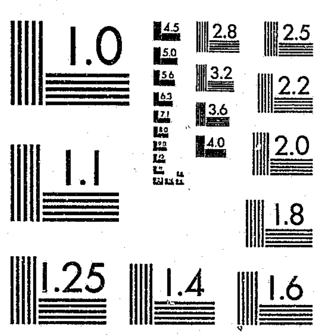

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CRIMINAL DETERRENCE IN NEW YORK: THE RELATIONSHIP BETWEEN COURT ACTIVITIES AND CRIME

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This study provides new evidence on the deterrent effects of criminal justice sanctions. The supply-of-crime function is tested using 1970 cross-sectional data for the 62 counties in New York State. Most studies consider only expected length of sentence when estimating the offender's cost of crime. The current analysis includes the length of time needed to dispose of a case and the severity of conviction charge as well as the expected prison sentence.

Many economists have focused on the problem of crime and crime control since the path-breaking work on the economics of crime by Gary Becker (1968). These analyses use a model which treats criminal activities as labor supply decisions. An individual decides whether to commit crimes and the decision depends on his/her expected gains from committing crime, the expected costs, and the opportunity cost which results from not working legally. Costs are incurred because the offender may receive sanctions from the criminal justice system. An increase in the level of sanction will deter crime because the expected gains from committing crimes are reduced. One of the uses to which the model can be applied is testing whether changes in criminal justice sanctions affect the level of crime. For example, Ehrlich (1974) considered alternative sanctions in the specific case of capital crimes — whether capital punishment deters murder. Mathieson and Passell (1976) examined the specific relationship between police enforcement and homicide and robbery crimes in New York City. Wolpin (1978) investigated the alternative effects of fines, sentences of recognizance and sentences of incarceration in England and Wales.

In the present application of the criminal deterrence model, the criminal sanctions specified in the empirical analysis are related to the alternative courtroom outcomes for felony[1] crimes in New York State. As in previous studies, our analysis tests the hypothesis that increasing

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1. According to the criminal laws, crimes are divided into three major categories: felonies, misdemeanors and violations. Felony crimes are the most serious category and violations the least serious.

the expected punishment deters crime. We test the deterrence hypothesis using a new data source.[2] Also, this analysis investigates the possibility that an offender may respond to changes in court procedures. That is, holding expected sentence constant, offenders may be deterred by changes in court processing such as mandatory sentencing or a reduction in the amount of plea bargaining permitted. The latter issue has not been addressed previously.

I. CRIMINAL JUSTICE PROCESSING

Criminal justice processing in New York State is complex. The offender faces a number of alternative sanctions together with different levels of severity for each sanction. The following is a simplified description of the criminal justice process for felony offenders in New York State.

After a person is arrested on a felony charge, the case is brought before the lower court (see Figure 1). At this stage, the case may be dismissed, the offender may be acquitted, the offender may be convicted of a misdemeanor (usually the result of the plea bargaining process) or the case may be continued to the higher court. A person charged with a felony offense who enters the higher court may be acquitted, convicted on a misdemeanor charge or convicted on a felony charge. Individuals who are convicted of a misdemeanor (in either court) may receive a jail sentence of up to one year or a sentence which does not require a period of incarceration. Individuals convicted of a felony may receive a non-incarceration sentence, a jail sentence or may be sent to a State prison for a term of one year or more.

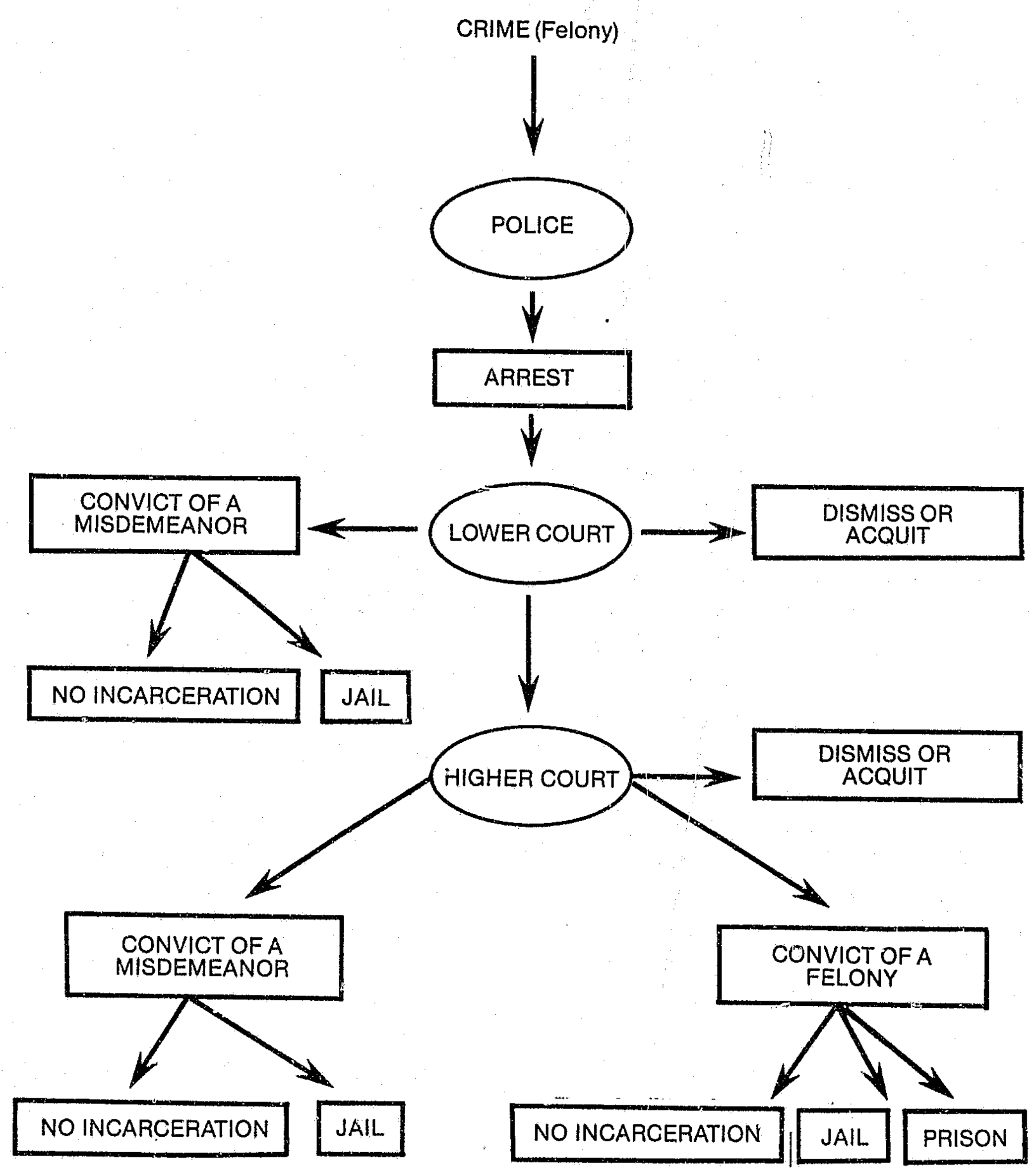
Thus, the possible sanctions facing the offender who is arrested are no conviction, conviction with a non-incarceration sentence, conviction and a jail sentence of up to one year, or conviction and a prison sentence of at least one year. Further, a felony offender may be convicted in either the lower court or the higher court, and may be convicted of a misdemeanor or a felony charge.

Different costs are incurred by the offender due to different types of processes within the criminal justice system, even though the outcome may be the same. For example, two offenders, both arrested and convicted for the same type of offense and sentenced to a six-month jail term, may experience a different process to resolve their cases. One offender may be convicted of a misdemeanor charge in the lower court while the other offender may be convicted of a felony in the upper court. The first offender incurs lower costs because his case can be resolved more quickly and when he is released from jail, he will carry a less serious criminal record. The second offender has spent more time in court and more time

2. Nagin (1978) argues that although there have been a number of deterrence studies there have been few independent tests of the deterrence hypothesis since many authors use the same data source.

FIGURE 1

Criminal Justice Processing in New York State



between court dates and carries a serious criminal record. A model which only includes punishment outcomes would consider these individuals as having incurred the same costs.

II. ESTIMATION OF THE SUPPLY-OF-OFFENSES

A. Model. The model in the current analysis is an extension of the one presented by Ehrlich (1973) which accounts for the diversity of

criminal justice outcomes. Ehrlich postulates an expected utility function which is the weighted sum of the utility derived from the total income in each possible state of the world. The weights are the probabilities of each state. He applies the model to two states: that of arrest, conviction and imprisonment and all other outcomes. His aggregate supply-of-crime function is specified as:

$$(1) \qquad (C/POP)_k = f(\overline{P}_{ik}, \overline{F}_{ik}, \overline{W}_{ik}, \overline{U}_{Lk}, \overline{V}_k).$$

The k subscript refers to the 50 states which were the units of observation. $\overline{P}_i$ is the average probability of arrest for crime type i, $\overline{F}_i$ is the average penalty for crime type i, $\overline{W}_L$ is the average earnings in the legal sector, $\overline{W}_i$ is average earnings in the illegal sector, $\overline{U}_L$ is the average unemployment rate in the legal sector and $\overline{V}$ is a vector of environmental variables. Ehrlich hypothesizes a negative effect of P and F on the crime rate.

Extending the model to n possible court outcomes, the aggregate supply-of-crime function is

$$(2) \quad (C/POP)_k = g(\overline{W}_{ik}, \overline{W}_{Lk}, \overline{P}_{ik}, \overline{R}_{1k}, \overline{R}_{2k}, \ldots \overline{R}_{nk}, \overline{C}_{1k}, \overline{C}_{2k}, \ldots \overline{C}_{nk}, \Pi_k).$$

Here, the $\overline{R}_{jk}$'s and the $\overline{C}_{jk}$'s are average probabilities and average costs (to the offender) of jth court outcome given arrest. Π_k refers to other variables in the kth area. Each $\overline{R}_j$ and $\overline{C}_j$ will have a negative effect on crime. Also, the more severe the court outcome, the greater will be the effect of $\overline{R}_j$ on the crime rate.

B. Variables in the Equation. The aggregate supply of offenses function is tested using 1970 cross-sectional data for counties in New York State. The county is used as the unit of regional aggregation since the criminal courts are administered separately in each county in the state. The dependent variable is the crime rate for all property-related felonies: burglary, grand larceny, robbery and auto theft.[3] The F.B.I.'s "index" crime data file provided the crime information. The tests of the crime supply model reflect the variety that there are of court outcomes. Nevertheless, the small number of observations in the test (only 62

3. It would be extremely difficult to estimate the crime function for smaller crime categories such as burglary, larceny, etc. This is because of the way that criminal charges are reduced as a case is processed through the criminal justice system. For example, a case which enters the lower court on a robbery charge may enter the upper court as a burglary charge and the offender may ultimately be convicted of criminal trespass. Since the data set is not based on individual cases but rather on inputs and outflows into each court, there is no way to estimate what percent of persons convicted of criminal trespass were arrested for robbery, burglary, etc.

The F.B.I. data indicate the number of offenses reported to the police. Studies have found that many crimes are never reported to the police and that the rate at which crimes are reported varies with the type of crime. Ennis (1967) found the reporting rate for crimes comparable to F.B.I. index crimes to be as follows: 60% for robbery, 65% for burglary, 30% for grand larceny and 90% for auto theft. We estimate the actual number of crimes in each offense category by dividing the reported number of crimes in each offense category by these reporting rates.

counties in New York State) limits the number of variables included in each specific crime supply function.

The first specification of the model tests whether criminals and potential criminals are sensitive to the severity of conviction charge. In this model, possible court outcomes are 1) felony conviction with a prison sentence (with a probability of R1), 2) felony conviction with a jail sentence (probability = R2), 3) felony conviction with a non-incarceration sentence (probability = R3), 4) misdemeanor conviction with a jail sentence[4] (probability = R4), 5) misdemeanor conviction with a non-incarceration sentence (probability = R5) and 6) no conviction (probability = R6).

A jail sentence is more severe punishment than a non-incarceration sentence, and prison terms are longer than jail terms. Therefore, deterrent effects of the court probabilities can be ranked as: R1 > R2 > R3 and R4 > R5. If (potential) criminals regard a misdemeanor conviction as a less serious outcome than a felony conviction the deterrent effects of increases in the court probabilities can be further ranked as R2 > R4 and R3 > R5.

The second specification of the model tests whether potential criminals are sensitive to the continuation of their case in the higher court. In this case, possible court outcomes are: 1) higher court conviction with a prison sentence (probability = Q1), 2) higher court conviction with a jail sentence (probability = Q2), 3) higher court conviction with a non-incarceration sentence (probability = Q3), 4) lower court conviction with a jail sentence (probability = Q4), 5) lower court conviction with a non-incarceration sentence (probability = Q5), and 6) no conviction (probability = Q6). Prison is a stronger sanction than jail and jail is a stronger sanction than non-incarceration. Thus, the deterrent effects can be ranked as Q4 > Q5 and Q1 > Q2 > Q3. If criminals perceive that a higher court conviction is a more severe outcome than a conviction in the lower court, then deterrent effects of the probabilities can be ranked as Q2 > Q4 and Q3 > Q5.

A list of the variables included in both specifications of the model is included in Table 1. For each variable, a short description and its mean value are given.[5] There are 62 counties in New York State. Since one county was eliminated because of missing data, all analyses are for 61 observations.

The probability of arrest for an offender in a given year depends on the level of police protection, which is exogenous to the crime supply function, and also depends on the number of crimes the offender commits, which is endogenous. An ideal measure of the probability of arrest would

4. Local jail terms range from one day to one year. State prison terms are for at least one year.

5. Socioeconomic data was derived from the 1970 Census of Population. Data for the probability of arrest *(PA)* and for all of the court outcome probabilities, the R_i's and Q_i's, were derived from annual tallies for local and county police and court activities in New York State in 1970.

TABLE 1

Variables in the Regression Equations

Variable Name	Mean Value	Description
CR	.0346	property-related felony crime rate per capita
PA	.150	probability of arrest per offense
POV	8.110	percent of the population of the county below the poverty level of income
PERNW	.042	proportion of the population of the county which is non-white
URBAN	51.230	percent of the population in the county living in urban areas
MODEL 1		
R1	.121	probability of a felony conviction and a prison term given arrest
R2	.087	probability of a felony conviction and a jail term given arrest
R3	.190	probability of a felony conviction and a non-incarceration sentence given arrest
R4	.089	probability of a misdemeanor conviction and a jail term given arrest
R5	.199	probability of a misdemeanor conviction and a non-incarceration sentence given arrest
MODEL 2		
Q1	.121	probability of a higher court conviction and a prison sentence given arrest
Q2	.161	probability of a higher court conviction and a jail sentence given arrest
Q3	.369	probability of a higher court conviction and a non-incarceration sentence given arrest
Q4	.015	probability of a lower court conviction and a jail sentence given arrest
Q5	.020	probability of a lower court conviction and a non-incarceration sentence given arrest

relate only to the exogenous level of police protection. This analysis approximates the exogenous component of the probability of arrest *(PA)* by measuring the average probability of offense per crime committed.[6]

The current measure of *PA* may not be entirely exogenous. An individual's probability of arrest per offense may increase as he commits more crimes. More victims of crime may describe the criminal to the police, police may detect a particular crime pattern and investigate, etc. On the other hand, criminals who commit many crimes may learn skills which help them avoid apprehension. In either case, *PA* is not independent of the number of crimes committed. If both of these effects occur, they may offset each other so that the average probability of arrest per offense may, in fact, be independent of the average number of crimes committed per offender.

Variables indicating the costs to the offender of unfavorable court outcomes, the C_j's, were not included in the analysis. Length of sentence decisions are determined at the state level by 1) a uniform state criminal code at the sentencing stage and 2) the State parole board once the criminal is in prison. Therefore, the C_j's do not vary greatly within the State.

C. Econometric Specification of the Supply-of-Crime Equation. Correct identification and specification of the supply-of-offenses function is a recurring issue in the economics of crime literature. Most researchers believe there is a simultaneous relationship between crime and sanction levels. Not only does the level of sanction affect a potential criminal's decision to commit a crime, but current and previous crime rates affect the levels of sanction which the criminal justice system can provide. Crime rates affect the public's demand for protection against crime and also affect the efficiency with which criminal justice agencies can operate.

The sign of the effect of the crime rate on sanctions is not clear. Presumably, if all else is equal, there will be a greater demand for protection against crime in high crime areas. However, the costs of providing additional protection in high crime areas may also be greater. In the short-run, diminishing returns set in, given the fixed resources of police, courts, jails and prisons. Long-run adjustments are slow, especially in providing additional jail and prison spaces when these institutions are filled to capacity. Thus, the reverse effect of crime rates on sanctions may be positive or negative.

The simultaneity problem may be solved by a system of equations which includes the supply-of-offenses function, the demand for protection and the production of protection. Researchers have used such a two- or three-stage equation system.[7] Fisher and Nagin (1978) places doubts on the validity of all previous cross-sectional studies which used a simultaneous equation system, arguing that incorrect identification of the system has yielded parameter estimates which are inconsistent.[8] Although perhaps biased and inconsistent, two generalizations can be made from the previous literature. Most studies find a negative effect of sanction levels on crime rates. And, in studies which use both OLS and multistage regressions, results indicate little difference in coefficients.

In the current analysis, a multi-equation regression model would be unwieldy, difficult and expensive to estimate. OLS was chosen to estimate the supply-of-offenses function here[9] since the advantages of performing a multi-equation model do not appear to warrant the costs. Due to the problems discussed above, results must be interpreted with caution.

Another problem is that measurement errors in the independent variable *PA* (probability of arrest) may cause spurious correlation with the dependent variable, since both of these variables contain values for the number of crimes in the fraction. In the present analysis, somewhat different sources of information were used to compute the crime rate and the probability of arrest. The former was computed from F.B.I. reports and the latter from New York State criminal justice reports, thus reducing the chance of bias in the coefficient on the probability of arrest.

Further error results when an untransformed value of the dependent variable is used in the analysis. The observed crime rate varies between zero and one, tending to be close to zero in most counties. Since a negative crime rate cannot be observed, the distribution of error terms may not be normal. Rather, the errors are truncated at a value of the crime rate at zero. In such a case, t-tests of significance for the coefficients are not valid. In our regression model, a logistic form of the dependent variable was chosen.[10] Use of the logistic form forces predicted values for the crime rate to vary between zero and one.

A problem arises when interpreting the regression results: an increase in the probability of arrest or the probability of jail or prison is expected to reduce crime through the incarceration effect. That is, holding all else constant, an increase in some variables will increase the number of offenders who are in jail or prison. If the supply of offenders is not perfectly elastic, crime will be reduced because offenders will be prevented from committing crimes while they are incarcerated. The coeffi-

6. Again, the actual number of crimes is derived by dividing the reported number of crimes in each category by the appropriate reporting rate.

7. See Nagin (1978) for an excellent review of the empirical literature. More recent studies were conducted by Wolpin (1978) and Bartel (1979).

8. One identification problem is that it is difficult to find variables which logically belong in the supply-of-offenses function and not in the supply of protection equation. Fisher and Nagin suggest that adding a time series component may correct for the inconsistency.

9. A correctly specified multi-equation model might solve a potential problem of multicollinearity among the R-variables and the Q-variables. Fortunately, the correlation matrix among variables R1 through R5 and among variables Q1 through Q5 do not reveal large correlations; however, multicollinearity may still exist.

10. The logistic form is

$$\log_e [\text{crime rate}/(1 - \text{crime rate})].$$

cients on PA, R1, R2, R4, Q1, Q2 and Q4 will include the incarceration effect as well as the economic deterrent effect. Coefficients on the other criminal justice variables: R3, R5, Q3 and Q5 will reflect pure deterrent effects, since none of these variables affects the size of the jail and prison populations.

Independent computations of the elasticity of the crime rate were calculated with respect to PA, R1, R2, R4, Q1, Q2 and Q4, assuming only an incarceration effect. By assuming a perfectly inelastic supply of criminals, our estimates are upward bounds of the actual incarceration effect. The maximum possible incarceration elasticity with respect to PA varies between .078 and .093.[11] The incarceration elasticity with respect to Q1 and to R1 varies between .079 and .122. The incarceration elasticity of the crime rate with respect to R2, R4, Q2 and Q4 never exceeds .01. Therefore, larger elasticities of the crime rate with respect to these variables can definitely be attributed to an effect other than incarceration.

III. RESULTS AND CONCLUSIONS

Regression results are presented in Table 2. For ease of interpretation, coefficients are converted to reflect the effects of the independent variables on the crime rate rather than on the logistic transformation of the crime rate.[12] Elasticities of the relevant and significant criminal

11. The estimation procedure is derived from Ehrlich (1973). His fo[illegible]r the crime rate, assuming only an incarceration effect and zero elasticity of supply of criminals [illegible]

$$CR = N\overline{S}/(1 + PT)$$

where P is the probability of arrest in a given year, T is the average length of sentence, N is the number of crimes committed per criminal per year and $\overline{S}$ is the proportion of the at-large population which is criminal. Using our formulation, the equation is:

$$CR = N\overline{S}/\{1 + P[(R1 \cdot \overline{PR}) + (R2 \cdot \overline{J}) + (R4 \cdot \overline{J})]\} \quad \text{for model 1 and} \tag{7}$$

$$CR = N\overline{S}/\{1 + P[(Q1 \cdot \overline{PR}) + (Q2 \cdot \overline{J}) + (Q4 \cdot \overline{J})]\} \quad \text{for model 2.} \tag{8}$$

$\overline{PR}$ is the average prison sentence and $\overline{J}$ is the average jail sentence. Estimates of $\overline{PR}$ and $\overline{J}$ are 2 year and .3 years, respectively (see Corman, 1978, p. 88). The probability of arrest in one year, P, must be estimated; since we only know the probability of arrest per offense. Assuming a binomial probability distribution with each independent probability as PA, the function can be approximated as:

$$P = 1 - e \ \exp[-(PA)N].$$

The average number of crimes committed per criminal per year, N, is estimated to vary between three and six (see Corman, 1978, p. 42).

The elasticity of the crime rate with respect to PA, R1, R2 and R4, assuming only an incapacitation effect, can be found by differentiating equation 7 with respect to these variables, multiplying by mean values for each of these variables divided by the crime rate, approximating the value of P, and substituting appropriate values for $\overline{PA}$, $\overline{R1}$, $\overline{R2}$, $\overline{R4}$. Incapacitation elasticities of the crime rate with respect to Q1, Q2 and Q4 can be similarly computed, using equation 8.

12. The original coefficients represented $\delta[\log_e(CR/1 - CR)]/\delta x$. To convert these to represent $\delta CR/\delta x$ we multiplied each coefficient by $CR(1 - CR)$ at the mean value of the crime rate.

TABLE 2

Regression Results

Dependent Variable: Property-related felony crime rate per capita

Variable	Coefficient**	Elasticity**	t-value
MODEL 1			
MEDY	$.068 \times 10^{-5}$		.30
POV	$.037 \times 10^{-2}$		.31
PERNW	.021		4.98
URBAN	$.013 \times 10^{-2}$		1.47
PA	−.082	−.35	−2.58
R1	−.033	−.11	−2.37
R2	−.039	−.10	−2.27
R3	.019		−2.14
R4	−.018		−.90
R5	−.006		−.58
Intercept	−.029		−4.02
F-ratio:	18.874		
R^2:	.7906		
MODEL 2			
MEDY	$.018 \times 10^{-4}$		.72
POV	$.065 \times 10^{-2}$		.52
PERNW	.169		2.72
URBAN	$.011 \times 10^{-2}$		1.12
PA	−.060	−.25	−1.86
Q1	−.030	−.10	−2.09
Q2	−.029	−.13	−2.39
Q3	−.017		−1.97
Q4	.019		.20
Q5	.018		.30
Intercept	−.020		−4.29
F-ratio:	17.932		
R^2:	.782		

*coefficients represent the effect of the x variables on the actual crime rate. The regression model used a logistic form of the dependent variable.

**elasticities are calculated at the mean crime rate and mean x values.

justice sanction variables are calculated at the mean values, and t-values for all of the coefficients are given. The regressions are unweighted.[13]

In both models, criminal justice sanction levels are found to have a significant negative effect on crime. This effect cannot be attributed strictly to incapacitation effects since the elasticities of *PA* (−.35 in model 1 and −.25 in model 2) well exceed the maximum incapacitation elasticity of −.093. Moreover, elasticities of variables R2 and Q2 exceed −.04.[14] Also, the significant coefficients on the probability of non-incarceration sentences found in variables R3 and Q3 can only be attributed to deterrence effects. In model 1, the probability of arrest *(PA)*, the probability of felony conviction and prison (R1), the probability of felony conviction and jail (R2) and the probability of felony conviction and non-incarceration sentence (R3), all have significant deterrent effects. In model 2, the probability of arrest *(PA)*, the probability of higher court conviction and prison (Q1), the probability of higher court conviction and jail (Q2) and the probability of higher court conviction and a non-incarceration sentence (Q3) all have significant negative effects on the crime rate.

In each specification of the model, court processing does seem to affect criminal behavior. In both models, outcomes 2 and 4 represent the same sentence: a jail term. Yet, an increase in the probability of a misdemeanor (or lower court) conviction with a jail sentence does not have the same deterrent effect as an increase in the probability of a felony (or higher court) conviction with a jail term. The larger effects of R2 and Q2 rather than R4 and Q4 could be explained solely by a possible differential in length of jail terms between felony (or higher court) and misdemeanor (or lower court) convictions. The probability of a felony conviction and no incarceration is found to have a significant deterrent effect on crime. Thus, the possibility of a lengthy court process and of receiving a felony criminal record, even though there is no incarceration, affects individual decisions to commit crimes. Unexpectedly, the probability of a misdemeanor conviction and jail (R4) and the probability of a lower court conviction and jail (Q4) were not found to have significant deterrent effects.

13. Typically, authors using cross-sectional aggregate data for the supply-of-offenses function have used a weighted regression. Although the fact that observations are aggregated suggests using weighted regressions, the data indicate that weighting is inappropriate. Using the procedure outlined by Goldfeld and Quandt (1972, p. 88) we tested for homoscedasticity using both weighted and unweighted regressions. Only in the case of unweighted regressions were we unable to reject the null hypothesis of homoscedasticity.

The same test for homoscedasticity was applied using three different specifications of the model: linear, log-linear and linear with a logit-transformed dependent variable. Only the latter form produced homoscedastic results. Thus, the typical log-linear form used in many supply-of-offenses functions was found to be inappropriate here, both using weighted and unweighted regression.

14. Coefficients on R1 and Q1 do not yield clear results. They may be explained by a large incapacitation effect and may or may not reflect a deterrence effect as well.

Overall, the current results add further evidence that criminal justice sanctions deter crime. In New York State, within the current range of sanction levels, criminals and potential criminals will have a somewhat weak reaction to changes in probabilities of arrest, conviction and severity of sentence. These results contrast with those of other authors who find stronger effects of sanctions on crime when estimated as a state-to-state cross section or as a national time series.

The results indicate that court processing does matter to the potential offender, even court outcome held as a constant factor. Thus, a policy such as plea bargaining, which results in more cases resolved at the lower court/misdemeanor level, may encourage crime, even if the expected sentence does not change.

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