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Volume 3 | Number 1 Article 2

4-1-1975

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In the past several years, there has been an extended dialogue in the literature concerning the question of the efficacy of sanctions as a means of deterring criminal behavior. There is some convincing evidence that threatened sanctions can and do deter some forms of behavior, such as parking violations and income tax evasion.[1] Do these findings extend to other forms of behavior which our society has defined as criminal? This issue is considered by Gibbs[2] in an article which appeared to find a clear link between the certainty and severity of sanctions and the murder rate. Gibbs' article stimulated additional research and analysis, some of which was intended to refute his findings. Most of these additional analyses ended up confirming his findings, at least so far as the crime of homicide was concerned.[3]

However, this resolution of the issue is unsatisfactory as there have been a number of challenges to the conceptualization and methods used in these analyses. There are two thrusts to these critiques. First, in order to accurately examine the deterrent effect of sanctions, isolated from confounding factors, it is necessary to look at simultaneous changes in sanctions and crime rates—that is, whether an increase in the severity of sanctions over time is associated with a decrease of criminal behavior over time. Chiricos and Waldo performed this analysis and reached such inconsistent results that they concluded their findings could not be attributed to deterrence.[4] As pointed out by Logan,[5] their analysis is far from perfect—leaving the validity of the substance of their critique unresolved.

The second major challenge to the cross-sectional studies initiated by Gibbs is his failure to make explicit the distinction between specific deterrence (that directed at the individual actually receiving the penalty) and general deterrence (that directed to other potential lawbreakers). Overall crime rates reflect the activities both of those offenders who have never been caught and subjected to criminal sanctions, and those who have served prior prison sentences. (What proportion of criminal offenses is committed by each group is unknown.) Thus current crime rates reflect the failure of both specific deterrence and general deterrence; if we are to understand the mechanisms behind either form of deterrence, it is necessary to sort out the effects (or lack of effects) of each type.[6] However, from a policy

planning viewpoint, it is useful to know the impact of manipulating the severity of sanctions regardless of the particular deterrent mechanism involved.

Another distinction which the students of criminal deterrence have generally failed to make is that between absolute deterrence, which asks the question, "does this particular sanction deter?" and marginal deterrence, which asks the question, "would a more severe penalty attached to this criminal prohibition more effectively deter?"[7] Since virtually the only way to study absolute deterrence is with an experimental or quasi-experimental design, and such designs are not possible for most kinds of criminal behavior, researchers have by necessity focused upon marginal deterrence.

The cross-sectional studies of marginal deterrence have consistently found a negative relationship between the murder rate and the certainty and severity of imprisonment. These analyses have used two different (though similar) sets of data and a variety of analytic techniques and statistical models, and this set of findings is in contrast to two other sets. Analyses of the marginal effect of capital punishment on the murder rate have uniformly shown no consistent and significant differences between states with death penalties and those without death penalties,[8] even after matching states for similar social and political cultures.[9] It is also in contrast to the analysis of the impact of certainty and severity of imprisonment on other forms of criminal behavior.

Tittle found no simple relationship between length of imprisonment and the crime rate for six offenses other than homicide (robbery, burglary, larceny, assault, auto theft, and sex offenses); but certainty of imprisonment was associated with crime rate for all of the above offenses except auto theft. Tittle suggests that this might be due to the very low level of certainty of punishment for offenses other than homicide; the average certainty index of homicide is .471, while for the other offenses it ranges between .015 and .141. Deterrence theory suggests that in order for a threatened sanction to effectively deter unwanted behavior, the certainty that the sanction will be applied must be high *and* the severity of the sanction must be high. That is, both certainty and severity of sanctions must be sufficiently great for deterrence to occur;[10] even if the penalties for a crime are very severe, the threatened penalties will have little deterrent effect if the potential criminal sees a very low probability of actually having to face those penalties. This argument, when translated into statistical terms, suggests that there should be an interaction between severity of sanctions and certainty of sanctions. This means that the combined effect of high severity and high certainty should be greater than the simple sum of the effects of high severity and high certainty; that is, the relationship should involve multiplicative as well as additive effects. Multiplicative interaction terms also can represent models in which neither severity nor certainty have any impact on crime rate at all until a sufficiently high level of both is achieved.

To test for interactions of this type, Tittle constructed tables showing the crime rate for each combination of high, medium, and low certainty, and high, medium and low severity. These tables were meant to test the hypothesis that "severity acts as a deterrent *only* when there is a high certainty of punishment."[11] After examining tables for each of the seven offenses (including homicide) he concludes that interaction effects appear to be present for robbery, burglary, larceny, and assault. There are two problems with this analysis. First, Tittle performs no

tests of significance upon his tables, and for good reasons; the mean crime rates presented in each cell of his seven tables are based upon extremely small n's. There are a total of 62 nonvacant cells in his tables; seventeen of these entries are averages based upon three or fewer observations, and twenty-six of the cells are based upon four to six observations. There may indeed be effects of one sort or another in these tables but to base that conclusion upon such small n's without statistical tests is highly questionable.

The other problem with Tittle's analysis is more damning: he has misinterpreted his tables. Tables 1(a) through 1(d) show hypothetical data which one would expect to find if certain types of relationships were present. These hypothesized tables show two types of interaction models and two types of additive (non-interaction) models. The data presented in Tittle's tables most closely resembles hypothetical Table 1(d) which is simply an additive table. Also since Tittle performs no tests for significant partial correlations (*i.e.*, severity controlling for certainty) we have no way of knowing from his analysis whether or not severity of imprisonment has a significant impact on crime rates after controlling for certainty; however, as mentioned above, he did find a simple effect for certainty of punishment.

TABLE 1

HYPOTHETICAL RELATIONSHIPS

(a)

Interactions according to Tittle's hypothesis
(both high severity and high certainty must
be present for deterrence to occur)

	SEVERITY		
CERTAINTY	high	medium	low
high	.01[a]	.10	.10
medium	.10	.10	.10
low	.10	.10	.10

(b)

Simple Multiplicative Interactions
(the combination of high severity and high
certainty has a greater effect than
the simple sum of the two effects)

	SEVERITY		
CERTAINTY	high	medium	low
high	.01	.06	.08
medium	.06	.08	.09
low	.08	.09	.10

(c)

Additive Effects (no interactions)
(Certainty and severity have equal effects)

	SEVERITY		
CERTAINTY	high	medium	low
high	.02	.04	.06
medium	.04	.06	.08
low	.06	.08	.10

(d)

Additive Effects (no interactions)

(Severity has a greater impact than certainty[b])

	SEVERITY		
CERTAINTY	high	medium	low
high	.02	.05	.08
medium	.03	.06	.09
low	.04	.07	.10

[a]Cell entries represent hypothesized crime rates.

[b]Severity has three times more impact than certainty. The situation could be easily reversed so that certainty had more impact than severity; the table would simply be transposed.

Using product moment correlations, Logan computed partial correlations of severity and crime rate controlling for certainty; he utilized the same data that Tittle's analysis was based upon. Logan found that, while five of the seven zero-order correlations (one for each of seven offense categories) between severity and crime rate had the wrong sign for deterrence to be operating, after controlling for certainty all of the signs were in the expected direction, except for the crime of auto theft. However, only the partial correlations for homicide and assault (which of the six other offenses is most similar to homicide) are statistically significant. To test for interactions as hypothesized by Tittle, Logan computed separate correlations for low and high certainty; the expected pattern of high correlations in high certainty states and low correlations in low certainty states did not appear.[12] Thus, except for the crime of homicide (and marginally for assault), there is no evidence that severity of prison sentences has any *direct* effect on crime rates either in a simple additive way or in a more complex multiplicative way.

Nonetheless, there remains evidence that severity of prison sentences does have some deterrent effect on the incidence of homicide. In this research note, I would like to turn once again to Gibbs' data in order to show that (1) introduction of proper control variables renders the relationships between severity and murder rate spurious, and (2) that previous analyses which have found such relationships have failed to apply deterrence theory in an adequate manner. This analysis will utilize both traditional regression techniques and one of the recently developed techniques for analyzing complex contingency tables.[13]

Analysis and Discussion

The first question that must be answered is whether or not the apparent relationship between severity of sanctions and murder rate is real or spurious. Zimring and Hawkins[14] tested this question using Tittle's data on homicide. The results of their re-analysis, which involved controlling for region are shown in Tables 2(a) and 2(b). By contrasting individual states with their regional average homicide rate rather than the national average, Zimring and Hawkins show that Tittle's simple severity effect for homicide was in fact spurious. Bean and Cushing applied linear regression analysis to Gibbs' data and introduced two separate controls. The first of these control variables was a dummy variable for region, South v. Nonsouth. The results of this analysis are shown in Table 3. Bean and Cushing

TABLE 2

RE-ANALYSIS OF TITTLE'S DATA[a]

(a)

Homicide Rates of States of the Union by Higher and Lower than National Average Homicide Penalties

	High-Penalty States	Low-Penalty States
Higher than national average rate	24%	54%
Lower than national average rate	76%	46%
Total	100%	100%

(b)

Homicide Rates of States of the Union by Higher and Lower than Average Homicide Penalties Compared on a Regional Basis

	Higher than Regional Average Penalties	Lower than Regional Average Penalties
Higher than regional average rate	50%	41%
Lower than regional average rate	50%	59%
Total	100%	100%

[a]Taken from Zimring and Hawkins (1973:261)

TABLE 3

REGION AND RACE AS A CONTROL VARIABLE

Variables included	Control Variable: Region[a] R^2			Control Variable: Race[b] R^2			Control Variable: Region[c] R^2		
Severity and Certainly only	.218			.218			.218		
Control variable only	.623			.703			.684		
All three	.696			.757			.752		
	Beta's (including three variables)								
	B	t	P	B	t	P	B	t	P
Severity	—.205	—2.33	<.01	—.167	—2.16	<.01	—.233	—3.04	<.01
Certainty	—.196	—2.39	<.01	—.179	—2.38	<.01	—.138	—1.80	<.05
Control	.717	8.31	<.001	.770	9.87	<.001	.758	9.72	<.001

[a]Bean and Cushing (1971:285); South includes Maryland, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Kentucky, Texas, Tennessee, Alabama, Mississippi, Arkansas, Louisiana, and Oklahoma.

[b]*Ibid.*, 288.

[c]West Virginia and Maryland are excluded from the Southern group.

then went on to argue that the important underlying variable reflected by region is the greater tendency of Blacks who are concentrated in the South to commit homicide.[15] Using this argument as a justification, they replaced the region control variable with percent Black. The results are also shown in Table 3; the fact that percent Black accounts for 8% more of the variance than the dummy variable region seems to justify their argument, at least at first glance. However, what about the effect of these control variables on the relationship between sanctions and homicide rate? Racial concentration accounts for 70% of the total variance; certainty and severity account for an additional 6%; this is 17% of the variance left unaccounted for by the control variable and constitutes a significant improvement in the R^2. The conclusion to be drawn from this analysis is that while certainty and severity still account for a significant amount of variation in homicide rate, the overall importance of these factors is not great.

Can the influence of certainty and severity be reduced still further by introducing different or additional control variables? Figure 1 shows a possible

FIGURE 1

ALTERNATE EXPLANATIONS OF THE IMPACT OF SEVERITY AND CERTAINTY ON CRIME RATE

explanation of the apparent relationship: local political and social culture is causing all of the relationships. If this were the case, one would expect region to be a good dummy variable to explain culture; but this seems to be disputed by the increased correlation with the racial control variable. Is there a race effect or does that effect simply reflect the local culture which in turn is confounded with the concentration of Blacks in the South? This author believes the latter to be the case. The improved correlation between using percent Black as opposed to region as a control variable, is simply an accident resulting from the way Bean and Cushing operationalized their region dummy variable. They included two marginal states in the Southern group, Maryland and West Virginia; both of these states have relatively low concentrations of Blacks. If these states are removed from the Southern groups, there is virtually no difference between the effect of the region control variable and the race control variable (compare columns 1 and 3 of Table 3); nonetheless, at least severity is still having a significant effect and the increase in R^2 when severity and certainty are added to the equation is still significant.

Unless the variable of interest is in fact a nominal variable, any dummy variable is going to be a crude indicator of the underlying dimension. In the case of regionally variable cultures this is particularly a problem since culture is not a unidimensional phenomenon. With this in mind, three additional control variables were introduced into the equation (which is shown at the bottom of Table 4). Each of these variables was seen as reflecting a distinctive aspect of political and

social culture. These variables were (1) percent of persons failing the mental portion of the armed forces preinduction physical (an aggregate measure of educational attainment), (2) percent of persons residing in a standard metropolitan statistical area—SMSA (a measure of urbanization), and (3) Jack Walker's[16] measure of innovation (an indicator of the level of political development within each state). This latter variable requires some additional explanation. Innovation measures the willingness of a state to adopt new administrative procedures and new political, social, and economic policies. It measures both whether new policies are adopted and how quickly it is done (*i.e.*, does the state take the lead in new policy directions or simply follow what other states have done). Thus in one sense, it measures the level of political development of each state. In states with a high level of political development, it is expected that violence will be an infrequent means of resolving conflict, both on the political level and the interpersonal level. Highly developed states are also expected to view violent behavior in a more negative light than those states in which violent behavior is more common, and deal with such behavior more severely. The total set of six predictors accounted for 89% of the variance in homicide rate;[17] and, as can be seen in Table 4, the impact of certainty

TABLE 4
PREDICTING MURDER RATE (y) FROM SEVERITY AND CERTAINTY WITH FOUR CONTROL VARIABLES

Variable	Beta	t	P
χ_1 Severity	—.051	—0.80	.438
χ_2 Certainty	—.078	—1.34	.187
χ_3 Innovation	—.355	—4.38	<.001
χ_4 Region	.354	4.26	<.001
χ_5 Educational Achievement	.449	5.60	<.001
χ_6 Urbanization	.224	2.76	.009

Equation: $y=\beta_1\chi_1+\beta_2\chi_2+\beta_3\chi_3+\beta_4\chi_4+\beta_5\chi_5+\beta_6\chi_6+\upsilon$

and severity completely disappears. This shows that the relationship between certainty and severity and murder rate is spurious: when the proper indicators of the local social and political culture are introduced the relationship between severity and homicide rate drops to insignificance.

These findings of spuriousness aside, there is a second major problem with the studies of criminal sanctions and deterrence, which is theoretical in nature. As discussed above, the theory of deterrence as applied to criminal behavior, or any phenomenon for that matter (*e.g.*, national defense), not only suggests, but *requires* the combined presence of severe sanctions and high certainty (*i.e.*, credibility) that those sanctions will be applied. Previous analyses have treated this proposition as an alternative rather than as a necessary condition as demanded by deterrence theory. If in fact, deterrence was occurring, one would expect to find multiplicative effects. As discussed above, neither Tittle nor Logan was able to find any such effects. Are there interaction effects to be found? Does the theory of deterrence apply?

Gray and Martin tried to deal with this problem. They applied two models to the Gibbs data. One included only additive effects, and one included only multiplicative effects. Both of the models explained approximately the same share of the variance, and consequently Gray and Martin concluded, for reasons of parsimony, that the additive model was appropriate.[18]

A more appropriate model would include *both* additive and multiplicative effects. With the advent of the new contingency table techniques referred to above, this can be done either with Gibbs' dichotomized data, or with the raw data using linear regression. Table 5 shows the results of the contingency table analysis; the

TABLE 5
INTERACTION EFFECT

Severity	Certainty	Murder Rate *low*	*high*
low	low	2	9
low	high	7	6
high	low	5	8
high	high	10	1

ANALYSIS OF VARIANCE

effect	*b*	*df*	X^2
Severity	.14	1	5.63
Certainty	.22	1	13.30
Interaction (Severity x Certainty)	—.04	1	0.49
Total (Severity, Certainty, Severity x Certainty)	—	3	28.32

[a]Each of the variables included in this table has been dichotomized based upon the median for that variable.

interaction term is not significant. The addition of an interaction term in the regression model increases the R^2 from .213 to only .225. Thus both the contingency table analysis and the regression analysis show that there are no significant interaction effects between severity, certainty and murder rate.[19] Furthermore, when an interaction term was added to the six variable model shown in Table 3, the interaction again was not significant. The failure of this analysis to find the multiplicative relationships suggested by a logically consistent application of deterrence theory, even though simple additive effects can be found, suggests very strongly that the apparent relationship between sanctions and crime rate may be attributable to factors other than deterrence. And, indeed, the control variable analysis reported above seems to confirm that such is the case.

Conclusions

This analysis has shown that when deterrence theory is rigorously applied to the analysis of the general deterrent effect of criminal sanctions, and when proper control variables are introduced, the apparent effect reported in previous papers disappears. It should be reemphasized that this analysis, and the ones that preceded it, have all dealt with marginal deterrence. There seems to be no viable evidence that variations in crime rates can be directly attributed to variations in the severity of sanctions; thus, the increasing of penalties for criminal conduct is likely to have little effect on the incidence of that behavior. The larger question of whether or not the threat of a penalty, any penalty (assuming that the potential penalty is nontrivial), deters criminal behavior has not been (and perhaps cannot be) dealt with. Criminal sanctions may deter, but the simple existence of the threat is more important than the severity of the potential penalties.

FOOTNOTES

[1]Albert Bandura, *Principles of Behavior Modification* (New York: Holt, Rinehart and Winston, 1969); Albert Bandura and Richard Walters, *Social Learning and Personality Development* (New York: Holt, Rinehart and Winston, 1963); William J. Chambliss, "The Deterrent Influence of Punishment," *Crime and Delinquency* 12 (1966), 70-75; and Richard D. Schwartz and Sonya Orleans, "On Legal Sanctions," 34 *University of Chicago Law Review* 274-300 (1967). 274-300.

[2]Jack P. Gibbs, "Crime, Punishment and Deterrence," *Southwest Social Science Quarterly* 48 (1968), 515-530.

[3]Louis N. Gray and David J. Martin, "Punishment and Deterrence: Another Analysis of Gibbs' Data," *Social Science Quarterly* 50 (1969), 389-395; Frank D. Bean and Robert G. Cushing, "Criminal Homicide, Punishment, and Deterrence: Methodological and Substantive Reconsiderations," *Social Science Quarterly* 52 (1971), 277-289; Charles R. Tittle, "Crime Rates and Legal Sanctions," *Social Problems* 16 (1969), 409-423; and Charles H. Logan, "General Deterrent Effects of Imprisonment," *Social Forces* 51 (1972), 64-73. For a general review of these and other studies, see Charles R. Tittle and Charles H. Logan, "Sanctions and Deviance: Evidence and Remaining Questions," *Law and Society Review* 7 (1973), 371-392.

[4]Theodore Chiricos and Gordon Waldo, "Punishment and Crime: An Examination of Some Empirical Evidence," *Social Problems* 18 (1970), 200-217.

[5]Charles H. Logan, "On 'Punishment and Crime' (Chiricos and Waldo, 1970): Some Methodological Commentary," *Social Problems* 19 (1971), 280-284.

[6]Douglas F. Cousineau, "A Critique of the Ecological Approach to the Study of Deterrence," *Social Science Quarterly* 54 (1973), 153.

[7]Franklin E. Zimring and Gordon J. Hawkins, *Deterrence: The Legal Threat in Crime Control* (Chicago: University of Chicago Press, 1973), pp. 14, 72.

[8]Edwin H. Sutherland and Donald R. Cressey, *Principles of Criminology* (Philadelphia: J. P. Lippincott, 1966), 335-353.

[9]Karl F. Schuessler, "The Deterrent Influence of the Death Penalty," *The Annals* 284 (1952), 54-62; and Thorsten Sellin, "Homicides in Retentionist and Abolitionist States," in *Capital Punishment* (New York: Harper and Row, 1967).

[10]Thomas Schelling, *Arms and Influence* (New Haven: Yale University Press, 1965), *passim;* Maynard L. Erickson and Jack P. Gibbs, "The Deterrence Question: Some Alternative Methods of Analysis," *Social Science Quarterly* 54 (1973), 542.

[11]Emphasis added. Charles R. Tittle, "Crime Rates and Legal Sanction," 417.

[12]Charles H. Logan, "General Deterrent Effects of Imprisonment," 70-71. After reversing the control process (*i.e.*, correlating certainty and crime rate, controlling for high and low severity) Logan reports small increases in correlations for four crimes.

[13]James E. Grizzle, C. Frank Starmer and Gary G. Koch, "Analysis of Categorical Data by Linear Models," *Biometrics* 25 (1969) 489-504; Robert G. Lehnen and Gary G. Koch, "A General Linear Approach to the Analysis of Non-Metric Data: Applications for Political Science," *American Journal of Political Science* 18 (1974), 283-313; and Herbert M. Kritzer, "NONMET: A Program for the Analysis of Nonmetric Data by Linear Models," *Behavioral Science* 18 (1973), 74-75. There are two other general techniques for contingency table analysis. The first was developed by Goodman and is described in James W. Davis, "Hierarchial Models for Significance Tests in Multivariate Contingency Tables: An Exegesis of Goodman's Recent Papers," in Herbert Costner (ed.), *Sociological Methodology 1973-74* (San Francisco: Jossey-Bass, 1974); Leo A. Goodman, "A Modified Regression Approach to the Analysis of Dichotomous Variables," *American Sociological Review* 77 (1972), 1035-1086; and Leo A. Goodman, "Causal Analysis from Panel Studies and other Kinds of Surveys," *American Journal of Sociology* 78 (1973), 1135-1191. The other general technique was de-

veloped by Bock, and is described in R. Darrell Bock, *Multivariate Statistical Methods in Behavioral Research* (New York: McGraw-Hill, 1974), Chapter 8.

[14]Zimring and Hawkins, *Deterrence,* pp. 199, 260-262.

[15]Marvin C. Wolfgang, "A Sociological Analysis of Criminal Homicide," *Federal Probation* 23 (1961), 48-55.

[16]Jack Walker, "The Diffusion of Innovations Among American States," *American Political Science Review* 63 (1969), 883.

[17]There is a potential hazard of multicollinearity here since the incorrelations among some of the control variables is as high as .70. However, the results of the analysis do not seem to indicate that this is in fact a problem. Two of the most frequent effects of multicollinearity are (1) unreliable estimates of parameters, indicated by large standard errors, and (2) parameters estimates taking on strange values. Neither of these problems seems to be occurring here. Farrar and Glauber cite a rule of thumb to use as a means of determining if multicollinearity is a problem: the problem is said to exist if any zero-order correlation between independent variables exceeds the multiple correlation of the regression correlation. This does not occur here. See Donald Farrar and Robert Glauber, "Multicollinearity in Regression Analysis: The Problem Revisited," *Review of Economics and Statistics* (1967), 98.

[18]Louis N. Gray and David J. Martin, "Punishment and Deterrence," 391.

[19]George Antunes and A. Lee Hunt, using data resembling Tittle's performed a similar analysis and obtained similar results: multiplicative terms, either taken alone or along with a simple additive term (they included only an additive term for certainty) add little to the predictive ability of a strictly additive model; "The Impact of Certainty and Security on Levels of Crime in American States: An Extended Analysis," *Journal of Criminal Law & Criminology* 64 (1973), 492.