



ARCHIVED - Archiving Content

Archived Content

Information identified as archived is provided for reference, research or recordkeeping purposes. It is not subject to the Government of Canada Web Standards and has not been altered or updated since it was archived. Please contact us to request a format other than those available.

ARCHIVÉE - Contenu archivé

Contenu archivé

L'information dont il est indiqué qu'elle est archivée est fournie à des fins de référence, de recherche ou de tenue de documents. Elle n'est pas assujettie aux normes Web du gouvernement du Canada et elle n'a pas été modifiée ou mise à jour depuis son archivage. Pour obtenir cette information dans un autre format, veuillez communiquer avec nous.

This document is archival in nature and is intended for those who wish to consult archival documents made available from the collection of Public Safety Canada.

Some of these documents are available in only one official language. Translation, to be provided by Public Safety Canada, is available upon request.

Le présent document a une valeur archivistique et fait partie des documents d'archives rendus disponibles par Sécurité publique Canada à ceux qui souhaitent consulter ces documents issus de sa collection.

Certains de ces documents ne sont disponibles que dans une langue officielle. Sécurité publique Canada fournira une traduction sur demande.

DETERRENCE AND THE DEATH PENALTY

A Critical Review of the Research
of Isaac Ehrlich

by

Robert G. Hann

Decision Dynamics Corporation
Toronto Ontario

A Research Report prepared under contract with
the Research Division of the Solicitor General
of Canada.

Ottawa, Ontario March, 1976

The views expressed in this Report are those of the
author and do not necessarily reflect the views of
the Solicitor General of Canada.

Crown Copyright Reserved

HV
8699
C3
H3
c.2

DETERRENCE AND THE DEATH PENALTY

A Critical Review of the Research
of Isaac Ehrlich

by

Robert G. Hann

Decision Dynamics Corporation
Toronto Ontario

Copyright of this document does not belong to the Crown.
Proper authorization must be obtained from the author for
any intended use
Les droits d'auteur du présent document n'appartiennent
pas à l'État. Toute utilisation du contenu du présent
document doit être approuvée préalablement par l'auteur.

A Research Report prepared under contract with
the Research Division of the Solicitor General
of Canada.

Ottawa, Ontario. March, 1976

The views expressed in this Report are those of the
author and do not necessarily reflect the views of
the Solicitor General of Canada.

Crown Copyright Reserved

HV
8699
C3
H3
c.2

[Faint, illegible markings or text]



Deterrence and Economic Analysis:

A Critical Review

INDEX

- i Abstract: General Policy Implications
- I Introduction and Summary of Conclusions
 - 1. Introduction
 - 2. Summary and Conclusions
 - i. Economic Behavioural models
 - ii. Empirical Results of Economic Studies supporting Deterrence
 - iii. Data limitations
 - iv. Statistical Limitations
 - v. General Conclusions
- II The Economics of Crime: A Conceptual Framework
- III Economic Theories of Behaviour
 - 1. Goals
 - 2. Opportunities
 - 3. Expected Effects
 - 4. Values
- IV Empirical Results of Economic Studies Supporting the Deterrence Hypothesis
 - 1. Increasing the Costs of Illegitimate Opportunities
 - 2. Increasing the Benefits of Legitimate Opportunities
 - 3. The effects of Values
- V Data Limitations
 - 1. Empirical Counterparts of Theoretical Variables
 - 2. Quality of Available Data
- VI Statistical Limitations
 - 1. Regarding Simplistic Solutions to Complex Problems
 - 2. Continuing Simultaneous Equations Bias
 - 3. Using Appropriate Estimating Techniques
 - 4. Stability of Results over Time
 - different year for cross section
 - different time periods for time series
 - 5. Functional Form

6. Missing Variables
7. Questionable Algebraic Assumptions

VII General Conclusions.

Selected Bibliography

The Author:

Robert Hann is a principal of Decision Dynamics Corporation and a special lecturer at the Centre of Criminology at the University of Toronto where he is teaching a course on the "Economics of Crime." He has undertaken major studies in the areas of Police Information Systems, Court Management, Correctional Planning and long range demographic forecasting.

"Deterrence and Economic Analysis: A Critical Review",
R.G. Hann

ABSTRACT

The people of Canada, through parliamentary debate, will soon decide whether capital punishment should be abolished totally or should be retained for certain specific crimes.

Because of the fundamental nature of the question, the resulting debate will, perhaps justifiably, have a high moral, religious and emotional content. Nonetheless, if there exist findings from any scientifically rigorous research bearing on the capital punishment question, such findings should be thoughtfully considered by proponents on all sides of the debate.

Of particular importance are research findings regarding whether or not capital punishment is more or less effective than other methods (such as imprisonment) for deterring convicted murderers or others from committing further capital offences.

Obviously, there are many psychological, sociological and economic factors that all affect in different ways the rate of murder in Canada. This makes it extremely difficult for researchers to estimate the effects of any one factor, such as the retention or abolition of the death penalty. One should, therefore, be aware that, given the state of our available research tools, any research in this area can at best hope to give only partial answers to the deterrence question.

However, if a great number of research studies done using different techniques and different data all produce the same "findings", then one can reasonably assume that that one finding is probably correct. Until recently, this was the case with research into the effect of the death penalty. One independent study after another failed to find any evidence that abolition of the death penalty resulted in any increase in the number of murders committed. A decision to retain the death penalty for purposes of deterrence could not, therefore, be based on the results of rigorous scientific research.

In 1975, a major study was released by an economist, Isaac Ehrlich. Ehrlich claimed to have used research tools statistically more sophisticated than those of previous researchers. He also claimed to have produced findings that were the opposite of previous deterrence research. His findings, he argued, implied that each execution may result, "on the average, in seven or eight fewer murders".

Ehrlich's findings, and the 'popularization' of those views by others, have been given widespread distribution by the media and by retentionists. Unfortunately, because of the novelty and technical complexity of his research, the majority of this public discussion has been based on second-hand and relatively uncritical evaluations of his work.

Recognizing the potential relevance of Ehrlich's work to the current capital punishment debate in our country, the Solicitor General of Canada commissioned this independent review of Ehrlich's work and the work of others employing similar techniques. The review uncovered a growing body of research in this area by a number of highly skilled economists. Of particular relevance is

the discovery of a number of thorough but as yet unpublished studies investigating whether Ehrlich's work meets the normal standards of scientific enquiry.

These investigations, done independently by economists at universities such as Columbia, Dartmouth and Northeastern, and at institutes such as the Institute for Law and Social Research in Washington, each concentrate on specific aspects of the work. Nonetheless, the conclusion shared by all is most revealing. According to these other economists who are totally familiar with Ehrlich's statistical techniques, Ehrlich's work suffers major flaws that render it totally inadequate for use in supporting either side of the capital punishment debate.

These other studies emphasize that, given the knowledge of human behaviour that now exists, given the woefully inadequate data available to test any hypotheses regarding the death penalty, and given the limitations of available statistical techniques, no policy inferences whatever can yet be drawn from work similar to Ehrlich's. Many would argue that, because of the magnitude of these problems, similar efforts will probably never yield results of sufficient credibility to be of use for supporting policy in this area.

The statistical techniques used by Ehrlich may be more appropriate than those used previously to analyze the deterrence question. However, serious statistical problems still exist. In fact, by using Ehrlich's techniques in a more appropriate manner, one can just as easily derive findings that do not support the hypothesis that executions deter murder, but instead support the hypothesis that increased use of the death penalty increases the murder rate, perhaps by providing a 'brutalizing' example for the rest of society. But again, the authors of such research emphasize

that the overpowering theoretical, data, and statistical problems render their own studies as impotent as that of Ehrlich.

Both abolitionists and retentionists must look elsewhere for arguments to support their position.

DETERRENCE AND ECONOMIC ANALYSIS: A CRITICAL REVIEW

I Introduction and Summary of Conclusions

1. Introduction

Whether or not the death penalty should be abolished is a question being addressed by Canadians in all walks of life.

Some individuals have based their position on this question strictly on moral or religious grounds. For these individuals, there is little that either theoretical or empirical research can do, except to point out the probable consequences to them and to society if their government were to adopt a position similar to their own.

Research may, however, be able to reinforce or change the opinions of those who have formulated their opinion on what they feel to be theoretical or empirical grounds.

For instance, many people base their support of the death penalty on the belief that they, their neighbours¹, and others are less likely to commit crimes if the penalty for doing so is made harsher. Since murder is a type of crime, and since the penalty of death is the most extreme penalty, then these people would believe that retention of the death penalty for murderers would result in fewer murders.

Others believe that harsher penalties generally do not deter crime or that executions in particular do not deter crime. Since taking life in any form is more harmful than other forms of punishment such as imprisonment (harmful at least to the convicted murderer), and since executions might (by setting a 'brutalizing'

1. Most crime is most likely to happen in surroundings familiar to the victim. The offender is also very likely to be someone the victim knows personally.

example), increase the number of murders, then these people would conclude that the death penalty should be abolished.

Any light that can be shed by research on the question of whether or not penalties (including capital punishment) deter crimes (including murder) would, therefore, be useful to Canadians taking either position in the capital punishment debate.

Unfortunately, researchers, like Canadians in other walks of life, do not always agree amongst themselves. Researchers concerned with the effects of deterrence in general or the death penalty in particular are divided. This division of opinion is not recent. In fact, it has existed for centuries, the majority position continually shifting back and forth from one side to the other. Until the late 1960's the prevailing position of 'research' has been that an increase in the harshness of penalties, and certainly the introduction of the death penalty, does not reduce crime. This research (done mainly by sociologists) is summarized in a number of books and articles² and will not be dealt with here.

During the past decade, a number of new studies have been undertaken. These studies (done mainly by economists³) use theoretical and statistical techniques that are markedly different from those used previously.

These studies, and especially those of Isaac Ehrlich, have been interpreted by some as 'proving' that harsher penalties (including the death penalty) do deter crimes (including murder):

"We have an unpleasant method - deterrence - that works, and a pleasant method - rehabilitation - that (at least so far) never has worked. Under the circumstances, we have to opt either for the deterrence method or for a higher crime rate." (Tullock, 1975: 110)

-
2. See for instance: Sellin(1959), Sellin(1967), Zimring and Hawkins(1973), Jaywardene, Fattah (1972), and Solicitor General of Canada (1972). A summary of the more recent sociological and psychological work (some of which supports the deterrence argument) can be found in Andenaes (1975) and Tittle (1973).
 3. The most relevant works are noted in the bibliography. See especially: Ehrlich(1973), Ehrlich(1975) and those reviewed by Silver (1974) and Tullock (1974).

"Put differently, an additional execution per year over the period in question may have resulted, on average in seven or eight fewer murders." (Ehrlich 1975: 414)

Thus people are now using these studies to support the retention of the death penalty.

On the other hand, upon closer examination, these same studies have been found by others to show nothing of the sort.

"... the time series model and the data used by Ehrlich permit no inference whatsoever about the deterrent effect of capital punishment." (Passell and Taylor, 1976)

"By no stretch of the imagination can Ehrlich's analysis be said to affirm a pattern of deterrence in the relationship between execution, risk and homicide rates". (Bowers and Pierce, 1975: 35)

Thus, Canadians are faced with two diametrically opposed views regarding the implications that can validly be drawn from the more recent 'economic' studies of the deterrent effect of capital punishment. Before Canadians accept either view, and certainly before they use such information to formulate opinions on the retention or abolition of the death penalty, they must take the time to determine the validity of these recent studies. The new research is, in a statistical sense, more sophisticated than the earlier work. Unfortunately this statistical sophistication also makes it difficult, even for people with a research background, to understand and evaluate the work.⁴

-
4. This problem is further exaggerated by the recent interpreters of their writing who, searching for a simple summary of very complex economic papers, take statements completely out of context. One then gets quotes, such as the one from Ehrlich above, and:

"These observations (regarding a test of the effect of the death penalty on murder) do not imply that the empirical investigation has proved the existence of the deterrent or preventive effect of capital punishment." (comments in brackets added).

These quotes seem contradictory. In fact they come from the same article (Ehrlich, 1975) now being quoted extensively by those favouring retention of the death penalty. Both have been taken out of context, thus destroying the meaning of each.

This paper, by summarizing and commenting in a non-technical manner on the recent "economics of deterrence" studies, will attempt to provide the reader with a balanced and comprehensible evaluation. The reader can then decide whether or not to re-evaluate his or her own position regarding the deterrent effect of punishment in general and capital punishment in particular.

The new research, like any other research, can be evaluated according to a number of generally accepted standards. These standards relate to:

- the validity of the underlying theoretical assumptions;
- the accuracy of the data analyzed; and
- the appropriateness of the statistical techniques employed.

The first step in research of this kind is to build a theoretical model describing how different factors (e.g. capital punishment) would be expected to affect the behaviour of interest (in this case murder). If the results of the research are to be used to understand how and why capital punishment affects murder rates, then the validity of the research could partially be judged against standards relating to the degree to which the assumptions about human behaviour (which are used to build the theoretical model) conform to our knowledge about such behaviour. If, of the other hand, the purpose of such work were solely to predict future behaviour under conditions similar to those in the past, the validity of these assumptions is less important. The sole criterion to use would be how accurately the research did, in fact, predict.

Capital punishment policy could have a serious impact on Canadian Society, both in its results and in the way those results are brought about. Canadian policy makers must therefore be able both to predict what will happen and to understand why and how it will happen. The validity of the behavioural assumptions made in the economics of deterrence research should, therefore, be investigated thoroughly.

Once the theoretical model has been developed, the researcher must test whether the behaviour the model implies is consistent with behaviour observed in the real world. If this were found to be the case, any policy implications derived from the model would have more weight if used as evidence to support policy decisions. Such testing would also guard against basing policy decisions on intellectual theories that bore no relation to the real world.

To perform this test, the researcher requires historical data on all the factors that play a key part in the theoretical model. The researcher also requires a set of statistical techniques that allows him or her to test the model against the data in a scientifically valid manner. Thus, there are two other types of standards against which the economics of deterrence studies can be judged: those relating to the accuracy of the data used and those relating to the appropriateness of the statistical techniques employed.

The following sections of this paper evaluate the "economics of deterrence" studies in light of standards in each of these three areas: theoretical assumptions, data and statistical techniques.

Emphasis will be given to evaluating the work of Isaac Ehrlich. Ehrlich's work is representative of the earlier economics of deterrence studies which have been interpreted as supporting the hypothesis that punishment in general, and capital punishment in particular, reduce the amount of crime. The "findings" of Ehrlich's work have also received the widest publicity. The general conclusions presented in subsequent sections of this paper regarding Ehrlich's research can safely be generalized to all economics of deterrence studies, whether they support retention or abolition of the death penalty.

Section II provides a conceptual framework for understanding the various ways economics can be applied to the study of crime and criminal justice. Section III presents a critical description in more specific terms of the theoretical framework utilized in the economics of deterrence research. This framework is used in Section IV to summarize the empirical "findings" of Ehrlich and others. Sections V and VI then address the questions of the accuracy of the data used and the appropriateness of the statistical techniques employed, respectively.

For the reader interested only in the conclusions of the analysis in the later sections, all results are summarized in the second part of this section (I.2).

Before presenting that summary, it should be emphasized that there is no one position taken by the "economists of deterrence". In fact, since most of the more informed and serious criticisms of Ehrlich's (et al) work have been made by other economists,⁵ this paper instead documents an on-going dispute occurring within the one discipline.⁶

Finally, the paper is not meant to be an exhaustive survey of all the problems encountered by economists or other scientific investigators into the deterrent effect of capital punishment. A representative sample of issues are treated, a sample of issues more than sufficient to demonstrate the virtually insurmountable problems faced by research of this type.

-
5. See especially Block and Heineke (1975), Passell (1975), Passell and Taylor (1976), Forst (1976), and Bowers and Pierce (1975).
 6. This is not to say that other disciplines have not made their own share of reasoned comments. See, for instance, Greenberg (1975).

I.2.i Economic Behavioural Models: Summary and Conclusions

The economic model of behaviour implies that criminal behaviour (including murder) is affected by changes in four types of variables: individual goals; the legitimate and illegitimate opportunities open to individuals; the expected consequences for individuals of choosing any particular combination of those opportunities; and the culturally and hereditarily determined preferences of individuals.

The effectiveness of alternative deterrence policy options (including capital punishment) within this framework will be determined first, by the effect of each option on these four types of underlying variables. For instance, employment policies affect the availability of legitimate job opportunities; retention of capital punishment will affect the expected consequences of committing murder. Second, the effectiveness of policy options will also depend on the effect of the underlying variables themselves on crime rates. For instance, more job opportunities may have a large effect on crime rates while the extension of capital punishment may have an insignificant effect. The task of estimating the magnitudes of these effects is directly addressed by the recent economic studies of deterrence.

The results of these studies would, if they were conclusive, have important implications for formulating deterrence policy in Canada.

Of all the economic studies whose findings are said to support the deterrence hypothesis, the most thorough and ambitious is that of Isaac Ehrlich. Ehrlich's work has, therefore, been taken as representative in this paper. The conclusions drawn regarding the acceptability of

Ehrlich's work can be generalized to all studies claiming to support the argument for retention of the death penalty on grounds that retention has a deterrent effect on murder.

The general conclusion of Section III is that Ehrlich's work suffers serious theoretical shortcomings from the standpoint of both economic theory and the theories of other disciplines. It also suffers shortcomings regarding its relevance to both the 'real' world and the set of policy alternatives presently available. On behavioural theory grounds alone, no policy inferences regarding whether or not capital punishment deters crime should be drawn from his work.

Ehrlich's claim that one can use his theoretical model of criminal behaviour to derive a theoretical argument in favour of the deterrent effect of capital punishment holds only if one accepts his very special assumptions regarding the way people make decisions. A more general and realistic economic model of human decision making would yield no clear implications for deterrence policy.

Ehrlich makes incompatible assumptions regarding goals held by each and every individual and goals held by criminal justice agencies (made up of some of those same individuals).

Ehrlich implicitly assumes that no institutional barriers prevent individuals from engaging in any legitimate or illegitimate activity. He also does not consider the fact that institutional barriers may exist which would prevent a total co-ordination of all prevention and deterrence strategies by all municipal, provincial, federal and private agencies concerned with crime deterrence in this country. Both positions are obviously in conflict with reality.

Ehrlich's focus is on the short run. If a long run perspective were adapted and quite plausible assumptions were made, the implimentation of the policies implied by Ehrlich's analysis could quite possibly increase rather than decrease the rate of crime in the future.

By concentrating on analyzing the effects of certain types of policy options, the economic studies divert attention away from other perhaps more effective deterrence options such as: unemployment policies, job retraining, law reform, legal education and diversion. Ehrlich is, however, himself careful to point out that his analysis indicates that the crime rate is at least as sensitive to unemployment rates as it is to execution rates. Ehrlich's capital punishment analysis does not include any reference to the lengths of sentences given murderers. The reader has no way of knowing whether the effect executions have on murder rates could be achieved more effectively by sentencing people to longer periods of incarceration.

The most widely publicized "finding" of Ehrlich is that "each execution results in 7 or 8 fewer murders". Actually, Ehrlich estimates the effect at between 0 and 24 murders. More importantly, he indicates that a more appropriate analysis suggests the effect is half of that. His precise meaning here is unclear. It is also irrelevant, given that later studies result in equally conclusive findings that each execution is related to more (not fewer) murders.

Finally, Ehrlich's treatment of the effects of culturally and genetically determined individual preferences and values is haphazard and simplistic, at best. He has virtually ignored the significant contributions to the criminal behaviour literature by other disciplines such as sociology

and psychology. This criticism is especially important since very few murders are the result of cold, calculated premeditation. Most murders are committed in moments of extreme passion or fear, some would say in moments of temporary irrationality. Even if such murderers were still aware of the probable consequences of their behaviour, those consequences would be expected to play a relatively minor role compared to the sociological and psychological factors which are not considered by the economic studies.

In summary, the behavioural theoretic shortcomings of Ehrlich's work are significant. Modifications in this area could well reverse his model's implications regarding the deterrent effect of the death penalty. If further work is warranted in this area (and it is far from clear whether work of sufficient reliability is feasible), these modifications should be undertaken not by one discipline, but by a number of disciplines each of which could contribute to the necessary multi-dimensional understanding of the deterrence question.

I.2.ii Empirical Results of Economic Studies Supporting
Deterrence: Summary

Section IV summarizes the major findings of the economic studies which support the theory that punishment deters crime.

Taken at face value (a very dubious strategy), the studies consistently imply that increases in the certainty of conviction are statistically related to decreases in the rate of crime. Further, Ehrlich's findings imply that an increase in the certainty of arrest has a separate and greater effect on crime than an increase in the certainty of conviction given arrest. Finally, for crimes of murder, both variables have a greater effect than an equal percentage increase in the certainty of execution.

These same studies provide inconclusive implications regarding the effect on crime of increasing sentence lengths.

Next, increases in crime (including murder) are consistently found to be related to decreases in the benefits of legitimate opportunities as measured by employment rates, median incomes and income distribution.

Finally, the effects of differences in values on crime rates is not adequately tested by these studies. However, some variables such as the percentage of non-whites in the population, the mean number of years of schooling, and the percentage of males in the 14 to 24 age group do appear as statistically significant in certain of Ehrlich's equations.

Sections IV and V of this paper provide additional evidence that the results cited above are extremely suspect. It must be concluded that no policy inferences whatever can be drawn from them.

I.2.iii Data Limitations: Summary

Section V considers whether the data used by Ehrlich and others can be considered adequate for deriving estimates of the effectiveness of deterrence methods in general, and of capital punishment in particular. The discussion has been illustrative rather than exhaustive. However, any person experienced in undertaking research in this area would agree with the general conclusion.

The data limitations alone destroy any credibility that might be attached to Ehrlich's results.

Data simply does not exist on certain of the critical variables used in the theoretical model Ehrlich purports to test. For instance, we have no accurate estimates of actual crime rates.

Further, we have no evidence that the variables Ehrlich eventually uses are valid 'proxies' for the correct theoretical variables. For instance, actual punishments handed down by the courts may have little to do with what potential offenders believe those sentences to be.

Differences in reporting practices between agencies and over time make analyses of crime trends between different jurisdictions over time extremely suspect. In particular, the data Ehrlich uses on murder rates, crime rates, arrest rates and conviction rates suffer significant inaccuracies.

Finally, when a more accurate data source is used to measure murder rates, the policy implications derived from Ehrlich's analysis are reversed. More executions

are related not to lower, but to higher murder rates.

In summary, the data used by the economists and others to test the deterrence hypothesis suffers serious shortcomings.

In light of the problems described in Section III, any behavioural and statistical sophistication demonstrated by the economics of deterrence studies is rendered impotent by the data.

These and other model building efforts have been useful in identifying data needs. It is now time to use that information on needs to develop more reliable criminal justice data collection, storage, and retrieval systems. After these have been built, we might then (and only then) be able to obtain estimates of the effect of deterrence programs, estimates in which we can have more faith.

I.2.iv Statistical Limitations: Summary

The statistical techniques Ehrlich and other economists have introduced to the study of deterrence are considerably more sophisticated and appropriate than those used previously. However, other economists, who are equally well versed in the use of such techniques, have also brought a greater awareness of the statistical problems that can be encountered when using any statistical techniques, including those of Ehrlich. In particular, the latter group of researchers have subjected Ehrlich's work to a detailed analysis to determine if it meets the generally accepted standards of statistical research.

The results of that analysis have demonstrated clearly that Ehrlich's work suffers statistical flaws of such a magnitude as to render it inappropriate for formulating policy in the deterrence area.

Ehrlich's techniques do seem better suited for jointly analyzing the many relationships that affect the phenomena of crime and crime deterrence. Nonetheless, Ehrlich's analysis excludes any consideration of relationships that could conceivably reverse his findings. For instance, if juries were (as they have in the past) to convict fewer people if the punishment were made 'too harsh', then increasing the use of executions might increase, not decrease, the murder rate. By ignoring such relationships Ehrlich's statistical results cannot be seriously used to argue any 'causal' link between executions and murders.

It has also been noted that many of Ehrlich's variables are probabilities; probabilities of arrest, of

conviction, of execution, etc. Probabilities cannot assume values less than zero or greater than one. However, the statistical techniques Ehrlich uses can only be relied on to give accurate results when they are applied to variables that are not restrained to taking a narrow range of values.

Ehrlich's findings are also extremely sensitive to the time period he chooses to analyse. Various attempts have been made to reproduce his results using data from different time periods. All have resulted in findings that do not support his capital punishment argument. Many of these studies can, with equal validity, be used for supporting the argument that executions increase the murder rate.

Similar results are obtained when researchers have tested the particular mathematical form Ehrlich uses to express the relationship between murder and executions. Equally plausible alternative forms yield no or opposite implications.

It is also quite possible that many of Ehrlich's deterrence variables are in reality capturing the effects not of deterrence programs, but rather of cultural and demographic factors which have been ignored in his analysis.

Finally, Ehrlich makes an extremely questionable algebraic assumption in deriving the implications of his findings. When an equally plausible assumption is substituted, Ehrlich's results are reversed. His own analysis, without any of the modifications suggested throughout this paper, implies that each execution is related to an increase of fourteen murders.

In summary, Ehrlich's work does not meet the generally accepted standards of statistical research.

I.2.v General Conclusions: Summary

The following sections present detailed evidence that the work of Ehrlich and others does not meet generally accepted standards in the areas of

- behavioural theory
- accuracy of data; and
- statistical techniques

Further, the limitations are not solely caused by lack of effort or lack of technical ability on the part of the economists and others who have attempted to estimate the effects of capital punishment. The problems in all areas, and in the data area in particular, are at present simply too overpowering to make the derivation of dependable results possible at this time.

II. THE ECONOMICS OF CRIME: A CONCEPTUAL FRAMEWORK

The task of this section is to provide a framework for understanding the different ways economists approach (or could approach) the study of crime. By doing so, we can identify the different ways economics might contribute to the specific problem of crime deterrence. This framework will also be used in later sections to identify the areas in which the current economic studies of deterrence could be improved.

In general, the 'economics of crime' is concerned with the allocation of scarce societal resources to satisfy the many demands of society for peace and security.

This leads to two separate but connected questions: "How are society's resources now used to provide peace and security?", and "How should society's resources be best used to provide peace and security?"

The way in which the two questions are connected can be demonstrated by examining the different steps in formulating either individual decisions or governmental decisions regarding crime and reaction to crime. These steps include:

- definition of goals
- defining objectives and indicators of success
- predicting the effects of alternative policies and programs
- evaluating alternatives
- choosing and implementing preferred alternatives
- monitoring success.

The first step is to determine what society wants to achieve - its goals. Economists as citizens have lately been more vocal in saying what society's peace and security goals should be. However, economics as a science provides minimal assistance to determine what society's goals should be - except that any goals or objectives should be achieved in the most efficient manner possible.⁷

Next, in order to decide later if our efforts to reach these goals have been successful, the goals must be defined in terms that can be measured. The 'welfare economics'⁸ literature contains considerable rigorous theoretical work related to developing indicators of the well-being of society and, more importantly, to developing tests of whether changes in these indicators can lead to unambiguous conclusions regarding whether society's well being has increased or decreased. The results of this work could make a significant impact. Unfortunately, it has as yet had relatively little publicity or use in the criminal justice field. This may be rectified soon given the recognition lately by Canadian and other governments of the need to develop standards and goals for criminal justice.⁹

-
7. For a discussion of the values and goals built into economic models see:

W.S. Vickery, "An Exchange of Questions between Economics and Philosophy," in The Goals of Economic Life, A.D. Ward (ed), Harper, 1953

8. See for instance, the papers in Phelps, E.S., (ed), Economic Justice, Penguin, 1973.
9. See, for instance, the numerous reports of the National (U.S.) Advisory Commission on Criminal Justice Standards and Goals, available from the U.S. Government Printing Office, Washington.

Once priorities have been set for the different goals, the next step is to develop strategies (programs) for achieving those goals. For an individual Canadian and for the Federal and Provincial governments, the choice of strategies could include better locks for residences, more police surveillance, more resources to courts to deal with apprehended defendants, better educational programs in prisons and in the schools, more legitimate job opportunities, compensation to victims of crime, law reform, longer prison sentences, capital punishment, etc. However, since no individual or government has sufficient resources to undertake full programs in all these areas, alternatives must be selected.

Welfare economic analysis (and common sense) would suggest that available resources should be allocated to different alternatives so that the last resource dollar spent in each alternative yields the same 'marginal' benefit. (Otherwise that last dollar would yield a higher benefit to society if it were spent on a different alternative). This point is important for the deterrence question. The question is not, "Does the particular program deter crime?" but rather, "Does the particular program deter crime better than other alternative programs costing the same?" In a world of increasingly scarce resources this distinction is critical. We will see later that it has also been ignored by most people who draw policy implications from the economics of deterrence literature.

To be able to choose one alternative program over another, one must be able to predict what the effects of each program would be and to evaluate the costs and benefits of those effects.

The offshoot of welfare economics (cost/benefit analysis), which deals with the latter evaluation question is fairly well known in the criminal justice field. The question addressed directly by the recent 'economics of deterrence' literature is the former, the relationship between alternative prevention programs and their effects (particularly on crime rates); the question of 'what is' (or will be) rather than 'what should be'.

This task requires an understanding of how the behaviour of individuals in the criminal justice system (both criminal justice officials and potential criminals) is affected by certain factors. Since any type of human behaviour is extremely complex, the economics of deterrence studies attempt to achieve this understanding:

- by using theories of human behaviour to build a model that captures the theoretically expected relationships between the key factors affecting behaviour and that behaviour;
- by then using statistical techniques and data on past behaviour to obtain numerical estimates of the magnitude and direction of these same relationships;
- by then statistically validating the empirically estimated model by testing whether it 'fits' other instances of the same type of behaviour.

Once models have been developed that describe past behaviour in terms of changes in certain factors (e.g. describe how murder rates have altered with the abolition of capital punishment), the same models can then be used to predict the effects of alternative future policies and programs. Alternative policies and programs are translated into specific levels of the 'underlying factors'

used by the model. The model is then used to predict the resulting behaviour.¹⁰

In summary, to choose policies and programs to achieve the state of society that 'should be', policy makers must be able to predict the effects of alternative policies and programs. To obtain useful predictions, they must in turn have an understanding of 'what is'. Most of the economic literature on deterrence has focused on the 'what is' question, as a means to develop predictions. To understand 'what is' one needs three tools:

- theories of human behaviour;
- statistical techniques; and
- data describing past behaviour.

By looking at the economic literature of deterrence in terms of whether or not it has appropriately used these three tools and the other branches of economics described earlier, we should be able to assess the validity of the conclusions being drawn from that literature. Unless the conclusions that 'punishment does or does not deter crime' are based on valid use of the appropriate tools, the conclusions should not be used to formulate individual or governmental positions on crime deterrence in Canada.

10. This prediction methodology obviously assumes that in the future these underlying factors will affect behaviour in much the same way as they did in the past.

III. ECONOMIC THEORIES OF BEHAVIOUR

Critical to understanding how a new deterrence strategy will affect crime is an understanding of how both potential criminals and criminal justice system personnel will react to the new strategy. Each social science has developed a number of theories of human behaviour. In this paper, we will only describe the theory of behaviour most often used by economists.

Most economists view man as acting as if he were rational. A rational person is, in turn, one who considers the opportunities open to him or her (both legitimate and illegitimate), evaluates the costs and benefits felt personally if each opportunity (or set of opportunities) were chosen, and then allocates his available resources (time and wealth) to undertaking the opportunities (or set of opportunities) which best allows him to achieve his goals.

Thus, within an economic behavioural model, both legitimate and illegitimate behaviour is determined by an individual's perceptions of:

1. his personal goals;
2. the opportunities open to him;
3. the personal resources available;
4. the expected effects (both good and bad) that he would feel personally if he were to choose each opportunity (legitimate or illegitimate) or set of opportunities; and
5. the value he places on each of these effects.

The propensity of people to commit crime could, therefore, be altered by changing individuals' perceptions of any of these pieces of information.

The way the economics of deterrence studies have treated each one will now be considered.

III.1 Goals

If the only goal of each person in society were to lead a law abiding life, then crime rates would fall. However, individuals do differ regarding what they want out of life, and each probably has not one goal but many. Further, it is often difficult to develop unambiguous measures of whether a person's goals are better satisfied under one optional 'state of the world' or another.

Economists generally (either explicitly or implicitly) deal with these problems by assuming that the 'wealth' an individual can expect under any one state of the world is a valid indicator of the degree to which that individual has achieved his goals. For Ehrlich (and most 'economists of crime') this translates into an assumption that a person's 'happiness or utility' after choosing a set of legitimate or illegitimate opportunities can be validly approximated by his present wealth plus the expected additions and subtractions (gains and losses) to that wealth that might occur if that set of opportunities were chosen.

The first implication is that the choice of what proportion of one's time and resources to devote to any legitimate or illegitimate opportunity depends (in the Ehrlich models) solely on the relative extent to which that opportunity increases an individual's expected wealth. All opportunities are treated as equally viable. Legitimate opportunities are not preferred for moral, philosophical, or religious reasons, over illegitimate ones. This assumption allows Ehrlich to say that

his theoretical model implies, for example, that an increase in the punishment for convicted offenders (or an increase in earnings from legitimate activities) will theoretically lead people to spend relatively less time in illegitimate opportunities.

However, if more reasonable assumptions are made as to what affects an individual's goal achievement, no such unambiguous implications can be drawn from the theoretical model. One such modification would be to assume that an increase in the amount of labour required to undertake a particular opportunity reduces 'utility' and that illegitimate tasks are relatively more irksome or demeaning than legitimate ones.¹¹

In fact, similar modifications can lead to the following general but very serious conclusion regarding the implications that Ehrlich says can be drawn from his theoretical model:

"Most significantly, changes in (i) wealth (ii) the payoff to illegal activity, (iii) enforcement, (iv) punishment, and (v) the degree of certainty surrounding punishment were seen to have no qualitative supply implications (i.e. no implications regarding their affect on the propensity to commit crime) under traditional preference restrictions" (Block and Heineke, 1975: 323)

(comments in brackets added)

In summary, then, the question of whether or not any of the above factors do or should deter crime cannot

11. A similar argument is made in:

Block and Heineke (1975) and Ross (1975)

be answered by economic theory alone. The parameters in the theoretical model must be estimated from available data before any policy implications can be drawn.

Ignoring the negative effects on goal achievement of undertaking illegitimate opportunities has a further important implication for policy makers. Because Ehrlich's research does not consider this factor, the policy maker's attention is focused on the deterrent effects of other factors, factors which might be more costly to alter by new policies or programs. For instance, Ehrlich's research focuses attention away from programs to increase understanding of the law, respect for the rights of one's neighbours, the harmful effects of criminal behaviour, etc. We have little evidence regarding the effects of these latter programs. Nonetheless, since there is at least a general feeling among many groups that they still hold promise, such diversion of attention is premature and potentially costly.

One final comment is in order regarding the way goals are specified in the Ehrlich-type models. As will be seen later, in the economic models the amount of crime that actually occurs is the result of factors affecting behaviour both of potential criminals (everybody) and of various groups in society who try to deal with crime. When Ehrlich considers each individual in society in terms of his or her potential for criminality, each is considered as being totally egoistic. That is, each is concerned solely with his own welfare. However, when Ehrlich talks about goals of the public in general and law enforcement agencies in particular, he assumes a completely different type of goal.

These latter groups are assumed all to be striving toward the achievement of the same altruistic goal - 'the minimization of the social harm from crime'. One cannot help but be sceptical when asked to believe that a group of individuals holds a goal that can easily be in conflict with the goals of each individual in the group.

One would have more faith in research that recognized that criminal justice agencies are made up of individuals who have personal goals, not all of which are described within the phrase 'minimize the social harm from crime'. One might at least pay attention to the criminological and legal literature discussing the different, and to some extent conflicting, goals and roles actually played (and expected to be played) by the different groups in the traditional criminal justice system: the police, the courts and corrections.

III.2 Opportunities

Ehrlich assumes that all legitimate and illegitimate activities are open to all individuals. No barriers, institutional or otherwise, prevent entry into any occupational field. Given the aggregate nature of the model, this simplifying assumption may not influence the short-run policy implications of the model. On the other hand, under more reasonable but contradictory assumptions, the longer run policy implications may be significantly altered.

For instance, suppose that increasing the probability of conviction and increasing sentences for convicted offenders do deter others from committing crime in the

short run. One could also reasonably assume that the longer an offender stays in prison, the more unlikely it is that he will be able to readjust to the outside community on release; the more likely his record will prevent him from getting a legitimate job; and the more likely his criminal record and contacts made in prison will aid him in undertaking an illegitimate job. In other words, if crime were a rational choice of occupation before he was convicted, then it is even more likely to be so after he is released from prison. If the probability of conviction were increased, in the short run, more people would be put in jail, and the crime rate would go down. In the long run, however, the larger numbers of people previously incarcerated will be released; they will find it even more irrational to choose a legitimate job; and the crime rate will increase significantly. It is, therefore, possible that the future crime rate might even be higher than if sentences had not been made longer.

The introduction of an alternative assumption into the Ehrlich-type model again probably reverses the policy implications of his analysis. Further work that differentiates between the ways certain factors affect the opportunities open to potential first offenders and the way those same factors affect the opportunities open to potential repeat offenders over time is required.¹²

This work should, for instance, take account of the voluminous criminological research¹³ concerning how 'labelling' individuals as criminals significantly affects

12. For comments expanding on this point see (Avio).

13. For different views on labelling theory see: Goode (1975) and Welford(1975).

the occupational options open to them. For instance, people with criminal records have difficulty in being bonded, holding public office or public service jobs, in short, getting and holding any legitimate job.

In general, more attention should be paid to developing more detailed models which explicitly consider how changes in institutional barriers (to movement between and among legitimate and illegitimate occupations) affect the amount of crime. By leaving these factors out of their models, the economists¹⁴ focus attention away from perhaps equally viable deterrence policy options.

An analogous problem arises concerning Ehrlich's lack of attention to the institutional barriers affecting co-ordination of criminal justice deterrence policies and programs. When presenting his results (that imply that more executions would lead to fewer murders), Ehrlich himself is careful to point out that:

"The actual tradeoffs between executions and murders thus depend partly on the ability of law enforcement agencies (including police, courts and corrections) to control simultaneously the values of all the parameters characterizing law enforcement activity" (Ehrlich, 1975 :415).

(underscore and comments in brackets added)

-
14. Most of the better known 'economists of crime' have been strongly influenced by the 'Chicago' school of economic thought. This school traditionally places more emphasis on the belief that the free market system is the best mechanism for allocating society's resources. This belief often results in the exclusion of institutional barriers (by monopolies, cartels, lobbies, strong unions, class structure, etc.) from their theoretical and empirical work.

However, in a criminal justice system made up of many different institutions, each with different goals and mandates, many of which report to different government departments, and where responsibility is divided between the municipal, provincial and federal governments, it is unlikely that all institutions could ever get together to 'control simultaneously the values of all parameters' (such as apprehension rates, clearance rates, conviction rates, sentence lengths, employment rates, income, etc.) Even if Ehrlich's theoretical and empirical work were valid (and we are already beginning to see that it contains serious flaws), it would be very unlikely that executions could ever be made to have the effect on murder that Ehrlich describes.

Ignoring the institutions existing in society severely reduces the validity and usefulness of Ehrlich's results. His models may imply policy that is institutionally impossible to implement. It is entirely possible that the feasible policy alternatives could significantly differ from those in the world of Ehrlich's model, a world that is devoid of institutional barriers.

The last point to be considered in this section also relates to the policy options open to those attempting to deter or prevent crime.

For various reasons, more publicity has been given to the 'results' of the recent economic studies that focus on the implications of altering those factors which affect an individual's perceptions of the expected negative effects or 'costs' of criminal opportunities. One is more likely to hear of the effects on crime rates of increasing the probability of conviction and/or

increasing the harshness of the punishment. Even if these particular results were valid, the important question from a policy point of view is, "Can society benefit more by instead using its resources to alter other factors affecting behaviour?"

For instance, from an economic perspective, there is no theoretical reason why increasing the benefits from engaging in legitimate opportunities would not have a greater effect on crime than increasing the costs of engaging in criminal behaviour.

Section IV will present the estimates made by the economic studies of the effect on crime of increasing the benefits of legitimate activity by, for instance, lowering unemployment rates, increasing wages and incomes, etc. It will be seen that an optimal crime deterrence strategy would also include policies to increase the expected returns from legitimate opportunities.

III.3 Expected effects

Once goals have been adequately defined and feasible legitimate and illegitimate opportunities identified, the next step assumed to be undertaken by the 'rational man' is the identification of the expected negative and positive effects on his wealth of each opportunity (or set of opportunities) open to him.

Illegitimate opportunities are likely to have effects that increase and/or decrease that future wealth. Expected increases in wealth are likely to vary directly with the amount of real goods or services obtained and/or any psychic effects. Expected decreases in wealth are likely to be associated with being charged, with being apprehended and with being convicted.

Since either no data or grossly inadequate data exist to measure directly any of the real or psychic effects from illegitimate opportunities, Ehrlich (and others) assume simply that these effects vary directly with the amount of time spent planning and carrying out the illegal activity. Given our knowledge in this area, this assumption may be as good as any other.

The empirical economic models of general deterrence make no direct distinction between the (probably significantly different) decreases in wealth associated with being charged, being apprehended and being convicted. In these models, the first two types of negative effects are implicitly assumed to vary directly with the third. The models are therefore of little use to policy makers interested in determining the relative effectiveness of deterrence programs aimed specifically at increasing (or decreasing, in the case of diversion programs) the

costs to the offender at different stages in the criminal justice process. Attention is again directed away from what might be equally viable deterrence policies.

The negative effects from being convicted are, in Ehrlich's general deterrence models (in his 1973 paper), assumed to vary directly with the average lengths of prison sentences handed out to offenders convicted of the type of offense being contemplated. Other types of sentences (such as cash fines) are considered in his theoretical discussion, but in his empirical model he assumes that the 'harshness' of alternative non-incarceration penalties varies directly with prison sentences for similar offences. The effect of non-incarceration sentences cannot, therefore, be estimated with the empirical model. Given our limited knowledge regarding how the offender perceives longer sentences as affecting his wealth, it is difficult to question Ehrlich's assumptions here. However, it is worth noting that again his choice of variables to include in his empirical model diverts policy makers away from considering the relative effectiveness of deterrence policies involving fines, probation, and suspended sentences as alternatives to periods of incarceration.

In his 1975 paper on the particular deterrent effectiveness of the death penalty, Ehrlich deals with the measurement of punishment in a different manner. Here, in the model from which he concludes that each execution prevents from 0 to 24 murders, the negative effect from punishment is measured by two variables, the probability of conviction given arrest for murder, and the probability of execution given conviction. In this model he does not include any measures of the length of sentence for murder if the murderer is not executed.

As noted before, when Ehrlich, in a second model, includes the length of prison sentence for murder as another measure of punishment, the estimated deterrent effectiveness of executions drops by over 50% (Ehrlich, 1975: 413).

The implications of this second model are more relevant for theoretical reasons. Further, since increasing prison sentences for murders is a viable alternative strategy to the death penalty, the second model is also more relevant for practical policy making reasons as well.

One further comment regarding these expected negative and positive effects is in order. Not only is the size of those effects important, but the probability of their being felt is important as well. For example, one measure of the effects to be considered by an individual contemplating a robbery would be the prison sentences given to convicted robbers. To arrive at the 'expected' effect, the robber is assumed to 'weight' this sentence length by the probability of his being caught. The more an offender feels he will be caught and convicted, the more he will take into consideration the punishment for conviction. Conversely, if he felt this probability were '0', then sentence lengths would be ignored.

The economics of deterrence studies do pay attention both to the absolute magnitude of the effects from legitimate and illegitimate opportunities, and to the probabilities of those effects being felt. The studies thus have considerably more worth to the policy maker concerned

with questions such as "will putting resources into police apprehension programs have a greater deterrent effect than putting resources into more institutions to accommodate a policy of longer prison sentences?"

The more general 1973 Ehrlich model does not differentiate among the relative deterrent effects of increasing the probabilities of apprehension, of conviction, and (in the case of murder) of execution. The effects of all these are combined into a variable measuring the probability of imprisonment. In the later 1975 paper, Ehrlich does explicitly consider each of these probabilities separately, in an attempt to estimate the relative deterrent effects of policies to alter each.

III.4 Values

The final factors influencing crime in the economic theoretical framework are individual values.

The economic model of behaviour is expected to apply to all men and women. However, because of different hereditary and cultural experiences, individuals differ in the values they place on the same goods or activities. These differences in values could result in two individuals with identical goals making quite different choices in situations that, to a third person, would seem identical. For example, people with different cultural and political backgrounds have in the past placed different values on the negative personal feelings associated with taking other lives in pursuit of what seems to be a similar goal.

Most economists do realize the critical role played by values in decision-making. The problem for an economist is that economic theory says very little about how values are formed or, more important, why differences in values occur. Whatever has been discovered by sociologists and psychologists regarding the way values are formed has not passed through the institutional barrier between those disciplines and economics.

The economics of crime literature is no exception. Most of the studies recognize that differences in values affect the choice between criminal and legitimate behaviour and most 'economic' models include variables

attempting to capture the environmental and hereditary factors expected to influence those values. However, the factors are included in a somewhat haphazard manner that reflects the primitive understanding of this phenomenon by economists. This would not be a problem if only a small proportion of the variation in human behaviour were accounted for by differences in values. However, this proportion is probably quite large.

The problem is compounded by the ample empirical evidence demonstrating that the precise way that factors affecting values are included in economic models significantly affects the estimates obtained regarding the way other economic 'effect' variables affect behaviour.¹⁵ One such example which affects Ehrlich's results in particular will be presented in Section VI.

This area, perhaps more than in any other, is one in which the economists of crime could benefit from a familiarity with the sociological, psychological and criminological literature. If the economists are to continue to undertake work in an area of public policy that directly affects the well being of society, they have an obligation to break out of their isolation and recognize the possible contributions of other disciplines.

(The reverse is obviously also true - the sociologists, psychologists and criminologists could learn much from the economists regarding model building and statistical techniques.)

15. See for instance the debate between Fleisher (1963, 1966, 1969 and 1970) and Weicher (1970) regarding the effects of punishment on juvenile delinquency.

A number of shortcomings in the theoretical models used in the economics of deterrence studies have been identified under the categories of 'goals', 'opportunities', 'effects', and 'values'. Sections V and VI of this paper will identify equally serious shortcomings relating to the data used to estimate the parameters in those models and the statistical techniques employed. The suggested alterations to the data and statistical methods used have been found in many cases to alter the policy implications of the research. The shortcomings are sufficiently serious to force the recommendation that the models not be used for fomulating deterrence policy at this time.

Now that a framework for looking at crime prevention and deterrence from an economic perspective has been established, it may be useful to review the 'results' of the economic studies which support the deterrence hypothesis.

IV. THE EMPIRICAL RESULTS OF ECONOMIC STUDIES
SUPPORTING THE DETERRENCE HYPOTHESIS

The most comprehensive summary of the results of the empirical economic studies supporting the deterrence hypothesis is contained in a paper by Morris Silver of the City College of the City University of New York (Silver, 1974). The paper reviews the major economic studies up to 1974. (Unfortunately, at that time the 1975 Ehrlich paper on the death penalty was not available. That paper will be dealt with later). The comments in the next few paragraphs are simply a paraphrasing of Silver's results. Estimates of the effects of increasing the costs of illegitimate opportunities, increasing the benefits of legitimate opportunities, and the effects of values, will be discussed in turn.

IV.1 Increasing the Expected Costs of Illegitimate Opportunities

In general, Silver finds that, in all but two of the studies surveyed,¹⁶ the results are reported as being consistent with the hypothesis that increases in the probability of conviction imply decreases in the crime rate. This relationship is usually found to be statistically significant in studies using different statistical techniques and data. The estimated magnitude of this effect does however, differ from one crime type to another.

While the hypothesis that longer sentences deter crime is not disproved by these studies, this does not mean that the hypothesis can be taken as 'true'. The results are often not statistically significant and three of the studies share the same data so they cannot be taken as independent and separate tests. Further, the

16. Studies by Carr-Hill and Stern (1974), Ehrlich (1973), Chapman (1971), Greenwood and Wadzycki (1973), Kobrin et al (1972), Orsagh (1973), Phillips et al (1972) and Sjoquist (1973).

results are not stable, but are very sensitive to changes in the precise statistical techniques used to estimate them. Silver offers, as a possible explanation of the apparent weaker effect of altering sentences, an argument similar to that made earlier (section II.2) regarding longer prison sentences resulting in more crime in the long run.

Ehrlich in his 1975 'death penalty' paper states that his results:

"are not inconsistent with the hypothesis that, on balance, capital punishment reduces the murder rate" (Ehrlich, 1975: 416).

As noted earlier, he interprets his findings as implying that each execution will result in between 0 to 24 fewer murders. These results are statistically significant. (In section VI.7, Ehrlich's results are shown to actually imply that each execution corresponds to an increase of 14 murders.)

Ehrlich also interprets his work to show that increases in the probability of arrest and increases in the probability of conviction (given arrest) are each separately and negatively related to crime rates. These results are also statistically significant. Further, the estimated percentage decrease in the murder rate resulting from a 1 percent change in the probability of apprehension is higher than that from the same change in the probability of conviction. Both have a greater effect than a 1 percentage change in the probability of an offender being executed (given execution). The policy implication is, therefore, that if the costs of altering these probabilities were equal (and if Ehrlich's results were valid), emphasis should first be placed on programs to increase the probability of apprehension.

These latter results would have definite policy

implications - if they were valid. It is always tempting for one in an uncertain position to accept conclusions that seem to dispel that uncertainty. However, given the many serious criticisms of Ehrlich's work, we are forced instead to agree with the quote from Passell and Taylor reproduced from an earlier page of this paper:

"...the time series model and data used by Ehrlich permit no inference whatsoever about the deterrent effect of capital punishment" (Passell and Taylor, 1976).

Further reasons for this conclusion will be presented shortly. First, however, we will consider certain equally important results from the economic studies concerning "effects", results that have received relatively less attention.

IV.2 Increasing the Expected Benefits of Legitimate Opportunities

These results concern the effects on crime rates of altering the gains and losses to wealth from engaging in legitimate activity. It is obvious from the theoretical economic model of behaviour outlined earlier that, although crime should theoretically be reduced by increasing the losses from illegitimate activity, crime should also (again, theoretically), be reduced by increasing the gains from legitimate activity. We will now look at the results of the same studies concerning the estimated effects of the latter type of policy option.

The gains from legitimate activity are represented in the economic models by estimates of wage rates, median incomes, and/or some measure of the present value of all future income ('permanent' income). Just as with illegitimate options, the gains and losses from legitimate activity are also not certain. This uncertainty is measured in the economic models by unemployment rates and labour force participation rates.

Silver (1974) concludes that, in general, the empirical results of the studies are consistent with the hypothesis that larger legal incomes induce individuals to refrain from committing crime. These results are consistently found to be statistically significant. Ehrlich also found a

"systematic relation between employment and earning opportunities and the frequency of murder and other related crimes" (Ehrlich, 1975: 416).

Ehrlich's 1975 study, which is most often quoted as supporting the retention of the death penalty argument

goes further:

"Of particular interest is that the effects of equal percentage changes in p^0 (the probability of execution given e/c conviction) and U (the unemployment rate) are found to be nearly alike in absolute magnitude... Indeed, preliminary time-series regression results show that the elasticities of robbery and burglary rates with respect to the unemployment rate are even larger in magnitude than the corresponding elasticities of the murder rate" (Ehrlich, 1975: 146).

(comments in brackets added)

Thus:

"the rate of murder and other related crimes may also be reduced through increased employment and earning opportunities". (Ehrlich, 1975: 411 and 417)

It is submitted that these results are as valid as those concerning punishment. Given the many social and economic benefits (some totally unrelated to crime) from decreasing unemployment, equal attention should be given to economic and social policy options for preventing and deterring crime. From an economic point of view, placing emphasis solely on policies and programs to increase the costs of illegitimate activity would not be an optimal strategy.

IV.3 The Role of Values

Our previous theoretical framework also established that culturally and genetically determined individual values also affect crime rates. It was also noted that economists have treated the role of factors affecting values in a manner that is haphazard at best.

With this caveat in mind, the relevant empirical results of the Ehrlich studies will be presented.

In his 1973 article, Ehrlich includes, as variables also affecting crime, the following:

- percentage of non-white in the population;
- percentage of all males in the age group 14 - 24;
- mean number of years of schooling of population 25 years old and over
- percentage of population in standard metropolitan statistical areas;
- number of males per 100 females;
- a variable distinguishing northern and southern states in the United States

Of all the above, the only variable¹⁷ that has a consistent statistically significant effect in all Ehrlich's regressions is the percentage of non-whites in the population. There appears to be a positive

17. Ehrlich does, however, find a statistically significant relationship in his law enforcement regression between the probability of conviction on the one hand and the percentage of population in standard metropolitan statistical areas (negative relationship) the percentage of non-whites in the population (positive), the mean number of years of schooling (positive), the percentage of all males in the age group 14-24 (negative), and the north/south variable.

and significant relation between crime rates for all offences and this variable.

In his 1975 paper concerned specifically with murder rates, only the variable measuring the fraction of residential (U.S.) population in the age group 14-24 has a statistically significant (positive) relationship to the murder rate.

In summary, Ehrlich's results do not lend overwhelming support to the hypothesis that values also affect crime rates. This could, however, be for a number of reasons. For instance, certain variables used by Ehrlich to measure what we have called 'opportunities' and 'effects' are ambiguous in the sense that they could be capturing differences in what we have called 'values'.

Examples include:

- median income of families;
- percentage of families below one-half of the median income;
- age specific unemployment rates; and
- age specific male labour force participation rates.

Further, in the 1973 Ehrlich paper, although the effects of the latter two variables are erratic, the first two are consistently found to be statistically significantly related to the crime rate. In the 1975 Ehrlich paper, variables similar to each of the above were statistically significant.

In general, though, given the rather haphazard way preference variables are included in these models, one would not expect them to be significant. Future

work should pay particular attention to the effects of such variables.¹⁸ However, to do this effectively, a more effective multi-disciplinary approach is required.

At the end of Section III of this paper it was claimed that the results just presented should not be relied upon as a basis for formulating deterrence policy. The next two sections provide further evidence to support this conclusion.

18. See, for instance, the results of Forst (1976) which are presented in section VI.

V. DATA LIMITATIONS

The limitations and deficiencies of data describing the operations of the Criminal Justice System in Canada and elsewhere are almost legendary.

For example, when Abdul Lodhi and Charles Tilly decided to test the effects of urban population and urban growth on crime, their first task was to choose a country and time period from which to collect their data. They chose data from 19th century France. Why? Because:

"...the data available concerning urbanization, crime, and collective violence in France during that period are exceptionally rich and exceptionally uniform, compared with the data available for any part of the world today or yesterday" (Lodhi and Tilly, 1973).

(underscore added).

Any further general comments on the data used by the economic deterrence studies would be redundant and anti-climatic. Suffice it to say that, in general, different people (in different parts of cities, different cities, different counties, different provinces or states, and different countries) regard different behaviour as different crimes, or not as crimes at all. The same people report a sometimes small but usually different percentage of those activities to the police. Different police forces then may redefine and record these activities as different crimes. Police recording practices are, in turn, affected by a multitude of unrelated factors including resources, policies and procedures. Police record keeping systems are still only seldom linked to court statistical systems. court Statistical systems have problems similar to those of police systems and are, in turn, not usually linked to correctional systems.

These and other problems make it extremely difficult for any reader of any studies based on public data to summon up enough faith in the data and, consequently, in the statistical results based on that data. Fortunately, considerable attention is being paid by governments at all levels in many countries to improve criminal justice statistics. However, we will still have to wait a considerable length of time before a sufficiently detailed data file covering a sufficient length of time is available to support effectively efforts such as those attempted by the economic deterrence studies.

Perhaps a few comments are in order regarding particular data problems faced by the economic deterrence studies.

V.1 Empirical Counterparts of Theoretical Variables

There are often instances when an empirically measurable counterpart of the variable that appears in the theoretical economic model simply is not available. For instance, the economic models try to relate the actual amount of crime in different years or geographical locations to factors expected to affect that crime. However, no data exists on the actual amount of crime. We do have estimates of crimes reported to the police, but special surveys have estimated that, for certain types of actual crime, only a small proportion are reported to the police. This proportion does vary with demographic, sociological, and economic factors.¹⁹ Thus the economic studies may be off by a factor from 2 to 10 on the main variable used in their analysis.²⁰ The implications regarding the credibility of research based on such data are obvious.

19. See, for instance, U.S. Department of Justice, Crime in the Nation's Five Largest Cities, advance Report.

20. This particular comment does not apply to murder studies where the reporting rate is fairly high.

A related problem concerns the use of variables measuring what objectively does occur rather than, more appropriately, what people believe occurred. For instance, the data used by the economic studies reflects 'actual' sentence lengths and probabilities of conviction. The theoretical economic models describe individual behaviour. Individuals act according to their perceptions of the real world. Thus, to predict or understand the processes leading to individual criminal behaviour, one would need to know not what sentence lengths or probabilities of conviction actually are, but rather what individuals believe them to be. It is submitted that most individuals, potential criminals or not, have very little idea what the real values of these parameters are. In Canada, because of a delay in publishing court statistics, even criminal justice officials do not know what sentence lengths or probabilities of conviction have been for the past few years. How could 'potential criminals' possibly know what they are? The economics of crime studies all recognise these problems, but still use statistics on actual rates. This may be the only alternative at present, but it surely reduces the faith one should put in the results of those studies.

V.2 Quality of Available Data

Even if empirical counterparts for the required theoretical variables could be found, the general data problem would still be far from solved.

Most of the econometric work, that by Ehrlich in particular, has been based on a comparison of state data for the same year or national U.S. data over a number of years. Differences in reporting practices alone between jurisdictions and over time make use of this data dangerous at best. For instance, when the New York police instituted revised procedures for reporting and storing information, the number of robbery occurrences reported rose over 150% in one year, while clearance rates fell by more than 50%.

Second, the accuracy of nationwide statistics would be expected to be sensitive to the number of agencies contributing to any national data gathering program.

The national F.B.I. crime statistics are no exception. Ehrlich bases his capital punishment results on figures from this source for the period from 1933 to 1969. In the 1930's, 400 agencies reported data to the F.B.I. Today, there are 8,500 agencies reporting. This fact (among many others) caused two U.S. government commissions to conclude:

"...trends of violent and non-violent crime during the early years of the UCR are highly questionable as representative of national figures". (Mulvihill et al, 1969: 171).

and

"figures prior to 1958 and particularly those prior to 1940, must be viewed as neither fully comparable with nor nearly as reliable as later figures." (President's Commission, 1967: 26)

Regarding the accuracy of the F.B.I.'s arrest and conviction data, Bowers and Pierce (1975) point out that "few have seriously considered them for research purposes" partially because the agencies reporting such figures "have remained a relatively small self-selected subsample throughout the entire period" (supra, page 30).

Third, there may exist more than one source of data on the same variable. Generally accepted scientific principles would dictate that the researcher should compare the probable accuracy of each source and then use the best source to test his hypotheses. Bowers and Pierce (1975) argue with reason that the causes of death statistics collected by the U.S. Bureau of the census are much more likely to be reliable and comparable over time than the F.B.I. murder statistics. Ehrlich, however, ignores the Bureau of the Census figures. This decision seriously affects the credibility of his results. In fact, Bowers and Pierce find serious discrepancies between both sets of figures in the 1930's. More relevant for this paper, when the preferable Bureau of the Census murder data were substituted for the F.B.I. statistics in Ehrlich's capital punishment model,

"the new homicide measure yields no empirical support for deterrence." (Bowers and Pierce, 1975: 35)

If one could accept the accuracy of the "improved" data they use, one would instead conclude that:

"...executions have a definite brutalizing effect on society" (Bowers and Pierce, 1975: 35).

Bowers and Pierce take the view that available data is totally inadequate for researching the deterrence question. However, they believe that, if Ehrlich were to continue to maintain confidence in the data, he would have to conclude from their analysis not only that capital punishment does not deter crime, but something much stronger, that capital punishment increases crime.

The next section of this paper will discuss the statistical modelling techniques used by economists to test their theories against the data just described. These statistical techniques in general are more sophisticated statistically than the relatively primitive techniques used previously by other disciplines to study deterrence. However, in light of the problems described in this section, this statistical sophistication is rendered impotent by the data.

These and other model building efforts have been useful in identifying data needs. It is now time to use that information on needs to develop more reliable criminal justice data collection, storage, and retrieval systems. Only after these systems have been built, might it be possible to obtain estimates of the effect of deterrence programs, estimates in which sufficient faith can be placed.

VI. STATISTICAL LIMITATIONS

In this section it will be argued that the 'economists of crime' and the earlier deterrence researchers (mainly sociologists) would agree that the simple correlation between past murder rates and execution rates is positive. It will, however, be argued that simple correlation analysis (as used by most earlier researchers) is an inappropriate statistical technique for drawing any inferences regarding the effects of deterrence programs. This will be followed by a brief description of the statistical techniques introduced into the deterrence literature by the economists. These techniques are not only more sophisticated from a statistical sense but, when used properly, are significantly more appropriate for analyzing the deterrence phenomenon.

Finally, we will see that using more sophisticated technology is not enough in itself. Even though the economists of crime have tried to be meticulous in their use of this technology, serious statistical problems have been discovered with their work, problems that render their conclusions invalid.

In the discussion that follows we will use the two Ehrlich papers (the 1973 paper on deterrence over many different crime types and the 1975 paper dealing specifically with the deterrence of murder) as examples representative of the most rigorous of the empirical work done by the economists of crime. Consequently, criticisms of Ehrlich's work by other economists will also be emphasized.

Although attempts have been made to write this section in a non-technical manner, there will be times when space limitations prohibit a full description of certain statistical techniques or problems. The reader will not lose the overall message by ignoring or skimming such sections and re-reading the summary presented earlier in Section I.2.iv.

The specific statistical topics to be considered fall into the following categories:

- treating crime and crime deterrence as multi-dimensional phenomena involving many different relationships and the difference between correlation and causality;
- problems in ignoring certain of the important relationships;
- choosing the appropriate statistical estimating techniques;
- ensuring that "findings" are not sensitive to the particular time period analyzed;
- choosing the appropriate mathematical form to represent the behaviour of interest;
- problems of ignoring important variables;
- questionable algebraic assumptions in interpreting findings.

VI.1 Regarding Simplistic Solutions for Complex Problems

Most of the earlier studies of deterrence have been based on a statistical test (simple correlation) that measures whether crime rates move down when expected punishment goes up, and up when the expected punishment goes down. In the special case of the deterrent effect of capital punishment, this translates into a test of whether the number of murders increases when the probability of execution decreases, and visa versa.

Most of the earlier work²¹ has found a positive simple correlation between murders and executions (that is, an increase in executions is related to an increase in murders). The major economic study of capital punishment (Ehrlich's 1975 study), reports a similar finding:

"..the simple correlation between the murder rate and estimates of the objective risk of execution given conviction for murder is positive in sign" (Ehrlich, 1975: 409).

Where the two groups of studies differ is in their interpretation of this finding. The earlier works take it as supporting the view that retention of the death penalty does not deter crime. The economic studies would conclude it is so weak a test statistically that it is almost worthless for policy purposes.

21. See especially:

Sellin (1959 and 1967) and Zimring and Hawkins, (1973).

The main basis for this apparent disagreement is that murder rates are obviously affected by a number of factors, only one of which is the risk of execution. Although the earlier studies have tried to 'control' for these other factors (by, for instance, comparing neighbouring similar states), these methods of 'controlling' are regarded by many as inadequate.

The relevant statistical problem is called in the econometric literature²² the 'identification problem'. The identification problem arises when statistical analysis of data gives results that are consistent with two or more, perhaps conflicting, hypotheses. It is, therefore, difficult to 'identify' which hypothesis is correct.²³ For instance, an observed positive correlation between murders and execution rates would be consistent with the hypothesis that:

"a higher probability of execution 'caused' potential criminals (e.g. robbers) to commit more murders to eliminate witnesses in order to avoid subsequent conviction".

On the other hand, the same positive correlation would be consistent with a quite different hypothesis:

'when the public saw more murders, the public (for a wide variety of reasons) put pressure on criminal justice officials to execute more convicted murderers.'

-
22. 'Econometrics' at first was defined as the analysis of economic data using economic models of behaviour and statistical techniques. These analyses have developed a number of statistical techniques that are appropriate for analysis of a wider range of problems. The word 'Econometrics' thus now also encompasses the use of these new statistical techniques. Standard references are: Johnston (1963), and Malinvaud (1966).
23. The 'identification' problem is similar to what is called the 'correlation/causality' problem in the literature of the other social sciences. The general implication is that the observation of a stable statistical relationship among a number of variables is not sufficient information to allow one to conclude that variations in some of the variables 'cause' the variations in the others. For more detailed discussion of this point, especially as it affects the economics of deterrence studies, see Friedman (1976).

Both hypotheses are consistent with the data, but both have totally different implications regarding criminal behaviour and, consequently, different implications for formulating policy to deter crime.

The challenge is to develop statistical tests that identify the correct 'causal' relationship and eliminate the others. Given the number of possible explanations for any behaviour this is not a trivial task to complete successfully. However, one should at least try to develop tests that eliminate the most plausible alternative explanations to the one finally chosen.

As mentioned before, the earlier studies have tried to do this by controlling for other variables in the relationship they are testing. Thus, instead of building tests that regard murders simply as a function of executions, they use models that regard murders as a function of executions and other factors such as: geographical location; age; urbanization; income; etc. By including all these other variables in their murder equation, they hope in general to isolate the effects of each, and in particular to prevent one variable from spuriously 'capturing' the affects of variables that have been omitted.

Unfortunately, it has been well documented²⁴ that this 'one equation' procedure often leads to misleading results. Again an example will be used to illustrate the problem.

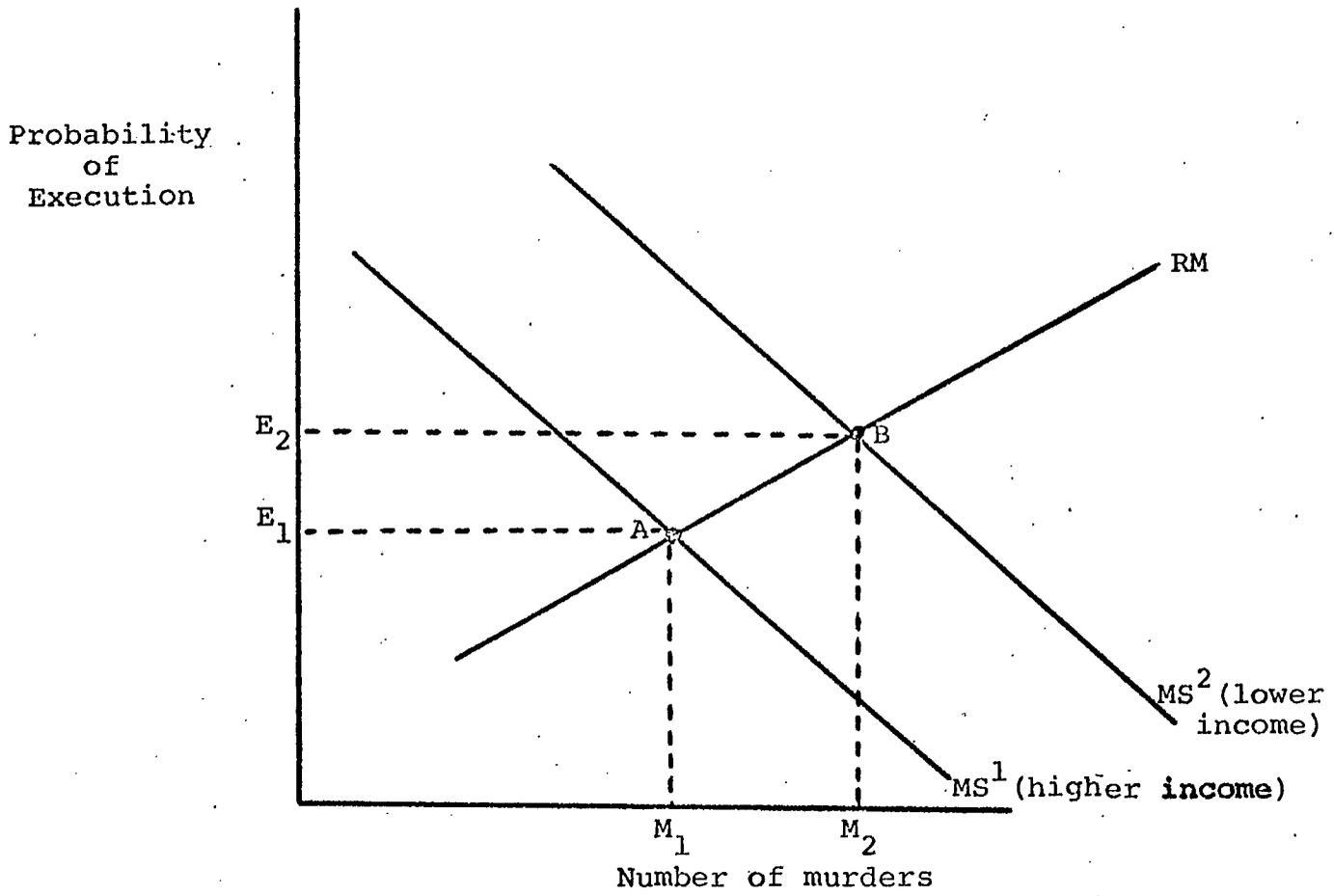
Assume that the number of murders observed over time has been a function of two processes which will be arbitrarily called the 'murder supply' process and the 'reaction to murder' process.

24. See, for instance, Johnston (1963).

The 'murder supply' process is the relationship between the number of murders people will commit and the factors affecting these decisions to murder. Assume, further, for the sake of argument, that two factors affect the number of murders that people will commit; the number of murders will fall if the probability of execution for murder rises and will also fall if family incomes rise. This relationship is represented as the line labelled MS in Figure 1. That line represents the number of murders that would occur at various probabilities of conviction, given a certain level of family income. If the level of family income were to fall, say in the next year, then at every probability of execution more murders would occur. The murder supply line would then shift to the right, say to MS², in the next year.

It is obvious that potential murderers are not the only people involved in the criminal justice process. Society is also involved, particularly as regards its reaction to various rates of murder. Here, the reasonable assumption will be made that, as the murder rate rises, society will instruct its police forces to devote more resources to catching murderers, its crown attorneys to devote more resources to preparing cases against murderers, and its judges to impose more death sentences on convicted murderers. This type of process can be represented by a 'reaction to murder' line, RM in Figure 1. As the number of murders rises, the probability of execution will be increased by society. Let us further assume for the present that society's reaction to murder is affected only by the observed murder rates, not by any other factor (such as family income).

FIGURE 1



The next point to make is that the number of murders observed in any one year will be determined not by one, but by the interaction of both these processes; the murder supply process and the reaction to murder process. The actual murder rate (and the probability of execution) observed in any one year will be the murder rate and the probability of execution that satisfy both these processes. In the first year, when family incomes are at the higher level, the actual rate of murder would be M_1 and the probability of execution would be E_1 . The murder rate M_1 is the only rate that allows both the murder supply (MS^1) and reaction to murder (RM) relationships to be satisfied at the same time.²⁵

Similarly, in the next year when a fall in family incomes has shifted the murder supply line to MS^2 , the 'equilibrium' rate of murder will be M_2 and the probability of execution will be E_2 .

What would happen if an analyst came along who was interested in the murder supply part of deterrence but did not think either, that observed murder rates were a function of two processes, or that murder supply was also affected by family income? He would collect data from year one (M_1, E_1) and year two (M_2, E_2). He would then notice that between year one and two the probability of

25. If the murder rate were above M_1 , society would (as shown by line RM) raise the probability of execution above E_1 . The higher probability of execution would then (see line MS) deter certain potential murders. The number of murders would fall and society would lower the probability of execution. This would continue until we returned to M_1 murders and a probability of execution of E_1 .

execution went up but so did the murder rate. By not including data on family incomes and not distinguishing between the two processes, he would then erroneously conclude that executions do not deter crime. What has actually happened is that, since the murder supply line has shifted but the reaction to murder line has not, he has really estimated the 'reaction to murder' process by mistake.

The earlier deterrence studies have tried to overcome this problem by trying in their murder supply equation to include (and therefore control for) other variables such as the family income variable in our example. The problem is that, if the observed murder rate is in reality the equilibrium effect of a number of different processes (only one of which is the murder supply process), and if the factors that appear in the murder supply equation also appear in other equations (each representing other relevant processes such as our 'reaction to murder' process), then the technique of controlling for other factors in a one equation approach has serious statistical shortcomings.²⁶

If one were to try to obtain estimates of the effects on the supply of murder of each of the factors in the supply of murder equation, in a statistical manner that ignored the other relationships, then one would probably not obtain

26. For instance, if in the example above society's reaction to crime were also conditioned by family incomes, then the RM line would also have shifted in Figure 1 in the second year. The observed murder rate and probability of execution in year 2 would have been some complicated function of movements in both lines. In fact, if the probability of execution, murder rates, and family incomes appeared in both the murder supply and reaction to murder equations, and no other factors appeared in either equation, it would be statistically impossible to estimate the precise form of either equation.

accurate estimates of those effects. This problem, called 'simultaneous equations bias', can be minimized by first identifying each process involved in determining murder rates, identifying the factors that appear in each process, and then using statistical techniques that in effect use information from each and every process whenever any one process is being estimated. These statistical techniques, 'simultaneous equations techniques', probably represent the most important contribution of economists to the study of deterrence. It has long been understood that crime is the result of a number of complex processes. These techniques are far more appropriate for unravelling better these processes and estimating the roles of various factors in each one separately.

Most economic studies model the multi-relationship deterrence problem using a system of simultaneous equations. The most familiar equation in that system is the 'crime generation' or 'crime supply' equation, the relationship between the number of crimes people will commit and the factors affecting that decision; goals, opportunities, effects and values. The discussion in section III of this paper related mainly to a description of this relationship.

Variables in the crime generation equation appear in other relationships as well. The 1973 Ehrlich paper specifically considers two other relationships. The first is the 'law enforcement production' relationship which links the output of law enforcement (the probability of conviction) to per capita expenditures on police, crime rates, and to a number of demographic variables. The second other relationship tries to measure society's 'demand for protection' which links per capita expenditures on police to crime rates, lagged expenditures, and losses from crime. The parameters of all equations, including

the crime generation equation, are estimated within this simultaneous equations framework using a number of different statistical estimation techniques.

Ehrlich's estimates of the parameters of the law enforcement production function are similar to those obtained by most of the economic studies.²⁷ The probability of conviction has a statistically significant and negative relationship with the crime rate. That is, higher crime rates imply less efficient law enforcement activities. One is tempted to interpret this as resulting from relatively scarcer law enforcement resources per crime in times of high crime rates.²⁸ However, Ehrlich fails to obtain a statistically significant relationship between the probability of conviction and the expenditures on law enforcement. In fact, the relationship between these two variables in other studies is found to fluctuate in sign and often to be statistically insignificant.

Ehrlich does not report the results for his demand for law enforcement equation. (Silver reports that Chapman (1973), in a totally different study, found that the number of police per capita is statistically significantly and positively related to per capita property crimes and a proxy of the expected loss from crime.)

27. See Silver, *op cit.*

28. See for instance the 'system capacity' argument put forth in Pontell (1974).

VI.2 Continuing Simultaneous Equations Bias

There are obviously far more than three processes determining crime rates, conviction rates and execution rates. The economic studies have begun to estimate certain of the more important ones. Earlier sections of this paper suggested other processes that might be singled out; the relationship between actual crime and reported crime, between perceptions of expected punishment and actual punishment, between court sentencing policies and police charging practices, and between recidivism and the type of sentence. By ignoring these other processes, the results of Ehrlich and others could still suffer a form of simultaneous equations bias. Although the economists have introduced statistical techniques that might make the task more feasible, sufficient untangling of the many complex processes has yet to occur.

Passell and Taylor (1976) discuss how Ehrlich's 'conclusions' regarding the effect of capital punishment on murder could be reversed if one other quite plausible relationship were considered as well in his system of equations. They cite several references to support their contention that 'juries and judges will apply stricter standards for convictions when there is a greater prospect of execution'. No estimates of this relationship are included in the 1975 Ehrlich paper. However, if a one percent increase in the probability of execution (given conviction) were to result in a percentage decrease in the probability of conviction greater than .174, Ehrlich's own results would imply that increasing the probability of execution would not decrease, but increase murder rates.

Nagin (1975: 16 to 36) introduces a related consideration. He points out that there is an algebraic relationship between reported crime rates and clearance or arrest rates (i.e. the latter are the ratios of the number of offences cleared or of arrests made to the number of reported crimes). He combines this algebraic fact with the plausible assumption that more discretion is likely in declaring reported crimes as 'unfounded' when the reported crime rate is high. The exercise of this discretion would lower the reported crime rate but increase the clearance or arrest rate (by lowering the denominator of the ratio). Thus, an inverse bias is introduced to data used to estimate the relationship between crime rates and clearance or arrest rates. Any inverse relationship found may not be the result of any deterrence phenomenon, but rather the spurious result of algebraic facts and the exercise of discretion in 'unfounding' reported crimes. Nagin uses similar arguments to demonstrate a similar bias introduced (by plea bargaining) to the data used to estimate the relationship between length of sentence and crime rates.

Finally, Nagin also, quite correctly, contends that the recent deterrence research has not adequately separated the deterrence effects of sanctions from the incapacitation effects of the same sanctions. That is, the research provides little help in deciding whether imposition of a prison sentence reduces (if it does) crime through deterrence of other criminals, or reduces crime by 'incapacitating' the individual sentenced during his stay in prison and, therefore, prevents him from committing crime during that period (thereby reducing the crime rate).

In summary, by not explicitly considering a number of relationships affecting crime, conviction and sentencing, the recent econometric models could be incorrectly attributing to conviction and sanction probabilities the effects that should rightly be attributed to other variables having little, if anything, to do with deterrence policies.

VI.3 Using Appropriate Estimating Techniques

The preceding discussion of the appropriateness and potential benefits of casting the deterrence problem in the context of a system of simultaneous relationships should be counterbalanced with a rather crucial point made by Passell (1975). If the variables entering each of the relationships 'behaved' like many other variables, then appropriate and readily available statistical techniques would exist to estimate the impact of each of these variables in each relationship. These techniques are the ones used by Ehrlich in his 1975 'capital punishment' paper.

Unfortunately, many of the variables in the economics of deterrence models do not 'behave' in the required manner. For instance, many variables are probabilities (probability of conviction, of arrest, of execution, etc.) and cannot take values less than zero or greater than one. Further, the same techniques could be expected to be appropriate only when used with a number of observations much larger than that available to Ehrlich. This means that the statistical estimating techniques used by Ehrlich may give estimates as biased as those that would be obtained if he had estimated each equation separately and ignored the simultaneous nature of the deterrence problem. In any case, the estimating techniques he uses are not as powerful and appropriate as he makes out.

VI.4 Stability of Results over Time

Very few people would base policy designed to alter the behaviour of people in modern day Canada on the results of one research study carried out, say, on people in Canada in the 14th Century. It would be reasonable to expect the significant technological, economic, institutional, and philosophical changes that have occurred since then to alter the way the same policy would affect behaviour between then and now.

The above is, admittedly, an extreme example. The point to be made is that, before research findings can be used as a basis for policy, it must be demonstrated that those findings would not be altered significantly if the research were to be based on analyses of data relating to a different recent time period. Ehrlich's capital punishment 'findings' fail this test decisively.

Ehrlich (1975) bases his capital punishment findings on the analysis of data from 1935 to 1969. He also contends that:

"Of more importance, the qualitative results... are for the most part insensitive to changes in the specific interval of time investigated in the regression analysis..." (Ehrlich, 1975, p.413)

Upon further examination this contention is found to be blatantly unjustified. Bowers and Pierce (1975) reproduced Ehrlich's analysis but used data from 10 slightly different periods, all beginning in 1935 but each ending in a different year in the 1960's. For the time periods ending in 1964 and earlier, the policy implications of the analysis are either nullified or reversed completely.

For instance, for the time period ending in 1964, the results imply that various forms of punishment (including capital punishment) increase rather than decrease murder rates. In short:

....it becomes evident that the so called deterrent effect of execution risk altogether disappears when the effective time period is foreshortened by dropping recent data points." (Bowers and Pierce, 1975: 12)

Bowers and Pierce provide further analysis to disprove the argument that capital punishment worked after 1964.

In a separate study, Passell (1975) used cross sectional data in various states in the U.S. for the period 1950 and 1960 to test Ehrlich's capital punishment results. Again, the findings were dramatically reversed:

"We know of no reasonable way of interpreting the cross section data which would lend support to the deterrence hypothesis". (Passell, 1975: 21)

Forst, (1976), replicated Ehrlich's (1973) more general deterrence work but used 1970 cross-state data. With this more recent data, Forst found:

"The crime rate to be virtually insensitive to cross state variation in either the probability or length of incarceration."

(Forst, 1976: 3).

In summary, Ehrlich's results, contrary to his own statements, are extremely sensitive to the time period chosen for analysis.

VI. 5 Functional Form

Behavioural theory may suggest which factors are likely to affect criminal behaviour. Theory often has little to say regarding the mathematical form of such a relationship. For instance, theory cannot give categorical rules for deciding whether a one percent increase in the probability of execution should reduce (or increase) murder by a certain fixed percent, a certain fixed number of crimes, or varying percents or numbers at different levels of executions.

Thus, a finding that executions do not affect murders using one way of expressing the relationship mathematically does not necessarily mean that the finding would be the same if the relationship were expressed in a different mathematical form. Conversely, if we were simply testing whether there is any relationship at all between two variables, we would have more confidence in findings that were not dependent on the researcher using one specific arbitrary way of mathematically expressing the relationship.

Ehrlich, in his 1975 capital punishment paper, tests whether the relationship between the probability of execution (given conviction) and murder is such that a one percent increase in the probability of executions will yield a fixed percentage decrease (or increase) in murders. Thus, a change in the probability of execution from 80 to 95% would have the same percentage effect on murder rates as a change from 1 to 15%.

Ehrlich is aware of the somewhat arbitrary way he has specified the mathematical form (the 'functional form') of the relationship, but contends:

"the regression results are found to be robust with respect to the functional form of the regression equation". (Ehrlich, 1975: 412)

Further research shows quite the opposite. Passell (1975 pages 14 to 16 and Appendix A) uses a more general functional form²⁹ which allows a much more exhaustive test of the sensitivity of Ehrlich's results to the functional form chosen. Passell finds Ehrlich's results are nullified and often reversed when equally reasonable alternative functional forms are used. These results in general indicate not a negative, but rather a positive relationship between execution and murder. Passell does, however, present additional analyses that support the hypothesis that 'higher murder rates cause higher execution rates' rather than the reverse.

When Bowers and Pierce (1975) replicated Ehrlich's study (even without excluding the last few years of data) and used the normal values for the variables rather than their logarithms (as done by Ehrlich), they found that there was no statistically valid evidence to support the deterrence hypothesis regarding capital punishment.

Forst, (1976), in his replication of Ehrlich's 1973 study using more recent data, also tested the sensitivity of Ehrlich's results to the specific functional form used. He found inappropriate not only the functional form used by Ehrlich, but also Ehrlich's use of weighted regressions.³⁰ Forst found that when more accurate alternatives were used, the appearance of any deterrent effects was virtually nil.

29. An equation linear in the nth power transformation of the actual variables.

30. Using the Goldfeld-Quant test for homoscedasticity.

In summary, Ehrlich's results have been found to
be:

"extremely sensitive to essentially arbitrary choices of model specification and to the period over which the model is estimated...this sensitivity raises grave (and in our opinion, overwhelming) doubt about the utility of Ehrlich's time series estimates." (Passell and Taylor, 1976: i and 11)

VI.6 Missing Variables

No researcher could be asked to explain behaviour with 100 percent accuracy. Given limited time and resources, researchers must limit themselves to including in their models only those considerations that will affect the validity of their findings concerning the problems which they have addressed. Many factors affect crime and society's reaction to crime. Inclusion of data on all of them would be impossible.

However, there is a very real danger in excluding information that might also bear on the question at hand. For instance, assume that the stability of family relationships was a major determinant of crime. Assume, also, for purposes of argument only, that the probability of executions had no effect on crime rates but was perfectly correlated with some measure of the stability of family relationships. If a researcher were to estimate the parameters of an equation including crime rates and probability of execution variables (but not including a family stability variable), his statistical results would indicate a strong relationship between crime and executions. These results would be totally spurious. The execution variable is really acting as a stand-in or proxy for family stability. The effect of family stability would have been incorrectly attributed to executions.

It is, therefore, important that Ehrlich's results be tested for the presence of this 'missing variables' problem.

Of particular relevance is the test of Ehrlich's 1973 deterrence model by Forst (1976). Forst hypothesized

that variables measuring demographic differences between states, variables not considered by Ehrlich, might also affect state crime rates. Specifically, he was interested in the effects of population migration (a measure of anomie), population density and broken home rates. Not only were these variables found to be statistically significant in an Ehrlich-like 'supply-of-offenses' equation, but crime rates were also more sensitive to cross-state variation in these demographic variables than to variations in Ehrlich's crime deterrence variables. Further, Ehrlich's estimate of the effects of the crime deterrence variables are reduced substantially when these additional demographic variables are added. This leads Forst to conclude that Ehrlich's crime deterrence variables were acting as 'stand-ins' for omitted demographic variables, and that:

...the relationship that Ehrlich finds between the probability of imprisonment and the crime rate is primarily spurious." (Forst, 1976: 15)

Similarly, in commenting on the results of their analysis discussed on page VI 16, Bowers and Pierce indicate that they have subsequently carried their analysis of Ehrlich's work somewhat further, and discovered that his so-called deterrent effects also disappear when indicators of alcohol consumption, gun ownership, and rates for other violent (non-capital) crimes are included in the analysis. They have also determined that the so-called deterrent effects disappear with the removal of highly colinear exogenous variables from the analysis.

VI.7 Questionable Hidden Assumptions

Friedman (1976: 39-41) points out a hidden assumption by Ehrlich which may not be justified and which if corrected may cause substantial changes in his estimates. Friedman contends that Ehrlich glosses over the changes necessary to treat the probability of arrest for murder as constant. This probability is the ratio of the actual number of arrests for murder and the actual number of murders. Since Ehrlich allows murders to change but claims the probability is constant, he must be assuming that arrests change too. Friedman points this out by using Ehrlich's own estimates of all parameters in the relevant equation (estimates which Friedman believes are not credible) to obtain a deterrent estimate which holds arrests constant. He finds that:

"...the marginal trade-off has the opposite sign from that reported by Ehrlich. Thus each execution, if the parameter estimates were correct, did not on average reduce the number of murders by 8, but in fact increased the number of murders by 14!"
(Friedman, 1975: 40).

Thus Friedman has shown that depending on the truth about this hidden assumption, policy implications drawn from Ehrlich's work could easily be reversed.

In summary, the work of Ehrlich and other deterrence researchers suffers statistical flaws of such a magnitude as to render the work grossly inadequate for supporting the formulation of deterrence policy.

VII. GENERAL CONCLUSIONS

The most recent wave of economic deterrence studies have challenged the prevailing wisdom that punishment does not deter crime. Certain people have claimed that 'the economists', using fairly elaborate theoretical models and sophisticated statistical techniques, have proven that punishment does deter, whether it be in the form of increased probabilities of conviction or execution or in the form of longer prison sentences.

On further investigation, however, one finds the economists whose work is being quoted as being somewhat less vociferous about their findings. One also finds a growing number of economists who are extremely critical of the position put forth by others as the 'economists' position'.

These latter economists have strongly criticised the most well known economics of deterrence studies and especially those of Isaac Ehrlich. They have presented substantial evidence that the studies suffer serious theoretical, data related, and statistical shortcomings. A summary of the major criticisms in each area is contained in Section I.2 of this paper.

The overall conclusion is that the 'true economic' position still challenges the prevailing wisdom that punishment does not deter crime. However, this wisdom is replaced not with 'punishment does deter crime', but rather with 'we don't know'. The economists have found enough new clues to justify a retrial, they have not yet reversed the decision with new evidence.

Given the difficulties of research in this area, policy makers will probably never have the luxury of formulating policy based on research that is absolutely conclusive in its findings. However, considerably more certainty is required than exists at present regarding the economics of deterrence studies. The techniques introduced by the economists may represent significant advances over those used in the past. These techniques and the behavioural models used by economists are, however, useless unless they are combined with sufficient accurate and relevant data. Unfortunately, it will be many years before data of sufficient quality and quantity is available for undertaking research which is adequate for supporting deterrence policy.

Until that time, uncritical publicity of the earlier economic findings, publicity that has in the past bordered on the irresponsible, should cease. Economists like Ehrlich should also exercise more professional responsibility in undertaking and reporting what amount to circumstantial results.

"If...one's results are intended as a basis of policy decisions, especially if the stakes are high, the highest professional and scientific standards should be required, particularly with respect to the care exercised in reporting findings." (Baltes and Cole, 1975: 12)

For further information contact:

Communication Division
Ministry of the Solicitor General

phone: 996-1061

SELECTED BIBLIOGRAPHY

- Allison, J.P., "Economic Factors and the Rates of Crime".
Journal of Land Economics, May 1972, 48(2), pp 193-196
- Andenaes, J., "General Prevention Revisited: Research and Policy Implications" The Journal of Criminal Law and Criminology, 66(3), p 338
- Angel, S., "Discouraging Crime Through City Planning", Working Paper No. 75, Berkeley Institute of Urban and Regional Development, February 1968
- Avio, K.L., "On Optimal Policies for a Criminal Justice System", University of Western Ontario, unpublished, undated.
- Baldas, D.C., and D.W.L. Cole, "A Comparative Analysis of the Empirical Work of T. Sellin and I. Ehrlich as a Basis for Inferring a Causal Relationship Between Capital Punishment and the Murder Rate in the United States", University of Iowa, unpublished, 1975.
- Becker, G.S. and William M. Landes, eds., Essays in the Economics of Crime and Punishment, National Bureau of Economic Research, Columbia University Press, New York, 1974
- Becker, G.S., "Crime and Punishment: An Economic Approach" Journal of Political Economy, Vol. 76, 1968, pp 169-217
- Bernier, R. and R. Gagnon (directed by S. Rizkalla), Bibliographical Guide: The Economics of Crime and Planning of Resources in the Criminal Justice System, International Centre for Comparative Criminology, University of Toronto, 1975.
- Block, M.K., "An Economic Analysis of Theft with Special Emphasis on Household Decisions under Uncertainty", Ph.D. dissertation, Stanford University, 1972
- Block, M.K., and J.M. Heineke, "A Labour Theoretic Analysis of the Criminal Choice", American Economic Review, LXV(3), June 1975
- Block, M.K. and G.J. Long, Subjective Probability of Victimization
- Bonger, W. A., Criminality and Economic Conditions, Boston, 1916
- Bowers, W.J. and G.L. Pierce, "Deterrence, Brutalization or Nonsense: A Critique of Isaac Ehrlich's Research on Capital Punishment", Center for Applied Social Research, Northeastern University, unpublished, 1975

- Capital Punishment, New Material: 1965-1972, Solicitor General of Canada
- Carr-Hill, R., "An Econometric Model of the Supply and Control of Recorded Offences in England and Wales", Oxford, England, Nuffield College, unpublished, 1972
- Chapman, J., "The Impact of Police on Crime and Crime on Police: A Synthesis of the Economic and Ecological Approaches", Institute of Government and Public Affairs, U.C.L.A., mimeographed, 1973
- Chapman, J., Crime in Medium Sized Cities: An Econometric Study, University of California, Berkeley, unpublished doctoral dissertation, 1971
- Church, A.M., Econometric Model of Crime in California, Claremont College, unpublished doctoral dissertation, 1970
- Doleschal, E., "The Deterrent Effect of Legal Punishment: A Review of the Literature", Information Review on Crime and Delinquency, 1(7), pp 1-17, June, 1969
- Econometric Study of Economy-Related Crime, paper no. N I 69-401, University of California, Santa Barbara, Study funded by the National Institute of Law Enforcement
- Ehrlich, I., "The Deterrent Effect of Capital Punishment: A Question of Life and Death", American Economic Review, LXV(3), June 1975
- Ehrlich, I., The Supply of Illegitimate Activities, Columbia University, New York, unpublished, 1967
- Ehrlich, I., "Participation in Illegitimate Activities: A Theoretical Empirical Investigation", Journal of Political Economy, 81(3), pp 521-65, May/June 1973
- Erikson, E., "The Social Costs of the Discovery and Suppression of the Clandestine Distribution of Heroin", Journal of Political Economy, pt 1, pp 484-86, p 354, July/August 1969
- Fattah, E.A., A Study of the Deterrent Effect of Capital Punishment with Special Reference to the Canadian Situation, Research Centre Report Number 2, Solicitor General of Canada, 1972
- Fernandez, R.A. "The Clandestine Distribution of Heroin: Its Discovery and Suppression: A Comment", Journal of Political Economy, 77(4), pp 487-88, July/Aug 1969
- Fleischer, B.M., "The Effect of Income on Delinquency: Reply", American Economic Review, LX(1), pp 257, March 1970

- Fleischer, B.M., "The Effect of Unemployment on Juvenile Delinquence", Journal of Political Economy, 71, pp 543-555, Dec. 1963
- Fleischer, B.M., The Economics of Delinquency, Quadrangle Books, Chicago, 1966
- Fooner, M., "Some Economic Factors in Crime and Delinquency", New York Law Journal, 161(46), March 1969
- Forst, B.E., "Participation in Illegitimate Activities: Further Empirical Findings", Policy Analysis, 2, Summer 1976.
- Friedman, L.S., "The Use of Multiple Regression Analysis to Test for a Deterrent Effect of Capital Punishment: Prospects and Problems", Working paper No. 38, University of California, Berkeley, (Revised), January 1976.
- Frese, R. and N. Heller, "Measuring Auto Theft and the Effectiveness of Auto Theft Control Programs", presented at the 38th Meeting of the Operations Research Society of America, 1970
- Frey, W., "Limits to Economy in Crime and Punishment", Social Science Quarterly, 50, pp 72-78, June 1969
- Furbotin, E. and S. Pejovick (eds), The Economics of Property Rights, Ballinger, Cambridge, Mass., 1970
- Goode, E., "On Behalf of Labelling Theory", Social Problems, No. 22, pp 570-83, June 1975
- Greenberg, D., "Theft, Rationality and the Methodology of Deterrence Research", Sociology Department, New York University, paper presented to the August 1975 meetings of the American Sociological Association
- Greenwood, M.J. and W.J. Wadycki, "Crime Rates and Public Expenditures for Police Protection: Their Interaction", Review of Social Economy, XXXI(2), pp 138-51, Oct. 1973
- Gunning, J.P., "The Economic Basis for the Punishment of Burglars", Center for Study of Public Choice, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, unpublished paper
- Harris, J.R., "On the Economics of Law and Order", Journal of Political Economy, 78(1), pp 165-74, Jan/Feb 1970
- Ireland, T.R., "Optimal Enforcement of Laws: A Comment", Journal of Political Economy, 80(2), pp 421, Mar/Apr 1972

- Jaywardene, C.H.S., The Canadian Experiment with the Penalty of Death, Department of Criminology, University of Ottawa
- Johnston, J., Econometric Methods, McGraw-Hill, 1963
- Katzman, M.T., "The Economics of Defense Against Crime in the Streets", Land Economics, 44(4), pp 431-40, Nov. 1968
- Kleinman, E., "The Choice Between Two 'Bads' - Some Economic Aspects of Criminal Sentencing", Hebrew University, Jerusalem, 1967, unpublished manuscript
- Kobrin, S. and E.W. Lubech and R. Jeaman, "The Deterrent Effectiveness of Criminal Justice Sanction Strategies, Summary Report", Public Systems Research Institute, U.C.L.A., Sept. 1972, Research undertaken under Grant No. 71-069 from the National Institute of Law Enforcement and Criminal Justice, L.E.A.A., U.S. Dept. of Justice
- Lamperti, J., "Does Capital Punishment Deter Murder?: a Brief Look at the Evidence", Dartmouth College, unpublished paper, 1975
- Landes, W.M., "An Economic Analysis of the Courts", Journal of Law and Economics, 14(1), April 1971
- Lodhi, A. and C. Tilly, "Urbanization, Crime and Collective Violence in 19th Century France", American Journal of Sociology, 79, 1973
- Malinvaud, E. Statistical Methods in Econometrics, Rand-McNally, 1966
- Mattei, ., "The Use of Taxation to Control Organized Crime", California Law Review, June 1961
- Mulvihall et al, "Staff report of the National Commission on the Causes and Prevention of Violence", as quoted by Bowers and Pierce (1975)
- Nagin, D., "General Deterrence: A Review of the Empirical Evidence", unpublished paper, August 1975
- Orsagh, R., "Crime, Sanctions and Scientific Explanation", forthcoming in Journal of Criminal Law, Criminology and Police Science, September 1973 (mimeographed)
- Passell, P. and J.B. Taylor, "The Deterrence Controversy: A Reconsideration of the Time Series Evidence", in Hugo Bedau and Chester Pierce, eds., Capital Punishment (AMS Press, 1976)
- Passell, P., "The Deterrent Effect of the Death Penalty: A Statistical Test", Stanford Law Review, Volume 28 (November, 1975)

- Phelps, E.S. (ed), Economic Justice, Penguin, 1975
- Phillips, L., and H.L. Votey, Jr., "An Economic Analysis of the Deterrent Effect of Law Enforcement on Criminal Activity", The Journal of Criminal Law, Criminology and Police Science, 1972
- Phillips, L. and H.L. Votey, Jr., and J. Howell, "Deterrence and Handguns: Minimizing the Cost of Homicide", University of California, Santa Barbara
- Phillips, L. and H.L. Votey, Jr., and J. Howell, "Apprehension, Deterrence, Guns and Violence:", delivered address to the Western Economic Association, Vancouver, Aug. 30, 1971
- President's Commission on Law Enforcement and Administration of Justice: Task Force Report, Science and Technology, Washington, U.S. Government Printing Office, 1967
- President's Commission on Law Enforcement and the Administration of Justice: The Challenge of Crime in a Free Society, Washington, Government Printing Office, 1967
- Ross, M., "Economic Conditions and Crime - Metropolitan Toronto, 1965-1972", Criminology Made In Canada, 2(2), Winter 1975
- Rottenberg, S. (ed), The Economics of Crime and Punishment, American Enterprise Institute for Public Policy Research, Washington, 1973
- Sellin, T., The Death Penalty, Philadelphia, 1959
- Silver, M. "Punishment, Deterrence and Police Effectiveness: A Survey and Critical Interpretation of the Recent Econometric Literature", report prepared for the Crime Deterrence and Offender Career Projects, City College of the University of New York, Feb 1974
- Sjoquist, D.L., "Property Crime and Economic Behaviour: Some Empirical Results", American Economic Review, 63(3), pp 439-46, June 1973
- Smigel, A., Crime and Punishment: An Economic Analysis, unpublished M.A. Thesis, Columbia University, New York, 1965
- Stigler, G.J. and G.S. Becker, "More on the Enforcement of Laws", unpublished paper, University of Chicago
- Stigler, G.J., "The Optimal Enforcement of Laws", Journal of Political Economy, 78(3), pp 526-36, May/June 1970
- Stigler, G.J., "Private Vice and Public Virtue", Journal of Law and Economics, IV, pp 1, 1961



storage

- Tittle, C., "Punishment and Deterrence of Deviance", in The Economics of Crime and Punishment, S. Rottenberg (ed), American Enterprise Institute for Public Policy Research, Washington, 1973
- Tullock, G., "An Economic Approach to Crime", Social Science Quarterly, Vol 50, pp 59-71, June 1969
- Tullock, G., "Does Punishment Deter Crime?", The Public Interest, No. 36, P 103, Summer 1974
- U.S. Department of Justice, Crime in the Nation's Five Largest Cities, Advance Report, 1975
- Vickrey, W.S., "An Exchange of Questions between Economics and Philosophy", in The Goals of Economic Life, A.D. Ward (ed), Harper, 1953
- Votey, H.L., Jr., and L. Phillips, Economic Crimes: Their Deterrence and Control, An Econometric Study, National Technical Information Service, Ref. No. PB 194 984, Springfield, Virginia
- Votey, H.L., Jr., and L. Phillips, "The Control of Criminal Activity: An Economic Analysis", to be published in Handbook of Criminology, D. Glaser (ed), Rand-McNally & Co., Chicago
- Weathersby, G.B., "The Determinants of Crime: An Econometric Analysis of Major and Minor Crimes in Boston", paper presented at the 38th meeting of the Operations Research Society of America, 1970
- Weicker, J.L., "The Effect of Income on Delinquency: Comment", American Economic Review, LX(1), pp 249-56, March 1970
- Welford, C. "Labelling Theory and Criminology: An Assessment", Social Problems, No. 22, pp 332-45, Feb 1975
- Zimring, F. and G. Hawkins, Deterrence, Chicago, 1970

