Deterrence and the Death Penalty: A Temporal Cross-Sectional Approach

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COMMENTS

DETERRENCE AND THE DEATH PENALTY: A TEMPORAL CROSS-SECTIONAL APPROACH

INTRODUCTION

It has often been argued that the imposition of capital punishment serves three general purposes: retribution, deterrence, and rehabilitation. The last goal dictates against the use of the death penalty, and the first is often criticized as archaic and barbaric. By a process of elimination, deterrence is left as the principal theory lending support to and serving as a rationale for this most extreme form of punishment. For this reason, "deterrence has received an increasing amount of attention from scholars in a variety of fields."[1]

Particular attention has been focused on the utility of the application of capital punishment as an effective deterrent force. Various statistical methodologies have been employed in attempts to measure and test the extent of the effects that the risk of death has on potential and actual murderers. To date, the empirical findings have been generally inconclusive.[2]

There are several reasons why such studies have been criticized for only marginally contributing to the debate over the efficacy of capital punishment as a means of deterring homicides. First, the data being used for the statistical tests are not generally considered to be random samples approximating the true population values.[3] Second, the question of which variables should be used is still open. One approach may examine capital punishment as a deterrent force by itself, while another methodology may phrase the issue in terms of which punish-

ment, death or life imprisonment, is the superior deterrent for policy purposes. Third, even if the death penalty is assumed to be an effective deterrent force, it would be difficult to prove since murders which are actually deterred will not be reflected in the crime statistics. In effect, crime data reflect those murders for which the threat of the punishment of death either did not represent a deterrent force to prevent the crime or was not considered at all.

The actual use of capital punishment itself as an acceptable form of societal penalty does not rest on solid grounds either. It is important to recognize that even if it is assumed that the potential fear of death can deter a crime, this in itself may not be a necessary and sufficient reason for use of the death penalty.[4] The execution of a convicted offender is not only the most severe form of punishment possible, but it is also permanent. Uncertainty reflecting the balancing of the high cost of imposing the death penalty against the as yet unproven gains resulting from the imposition of death in turn produces two further uncertainties. First, the imposition of the death penalty, if it truly has no deterrent effect, results in the probability of a net loss to society while achieving no goal other than retribution. Second, even if a potential victim's life is saved because of the deterrence impact, there will be a net gain to society only if the life of an offender is valued differently from that of a victim.[5] These questions are essentially moral and value judgments which even the best empirical findings cannot be expected to answer in any substantive way.

Studies of deterrence and capital punishment rest on a crucial assumption which may be unwarranted: men are rational in their behavior. This involves two related factors directly impinging upon the proposition that potential murderers generally react the same to different types of situations

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[1] F. ZIMRING & G. HAWKINS, DETERENCE 2-3 (1973).

[2] Most of the studies are discussed in this study; for example, see Ehrlich, *The Deterrent of Capital Punishment: A Question of Life and Death*, 65 AM. ECON. REV. 397 (1975); Forst, *The Deterrent Effect of Capital Punishment: A Cross State Analysis of the 1960's*, 61 MINN. L. REV. 743 (1977); Passell, *The Deterrent Effect of the Death Penalty: A Statistical Test*, 28 STAN. L. REV. 61, 66 (1975); Sellin, *Experiments with Abolition*, in CAPITAL PUNISHMENTS 122 (1967) (hereinafter cited as Sellin Experiments); Sellin, *Homicides in Retentionist and Abolitionists States*, in CAPITAL PUNISHMENTS 135 (1967) (hereinafter cited as Sellin Homicides).

[3] *See* Note, *Crime Statistics—Can They Be Trusted*, 11 AM. CRIM. L. REV. 1045 (1973), for a general discussion of the available data and the shortcomings of these sources.

[4] Tullock, *Does Punishment Deter Crime?*, 36 PUB. INTEREST 103, 108 (1974).

[5] Van den Haag, *On Deterrence and the Death Penalty*, 60 J. CRIM. L.C. & P.S. 141, 146-47 (1969).

and stimuli—a rational thought process and knowledge. First, if the crime is one of passion or provocation as opposed to premeditation and deliberation, as many if not most murders are considered to be, then the threat of a particular punishment or the difference between types of punishment will be effectively nullified.[6] In other words, the relevant variable is actually only that part of all homicides and non-negligent manslaughters that is the result of deliberation, malice and aforethought. Thus, although there is evidence that the threat of punishment does deter "burglary and other property crimes, it is unlikely to have much effect on crimes of impulse, such as rape and many murders."[7] The only satisfactory solution to this problem is data which reflect only murders resulting from rational thought processes and choices; unfortunately no such data exist. The other prong of the rational man theory involves the assumption of knowledge on the part of the potential offender. That is, even assuming a potential murderer is calculating and deliberate in his actions,

> [f]or punishment to have a deterrent effect, potential criminals must have at least some information about its likely severity and frequency. Presumably, the effect of variations in punishment would be greater if criminals were well-informed than if they were not. In practice, of course, potential criminals are not very well-informed about these things, but they do have some information.[8]

The issues, shortcomings, and questions raised above must be recognized in order to evaluate properly and objectively the results of empirical situation. Solutions to many of these may well involve an individual moral resolution of the values involved, a task not attempted in this study.[9] Moreover, the fact that the statistical and theoretical underpinnings of such studies have been subjected to such criticism does not mean there is little or no information to be obtained from their findings. On the contrary, even given these limitations, such research has resulted in "modest increments in understandings."[10] Any additional empirical evidence, even if suggestive rather than definitive,[11] contributes information which is invaluable in trying to determine whether capital punishment really represents a viable and effective means for society to vindicate its values.

The focus of this comment will thus be two-fold: first, to analyze those studies which have attempted to verify empirically the existence of a deterrent effect of capital punishment, and second, to present the results of new empirical research which has tried to take into account many of the criticisms directed at the analyses to be discussed. The issues highlighted above, as well as others to be raised later,[12] serve the useful function of placing these statistical studies in their proper perspective by indicating the problems raised by an empirical approach. There is at the same time, however, a realization that this type of research may yield

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[6] As United States Supreme Court Justice Brennan, concurring in Furman v. Georgia, 408 U.S. 238 (1971), said:
> It is not denied that many, and probably most, capital crimes cannot be deterred by threat of punishment. Thus the argument can apply only to those who think rationally about the commission of capital crimes. Particularly is that true when the potential criminal, under this argument, must not only consider the risk of punishment, but also distinguish between two possible punishments. The concern, then, is with a particular type of potential criminal, the rational person who will commit a capital crime knowing that the punishment is long-term imprisonment, which may well be for the rest of his life, but will not commit the crime knowing that the punishment is death.

Id. at 301 (Brennan, J., concurring).

[7] Tullock, *supra* note 4, at 108.

[8] *Id.* at 109.

[9] In this regard, one writer has concluded that "we have no right to risk additional future victims of murder for the sake of sparing convicted murderers; on the contrary, our moral obligation is to risk the possible ineffectiveness of executions." Van den Haag, *supra* note 5, at 147.

[10] ZIMRING & HAWKINS, *supra* note 1, at 3.

[11] *Id.*

[12] In Rudolph v. Alabama, 275 Ala. 115, 152 So. 2d 662 (1963), *cert. denied,* 375 U.S. 889 (1963), Justice Goldberg, dissenting from denial of certiorari, observed:
> The following questions, *inter alia,* seem relevant and worthy of argument and consideration:
> (1) In light of the trend both in this country and throughout the world against punishing rape by death, does the imposition of the death penalty by those States which retain it for rape violate "evolving standards of decency that mark the progress of [our] maturing society," or "standards of decency more or less universally accepted?"
> (2) Is the taking of human life to protect a value other than human life consistent with the constitutional proscription against "punishments which by their excessive ... severity are greatly disproportioned to the offenses charged?"
> (3) Can the permissible aims of punishment (e.g., deterrence, isolation, rehabilitation) be achieved as effectively by punishing rape less severely than by death (e.g., by life imprisonment); if so, does the imposition of the death penalty for rape constitute "unnecessary cruelty?"

375 U.S. at 889–91 (Goldberg, J., dissenting) (footnotes omitted).

information which may contribute to the goal of satisfactorily resolving these issues.

Isaac Ehrlich and Deterrence

Until recently, very little had been done in the way of statistically testing the deterrence hypothesis in a rigorous manner. The studies that had evaluated capital punishment as an effective means of preventing murders tended to analyze the issues on a non-empirical level, relying on sociological, economic, demographic and psychological theories. The studies that were statistically-oriented did not involve sophisticated models, and the great majority rejected the hypothesis that the threat of death does affect the commission of homicides. In addition, Supreme Court decisions, principally *Furman v. Georgia*[13] and *Gregg v. Georgia*,[14] not only served to fuel the debate over capital punishment, but also seemed to stimulate social scientists and econometricians to redouble their efforts in attempting to isolate and identify what, if any, deterrent effect exists. The potential utility of such evidence was underscored by the references made in the amicus curiae brief of the Solicitor General of the United States in *Fowler v. North Carolina*.[15] The brief cited as principal evidence of the positive deterrent effect of capital punishment a 1975 study by Isaac Ehrlich.[16]

Recognized as the principal proponent of the value of capital punishment as a tool of deterrence, Ehrlich has tested several sophisticated econometric models, all purporting to demonstrate that the deterrence hypothesis should be accepted. In reviewing the pro-deterrence literature, primary attention will be paid to Ehrlich's research; his methodological approach, findings, and conclusions will be discussed, analyzed, and criticized.

Ehrlich's Research: Accepting the Deterrence Hypothesis

Ehrlich's original study was published in 1975 and quickly became a center of controversy. Using

[13] 408 U.S. 238 (1971). The Supreme Court, in a 5-4 decision, held that the imposition of the death penalty in a murder case constituted cruel and unusual punishment in violation of the eighth and fourteenth amendments, and concluded that the punishment of death does not invariably violate the Constitution.
[14] 428 U.S. 153 (1976). The Supreme Court upheld the sentence of death in an armed robbery and murder conviction against the challenge of cruel and unusual punishment in violation of the eighth and fourteenth amendments and concluded that the punishment of death does not invariably violate the Constitution.
[15] 428 U.S. 904 (1976).
[16] Ehrlich, note 2 *supra*.

an economic approach to murder, Ehrlich constructed a supply function of murders[17] and used it to test the basic hypothesis that as the use of capital punishment increases, the rate of homicides will decrease. Each murderer was hypothesized to have a utility function which reflects the direct costs of planning and executing the crime as well as the risks of incurring detrimental losses if apprehended, convicted and/or executed. All other things being equal, it was theorized a rational offender will exhibit behavior designed to maximize his utility and will commit the crime only if the expected utility is greater than the expected utility of the second-best or second-choice action.

Given these basic behavioral assumptions, Ehrlich then isolated for statistical purposes three deterrence variables: the probability of being apprehended, the conditional probability of being convicted if apprehended, and the conditional probability of being executed given conviction. In terms of actual effectiveness, Ehrlich ranked apprehension first and execution last on the basis of the magnitude of the corresponding elasticity.[18] As he noted, "On the basis of this analysis, it can be predicted that while the execution of guilty murderers deter acts of murder, *ceteris paribus*, the apprehension and conviction of guilty murderers is likely to have an even larger deterrent effect."[19]

In addition to these deterrence measures, Ehrlich also included in his equation economic variables for the United States, labor force participation rate (the per cent of the population having or actively seeking employment), the unemployment rate, per capita permanent income, and age distribution. The deterrence variables actually inserted in the

[17] Ehrlich's function postulates that the supply of homicides will be determined by the interaction of deterrence, economic, and demographic/social variables. That is, assuming all other factors remain constant, an increase in the rate of execution (a conviction or apprehension) will result in a decrease in the ratio of homicides. This simple supply function is then combined with the negative social demand for murder and asserts as a basis for the analysis that the offender will respond to certain incentives included in the supply equation. *Id.*
[18] An elasticity basically measures the percentage change in one variable brought about by the percentage change in another or the responsiveness of the quantity demanded of a variable to change in its price. If the elasticity is greater than, less than, or equal to one, the relationships (usually demand) is said to be relatively elastic, inelastic, or unitary elastic, respectively. For additional information, see Johnston, Econometric Methods (1972) or Chiang, Fundamental Methods of Mathematical Economics (1967).
[19] Ehrlich, *supra* note 2, at 402.

equation were constructed using proxies. The probability of being apprehended was measured by clearance rates (estimates of all murders "cleared" by the arrest of a suspect), the probability of conviction was the fraction of all persons charged with murder over those who were convicted of it, and the probability of execution had different measures involving lagged and current values of executions and convictions. The left-hand or dependent variable is the homicide rate, represented by the number of non-negligent manslaughters and murders per 100,000 persons.

The structural equation actually estimated is of the Cobb-Douglas variety, meaning that the estimated coefficients of the explanatory variables may be interpreted as elasticities.[20] To correct for interdependencies among the murder rate and the probabilities of conviction and execution, Ehrlich utilized a regression technique known as two-stage least squares,[21] which merely involves the insertion of certain exogenous or instrumental variables into the equation to solve this problem of simultaneity. The equation is estimated for the United States for the period 1933-1969 and consists of variables in modified first-difference form (autoregressive transformations of the original variables measured in natural logarithms).[22]

Ehrlich found that the regression results indicated that his hypothetical ranking of the effect of the deterrence variables is correct and that the signs of the estimated coefficients (elasticities) and their magnitudes conform to general theoretical expectations.[23] In defense of his techniques, Ehrlich contended that his results are

> robust with respect to the functional form of the regression equation. In addition, estimating the regression equations by introducing the levels of the relevant variables rather than their modified first differences (that is, assuming no serial correlation in the error term) artificially reduces the standard errors of the regression coefficients as would be expected on purely statistical grounds.[24]

In terms of the implications for the trade-off between murders and executions, Ehrlich's results suggest that every additional execution would save the lives of seven or eight potential murder victims.

In evaluating his own findings, Ehrlich did not claim to have proved the deterrence hypothesis since he recognized the possibility of bias due to the absence of data on the severity of alternative punishments, although he did not know which way this would bias his results. On the contrary, Ehrlich claimed merely a tentative acceptance of the hypothesis. As Ehrlich maintained, "[I]n view of the new evidence presented here, one cannot reject the hypothesis that law enforcement activities in general and executions in particular do exert a deterrent effect on acts of murder. Strong inferences to the contrary drawn from earlier investigation appear to have been premature."[25]

In addition to this time series analysis, Erhlich also tested in a separate study the deterrence hypothesis using cross-sectional data.[26] The focus was on the cross-sectional patterns of murders and executions for the years 1940 and 1950. The principal advantage to this analysis as compared to the first study is the availability of data for variables not

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[20] A Cobb-Douglas production function takes the form of the following (expressed in Ehrlich's terms):

$$Q/N = C * P_a^{\alpha_1} * P_{c/a}^{\alpha_2} * P_{e/c}^{\alpha_3} * U^{\beta_1} * L^{\beta_2} * Y_p^{\beta_3} * A^{\beta_4} \exp(v_1)$$

where Q/N   rate of non-negligent manslaughter and murder
      P_a probability of apprehension
      $P_{c/a}$ probability of being convicted
      $P_{e/c}$ probability of being executed
      L   labor force participation rate
      U   unemployment rate
      Y_p permanent income per capita (Friedman measure)
      A   per cent of population between ages of 14-24
      C   constant term
      v_1 disturbance term assumed to have first order serial correlation

When the equation is estimated, the estimated coefficients are the exponent (α and β) and may be interpreted as elasticities. That is, α_3 represents the responsiveness of Q/N to a unit percentage change in $P_{e/c}$. *Id.* at 406-07.
[21] An increase in the execution rate will presumably result in lower jury convictions for capital crimes, thus, if rising executions cause a decrease in convictions, then the perceived effects of executions on the homicide rate might appear positive. Two-stage least squares allows the effect of the two variables to be separated in a systematic way.

[22] *See* Klein, Forst & Filatov, *The Deterrent Effect of Capital Punishment: An Assessment of the Estimates*, in NATIONAL RESEARCH COUNCIL, DETERRENCE AND INCAPACITATION: ESTIMATING THE EFFECT OF CRIMINAL SANCTIONS ON CRIME RATES, 336-52 (1978).
[23] Ehrlich, *supra* note 2, at 411.
[24] *Id.* at 412.
[25] *Id.* at 416.
[26] Ehrlich, *Capital Punishment and Deterrence: Some Further Thoughts and Additional Evidence*, 85 J. POL. ECON. 741 (1977).

available over time, such as estimates of the severity of punishment (median time spent in prison prior to first release or the actual length of the prison sentence) for murder and other crimes.

This approach rests on key structural relations: first, the supply function for offenses, and second, the demand for enforcement activities. The typical deterrence variables were specified again as prices, costs, or negative rewards. The explanatory variables were grouped into two categories—deterrence and economic/demographic. The former consisted of the probability of conviction measured by the ratio of convictions per number of homicides, the median time spent in prison prior to first release, and the probability of execution measured by the ratio of the average number of executions in the last "x" number of years to the number of convictions for murder in the current year. The demographic/economic variables included the per cent of nonwhites in the population, the per cent of families with incomes less than one-half of the median family income for the state, the median family income lagged one year, the per cent of the population between ages fifteen and twenty-four, and the per cent of the urban population to the state population.

The estimation technique was ordinary least squares;[27] two-stage least squares could not be used because of data exigencies. Supply functions were estimated separately for executing states as well as the full sample because the estimated levels of the conditional risks of execution in abolitionist states were effectively zero. Tests for homoscedasticity (changing variance in the error term) proved negative, so generalized least squares estimators were obtained by weighting all the variables by the square roots of either the urban, state, or relevant sample populations.

The regression results again indicated that the three deterrence variables (apprehension, conviction, and execution) are statistically significant and negatively related to the rate of homicides. The elasticity of the rate of homicides with respect to

the conditional probability of conviction was, as hypothesized, greater than the elasticity with respect to the conditional probability of execution. The inclusion of a dummy variable[28] in the full sample equation to account for abolitionist and retentionist states permitted a test to be made of their statistical difference. As Ehrlich stated, "the only valid inference to be drawn from the estimated effect of [the dummy variable] is that it indicates the existence of a statistically significant difference between the mean rates of murder in executing and non-executing states after the effects of the other variables . . . have been accounted for."[29] On the basis of these results, which largely confirmed and reinforced the findings and conclusions of his time series study, Ehrlich concluded that

it is noteworthy that all the deterrence variables examined in this analysis yield the expected results in connection with murder and other crimes, and that the coefficients associated with explanatory variables other than constant terms appear statistically indistinguishable across different samples as well as across subsets of executing and non-executing states.[30]

As the foregoing discussion illustrates, Ehrlich's work has had a considerable impact on the capital punishment-deterrence debate. First, his models represent the first sophisticated econometric attempts at isolating and evaluating the marginal effect of an execution on the murder rate. Second, this conclusion that the execution of a convicted murderer will deter potential murderers and thus save the lives of would-be victims cannot be regarded too lightly, despite the existence of a number of criticisms of his work tending to diminish the actual impact of his findings. Given these criticisms (to be examined in the next section) and the questionable validity of the statistical and theoretical assumptions underlying both Ehrlich's methodology and more generally the application of econometrics to this problem (discussed in the previous section), Ehrlich's work cannot be said to have proven the deterrence hypothesis, but it has cast some doubt on the belief that capital punishment no longer serves any of the legitimate or

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[27] Briefly, ordinary least squares "is a method of developing an equation which relates one variable (such as a company's sales) to one or more other variables which should explain the first (such as price, economic demands, competition, etc.). This method is mathematically contrived so that the resulting combinations of explanatory variables produces the smallest error between the historic actual values and those estimated by the regression." McLagan, *A Non-econometrician's Guide to Econometrics*, 8 BUS. ECON. 38 (1973).

[28] The dummy variable assigns a value of 1 to retentionist states and a 0 to abolitionist states. The purpose is to see if there is any significant difference in the legal status of the death penalty among states.

[29] Ehrlich, *supra* note 26, at 757.

[30] *Id.* at 778.

historical societal goals of retribution, rehabilitation, and deterrence.

CRITICS OF EHRLICH AND HIS RESPONSES

There are three basic categories in which criticisms of Ehrlich's study may be grouped: data imperfections, methodological problems, and questionable assumptions. The most basic attack is leveled at the inadequacies of the data used in the study. Ehrlich relied on Federal Bureau of Investigation data as reported in the Uniform Crime Reports compiled annually by voluntary submission by local police departments. At best, these statistics represent no more than a sampling of total crime, and although this source may be the best set of nationwide data around, there is still much doubt as to its reliability for econometric use.[31]

Related to the issue of data reliability is the time period and frequency used in the actual regression. Ehrlich's time series analysis spanned the period 1933–1969 and involved annual data for the United States on an aggregate level. However, the inclusion of the years after 1960 may have produced a deterrent effect which is spurious in nature. The last execution in the United States (excluding the recent Gary Gilmore incident in Utah) took place in 1967. Over time, the absolute numbers of executions have been decreasing: 1,667 for 1930–39, 1,284 for 1940–49, 717 for 1950–59, and 191 for 1960–69 (of which 145 occurred between 1960 and 1962).[32] Although this distinct downward trend presents problems in itself (for example, the difficulty in accounting for political decisions, social factors, and value changes which might lie behind this decline in the use of the death penalty), it is clear from the figures that inclusion of the 1960's data may distort the results since executions were declining while homicide rates were increasing significantly.[33] That is, Ehrlich's use of the 1960's data, the period when the death penalty was discontinued as a means of punishment, may have produced spurious estimated coefficients of the regression variables. A recent study found this problem to be of a critical nature:

In fact, the real contribution to the strength of Ehrlich's statistical finding lies in the simple graph of the upsurge of the homicide rate after 1962, coupled with the fall in the execution rate in the same period. The whole statistical story lies in this simple pairing of these observations and not in the theoretical utility model, the econometric type specification, or the use of best econometric method. Everything else is relatively superficial and dominated by this simple statistical observation.[34]

Moreover, this criticism of Ehrlich's research has been accepted by Justice Marshall, dissenting in *Gregg*:

> The most compelling criticism of the Ehrlich study is that its conclusions are extremely sensitive to the choice of the time period included in the regression analysis. Analysis of Ehrlich's data reveals that all empirical support for the deterrent effect of capital punishment disappears when the five most recent years are removed from his time series—that is to say, whether a decrease in the execution rate corresponds to an increase or decrease in the murder rate depends on the ending point of the sample period. This finding has cast severe doubts on the reliability of Ehrlich's tentative conclusions.[35]

Aside from the criticisms directed at Ehrlich's time series, there have been criticisms aimed at the methodology employed by Ehrlich in his studies. One alleged flaw involves the procedural aspects used by Ehrlich in constructing his model. As indicated in one study:

> [Ehrlich's] analysis is extraordinary at least insofar as it employs a vast array of manipulations: to create values of missing data, to test alternative time-lag structures to reduce bias or efficiency loss associated with autoregressive disturbances, to avoid undefined values of central interest, and to test alternative systems of simultaneity.[36]

Second, even small errors in estimates of any of the variables used in constructing the deterrence variables could produce an unusually strong but spurious appearance of a deterrent effect.[37] Measurement errors tend to bias the regression coefficients towards zero. In Ehrlich's study, the "errors in these crucial variables—(homicides, probability of apprehension, probability of conviction)—all appear to work in such a way as to bias the

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[31] Bowers & Pierce, *The Illusion of Deterrence in Isaac Ehrlich's Research and Capital Punishment*, 85 YALE L.J. 187 (1975).
[32] Board of Prisons, National Prisoner Statistics: Capital Punishment 1930-68. 8 (1969).
[33] These trends raise the important question of whether and to what extent the decline in and the end of executions during the 1960's caused the sharp rise in the homicide rate. *See* Klein, Forst & Filatov, *supra* note 22, at 345.

[34] *Id.* at 344–45.
[35] 428 U.S. at 235–36 (footnotes omitted).
[36] Klein, Forst & Filatov, *supra* note 22, at 339.
[37] Zeisel, *The Deterrent Effect of the Death Penalty: Facts and Faith*, 1976 SUP. CT. REV. 317, 335 (1976).

coefficient of (the execution rate) negatively."[38] In response, Ehrlich has contended that even if these measurement errors do exist, they would generally lead to the underestimation in a regression analysis of the true effects of an explanatory variable subject to random measurement imperfections.[39] In either case, the root of the problem is still the lack of reliable historical period, a defect not likely to be corrected.

The national approach adopted by Ehrlich in his first study tends to conceal the impact and effects of state and regional differences. For instance, on an aggregate level, if one state shows an increase in executions and another a decrease in homicides, the overall effect might appear to be one of deterrence which would not exist at all.[40] Furthermore, a time series approach lacks many of the desirable properties of a cross-sectional analysis which

> provides the potential for a more thoroughly controlled estimate of the effect of changes in elasticities on homicides not only by way of the existence of large inter-regional variation in several of the included variables, the incorporation of regional dummy variable, and a corresponding reduction in aggregation bias, but also by way of the opportunity to include a term-of-imprisonment variable, which is not available in time series.[41]

The functional specification used by Ehrlich has also been criticized. Ehrlich assumed a multipli-

cative equation in the nature of the Cobb-Douglas production function;[42] the regression was estimated using the natural logarithmic values of the variables as a means of transforming the specified relationship into an equivalent linear form. Some studies, attempting to duplicate Ehrlich's work but not using log transformations, have concluded that the deterrence impact is a statistical artifact, in essence a result of the functional specification.[43] While it is true that the incorrect use of the logarithmic form can cause relatively small values for the risk of execution to appear to be statistical aberrations influencing the regression fit, this same problem may exist with respect to a linear form for the same values.[44] The data available for a study will often play a crucial role in determining whether a non-linear specification should be used. In Ehrlich's case, there does not appear to be any reason dictating against the use of a non-linear specification. In fact, Ehrlich claimed that his approach represents a superior format because the magnitude of the errors in his data is approximately proportional to the level of the variables the data are purporting to measure. For this reason, Ehrlich believed his results are not exclusively dependent on the specific functional form chosen but are basically unaffected qualitatively by this choice.[45]

In any regression using ordinary least squares, a critical property is the inclusion of all relevant variables. Omitted variables will seriously bias the estimated coefficients of the deterrence variables as well as the associated standard errors.[46] Ehrlich himself admitted the presence of this statistical problem in his time series analysis. In his cross-sectional study, Ehrlich included variables such as the severity of imprisonment for murder and other crimes which are not available over time.[47] The variables omitted from the time series regression equation are first, a proxy measure for individuals who are undeterred by social sanctions against murder for other reasons such as the absence of strong family ties or lack of friends,[48] and second, variables representing migration from rural to ur-

[38] Klein, Forst & Filatov, *supra* note 22, at 348–49.

[39] Ehrlich, *Deterrence: Evidence and Inference*, 85 YALE L.J. 209, 213 (1975).

[40] Baldus & Cole, *A Comparison of the Work of Thorsten Sellin and Isaac Ehrlich on the Deterrent Effect of Capital Punishment*, 85 YALE L.J. 170, 176 (1975). Justice Marshall, dissenting in Gregg v. Georgia, 428 U.S. 153 (1976), recognized this point explicitly:

> It has been suggested, for example, that the study is defective because it compares execution and homicide rates on a nationwide, rather than a state-by-state, basis. The aggregation of data from all states—including those that have abolished the death penalty—obscures the relationship between murder and execution rates. Under Ehrlich's methodology, a decrease in the execution risk in one State combined with an increase in the murder rate in another State would, all other things being equal, suggest a deterrent effect that quite obviously would not exist. Indeed, a deterrent effect would be suggested if, once again all other things being equal, one State abolished the death penalty and experienced no change in the murder rate, while another State experienced an increase in the murder rate.

Id. U.S. at 234–35 (Marshall, J., dissenting) (footnotes omitted).

[41] Klein, Forst & Filatov, *supra* note 22, at 341.

[42] *See* note 20 *supra*.

[43] *See* Bowers & Pierce, *supra* note 31, at 199; Baldus & Cole, *supra* note 40, at 185.

[44] Peck, *The Deterrent Effect of Capital Punishment: Ehrlich and His Critics*, 85 YALE L.J. 359, 361 (1976).

[45] Ehrlich, *supra* note 39, at 217–18.

[46] Passell, *supra* note 2, at 66.

[47] Ehrlich, *supra* note 26, at 742.

[48] Passell, *supra* note 2, at 66.

ban areas, per capita ownership of guns, and the level of violent crimes against property.[49]

Ehrlich found that conviction rates would decrease as executions increased.[50] Given the nature of ordinary least squares regression analysis, the trade-off between the homicide rate and the execution rate depends upon holding constant all the other variables in the system, including the apprehension and conviction rates.[51] Since both of these deterrence variables were found to have negative effects on the homicide rate, this implies that the effect of a decline in the conviction rate will offset the effect of an increase in the execution rate, and in fact will outweigh it given the magnitude of their elasticities.[52] Given this reasoning, it is consistent with the conclusion that an increase in executions will cause a net increase, not decrease, in the homicide rate.[53]

The final criticism may be the most damaging to the credibility of Ehrlich's findings, and is directly related to the earlier criticism concerning the time period chosen. Econometric theory teaches that if the results of a time series regression are an accurate representation of the underlying causal processes, then the values of the estimated coefficients will be independent of specified time periods. Although neither Ehrlich nor his critics did any rigorous testing for structural changes over the sample period, one study, attempting to duplicate Ehrlich's equation, found that all evidence of deterrence disappears when the last five years are dropped from the regression.[54] This should not be too surprising since inclusion of the 1960's in the time interval may drastically distort the results because executions dropped dramatically or were eliminated while homicide rates increased significantly.[55] In examining the inclusion of the 1960's

in a regression analysis, a recent study has concluded that "ending the practice of capital punishment in the 1960's does not constitute a controlled experiment from which one can safely draw conclusions about deterrence by observing only homicides and executions. Factors other than the ending of capital punishment severely affected the homicide rate during this period."[56]

Ehrlich, however, did do some testing of his temporal specification by dropping some of the earlier and later years. His test results showed no appreciable change in the elasticity of the homicide rate with respect to the execution variable.[57] However, Ehrlich has indicated that this criticism of his model is unjustified because "[s]elective elimination of a sufficient number of observations from a regression analysis is a virtually foolproof method for reversing any single result derived from an original sample."[58]

Moreover, Ehrlich has claimed that the elimination of the data points relating to murders in the 1960's (over 17% of Ehrlich's sample) amounts to, in effect, the selective, non-random exclusion of observations crucial to an efficient estimation. This is especially true when the observations omitted (1960's) significantly reduce the variability in the estimate of the execution rate. The rate of change in executions had been stable over the 1940's and 1950's but declined sharply in the 1960's, accurately reflecting the true risk of execution. Thus, eliminating these years and the corresponding variability seriously affects the magnitude of the estimated coefficients by reducing the overall variability in the estimates of the execution rate.[59]

This change in the coefficients resulting from the choice of various time intervals could be the result of a structural change or shift over time, or the result of an incorrect specification of the model for the entire time period.[60] In any case, the instability of the coefficients indicates there is a possibility that the deterrent effect is spurious. Ehrlich should have more rigorously tested the structural stability of his equation; the fact that he may have done so but did not present the results casts a shadow on his findings.

Given Ehrlich's findings, the criticisms of his work, and his rebuttals, it is difficult to formulate and defend any position regarding the deterrence

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[49] Baldus & Cole, *supra* note 40, at 180.

[50] Ehrlich postulated that any exogenous factor causing a decline in the severity of punishment for murder via a decline in the conditional probability of execution given conviction will increase the probability of conviction, since the marginal costs of conviction will decrease but its marginal revenue will increase. That is, the rates of execution and conviction are substitutes with respect to the costs of each activity. Ehrlich, *supra* note 2, at 405–06.

[51] Passell, *supra* note 2, at 64.

[52] The sign of the elasticities (estimated coefficients) and their magnitude conform to the general theoretical expectations that the elasticity with respect to the apprehension ratio is the largest, the execution ratio elasticity the smallest. Ehrlich, *supra* note 2, at 401, 411.

[53] Baldus & Cole, *supra* note 40, at 182; Passell, *supra* note 2, at 64.

[54] Bowers & Pierce, *supra* note 31, at 197–98.

[55] *See* text accompanying note 28 *supra*.

[56] Klein, Forst & Filatov, *supra* note 22, at 345.

[57] Bowers & Pierce, *supra* note 31, at 197; Ehrlich, *supra* note 2, at 409–16.

[58] Ehrlich, *supra* note 39, at 214.

[59] *Id.* at 214–16.

[60] Peck, *supra* note 44, at 361.

hypothesis. A recent study has wisely concluded that

> it seems unthinkable to us to base decisions in the use of the death penalty on Ehrlich's findings, as the Solicitor General of the United States has urged. They simply are not sufficiently powerful, robust, or tested at this stage to warrant use in such an important case. . . . It is not that Ehrlich's estimates are demonstrably wrong; it is merely that they are too uncertain and must, at best, be interpreted as tentative at this stage.
>
> There is nothing wrong with Ehrlich's particular numerical findings. His arithmetic is correct; his formulation is imaginative; but application to the most serious of issues is premature. In short, we see too many plausible explanations for his finding a deterrent effect other than the theory that capital punishment deters murder.[61]

EVIDENCE OF NO DETERRENT EFFECT

Much of the recent literature on the topic of capital punishment and deterrence has focused on Ehrlich's findings, analyzing and critiquing his hypothesis and methodology. This interest has stimulated the development of several econometric models designed to test and identify the causal relationship between the death penalty and homicides, usually with a goal of refuting Ehrlich's conclusions. These modeling attempts are sophisticated additions to the graphical and statistical analyses of the 1960's and 1970's, which could not find any significantly acceptable evidence of deterrence. The studies and findings of these groups (the chartists-comparativists and the econometricians) are deserving of recognition and are discussed briefly in this section. While the impact of these research projects has not been as strong as Ehrlich's, it is nevertheless important to be aware of the fact that statistical evidence contrary to Ehrlich's does exist. It must be borne in mind, of course, that neither position has been conclusively established or accepted.

Chartist-Comparativists: Sellin and the Matching Technique

The principal studies concluding that the use of capital punishment does not deter homicides have been done by Thorsten Sellin.[62] His first attempt to isolate a deterrent effect was simply an examination of what happened with respect to the homicide rates in those states which abolished the death

penalty and later reinstituted the punishment. Using a comparative analytical scheme, Sellin concluded that "there is no evidence that the abolition of the death penalty generally causes an increase in criminal homicides or that its reintroduction is followed by a decline."[63]

Recognizing that few states have changed policies in this manner and thus that this finding did not have great probative value, Sellin extended the scope of his inquiry by comparing contiguous retentionist and abolitionist states. This implicitly assumes that neighboring states are similar in terms of economic, social, political, and demographic conditions, an assumption that is difficult to justify empirically. The purpose of this "matching" technique was to test the hypothesis that states that have abolished the death penalty have lower homicide rates than states that have retained capital punishment. The rate of murders and non-negligent manslaughters were compared over the period 1920 to 1963. Since actual capital murders are hidden in the data but are the relevant variable, it was necessary for Sellin to make the implicit and crucial, though unproven, assumption that the proportion of capital to total murders remains constant over time. On the basis of this comparative analysis, Sellin found that

> [a]n inspection of the figures shows (1) that the level of the rates is not the same in all regions; (2) that within each group of contiguous states it would be impossible to identify the abolitionist state, were it not designated as such; and (3) that the trends of the rates of the states compared are similar. The conclusion is inevitable that the presence of the death penalty—in law or practice—does not influence homicide death rates.[64]

Other studies have adopted the approach and methodology of Sellin and have arrived at the same results. For instance, Chambliss reported that a preponderance of his evidence indicates that capital punishment does not act as a deterrent to murder.[65] His comparative research demonstrated

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[61] Klein, Forst & Filatov, *supra* note 22, at 358.

[62] Sellin Experiments, note 2 *supra*; Sellin Homicides, note 2 *supra*.

[63] Sellin Experiments, *supra* note 2, at 124.

[64] Sellin Homicides, *supra* note 2, at 136. Sellin paired sets of contiguous states in order to match the homicide rates of retentionist and abolitionist states. Six pairings were examined, the abolitionist states being listed first: Maine with Vermont and New Hampshire, Rhode Island with Massachusetts and Connecticut, Minnesota and Iowa with Wisconsin, Michigan with Indiana and Ohio, Kansas with Missouri and Colorado, and North Dakota and South Dakota (until 1939) with Nebraska.

[65] Chambliss, *Types of Deviance and the Effectiveness of Legal Sanctions*, 1967 WIS. L. REV. 703 (1968). In reaching his conclusions, Chambliss compared the number of per-

three facts: first, that murder rates had remained constant from 1951-1966 despite a trend away from the use of capital punishment; second, that within the United States, there is no significant difference in the murder rate between abolitionist and retentionist states, and third, that the possible consequences of the act of murder are not considered by the murderer at the time of the commission of the crime.

Similarly, a research effort by Savitz analyzed the homicide rate in Philadelphia before and after highly publicized executions in order to test the hypothesis that the deterrence impact will be most effective during the days following executions in a locality where the crime was committed and/or where the criminal was known.[66] This study concluded that "there was no significant decrease or increase in the murder rate following the imposition of the death penalty on four separate occasions."[67]

These studies are the most reliable non-econometric evidence that the death penalty serves no deterrence purpose. Sellin's findings have been cited as superior to Ehrlich's because of the existence of several significant factors in his study, but absent from Ehrlich's: (1) the choice of variables and the way the threat of capital punishment is measured; (2) the use of state rather than national data; (3) the techniques used to control for the influence of other variables affecting homicide rates; and (4) the consistency of the findings.[68]

Sellin's work has also found support and accept-

ance in judicial quarters. In a Massachusetts decision addressing the question of the imposition of death in a rape-murder case, a concurring judge argued that a

> review of the available studies and other materials cited reveals no firm indication that capital punishment acts as a superior deterrent to homicide than other available punishments. At best the evidence is equivocal. I am thus unable to find that the Commonwealth has a compelling interest in deterrence which cannot adequately be served by other less restrictive means of punishment.[69]

Justice Marshall also examined Sellin's statistical evidence and concluded in *Furman* that "Sellin's statistics demonstrate that there is no correlation between the murder rate and the presence or absence of the capital sanction."[70]

Despite the general acceptance of his findings, Sellin's research, like Ehrlich's, has been subjected to critical review. The major criticism by econometricians charges that Sellin's methods do not present a systematic test of the main implications of general deterrence theory; that is, that potential offenders respond to incentives. In this respect, Sellin's use of the legal status of the death penalty as a means of comparison has been deemed misleading since the relevant variable is the actual risk of execution.[71] More specifically, Ehrlich has concluded that Sellin's efforts are nothing more than

> informal tests of the sign of the simple correlation between the legal status of the death penalty and the murder rate across states and over time in a few states. Studies performing this test have not considered systematically the actual enforcement of the death penalty, which may be a far more important factor affecting an offender's behavior than the legal status of the death penalty. Moreover, these studies have generally ignored other parameters characterizing law enforcement activity against murders, such as the probability of apprehension and the conditional probability of conviction, which appear to be systematically related to the probability of punishment by execution. In addition, the direction of the causal relationship between the rate of murder and the probabilities of conviction, apprehension and execution is not obvious, since a high murder rate may generate an upward adjustment in the levels of these probabilities in accordance with optimal law enforcement. Thus the sign of the simple correlation between the murder rate and the

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sons executed with the homicide rate for each year from 1951 to 1966 and found that the murder rate did not appear to be connected with executions. Second, Chambliss did a Sellin-type analysis and concluded that the annual average murder rate in selected contiguous states (each pairing having one retentionist and one abolitionist state) were not significantly different.

[66] Savitz, *A Study in Capital Punishment*, 49 J. CRIM. L.C. & P.S. 338 (1958). Specifically, Savitz examined four case studies, concentrating on the eight-week period before and after the sentence of death to determine what the effect would be on the commission of capital crimes. On an individual basis, Savitz found somewhat of a decrease after sentencing, yet when the data from all four were combined, the impact was insignificant. In the period before imposition, 43 total capital crimes were reported of which 23 were definitely capital in nature and 20 were possibles; in the period after, 41 total capital crimes occurred, 28 being defined as definites. The total decrease in capital crimes measured 4%, caused principally by a sharp decline in possible capital crimes.

[67] *Id.* at 341.

[68] For a more detailed comparison of Ehrlich and Sellin, see Baldus & Cole, *supra* note 40, at 185-86.

[69] Commonwealth v. O'Neal, 339 N.E.2d 676, 685 (Mass. 1975) (Tauro, C.J., concurring) (footnotes omitted).

[70] 408 U.S. at 350 (Marshall, J., concurring).

[71] Ehrlich, *supra* note 39, at 222.

legal status, or even the effective use of capital punishment, cannot provide conclusive evidence for or against the existence of a deterrent effect.[72]

Furthermore, argue the Sellin critics, it was not possible to have a random assignment of treatment levels in Sellin's comparative approach because the data were not generated in a controlled experiment and the choice of the state pairings was subjective and deliberate.[73] In addition to the absence of laboratory conditions underlying Sellin's approach, there are basic structural problems as well:

the similar areas are not similar enough; the periods are not long enough; many social differences and changes, other than the abolition of the death penalty, may account for the variation (or lack of) in homicide rates with and without, before and after abolition; some of these social differences and changes are likely to have affected homicide rates.[74]

Finally, it has been claimed that Sellin's matching technique also ignores the possible response of punishment policies to homicide rates—if a high or rising homicide rate leads one state to institute the death penalty and low or falling rates lead other states to abolish it, retentionist states would tend to have higher homicide rates. This result by itself could cancel out a possible negative correlation which would be produced if the penalty were in fact an effective deterrent.[75]

Econometricians and the Death Penalty

There have been several major research efforts which have econometrically tested the deterrence hypothesis of Ehrlich, but have arrived at contradictory results. All of these models failed to find any significant evidence that capital punishment influences the homicide rate.

The Bowers and Pierce study, for example, tested the Ehrlich conclusions by attempting to duplicate Ehrlich's model.[76] Specifically, this study focused on the criticism of Ehrlich that the deterrent effect disappears when certain years of data are deleted from the analysis. The results indicated that the coefficients of the deterrence variables are not negative as expected, but rather are predominantly positive and become even more so as additional years are deleted.[77] However, this study is not

conclusive as either a rejection of Ehrlich's findings or as an independent finding tending to establish that there is no deterrence effect. The data used by Bowers and Pierce were not the same as that used by Ehrlich since Ehrlich had not released his statistical base at that time.[78] Furthermore, the intervals used by Bowers and Pierce were different from Ehrlich's study since this study ended in 1963 and Ehrlich's study included data up to 1969.

Passell[79] estimated a cross-sectional model similar to the cross-sectional equations of Ehrlich. This study focused on the years 1950 and 1960, compared to Ehrlich's concentration on 1940 and 1950. Another significant difference between the two models is that Passell's deterrence variables were constructed somewhat differently. Passell's version included the perceived probability of punishment (defined as the subjective probability of arrest and the probability of conviction given arrest), the length of the prison sentences of those convicted but not executed, and the typical execution variable. Other variables inserted in the equation were a demographic adjustment for age groups, an economic adjustment for income groups, and a social and family relationship adjustment. Using both ordinary and two-stage least squares estimation techniques, Passell found the execution rate to be positive but insignificant, indicating no deterrent effect. Although Passell did utilize sophisticated statistical techniques to achieve these results, he nevertheless concluded that "it cannot be proven that executions do not serve as a deterrent to murder. Proof is simply beyond the capacities of empirical social science. At a minimum, however, students of capital punishment must look elsewhere for evidence confirming deterrence."[80]

Forst also estimated a cross-sectional model, in testing the Ehrlich results, but concentrated on the years 1960 and 1970, representing a period when the rate of executions was falling dramatically but the homicide rate was rising.[81] These years were considered to be the best available to test the hypothesis that "to the extent that capital punishment deters homicides, the homicide rate should have increased by the largest amounts from 1960 to 1970, *ceteris paribus*, in those states with the greatest reductions in the probability that a person

[72] Ehrlich, *supra* note 2, at 415.
[73] For a critical analysis of Sellin's matching technique, see Peck, *supra* note 44, at 364.
[74] Van den Haag, *supra* note 5, at 145–46.
[75] Peck, *supra* note 44, at 364.
[76] Bowers & Pierce, *supra* note 31, at 204–05.
[77] *Id.*

[78] Since then, Ehrlich has apparently relented and allowed Klein, Forst, and Filatov use of the data in their study. *See* Klein, Forst & Filatov, *supra* note 22, at 352.
[79] Passell, note 2 *supra*
[80] *Id.* at 79–80.
[81] Forst, note 2 *supra.*

convicted of murder would be executed."[82] Forst included a wide range of variables in his equation specifications, including Passell's three deterrence factors and various social, demographic, and economic variables. Using ordinary least squares to estimate the equations, Forst could not find any support for the deterrence hypothesis with respect to the risk of execution, although the probability of conviction coefficient was negative and significant, suggesting that a higher risk of conviction would serve as a more efficient deterrent force than the risk of death. Although it has been suggested that Forst's findings are spurious, they nevertheless indicate that the certainty of punishment may be a more effective deterrent than its severity.[83] With regard to executions alone, Forst went beyond Passell and asserted affirmatively that

> the finding that capital punishment ... does not deter homicide is remarkably robust with respect to a wide range of alternative constructions of the execution rate, alternate assumptions about simultaneity among the crime and sanction variables, whether or not the observations are weighted, and the inclusion of different subsets of available control variables.
>
> The results of this analysis suggest ... that it is erroneous to view capital punishment as a means of reducing the homicide rate.[84]

While these econometric studies do seem to raise questions regarding the Ehrlich findings, they are subject to criticisms as well, including many discussed in relation to Ehrlich's methodology. Thus, at this point, it is apparent that there is credible empirical evidence on both sides concerning the deterrence effect of capital punishment, although no definitive study has yet been done. Furthermore, it can hardly be asserted with certainty that any empirical study will conclusively resolve the issue, although additional empirical research will yield valuable new evidence, permitting a more informed judgment to be made about this controversial issue. The next section presents the results of another empirical attempt to isolate, identify and measure econometrically the deterrent impact of capital punishment on homicide rates.

ADDITIONAL EVIDENCE ON DETERRENCE

The following analysis has been purposefully designed to account for many of the problems identified in other econometric models and to in-

corporate methods aimed at ameliorating these defects. As already noted, there are problems which are inherent in attempting to estimate an econometric model of the death penalty, and this study is no different. However, by accounting for the criticisms of prior modeling efforts, this analysis presents a new and theoretically more valuable and acceptable approach.

Thus far, the statistical efforts aimed at isolating the effects of capital punishment have proceeded along three basic lines of inquiry: (1) econometric models using time series; (2) cross-sectional data studies; and (3) a matching or "paired-comparison" framework. An analytical scheme utilizing time series is valuable because the movement over time of independent or exogenous variables can explain much of what "causally" determines any dependent or endogenous variable. The principal disadvantage of time series, however, is that in a number of instances many of the key explanatory variables may not be available either for a given historical time period or for a sufficient length of time to insure adequate degrees of freedom.

Cross-sectional analysis solves this problem by allowing "the researcher to observe larger differences in the relevant factors, to control for specific regional effects, and to include potentially important factors about which information is not available on an annual basis."[85] Yet, all of the cross-sectional and time-series studies done so far have failed to resolve the deterrence controversy, and this has potentially serious implications:

> The failure of these cross-sectional studies to find a significant deterrent effect is similar to discrepancies that have arisen in econometric investigations of consumer spending. In national time-series samples, there is evidence of significant positive association, at the margin, between an index of consumer attitudes and spending on durable goods; but in cross-section samples, with family-to-family variation, this same effect cannot readily be found. This lack of correspondence between the time-series and cross-section findings has always cast some doubt on the validity of the former. It has also been the case that significant time-series effects have not always carried over from sample to extrapolation. There have been serious enough reversals in appraisals of the macro-economy through methods based on time-series that we may be led by analogy to mistrust the policy extrapolation of Ehrlich's time series results in the absence of cross-section as well as other confirmations of his findings.[86]

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[82] *Id.* at 749.
[83] *Id.* at 763.
[84] *Id.* at 764.

[85] *Id.* at 747 (footnotes omitted).
[86] Klein, Forst & Filatov, *supra* note 22, at 342.

However, by combining both of these analyses into a technique known as pooled cross-sectional time series analysis, a different analytical approach may be taken in which less historical data are needed because the cross-sectional data compensate for the loss in yearly information. Further, a greater number of relevant variables can be included because of their increased availability. By examining and comparing states and regions in a way comparable to the matching technique of Sellin, additional comparative information is obtained reflecting the relative deterrent impact of capital punishment. Thus, it seems logical that the next step in the attempt to estimate econometrically the influence of executions on homicides should combine all three methodologies in order to obtain additional evidence on this controversial issue. As one economist has noted in critiquing the work done thus far, a major improvement in this field could be accomplished by applying econometric techniques to time-series data across states or regions in ways which, to a considerable extent, will bring the analysis closer to the paired-comparison method.[87]

ANALYTICAL FRAMEWORK

The approach taken in this attempt to test the deterrence hypothesis involves ordinary least squares in a pooled cross-sectional time-series framework. The principal advantage is that movements of the dependent variable (the rate of homicide) can be explained by the variances of the independent variables both over time and across regions or states, thus providing additional information as to the true relationship existing between variables. Although this approach does increase the number of observations in a regression compared to the cross-sectional or time-series approach alone, other things being equal, there is the disadvantage that it is not possible to correct for interdependencies among the variables by resort to two-stage least squares.

Two basic situations are selected in which to test the deterrence hypothesis. First, the national data is disaggregated to a regional level to see if variations between various sections of the country offer any additional evidence. In both the regional and the state-by-state equations, the sophisticated pooling technique of cross-sectional data over time is used. The second scenario involves an analysis of state data; this level of disaggregation is designed to discover what, if any, information can be obtained by accounting for individual state experiences.

As is the case in many statistical studies, the interval chosen for the period of estimation is dictated by the availability of data. In choosing the interval, the goal is to isolate those years in which the death penalty represents a commonly utilized form of punishment. All years after 1960 are deleted for the equations since the number of executions fell dramatically during that decade, and none occurred after 1967. The time span 1940 to 1960 seems best suited to fulfilling this goal; unfortunately, some of the relevant economic, demographic, and crime variables are not available during the earlier years on a state or regional basis. For this reason, the regressions are performed over the subperiod 1950-1960.

This approach to the choice of the estimation interval is subject to the same criticism that Ehrlich's research has drawn, that is, that the elimination of certain years amounts to, in effect, the selective, non-stochastic exclusion of observations which are arguably crucial to a reliable estimation of the key deterrence variables.[88] "The principle argument against changing the sample to investigate only the period up to 1962 is that valuable statistical observations are lost—not simply the observations that make the case, but observations that contribute in a general way to the overall number of degrees of freedom, which are precious, and in short supply for the analysis of the problem at hand."[89] Theoretically it is true that the nonrandom exclusion of data does eliminate valuable information, but here this loss of data may not be as critical an issue, since the deletion of observations and the information carried with them by restricting the interval to 1950-1960 is offset by the additional information gained through the use of temporal cross-sectional data matrices.

Furthermore, even though the availability of data is often a constraint on the estimation period which can be selected, the estimated coefficients are, other things being equal, expected to be unbiased in the ordinary least squares situation, although the confidence interval may be wider as a result. Finally, if the death penalty really does have a deterrent effect, the 1950-1960 time period represents a good interval over which to test the hypothesis for several reasons. First, although the Uniform Crime Reports do have reporting and compilation deficiencies, this source is nevertheless

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[87] Peck, *supra* note 44, at 367.

[88] Ehrlich, *supra* note 39, at 209.
[89] Klein, Forst & Filatov, *supra* note 22, at 353.

TABLE A

MNEUMONICS FOR VARIABLES USED IN THE REGRESSION EQUATIONS

Mneumonic	Variable	Level
O%N@	homicide rate per 100,000 (murders and non-negligent manslaughters)	national, regional, state
PA@	probability of apprehension (per cent of murders cleared by arrests)	national, regional
PGOC@US	conditional probability of being convicted of offense charged (murder) given apprehension	national
E%US@	per cent of executions occurring in the U.S. in a state or region	regional, state
PE1	number of executions in a given year divided by number convicted in previous year	national
%NW15@24	per cent of nonwhites in varying population age groups	national
%NW25@34		
SGF%NR@	per capita government expenditures as reflected by tax revenues	national, regional, state
NR@	resident population	national, regional, state
RU	national unemployment rate and the rate for selected age groups	national
RU16@19		
RU20@24		
N15@24	per cent of U.S. population between 15 and 24	national
YP%N@	per capita income	national, regional, state
LC%NR	labor force participation rate	national

the best available and is generally considered to be more accurate for post-1950 periods than for earlier years of publication.[90] Second, there is no significant trend in the use of capital punishment during this period as compared to the 1960's. Finally, the death penalty was still considered to be an acceptable form of punishment in the 1950's as compared to the abolitionist trend of the 1960's.

As noted, the crime data used in these regressions are taken from the Uniform Crime Reports (UCR) published by the Department of Justice. The only exception is the number of executions, which is compiled by the Justice Department in the National Prisoner Statistics Bulletin. The economic and social variables used in this analysis are from three principal sources, the Bureau of the Census (Commerce Department), the Bureau of Labor Statistics (Labor Department), and the Bureau of Economic Analysis (Commerce Department).

In all of the regressions, the dependent or endogenous variable is the rate of homicides (defined as murders and non-negligent manslaughters) per 100,000 persons. The independent or exogenous ("explanatory") variables reflect the deterrent effects of apprehension, conviction, and execution and the impact of various economic/social/demographic factors.

As Table A illustrates, the first deterrence variable is the probability of being apprehended for murder in the United States (PA@US) or in a region (PA@ region); individual state data are not

available for this concept. This probability is derived from the percentage of murders cleared by arrests.[91] PGOC@US is the conditional probability of being convicted of the offense of murder given apprehension for the entire United States. Since no state or regional data is available for this concept, the national variable is used in all levels of analysis. This deterrence variable is measured by the number of persons found guilty once charged. Finally, the conditional probability of being executed given conviction is measured in two ways. First, for the United States only, PE1 is the number of executions in a given year divided by the number convicted in the previous year. The variation of this variable is the per cent of all executions in the United States occurring in a given state (E%US@ state) or region (E%US@ region). This latter measure is designed to capture the effect, if any, of publicity and the subjective fear of being executed in a given state. The sign of each deterrent variable is expected to be negative, and the magnitude of the elasticities is expected to range from apprehension (largest) to executions (smallest).

The remaining explanatory variables are chosen by hypothesizing which economic and social factors are most likely to exert significant influence on the murder rate. Variables representing the per cent of non-whites in varying population-age groups (%NW15@24, %NW25@34) in the United States are designed to isolate the effect of race on homicide rates. Per capita state or regional

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[90] Bowers & Pierce, *supra* note 31, at 187-89.

[91] A murder is "cleared" for reporting purposes when a suspect is actually arrested for that murder.

TABLE B-1

REGIONAL BASIS: MURDER RATES REGRESSED AGAINST SELECTED VARIABLES (1950–1960)[1]

Variable	(1) E.C.	(1) S.E.	(2) E.C.	(2) S.E.	(3)[3] E.C.	(3) S.E.[4]
Constant	−368.509	602.500	−376.063	485.000	−1018.590	489.000
PA[2]	−0.025	0.031	−0.032	0.030	0.021	0.416
PGOC@US	10.781	29.170	25.632	19.430	0.784	1.784
PE1	4.483	35.030	—	—	—	—
E%US	—	—	1.799	1.552	0.063	0.230
%NW15@24	155.982	619.800	—	—	—	—
%NW25@34	−774.514	506.400	—	—	—	—
%NW15@34	—	—	−642.389	828.500	49.219	25.990
SGF%NR[2]	2.235	7.755	0.847	7.696	−0.623	0.194
NR[2]	0.150	0.096	0.133	0.096	1.284	0.335
RU	−0.712	0.937	—	—	—	—
RU16@19	—	—	−0.643	0.874	−6.935	2.102
RU20@24	—	—	0.067	0.999	2.258	1.525
YP%N[2]	−0.000	0.000	−0.000	0.000	0.006	0.012

[1] corrected for first-order autocorrelation   E.C. = estimated coefficient
[2] regional variables   S.E. = standard error
[3] estimated in logarithms
[4] The t-statistic is merely the estimated coefficient divided by the standard error.

government expenditures on crime prevention (SGF%NR@) is reflected by tax revenues, which represent the budget constraint on what can be spent.[92] As such expenditures increase (as tax revenues increase), the murder rate should, other things being equal, fall. The resident population of a given area (available for state and regional levels) is an indicator of the effects of population density and tests the hypothesis that more murders will be committed in more densely populated regions. The overall national unemployment rate (RU) and the unemployment rate for selected age groups (RU16@19, RU20@24) are proxies for the effect of economic cyclical behavior on well-being and mental attitudes. YP%N is per capita income for the United States and individual regions or states and is included in the equations to identify the relationship between homicide rates and the expectations resulting from different standards of living. The labor force participation rate (LC%NR) also may have an important influence as might the resident population (NR) and the age distribution of the population (N15@24).

The Deterrence Hypothesis at the Regional Level

At the regional level, the standard government classification is used to group the forty-five

[92] The assumption underlying this hypothesis is that as the amount available for government expenditure increases, part of this amount will be channeled towards crime prevention programs.

states:[93] Alaska and Hawaii are left out of both the state and regional analysis, due to late statehood, as are Vermont, North Dakota, and South Dakota, because of poor or unavailable data. An advantage of doing an analysis on a regional basis lies in the fact that more crime data is available at this level than on the state level. Application of a temporal cross-sectional estimating format in a regional set-

[93] The regions contain the following states:
NEW ENGLAND: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont
MIDDLE ATLANTIC: New Jersey, New York, Pennsylvania
EAST NORTH CENTRAL: Illinois, Indiana, Michigan, Ohio, Wisconsin
WEST NORTH CENTRAL: Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota
SOUTH ATLANTIC: Delaware, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia
EAST SOUTH CENTRAL: Alabama, Kentucky, Mississippi, Tennessee
WEST SOUTH CENTRAL: Arkansas, Louisiana, Oklahoma, Texas
MOUNTAIN: Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming
PACIFIC: California, Oregon, Washington

ting has the further advantage of not only producing overall statistics from the principal equation but also of permitting analysis of the individual regions themselves with respect to the causal relationships specified in the equation. Ordinary least squares is the regression technique used in these estimations, and the equations have been corrected for serial correlation.

Table B-I presents in a condensed form the results of three regressions run on a regional level. The left-hand variable in all the equations is once again the rate of homicide per 100,000, and there are nine explanatory variables. The first equation includes as the execution variable the percent of those executed in a given region to total executions (PE1). Equation two substitutes regional measures of the execution rate (E%US) for the national measure. In addition, the race variables are combined into one (%NW15@34) and the unemployment rate is split into two age groups (RU16@19, RU20@24). The third regression is the same as the second except it is estimated in logarithms.

In these equations, both the execution and the conviction rate variables are insignificant and positive. The substitution of execution measures (E%US for PE1) does not significantly alter these findings. Surprisingly, the probability of apprehension at the regional level is statistically insignificant in all three specifications; this contrasts with the substantial deterrence effect found at the state level (see Tables C-1, C-2, and C-3). Although the signs of the estimated coefficients of several of the other explanatory variables are different from what was expected, most are not significant, and a high degree of confidence cannot be placed in these

results. When equation two is estimated in natural logarithms (equation three), two variables change signs (%NW15@34 and YP%N) while the coefficients of others become significant (SGF%NR, NR, and RU16@19). This result does lend weight to the criticism that Ehrlich's finding of a deterrent effect of executions is nothing more than a statistical artifact arising from the use of logarithms.

Three more specifications are tested at the regional level, decreasing the number of variables and thereby decreasing the multicollinearity which may have existed in the above equations. Basically, these equations contain the same variables used in Ehrlich's time series analysis. The deterrence variables are the same as in Table B-1 except PE1 is used throughout. The remaining explanatory variables include the labor force participation rate, the unemployment rate, per capita personal income, and the per cent of the population between ages fifteen and twenty-four. Equation four is estimated using modified first differences, equation five borrows the specification of four but uses levels, and equation six is merely equation five expressed in natural logarithms.

Even based on Ehrlich's original specification, no evidence of deterrence results from these estimations (see Table B-2). There are many different explanations for this, including the fact that executions may not be a deterrent at all with respect to homicides. The equations in Table B-2 use five national variables but only two regional variables to explain regional homicide rates. In this regard, using national trends to explain regional variances may cause the overall effect of the explanatory variable to be negated or entirely deleted. The

TABLE B-2

REGIONAL BASIS: MURDER RATE REGRESSED AGAINST SELECTED VARIABLES (LEVELS, 1950–1960 FIRST DIFFERENCES, 1951–1960)[1]

Variable	(4)[2]		(5)		(6)[3]	
	E.C.	S.E.	E.C.	S.E.	E.C.	S.E.[5]
Constant	0.455	0.281	750.979	446.700	80.749	81.790
PA[4]	−0.083	0.358	−0.023	0.030	−0.004	0.005
PGOC@US	−0.111	0.212	14.282	24.740	2.596	1.847
PE1	0.146	0.075	3.106	29.180	0.263	0.545
LC%NR	2.292	2.125	431.070	188.400	−1.557	0.662
RU	−0.129	0.072	−0.607	0.761	−38.476	12.666
YP%N[4]	−1.074	0.680	1.940	0.988	−0.015	0.012
N15@24	−0.023	0.016	−1.581	1.146	−5.002	3.681

[1] corrected for first-order autocorrelation

[2] estimated in first-differences

[3] estimated in logarithms

[4] regional variables

[5] The t-statistic is merely the estimated coefficient divided by the standard error.

problem of omitted variables is also significant. The homicides which have the greatest potential for deterrence are murders for hire or those which are premeditated and deliberated. There is no variable to account for those homicides which are spontaneous, provoked, or based on passion.

This regional analysis is based on the additional information obtained from combining cross-sectional and time-series analyses and introducing regional variables. Thus, despite the above problems, this disaggregated approach nevertheless does provide new research findings concerning the existence of a deterrent effect. However, given the subperiod selected, the variables tested, and the regional focus, the hypothesis that capital punishment does deter homicides cannot be accepted on the basis of the regression evidence presented in this part of the study. There is one further level of disaggregation that can be used as a basis for testing this hypothesis. A regression analysis based on state data provides even more bits of information than one based on regional data and would seem to be the most favorable framework of the possible data levels in which to test the Ehrlich deterrence hypothesis.

The Deterrence Hypothesis at the State Level

By examining the data for forty-five states over a ten-year period, it is possible to increase the number of observations in the estimation to 495 as compared to 99 on the regional level. These additional pieces of information should provide additional reliable evidence as to the existence or nonexistence of a deterrent effect.

In structuring the equations to be estimated at the state level, no attempt is made to reestimate Ehrlich's equation using state data. Instead, a hypothesis is formulated and then tested, and the results are presented as estimated. In most of the equations, there are statistically insignificant variables which do not appear in other studies. The reason for the presence of such variables may be due to misspecification of the equation itself, or it could be a result of the absence of "data mining." In other words, these equations are not estimated on a trial-and-error basis. There are underlying reasons for the inclusion of each variable, and justifications for what the magnitude and sign of each estimated coefficient is expected to be. Undoubtedly, a better fit could have been obtained by dropping the insignificant variables in a succession of equations until finally arriving at the "best" fit in terms of t-statistics and other descriptive measures. However, this process, often done but

seldom admitted, may theoretically bias the results, since a hypothesized relevant variable is deleted from the equation and a new estimation performed with fewer variables. This produces the problem of omitting variables which were originally hypothesized as theoretically justifiable and relevant.

Table C-1 presents the results of the primary equation estimated on a state level. The dependent variable again is the rate of homicides per 100,000 persons in a given state. The three usual deterrence variables are included in the equation, although each reflects national, not state, trends. The sign of each is expected to be negative. Six additional explanatory variables are in the final specification, three of which represent state-specific economic, social, and demographic factors. The three national variables are the per cent of non-whites between the ages of 15-24 and 25-34 and the unemployment rate. The race variables are hypothesized to be positively related to homicides as is the unemployment rate. The three state variables include government expenditures per capita (expected to have a negative correlation), resident population (postulated to have a positive influence on homicides), and per capita income (expected to have a negative influence).

Two of the three deterrence variables are not only insignificant but also have the wrong sign (see Table C-1). Only the probability of being apprehended reflects any deterrent impact at all. This result is in accord with other studies mentioned above which found no deterrent effect in execution,

TABLE C-1

STATE BASIS: MURDER RATES REGRESSED AGAINST SELECTED VARIABLES (1950–1960)

Independent Variables	Estimated Coefficient[1]	Standard Error[4]
Constant[3]	−350.225	184.500
PA@US	−1.528	0.552
PGOC@US	9.793	13.380
PE1	10.833	14.760
%NW15@24	−343.448	372.600
%NW25@34	−89.385	226.400
SGF%NR[2]	−4.610	7.446
NR[2]	0.057	0.154
RU	−0.511	0.384
YP%N[2]	0.064	1.407

[1] corrected for first-order autocorrelation

[2] state-specific variables

[3] each state equation has its own individual intercept (constant term)

[4] The t-statistic is merely the estimated coefficient divided by the standard error.

but which did conclude that the subjective probability of being caught and convicted may play a powerful role in deterring criminal behavior. The signs of some of the other variables are also different from what was predicted. However, the standard errors of the estimated coefficients are so large that no confidence can be placed in these signs or in the magnitudes of the coefficients.

Table C-2 displays the results of a second specification containing a different measure of the death penalty variable (the per cent of total executions occurring in each state), only one racial variable combining the age distribution (NW15@34) but now on a percentage change basis, and two unemployment rates also based on age (RU16@19, RU20@24). The major difference, however, is that the conviction rate is dropped from the equation in order to isolate and estimate better the impact of the two remaining deterrence variables. The estimation results are not significantly different from the regression in Table C-1. The apprehension rate is again negative and significant while the execution rate is not statistically different from zero.

The final hypothesis tested focuses on those states which retained the death penalty during the 1950's. The five abolitionist states deleted from the equation are Maine, Rhode Island, Minnesota, Wisconsin, and Michigan. The hypothesis tested is that one reason the retentionist states have retained the death penalty as a form of punishment may be because it achieves the socially desirable goal of

TABLE C-2

STATE BASIS: MURDER RATES REGRESSED AGAINST
SELECTED VARIABLES (1950–1960)

Independent Variables	Estimated Coefficient[1]	Standard Error[4]
Constant[3]	−280.004	137.200
PA@US	−1.252	0.429
E%US@[2]	−0.037	3.175
%NW15@34	−327.575	391.200
SGF%NR@[2]	−5.494	7.379
RU16@19	−0.028	0.327
RU20@24	−0.218	0.379
NR@[2]	0.062	0.155
YP%N@[2]	0.077	1.405

[1] corrected for first-order autocorrelation

[2] state-specific variables

[3] each state equation has an individual intercept (constant term) not shown

[4] The t-statistic is merely the estimated coefficient divided by the standard error.

TABLE C-3

STATE BASIS: RETENTIONIST STATES MURDER RATES AND
SELECTED VARIABLES (1950–60)

Independent Variables	Estimated Coefficient[1]	Standard Error[4]
Constant[3]	−315.236	156.100
PA@US	−1.192	0.474
E%US@[2]	−0.280	3.206
%NW15@34	−490.105	426.300
SGF%NR@[2]	−7.136	7.882
RU16@19	0.044	0.362
RU20@24	−0.291	0.420
NR@[2]	0.052	0.166
YP%N@[2]	0.560	1.479

[1] corrected for first-order serial correlation

[2] state-specific variables

[3] each state equation has an individual intercept (constant term) (not shown)

[4] The t-statistic is merely the estimated coefficient divided by the standard error.

deterrence. The specification estimated is the same as in Table C-2, and the results are presented in Table C-3. There appears to be no significant difference between all of the states and just the retentionist states with respect to deterrence. Apprehension again provides the only evidence of deterrence, while the execution variable remains insignificant.

In summary, these state equations offer no evidence that the deterrence hypothesis with respect to executions should be accepted. This finding is surprising in that the methodology employed in this study would seemingly favor Ehrlich's hypothesis for two reasons: first, much more information is available through the use of a temporal cross-sectional analysis and the reliance on state and regional data to isolate and clarify further the relationship between the death penalty and homicides, and second, the interval chosen is favorable in that executions were still an acceptable and widely used form of punishment.

The estimated equations do not, however, contain strictly state-specific data. To estimate state variables more efficiently and accurately, state data on the apprehension, conviction, and execution rates and on the economic/social/demographic factors are essential. Until such data are available, the true relationships between variables may tend to be obscured by this mix of state and national variables. The inclusion of a global or national variable in an equation with a state-based dependent variable implicitly assumes that the effect of the national variable will be uniform across all

states; this may not be true with respect to the deterrence variables tested here.

ANALYTICAL AND POLICY CONCLUSIONS

The analysis undertaken above seems to lead to the conclusion that the "efficacy of capital punishment ... to deter others from crime remains a matter about which reasonable men and reasonable legislators may easily differ."[94] Statistical studies and tests have not been satisfactorily conclusive either way. "The deterrent effect of capital punishment is definitely not a settled matter, and this is the strongest social scientific conclusion that can be reached at the present time."[95] The hypotheses tested in this study are intentionally designed and specified in such a way that if capital punishment is a deterrent, this data should prove it. In none of the equations, however, could the death penalty be regarded as an effective deterrent. Only the probability of apprehension could be found significant and even then only on the state level.

Indeed, the proper question might be not whether executions do or do not deter homicides, but rather, given the available data and the problems involved in estimation, whether the use of statistical techniques can settle the issue or perhaps even whether they should be allowed to do so.[96] Even though there is no clear statistical evidence to resolve the debate conclusively, such evidence has been used, often inappropriately, as a basis for a judgment most likely already formed. Justice Marshall, concurring in *Furman*, interprets such inconclusive evidence to favor the abolitionists by deciding that "[d]espite the fact that abolitionists have not proved non-deterrence beyond a reason-

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[94] Roberts v. Louisiana, 428 U.S. 325, 355 (1976) (White, J., dissenting).

[95] Klein, Forst & Filatov, *supra* note 22, at 359.

[96] However, it is not at all clear that the courts will rely on or even use this evidence in testing the constitutionality of a death penalty statute. Justice White, dissenting in Roberts v. Louisiana, 428 U.S. 325 (1976), observed:

It will not do to denigrate these legislative judgments as some form of vestigial savagery or as purely retributive in motivation; for they are solemn judgments, reasonably based, that imposition of the death penalty will save the lives of innocent persons. This concern for life and human values and the sincere efforts of the States to preserve them are matters of the greatest moment with which the judiciary should be most reluctant to interfere.

Id. at 355 (White, J., dissenting).

Justice Stewart expressed a similar view in his concurring opinion in Gregg v. Georgia, 428 U.S. 153, 234-35 (1976) (Stewart, J., concurring).

able doubt, they have succeeded in showing by clear and convincing evidence that capital punishment is not necessary as a deterrent to crime in our own society. This is all they must do."[97]

All that is really clear is that studies such as this one have failed to find evidence sufficient to prove the deterrence hypothesis. This is, of course, quite different from proving that executions have no deterrent effect. In testing the hypothesis and rejecting it, all that can be said is that the deterrence theory cannot be accepted, not that the converse is true. No evidence of deterrence could be found in this research but the results are not conclusive either way. This is not to say, however, that such evidence is unobtainable, although one observer has commented that, in light of the shortcomings inherent in these deterrence studies, it may be doubtful "that the presence or absence of a deterrent effect of the death penalty is likely to be demonstrable by statistical means."[98]

This conclusion does not seem to be a very satisfactory way in which to end an inquiry. What is at stake in these attempts at resolving this issue are human lives, and a rational and morally acceptable policy requires, even demands, additional evidence and information (statistical or otherwise) upon which a proper evaluation of the deterrence impact of the death penalty may be made. The only rationale left to support capital punishment is deterrence, and so far the only evidence favoring this rationale is the work of Ehrlich. It does not seem reasonable to weigh lives against such questionable statistics and find in favor of the numbers.

In considering the evidence, a policy judgment may well depend on who has the burden of proof, the abolitionists or retentionists. Given the context of permanent and irreversible punishments, the answer is clear. Not only has the theory of deterrence been subject to intense criticism, but also the use of capital punishment has been critically questioned as to its desirability in a society espousing the goal of rehabilitation and not retribution. The retentionists have the obligation, both morally and politically, to find conclusive evidence that the execution of a convicted murderer will deter others from committing the same crime. Although it has been suggested that such statistical evidence is just not possible to find, this does not in any way change the situation. Until it is conclusively shown that there is a compelling and justifiable state interest in overriding the fundamental goal of pre-

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[97] 408 U.S. at 353 (Marshall, J., concurring).

[98] Van den Haag, *supra* note 5, at 1.

serving human life, the death penalty is, from a policy standpoint, an unacceptable means of punishment.

The only policy judgment that can be made based on this analysis is that the probability of apprehension is the only deterrence variable which has any effect at all. This finding reinforces in some ways the conclusion of one study which argued that

> the appropriate criminal justice policy is one which attempts tó reduce crime by increasing the probability of apprehension and prosecution. This would have the advantage of not only increasing the level of general deterrence, but might also result in an increased sense of the fairness of punishment and lower rates of recidivism.[99]

[99] Antunes & Hunt, *The Impact and Certainty and Severity of Punishment on Levels of Crime in American States: An Extended Analysis*, 64 J. CRIM. L. & C. 486, 493 (1973) (footnotes omitted).

If the certainty of apprehension for committing a crime like murder, which carries with it a severe sentence rises, then the findings suggest that homicides will fall. In light of this analysis, increased attention, research, and expenditures in this area of crime prevention should be chosen over executions justified only by a questionable deterrence theory.

The purpose of this comment has been to evaluate and critique the existing evidence of the deterrent effects of the death penalty and attempt to add additional information by utilizing a different approach to the issue. If anything can be concluded from the foregoing, it is that the deterrence hypothesis may have no real basis in fact. Therefore, attempts to justify the use of capital punishment by relying on this theory must be carefully examined and evaluated, since the consequences of accepting such a justification as legitimate is literally a matter of life or death.

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