the phase of the business cycle, unemployment is likely to be superior to others (*e.g.*, the gross national product or aggregate investment). We therefore take the unemployment rate as an indicator of the state of the economy. For the period 1945–1959, we find that the correlation between per capita admissions to prison and the proportion of the labor force seeking employment is $r = 0.92$; this strongly confirms the hypothesis.[11] When the period is extended back to 1938, the earliest year for which the relevant data are available, the correlation is still positive but not as strong; apparently the relationship is distorted by the Depression and War years.

As can be seen from inspection of Figure 1, which shows both prison admission rates and unemployment rates for the years 1945–1959, the high correlation between unemployment and commitments to prison is not a trend effect, created by causally unrelated monotonic increases or decreases in both variables. Both rates move up and down, prison commitments following changes in unemployment quite closely, with some evidence of prison admissions lagging a bit behind unemployment. This may be a consequence of court delay.

A similar relationship has been shown to hold for prison admissions in the United States; for the period 1960–1972, the correlation between the unemployment rate and the rate of first admissions to federal prison was 0.91, and for first admissions to state prison, 0.86.[12]

[9] *See* Ehrlich, *Participation in Illegitimate Activities: A Theoretical and Empirical Investigation,* 81 J. POL. ECON. 521 (1973).

[10] G. RUSCHE & O. KIRCHHEIMER, PUNISHMENT AND SOCIAL STRUCTURE (1939).

[11] Unemployment rates and prison admission rates per population, for ages 16 and over, are taken from M. URQUHART & K. BUCKLEY, HISTORICAL STATISTICS OF CANADA 61, 644, 656 (1965). Data for more recent years are not available.

[12] *See* W. H. ROBINSON, P. SMITH & J. WOLF,

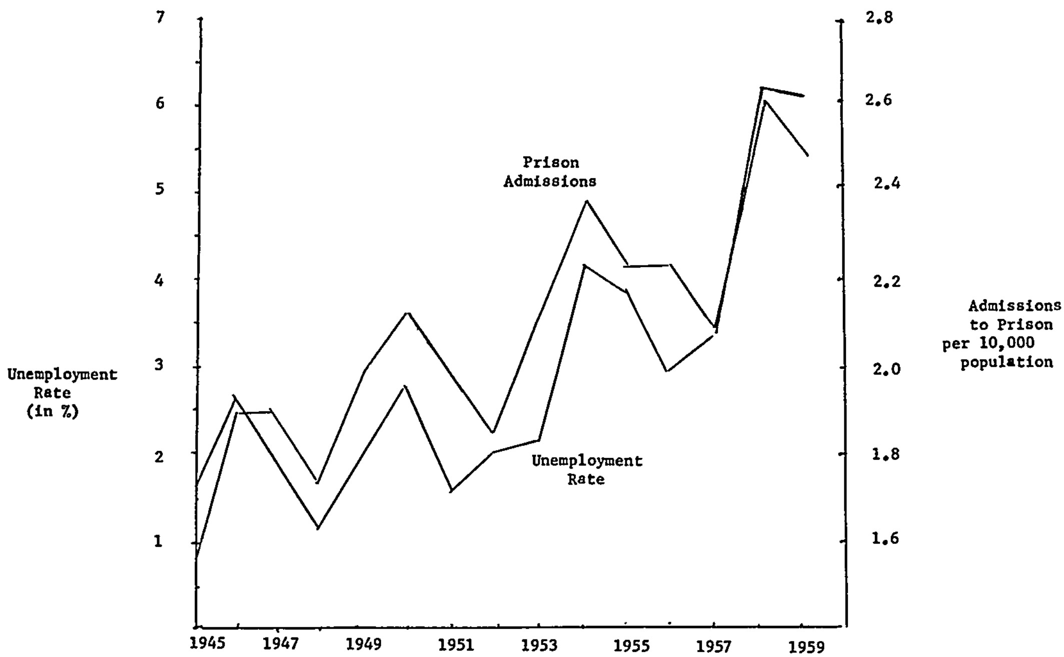

FIGURE 1. Prison Admissions and Unemployment Rate in Canada, 1945–1959.

Again, this was not a trend effect; prison admissions rose and fell with the unemployment rate.

For the Canadian data, the correlation between per capita prison *population* and the unemployment rate is also positive but considerably weaker than for per capita prison admissions ($r = 0.28$; when unemployment is lagged by one year, $r = 0.36$). This is hardly surprising. When the mean sentence length is not short as compared to the period of business cycle, the prison population at a given time will contain cohorts admitted at different stages of the cycle. Also, each cohort will contain prisoners with sentences of different lengths. Both effects will tend to wipe out the population, partially obliterating the effect of unemployment.

Because of the moderately strong positive first order autocorrelation among unemployment rates ($r_{u_t, u_{t-1}} = 0.654$), the serial correlation among the error terms of equation (1) will be much smaller in this model than in the random admissions model.

Having verified the existence of a strong relationship between prison admissions and unemployment, one may ask how this relationship can be explained. In arguing that the prison admission rate and the unemployment rate might be related, we suggested several possible causal processes that might lead to such a relationship. One possibility involved a relationship between the crime rate and the unemployment rate. This model suggests that the crime rate increases with the unemployment rate. With constant conditional probabilities of arrest and conviction, more offenders will be brought into court and sentenced when unemployment is high, increasing the number of admissions to prison. For more than a hundred years, writers who analyzed the relationship between crime and unemployment using data on officially labeled offenders, have assumed that this is the model they were testing.

If this "workload" model is correct, we should find a high correlation between the unemployment rate and the crime rate, a high correlation between the crime rate and the conviction rate, and a high correlation between the conviction rate and the imprisonment rate. The data necessary to test all these predictions are not available. However, partial tests can be carried out. Empirically, the correlation between the per capita rate of admissions to prison and the per capita rate of convictions is

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approximately 0.01, in total disagreement with the final prediction.[13] High rates of commitment to prison during periods of unemployment thus cannot be explained as a passive judicial response to a larger caseload.

Reported crime rates for the full range of offenses are not available for Canada, but the *U.N. Demographic Yearbook* does report annual homicide rates for Canada. For the years 1953–1970, the correlation between the homicide rate and the unemployment rate is 0.22. This is in the predicted direction but not strong enough to support the "workload" model.

We cannot fully test the hypothesis that judges respond to perceptions of a higher crime rate with increased sentences, but this explanation is consistent with the observed correlations only if perceptions of the crime rate are far more strongly related to the unemployment rate than to the reported crime rate, at least to the extent that the homicide rate is an index of the overall crime rate. We know too little about perceptions of crime to fully assess this possibility, but on the surface it appears somewhat implausible.

Of course it may be that the homicide rate is not a good index of the overall crime rate. Homicide occurs infrequently by comparison with theft offenses, and may be more weakly related to unemployment than the latter. If so, the overall crime rate, for which we have no data, may be more strongly related to unemployment than the homicide rate, for which the correlation is small.

The American data, however, suggest that prison sentences may not be closely related to perceived crime rates. During the mid to late 1960's, a period of economic expansion, crime rates and arrest rates rose. Since increased crime rates were the subject of extensive public discussion and figured in national political campaigns, it is likely that judges were aware of this increase. Yet admissions to prison declined during this period. With the recession of the early 1970's, crime rates continued to rise, but no more rapidly than before, and prison commitments increased dramatically.

It thus appears that in both Canada and the United States, changes in commitments to prison can be explained almost entirely by changes in the unemployment rate. Changes in the number of cases entering the criminal justice system and potentially available for imprisonment seem to be unimportant, as does the crime rate, at least as far as we can measure it.

Rusche and Kirchheimer's proposal that penal policies are governed by labor market considerations irrespective of the problems crime poses for society is not contradicted by the data, but nevertheless seems implausible for the period under consideration, for it requires that we assume that Canadian and American judges, almost without exception, orient their sentencing policies to the requirements of the labor market and that they agree on how this can best be done. For the present period, this assumption is farfetched. Perhaps the absolute monarchs of seventeenth century Europe could instruct judges to commute sentences in order to obtain galley slaves,[14] but neither the prime minister of Canada nor the president of the United States exercises comparable authority over sentencing.

For the present era, it is more plausible to assume that judges are less willing to grant probation to offenders when they are unemployed, or that unemployment affects levels of community tolerance toward offenders, to which judges respond in sentencing. The data needed to determine whether this speculation has merit are unfortunately not at hand.

Discussion

We have shown that a model in which prison sentences are geometrically distributed, and in which admissions to prison are governed by the unemployment rate, fares reasonably well when compared with a least squares fit to a second order autoregressive equation for the per capita imprisonment rates. As the difference equation predicted by the model is not of precisely the same form as the one for which the least squares fit was obtained (because the model involves a time-dependent driving term), the comparison must be taken as merely suggestive.[15]

It follows from the analysis presented here that the testing of a model that contains assumptions about admissions and releases from prison must be undertaken with caution. In

[13] Annual conviction rates are reported in M. Urquhart & K. Buckley, *supra* note 11, at 643.

[14] *See* G. Rusche & O. Kirchheimer, *supra* note 10, at 53–71.

[15] This reservation does not apply to our findings concerning the relationship between unemployment and prison admissions.

the models presented here, separate tests of the assumptions made about releases and admissions were possible. However, the test of the assumptions made about releases was not as strong as it would have been possible had detailed information about the distribution of sentence lengths been available.

In the BCN models, separate tests of the various model assumptions are less easily performed. Blumstein, Cohen and Nagin's best model does lead to good predictions for the coefficients of equation (1), but as we have seen, this may be true of alternative models as well. A stronger test would involve a comparison of crime rates and imprisonments with those predicted by the model.

Unfortunately, annual crime rates do not appear to be available for Canada for the years in question. However, the analysis of prison admissions presented here does cast doubt on the validity of the assumptions made in the BCN model about the admissions process. We find that whatever effect punishment may have on crime, oscillations in the rate of admissions to prison in Canada in recent years have been governed almost entirely by changes in the unemployment rate. The same relationship appears to hold in the United States as well. In light of this cross-national similarity, further investigation to determine whether the same pattern is found in other nations appears warranted.

The relationship between unemployment and admissions to prison discovered here is of particular interest in connection with the labeling perspective in deviance theory, which has, among other things, directed attention to the role of extra-legal contingencies in criminal justice dispositions. For the most part, attention has focused on the effect of *individual* offenders' extra-legal attributes on the dispositions they receive. However, extra-legal considerations may also influence the dispositions received by offenders *collectively*. In the short run, it appears that economic considerations have an important bearing on the likelihood that someone who has been convicted will be sentenced to prison or will receive a non-prison disposition.

Our findings have implications for reformers who seek to reduce prison populations. In recent years, reformers have sought to "divert" offenders from prison by creating "alternative" dispositions, not involving incarceration. Yet in recent years, prison populations have risen to historically unprecedented levels. Moreover, accumulating evidence suggests that many of those sentenced to diversion programs would not have been sentenced to prison in the absence of diversion programs. Instead, their cases would have been dismissed, or they would have been granted probation. It thus appears that the development of diversion programs may be an ineffective way of changing the size of the prison population. Although we are not accustomed to thinking about the manipulation of the state's fiscal and monetary policies as a way of influencing judicial sentencing patterns, such an approach might prove more effective than strategies now being employed, if it could be implemented.

The major difficulty here will be the obvious fact that levels of employment are governed by other considerations besides penal policy. Corporations make investment decisions on the basis of profit considerations, and federal policies that impact on unemployment take into account the needs of continued capital accumulation, the balance-of-payments problem, the exigencies of election year politics and so on. These are problems that surely carry much greater weight with policy-makers than considerations of penal policy.

The counterposing of "conflict theory" and "consensus theory" approaches to criminology has often been framed as if the crucial question at issue was whether the population was united or divided on such matters as the substantive content of the criminal law and the appropriate methods of enforcement. Notwithstanding such issues, the analysis presented here shows that conflict theory may be relevant to an understanding of the criminal justice system in another way. High levels of employment function to reduce income to the working class and prevent rising wages because of eroding business profits,[16] and the business cycle which plays such a large role in determining the rate of admissions to prison is a feature of capitalist economic systems, that is, of a particular kind of class system. Moreover, the bulk of the prison population is drawn from the working class. Thus, the notions of class and class conflict are directly relevant to an understanding of the functioning of the prison system.

[16] Boddy & Crotty, *Class Conflict and Macro-Policy: The Political Business Cycle*, 7 REV. RADICAL POL. ECON. 1 (1975).