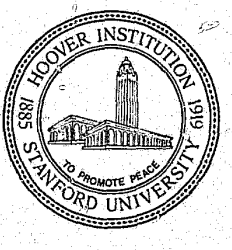
CENTER FOR ECONOMETRIC STUDIES
OF THE JUSTICE SYSTEM

RESEARCH DEVELOPMENTS

June 1979



HOOVER INSTITUTION
STANFORD UNIVERSITY

CENTER FOR ECONOMETRIC STUDIES
OF THE JUSTICE SYSTEM

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PART ONE

Overview

I. BACKGROUND

As part of a Research Agreement Program between the Hoover Institution and the National Institute of Law Enforcement and Criminal Justice, the Center for Econometric Studies of the Justice System—originally titled the Center for Econometric Studies of Crime and the Criminal Justice System—was established in September 1975. The project description outlined clearly the objective of this new Center:

> . . . the work of this Center will focus upon the relatively new but developing application of econometrics to the analysis of crime rates and criminal behavior. Utilizing econometric techniques, studies will be undertaken to identify and measure the impact of factors affecting the crime rate which are subject to control through public policy.

The charter of the Center was straightforward: to bring the techniques of economics and econometrics to bear on policy problems in the criminal justice area.

By mid-1975, a number of scholarly articles using economic models to analyze deterrence had been published. The most provocative involved the application of traditional econometric techniques to the deterrence question. Generally, the authors of these works found the evidence to be consistent with the deterrence hypothesis. Specifically, using statistical techniques borrowed from the study of more traditional supply and demand relationships, economists found the available data did not contradict the hypothesis that adherence to the law could be increased by making punishment for the crime more certain and/or more severe. Some criminologists had obtained similar results, but conventional wisdom in criminology held that the deterrence hypothesis could not be firmly established. The economists' initial findings were so controversial that the National Academy of Sciences formed the Panel on Research on Deterrent and Incapacitative Effects to investigate the state of scientific knowledge in this area. Interestingly, in the Panel's 1976 report on the empirical evidence on general deterrence, twelve of the twenty-four studies formally reviewed were performed by economists. This was particularly striking since economists did not start publishing empirical work in the area until 1973, barely two years before the organization of the panel. Moreover, among the studies reviewed, economists performed all eleven studies that employed moderately sophisticated statistical techniques (such as the estimation of a simultaneous equation system). In only a few years, economists had transformed an almost moribund topic—deterrence—into a central concern for both scholars and policymakers.

It was against this background and partly in response to this challenge that the National Institute established a center to specialize in the application of econometrics to concerns of policymakers in the criminal justice system. The issues surrounding deterrence remain a central element of the Center's research program. We are beginning, however, to integrate these concerns into a more general research agenda involving the application of economics and, specifically, econometric techniques to various aspects of the administration of justice.

II. ORGANIZATION

The Center is administered as part of the Hoover Institution's Domestic Studies Program. During its intital phase of operations from 1975 to 1977, the director of the Center was Thomas G. Moore, Senior Fellow and director of the Domestic Studies Program. Since 1977, Michael K. Block, a Senior Research Fellow in the Domestic Studies Program, has served as full-time director of the Center. Outside review and direction of the research program is provided in large part by the Center's distinguished board of advisors, chaired by Professor James Q. Wilson. In 1979, the members of the board were:

Gary S. Becker, University Professor
Department of Economics, University of Chicago

Alfred Blumstein, Director, Urban Systems Institute
School of Urban and Public Planning, Carnegie-Mellon University

Zvi Griliches, Professor
Department of Economics, Harvard University

John Kaplan, Jackson Eli Reynolds Professor of Law
School of Law, Stanford University

Lawrence J. Lau, Professor
Department of Economics, Stanford University

Mark H. Moore, Associate Professor
John F. Kennedy School of Public Policy, Harvard University

Walter Oi, Professor
Department of Economics, University of Rochester

George Stigler, Walgreen Professor of American Institutions
Charles R. Walgreen Foundation for the Study
of American Institutions, University of Chicago

James Q. Wilson, Henry Lee Shattuck Professor
Department of Government, Harvard University

I. MAJOR CONCERNS AND RESEARCH PROJECTS

Although the Center's resources have been devoted mainly to empirical studies, in the early phases of our operations we did explore several methodological issues.

A. *Methodological Studies*

One of our first research efforts at the Center involved an exhaustive review of the theory of deterrence, the subject that had in large part inspired the establishment of the Center. The results of this review were summarized in a Center Technical Report, "Economic Models of Criminal Behavior: An Overview," by J.M. Heineke. An important contribution of this work was its clear delineation of the limits of simple economic models of deterrence. The report is required reading for anyone seriously interested in a critical appraisal of the logical models of criminal choice.

Although this review of the "state of the art" was our first effort, our major methodological undertaking has been to adapt innovative techniques developed by economists to problems in the criminal justice area. In recent years, economists have made significant progress in estimating behavioral relationships. Part of this progress may be attributed to their use of extremely sophisticated and hence flexible mathematical representations of these relationships. Intuitively, the more sophisticated the mathematical representation of, say, a demand relationship is, the less restrictive the assumptions about the behavior generating that relationship are. For example, a linear demand curve, certainly one of the simplest mathematical representations, is an appropriate specification only in special circumstances.

Another factor in the recent advance of empirical economics is increased efficiency in estimating systems of supply and/or demand relationships. System estimation (that is, estimation of all equations simultaneously) enables an investigator to exploit the logical properties of that system. To test whether these same methodological advances yield equally productive results in the study of crime and crime prevention, we initiated research on the application of "state of the art" modeling techniques to this area. A report on the purely mathematical results of this project is contained in a Center Technical Report, "The Supply of Legal and Illegal Activity: An Econometric Model," by J.M. Heineke.

The econometric model developed for this project was used to discover the relation of the level and composition of crime in a municipality to the net returns from burglary, robbery, and larceny, as well as to the wage rates of legitimate employment. This application demonstrated an important contribution of the project: it facilitated a rather complex estimation of the relations between deterrent and employment effects for selected property crimes. Without the framework provided by this modeling effort, we would have been unable to explore fully the statistical relationships among burglary, robbery, larceny, and legitimate employment.

Our latest methodological effort concerned testing the major issues involved in the deterrence hypothesis with data on individual offenders. The National Academy of Sciences panel, as well as other investigators, suggested that significant advances might be made in deterrence research by using data on individual offenders. They proposed that in place of studies utilizing aggregate Uniform Crime Reports (UCR) data, investigators in the deterrence area use information on individual crime histories. We at the Center have devoted considerable thought to this matter. Our efforts have involved participation in conferences, including the Woods Hole meeting of the National Academy of Sciences panel on deterrence research, and original research projects utilizing nontraditional data sources. A number of important issues in the use of individual observations to test the deterrence hypothesis were raised in a Center Technical Report, "A Note on Using Data for Individual Offenders in Econometric Studies of the Criminal Justice System," authored by F.C. Nold.

B. *Empirical Studies*

As noted above, most of our efforts at the Center have been devoted to empirical studies of crime and crime control. These studies have used traditional econometric techniques and concentrated on four major problem areas: deterrence, unemployment and crime, the costs of crime control, and finally, the costs of crime commission.

Deterrence has been, and continues to be, a major research concern at the Center. Our mandate in this area is clear. According to the initial project summary:

> . . . a particular concern of the Hoover Institution's effort will be the refinement and further testing of the deterrence hypothesis; that is, the hypothesis which states that adherence to the law can be increased by making punishment for a crime more certain and/or more severe.

To date, four major studies concerned with testing and refining the deterrence hypothesis were undertaken and completed at the Center.[1] Although the crimes studied and the specific tests employed differed widely in these studies, one common finding emerged. The available data did not contradict the deterrence hypothesis. Specifically, we did not find any convincing evidence inconsistent with the hypothesis that increases in capture or punishment rates—as well as increases in the severity of punishment—decrease an individual's propensity to commit crimes.

[1]The four Center Technical Reports in this area are: "Property Crimes and the Returns to Legitimate and Illegitimate Activities" (see page 26); "A Note on Using Victimization Rates to Test Deterrence," by I. Goldberg (see page 28); "Does Reporting Deter Burglars?" by F.C. Nold and I. Goldberg (see page 27); and "The Deterrent Effect of Antitrust Enforcement: A Theoretical and Empirical Analysis," by M.K. Block, F.C. Nold, and J.G. Sidak (see page 29).

Moreover, for at least one white-collar crime (price-fixing), we found that monetary punishment alone was an effective deterrent.

In a study of selected property crimes employing a rather sophisticated modeling technique (translog supply approximations) and utilizing both the Center's extensive collection of Federal Bureau of Investigation UCR data and information from the National Council on Crime and Delinquency (NCCD), we found that the crimes of burglary, larceny, and robbery were moderately sensitive to their own net returns. In other words, an increase in the penalty or arrest or conviction rates for any one of these crimes was associated with a decrease in its prevalance. Only very limited evidence of substitution between crimes was found in this study. For example, while an increase in the net returns to robbery produced by a decrease in expected punishment increased the robbery rate, it did not appear to detract effort from the commission of burglaries. This is a curious finding, worthy of further exploration. A description of this study is presented in a Center Technical Report entitled, "Property Crimes and the Returns to Legitimate and Illegitimate Activities."

This study was the first rigorous examination of substitution among the various property crimes and between specific property crimes and legitimate employment. Interesting as the findings of this study are, their interpretation must be tempered by the problems inherent in the data sources. No less than previous investigators, we are aware of the shortcomings of the UCR and NCCD data bases. For instance, of the 910 potential observations from Standard Metropolitan Statistical Areas with populations over 250,000 only 121 meet minimal completeness requirements. These data limitations, as well as the possible simultaneity problems in this type of aggregate analysis noted by the National Academy of Sciences panel, have militated against extensions of this work.[2] Our experience leads us to believe that refinements of the important deterrence issues are best performed by using independent data bases, rather than data sets based on the traditional UCR information.

Taking our own advice, we have devoted considerable effort to testing the deterrence hypothesis using National Crime Panel (NCP)—commonly known as "victimization"—data. In a straightforward study using aggregate citywide data, we found that criminal sanctions had negative and significant effects on the six crimes (rape, robbery, assault, burglary, larceny, auto theft) covered in the NCP surveys, whether this relationship was tested with UCR or NCP data; that is, the simple negative correlation between crime rates and sanction levels was not a unique attribute of the

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[2]Simultaneity in this context refers to the hypothesis that although sanctions influence the level of crime, there is also a simultaneous effect of crime on sanctions. The latter is usually assumed to result from such factors as congestion.

UCR data base. Details on this research project are contained in a Center Technical Report, "A Note on Using Victimization Rates to Test Deterrence," by I. Goldberg.

A somewhat more ambitious and sophisticated use of the victimization data is evidenced in our work at the Center on reporting and deterrence. Using a sample of more than 300,000 households from NCP surveys conducted in 1972-1975, we investigated whether, and to what extent, expected gains or "loot" and—perhaps more significantly—expected reporting behavior influenced the chances of becoming a victim of burglary. The perceived reporting probability of a given household was considered to be a household-specific deterrent variable. Hence, our analysis of this activity provided direct evidence of the deterrent effect of one form of self-protection: specifically, were households that were more likely to engage in the self-protective behavior of reporting a crime less likely to be victimized? Apart from our concern with private enforcement, this study was an empirical reinvestigation of the deterrence question using individual observations on victims and potential victims. The data used in this test had several advantages over the traditional aggregate crime statistics used in former studies. First, as noted above, the deterrent variable was victim-specific as opposed to merely city-specific. Second, information on potential losses was, again, victim-specific and not simply city-specific. Third, in contrast to police statistics, victimization statistics here included non-reported as well as reported burglaries. Finally, the use of individual data reduced the simultaneity problem: the possible effect of crime on sanctions in addition to the effect of sanctions on crime.

The results of this study were reported in a Center Technical Report, "Does Reporting Deter Burglaries?," coauthored by F.C. Nold and I. Goldberg. This work strongly supported the hypothesis that the perceived victim-specific probability of reporting a burglary affected a household's victimization probability: households that appeared more likely to report crimes to the police were less likely to be victimized. The authors also found evidence consistent with an aggregate effect of reporting on crime. It appeared that reporting was not all "beggar thy neighbor": an increase in the citywide reporting rate reduced the victimization rate for all households in that area. These results provide the foundation for a further investigation of private efforts to deter victimization. Currently, we plan to focus on a direct test of the deterrent effect of self-protection devices.

Our most recent test of the deterrence hypothesis involved an interesting crime and a rather unique data set. The crime under consideration in this study was price-fixing, a long-standing but infrequently studied white-collar offense. One immediate difficulty in studying this crime was measuring the level of commission. Here the economist had a comparative advantage: traditional economic techniques made measuring the extent of price fixing

within an industry a manageable task.

We chose to analyze the bread-baking industry, ideal for our purposes for two reasons. First, the prices of the industry's output and most of its inputs were all readily available in published sources. Second, bread price-fixing incidents were well-represented among the Department of Justice's regional price-fixing cases. Our first empirical task was to estimate the offense level: the degree of price-fixing in a specific geographic market. Using data from twenty cities over twelve years, we estimated the profit or markup levels in each city during each of the relevant years. We assumed that, all other things being equal, the higher the profit level, the more the bakers engaged in collusion.

Enforcement was measured in two ways. To quantify federal or public enforcement efforts, we used historical data on the times and locations of bread price-fixing cases brought by the Department of Justice, as well as on the budget level of the department's Antitrust Division. Private enforcement was measured by constructing variables to indicate the years when class actions represented a credible threat to price fixers. Our results were clear: a price-fixing case brought against bakers in one location deterred bread price-fixing in neighboring cities. That is, Department of Justice enforcement actions reduced markups on bread not only in one location, but in nearby cities as well. But this deterrent effect was apparent only after follow-up private litigation, in the form of class actions, became a credible threat. The expected punishment from government actions alone was insufficient to deter price-fixers. An interesting implication of our findings is that substantial monetary punishment is an effective deterrent for an important class of white-collar crimes.

A full description of the testing procedures, results, and data was presented in a Center Technical Report, "The Deterrent Effect of Antitrust Enforcement: A Theoretical and Empirical Analysis," by M.K. Block, F.C. Nold, and J.G. Sidak. The apparent importance of class actions in the area of price-fixing suggested the need for a better understanding of this legal measure. We are currently in the process of drafting a research agenda for analysis of this important procedural device.

As we view the criminal choice, the relationship between unemployment and crime is related to the problem of deterrence. These research areas are both manifestations of a more fundamental question: What is the relation between crime levels and the returns to legitimate and illegitimate activities? After all, changes in employment opportunities usually alter expected monetary returns from both legitimate and illegitimate activities (the latter primarily by affecting the expected monetary costs of imprisonment). Hence, considering the effect of changes in the unemployment rate on levels of property crime may be seen as part of the larger problem of determining the effect of changes in monetary returns on overall crime levels.

We take precisely this view in our research efforts in this area.

The research project, reported in "Property Crimes and the Returns to Legitimate and Illegitimate Activities," was in part concerned with the impact of employment on the decision to commit crimes. Burglary was found to be responsive to contemporaneous changes in unemployment, while all property-rates were found to be moderately responsive to unemployment rate changes that were perceived to be permanent. The explanation of this asymmetrical result was quite simple. Only burglary and legitimate employment were found to be substitutes for each other; only in the case of burglary did a change in the expected legitimate wage rate appear to directly affect the decision to commit a crime. Hence, a short-term or temporary change in employment opportunities, since it impacts only on the returns from legitimate activity, has a direct effect on crime only to the extent that it affects burglary rates. When perceived as long-lasting or permanent, however, changes in employment opportunities do, of course, affect the monetary costs of imprisonment and hence the net returns from all crime. Actual estimates of employment elasticities—the percentage change in crime levels due to a 1% change in both temporary and permanent employment rates—were computed and appeared in the Center Technical Report noted above.

The policy implications of these findings are quite important. Our results suggest that programs designed to provide temporary employment are likely to make a disappointingly small reduction in the level of property crime. Specifically, such programs are likely to affect only burglary rates and even then only modestly. It is only permanent changes in employment opportunities that appear to have general and substantial effects on the crime rate. The ability of policymakers to influence these opportunities is, of course, subject to some debate.

In addition to testing for and estimating the effect of employment opportunities on crime, we conducted a small study of the impact of crime opportunities on the decision to work. Using observations on individual offenders drawn from the files of corrections, policy and parole agencies in California, we estimated the impact of legal and illegal labor market opportunities on the decision to work. We found that an individual's probability of employment during a specific time period was related positively to the average wage and to imprisonment rates, and negatively to the average return to property crime. There were some bothersome technical aspects of this study that require further elaboration; the immediate results, however, were interesting. Here for the first time was evidence, albeit limited, that the decision to engage in a legitimate pursuit—at least for some individuals—depended on the returns of illegal activity. This project was described in a Center Technical Report, "Unemployment and the Allocation of Time by Criminal Offenders," by D. Weller, M.K. Block, and F.C. Nold.

As we noted in the beginning of this section, all our results are consistent with the hypothesis that increases in the monetary returns to crime encouraged the commission of crime. Our basic results are consistent with public policy that attempts to control crime by altering the net returns to illegal undertakings. The results concerning the relationship between such traditional crime suppression activities as arrest and punishment and the level of crime, however, are not sufficient to judge the cost effectiveness of public policy in this area.[3] For example, we find that increasing the arrest rate deters potential burglars, but how much does this additional deterrent cost? Can it be secured less expensively by altering punishments?

To provide more information on the cost effectiveness question, we have undertaken a series of studies on the actual costs of crime control. By merging data from the survey of major police departments conducted by the Kansas City Police Department with crime, value of property stolen, and arrest data from the Center's extensive UCR data base, we were able to estimate the structure of costs in the public crime solution or arrest "industry." In much the same way that private and public firms produce shoes or electricity, police departments produce arrests. Estimates of the structure of production and the marginal or incremental costs of producing various numbers of arrests or clearances were obtained in a major research project conducted at the Center. This study was reported in the Center Technical Report, "An Econometric Investigation of Production Cost Functions for Law Enforcement Agencies," by J.M. Heineke.

This study contained several revealing results. First, it showed that the behavior of police departments was not entirely consistent with the hypothesis of cost minimization; solutions did not seem to be produced at minimal cost, and there was some inefficiency in the provision of arrests. Second, there did not appear to be a simple proportional relation between the number and cost of solutions. Doubling the number of arrrests did not appear to double costs in all cases; for small police departments, for instance, costs more than doubled, for large departments they less than doubled. Finally, we found that the cost of an arrest depended critically on the type of crime involved. An additional larceny arrest, for example, appeared to cost approximately $350, while an additional robbery arrest cost about $580; a solution to an additional crime against the person, over $7,500.

The finding that police departments' behavior did not always conform to cost-minimizing behavior also appeared in a smaller-scale and more specialized study of police departments conducted at the Center. Using

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[3] As indicated by the original project summary, exploring cost effectiveness is an important objective of the Center's research program. Specifically, the summary states: "The results of these studies will form the basis for observation concerning the cost effectiveness of various allocations of criminal justice resources."

1960-1975 data and employing only a general index of output, we estimated production relations for the police departments of four major California cities. The results of this analysis sugggested that there was considerable inefficiency in large-city police departments. As the researcher on this project, Llad Phillips, stated the proposition: "The amount of public safety that citizens enjoy in any particular city will depend not only upon income and the price of substitutes, but also upon the inefficiency of their police department." Details of this study were presented in the Center Technical Report entitled "Factor Demands in the Provision of Public Safety."

Solving crimes or capturing offenders is obviously but the first step in the administration of justice. Following capture, there is the task of determining culpability and setting specific sanctions. At least in part, these tasks are performed by the judiciary. A natural outgrowth of our concern with the costs of crime control, then, is a concern with the costs of judicial services. In a modest research project designed to provide initial estimates of the costs of judicial services—specifically, the costs of various dispositions—we used data obtained from both the California Judicial Council and the California Bureau of Criminal Statistics.

Our results confirmed, in general, some widely held beliefs concerning court costs. Cases disposed of by guilty pleas, for example, were found to have a dramatically lower cost (by a factor of seven) than those which required a trial. This result appears to support the view, advanced by Landes and others, that plea bargaining represents, in part, an opportunity for the court to economize on the use of its resources.

Jury trials were found, as expected, to be more costly than those trials which did not require a jury. It was noted, however, that while most jury trials in California involve a full presentation of evidence by both sides, the majority of nonjury trials are terminated at some intermediate stage (on a motion to dismiss, for example). This fact appears to account for most of the observed difference in cost between jury and nonjury trials. Among the trials in our sample in which evidence was presented by both sides, the data did not support the hypothesis that jury trials were significantly more costly than non-jury trials.

The costs estimated in this study are marginal costs, that is, the cost to the system of processing one additional disposition. An effort was also made to determine whether the *average* cost of handling cases was related to the size of the court. We found evidence of decreasing returns to scale: small courts had somewhat lower average costs than large ones. The results of this project are reported more fully in "Estimating the Cost of Judicial Services," by D. Weller and M.K. Block.

Finally, as a component of our cost of crime control research program, we have initiated an investigation of the costs of drug control. Of particular in-

terest to our researchers was the question: Does drug enforcement impose a hidden cost by driving up the property crime rate? Received doctrine suggested that drug control measures, by making drugs harder to obtain and thus more expensive, induced the addict to commit more property crimes to finance his addiction. To test this hypothesis, we used data on: (1) heroin prices obtained from the Drug Enforcement Administration (DEA) STRIDE data system; (2) drug arrests, from DEA and FBI sources; (3) UCR crime and disposition data; and (4) serum hepatitis data collected by Center personnel from state departments of health.

Our findings to date suggest that drug enforcement does in fact significantly influence the price of heroin. Judging from the New York City data, increasing drug arrests and/or increasing the likelihood of receiving punishment for selling or distributing drugs does increase the price of heroin. Moreover, considering four property crimes—robbery, burglary, larceny, and motor vehicle theft—we found all four to be responsive to the price of heroin. Specifically, an increase in the price of heroin was associated with an increase in the level of each of these property crimes. A Center Technical Report describing the research on this project is now being prepared.

In addition to providing information useful in analyzing the cost effectiveness of specific criminal justice policies, our objective is to make possible calculations that will yield information for decision makers on whether the level of deterrence currently obtained is, indeed, optimal. In order to accomplish this, we begin with the concept that the value of crime control is the averted costs of crime. In other words, reducing the costs of crime is the benefit secured by crime control. As straightforward as this theoretical concept may be, this is an extremely difficult subject to analyze empirically. Specifically, how are the costs of crime to be measured? Is the cost of a burglary, for instance, merely the value of the property stolen or destroyed? How then do we account for the fear of crime and the social and economic consequences engendered by that fear?

Fortunately, our economic model suggests several concrete methods of "costing out" crime. One approach we have adopted is to obtain a measure of the costs of crime by looking at the impact of crime on property values. To the extent that crime is location-specific, the value of real property varies according to the site-specific threat of crime. In a study supported under a grant from the Center, M.J. Boskin demonstrated the strong relationship between the threat of crime and property values: stated simply, higher crime rates reduced property values. Using a sample of properties in northern California communities with varying crime rates, Professor Boskin found that an increase in the neighborhood crime rate of 10% reduced the value of a residence by approximately $1,600. A summary of this work was presented at the Conference on the Costs of Crime held in March 1978,

jointly sponsored by the Center and the National Institute of Criminal Justice and Law Enforcement. A Center Technical Report is forthcoming on this project.

Taking a somewhat different approach to the problem of estimating the costs of crime, we have recently begun a study at the Center using information on wage differentials. Merging data on local crime rates with data on individual labor force participants has enabled us to estimate the impact of crime levels on wages; that is, we have estimates of the wage premium necessary to attract an adequate labor force into areas with high crime rates. At present, only preliminary results are available, but this promises to be a provocative and important study.

Looking to the future, we anticipate an extension of our analyses of two previously considered problems: antitrust enforcement and self-protection. Our price-fixing research has shown the substantial importance of private enforcement, in the form of class actions, to the antitrust area. This finding suggests the value of further analysis of this important procedural device. Likewise, the results of estimating the deterrent effects of reporting obtained by using the victimization data suggest the productivity of further work on self-protection.

PART TWO
Technical Reports

I. AVAILABILITY

Technical Reports are prepared for all major research projects and single copies of these reports will be provided on request. Many of the Center's Technical Reports have also been published in the professional literature.

II. REPORTS ISSUED

A. *Methodological Issues*

1. "Economic Models of Criminal Behavior: An Overview," by J.M. Heineke, Center Technical Report EMCRD-1-77.

   Problem/Objective: The purpose of this paper is to provide some perspective on the problem of modeling the decision to commit crime. The work of Allingham and Sandmo, Block and Heineke, Block and Lind, Ehrlich, Heineke, Kolm, Singh and Sjoquist is reviewed, and an attempt is made to analytically summarize this literature.

   Major Results: Four rather broad classes of models of criminal behavior are constructed. The properties of each class are analyzed and special emphasis is placed on deriving testable implications. The rather dramatic differences in implications across classes of models are discussed in some detail.

2. "The Supply of Legal and Illegal Activity: An Econometric Model," by J.M. Heineke, Center Technical Report CERDCR-1-78.

   Problem/Objective: This paper presents the results of a model development effort designed to provide a framework within which to answer the question: To what extent do individuals respond to changes in expected returns by moving from one property crime to another and between crime and legitimate employment?

   Major Results: A formal econometric model of legal and illegal labor supply is derived in this paper. The closest possible degree of correspondence between the underlying choice model and the resulting econometric model is achieved by exploiting several results from modern duality theory. The resulting econometric model is quite powerful and can be used to estimate: 1) the degree of substitutability or complementarity that exists among the income-generating activities of burglary, robbery, larceny and legitimate employment, and 2) the "net" or system-wide response of participation rates in these several income-generating activities as expected returns and

costs vary. Also explicitly derived are simple empirical measures that might be used to assess the system-wide effects of changes in such major criminal justice variables as arrest rates, conviction rates and sentencing practices.

3. "A Note on Using Data for Individual Offenders in Econometric Studies of the Criminal Justice System," by F.C. Nold, Center Technical Report ESCD-3-76.

   Problem/Objective: This brief theoretical note discusses the problems inherent in using data on arrested individuals to predict the sensitivity of both the potential and actual criminal populations to sanctions and legal opportunities. The Center's individual offender profiles are used for archetypal examples of the data available from the files of the criminal justice system.

   Major Results: The theoretical problems in using data on apprehended individuals to study the responsiveness of the population to incentives are formidable. The great breadth and depth of information needed to estimate consistently the effect of public policy variables on criminal activity exceed the capacity of current data sources. The structure of existing criminal justice information systems and the imprecise recording of individual offender statistics severely hamper estimation of the apprehension process.

B. *Deterrence and Related Issues*

1. "Property Crimes and the Returns to Legitimate and Illegitimate Activities," Center Technical Report CERDCR-2-78.

   Problem/Objective: This report gives the results of the empirical implementation of the model developed in "The Supply of Legal and Illegal Activity: An Econometric Model." In the process of applying this framework we addressed four main topics: 1) the degree to which property crimes are substitutes or complements to legal activity, 2) the degree to which substitution takes place among income-generating crimes, 3) the effects of sanctions on property crime rates, and 4) the effect of legal employment opportunities on property crime rates. We make use in this work of a specially constructed SMSA crime, sanctions and economic opportunity data set.

   Major Results: This research indicates that legal and income-generating criminal activities are either weak substitutes for or independent of each other. The most pronounced substitutability, measured with and without considering the effects of legal returns on imprisonment costs, is between burglary and legal activity. If the effects of legal opportunities on imprisonment costs are not considered, the other cross elasticities with respect to legal returns are

also negative, indicating substitution, but are not statistically significant. On the question of substitution between crimes, we find that legal income-generating activities are independent of one another; their levels appear insensitive to the expected returns in other property crimes.

The framework adopted in this research is particularly useful for addressing systemwide effects since it explicitly allows for complementarity or substitutability among activities. However, our findings indicate that, in the range of variation we observe, approaches which focus on a single crime and legal activity would provide a sufficiently rich framework to address the effects of returns on illegal activities. An implication for policy makers of the apparent independence of illicit income-generating criminal activities is that campaigns designed to suppress a specific type of crime by diminishing its expected returns are not likely to have the perverse effect of increasing other property crime rates.

On sanction effects, results which are generally consonant with previous findings emerge. We find a deterrent effect to increases in either clearance rates or prison sentences. These effects, at least in the sanction levels represented in this sample, are modest. So modest, in fact, that it appears that substantial expenditures of resources would be required to orchestrate a significant decline in property crime rates.

Finally, property crime rates are found to be moderately responsive to permanent changes in employment opportunities, with crime commission decreasing when there is a perceived permanent increase in the employment rate. Of course, the ability of policymakers, at least at an aggregate level, to significantly increase this employment rate is subject to some debate. In general, while we have found that property crime rates are moderately sensitive to net returns they appear to respond only very modestly to policy instruments affecting net returns.

2. "Does Reporting Deter Burglars? An Empirical Analysis of Risk and Return in Crime," by I. Goldberg and F.C. Nold, Center Technical Report CERDCR-4-78.

Problem/Objective: Approximately half of all criminal victimizations are never reported to the police. Yet reporting is an important example of the private behavior which, in conjunction with public protection, can deter crime. This study considers the effect of the likelihood of reporting behavior on victimization. The basic premise is that potential victims perceived by burglars to have a higher tendency to report are less attractive as burglary targets. This study introduces the use of individual victimization observations to test

the deterrence hypothesis. The NCP victimization surveys are used in testing this hypothesis.

Major Results: Our analysis of the individual observations sample provides strong support for the hypothesis that the perceived victim-specific probability of reporting has a deterrent effect on burglars: households that are more likely to report crimes are less likely to be victimized. Since we believe that reporting is an important example of private law enforcement, we view this finding as an evidence of a deterrent effect of such private behavior. This paper provides a microeconomic analysis of crime which is an improvement in some important respects over previous studies of the deterrence question. Mainly we are able to consider the fact that different victims present the offender with different potential payoffs and risks.

In addition to victim-specific deterrence, we find an aggregate deterrent effect, which has public policy implications: A higher reporting rate reduces the victimization rate because offenders shift from burglary to legal activities. This is an important conclusion because reporting can be influenced by public policy. Our results suggest that reporting is strongly influenced by the potential of recovery; in particular, the availability of insurance has a very significant effect. Obviously, the tax deductions for losses from theft are a policy variable that can be used to increase reporting. Although our results about the effect of time-cost on reporting are inconclusive, it is possible that lowering this cost by making reporting easier can enhance the tendency of victims to report. Finally, the finding of aggregate deterrence in this study indicates that neighborhood action designed to increase reporting can influence the crime rate.

3. "A Note on Using Victimization Rates to Test Deterrence," by I. Goldberg, Center Technical Report CERDCR-5-78.

Problem/Objective: This paper reports on a project designed to test how sensitive the deterrence results obtained using the Uniform Crime Reports (UCR) are to the aggregate level data source used in the estimation.

Data: NCP Victimization Survey and Uniform Crime Reports from selected years.

Major Results: The negative relationship between criminal sanctions and crime rates is found to be significant when the NCP data, rather than the UCR data, are used to construct measures of criminal activity and sanctions. The effects of sanctions turn out to be significant in all six types of crimes covered by the NCP surveys. The argument that there is a systematic bias in the NCP rates due to the

under-reporting (to the NCP interviewer) of minor incidents in high crime areas is found to be inconsistent with the evidence. Another source of measurement error considered is that arising from the aggregation of household and commercial victims in the police clearance data; dramatic changes in the results are produced by taking account of this problem.

4. "The Deterrent Effect of Antitrust Enforcement: A Theoretical and Empirical Analysis," by M.K. Block, F.C. Nold and J.G. Sidak, Center Technical Report ISDDE-1-78.

Problem/Objective: Although several economists have studied the effects and determinants of government antitrust activity, none has tested the extent to which antitrust enforcement actually deters price-fixing. This paper is a first attempt to answer that question. To do so, we construct a theoretical model of the collusive pricing decision and assess empirically the deterrent effects of public and antitrust enforcement on the decision to collude.

Data: Specially constructed data set containing prices, markups, complaints, dispositions, Antitrust Division expenditures, and, where applicable, class actions data for the bread industry for twenty cities over a twelve year period.

Major Results: In order to test for the deterrent effect of antitrust activity, we first develop a measure of the markups on white bread in twenty major cities for 1964-1976. Next we develop several measures of enforcement and find that both the Antitrust Division's budget and a regional and specific indicator of antitrust enforcement performed as expected. Most dramatically, it is shown that the Department of Justice does create a deterrent effect by bringing a price-fixing case. Bread markups in neighboring cities fall in the wake of a Department action against a conspiracy among bakers in a particular city.

We are further able to show that, at least until 1976, the end of our sample period, the deterrent effects of Department actions were in large part due to the existence of subsequent private civil litigation. Only after the advent of class action suits as a private remedy did the bringing of a bread price-fixing case by the Department act as a deterrent to other colluders in the industry.

Having provided some evidence on the importance of class actions in general, we then present somewhat more speculative findings on the importance of consumer class actions. A simple test of the *Eisen IV* decision produces the expected results, indicating that the decision caused a statistically significant reduction in deterrence. A crude test of the combined effect of the Hart-Scott-Rodino Act and

the *Arizona Bakery Product Litigation* indicates an increase in deterrence but, unlike the test of the *Eisen IV* decision, the results prove statistically insignificant. Overall, the results of our studies on consumer class actions, though not conclusive, do suggest that such actions have an independent deterrent effect. This is likely due to the large settlements involved in consumer class actions and the perhaps unexpected degree of risk aversion among colluders.

5. "Unemployment and the Allocation of Time by Criminals," by D. Weller, M.K. Block and F.C. Nold, Center Technical Report CERDCR-3-78.

   Problem/Objective: This research examines the relationship between unemployment and crime in the context of a model of the individual's allocation of his time to work, leisure and illegal activity.

   Data: Specially constructed data set using individual offender profiles, data on state and local wages, unemployment, and arrests.

   Major Results: The individuals in our data set do appear to respond to changes in the relative returns to legal and illegal activity. The probability that an individual will be legally employed in a given period is positively related to the earnings of workers in legal activity during the period, and negatively related to the rate of unemployment. Of particular interest is the finding that the return to illegal activity, measured by the amount taken per property crime, has a significant and negative effect on the probability of legal employment. The probability, in turn, that an individual will be arrested is negatively related to the probability that he will choose to be employed.

C. *The Costs of Crime Control*

1. "An Econometric Investigation of Production Cost Functions for Law Enforcement Agencies," by J.M. Heineke, Center Technical Report ACBA -1-77.

   Problem/Objective: In this paper the relationship between total costs or department budget levels, input prices (especially wages of patrolmen) and activity levels (particularly solutions or clearances) is studied for a sample of approximately thirty medium-sized city departments for the years 1968, 1969, 1971 and 1973. Our interest lies in determining the structure of law enforcement production technology: that is, how costs vary with the level and composition of police output.

   Data: Special data set created by merging UCR and Kansas City Police Data information.

Major Results: This study indicates that the decisions of police administrators are not consistent with cost minimization. In other words, solutions or clearances are not being produced at minimum cost by the departments sampled. In addition, the hypothesis of constant returns to scale is strongly rejected: doubling solutions does not simply double costs. Moreover, we find that scale economies vary considerably with activity levels—which points to the inappropriateness of maintaining a traditional Cobb-Douglas production structure in studies of law enforcement production technology. Finally, we calculate marginal and average costs at the sample means for various types of solutions. What a department solves appears to affect its budget quite dramatically: the additional cost of a larceny solution, for example, is approximately $350, while solving an additional crime against a person is likely to cost more than $7,500.

2. "Factor Demands in the Provision of Public Safety," by Llad Phillips, Center Technical Report ACBA-3-77.

   Problem/Objective: Do police departments use the most efficient combination of such factors as officers, civilian personnel and vehicles? Can a useful single measure of the output of a police department be derived? If not, can efficiency be analyzed without explicitly considering output? This paper explores these questions by estimating production and cost functions and then determining if factor utilization, given the estimated parameters and input prices, is optimal.

   Data: Information on selected California police departments for the years 1960-1975.

   Major Results: Using only input quantities and prices, it is possible to determine all aspects of production function and cost function, except the returns to scale. These results suggest considerable inefficiency in large city police departments. The amount of public safety that citizens enjoy in any particular city depends not only upon income and the price of substitutes, but also upon inefficiency in their police department. This inefficiency raises the price and hence decreases the amount of public safety that otherwise would be enjoyed.

   Of the three California cities (Long Beach, San Diego and Oakland) receiving the most intensive study, San Diego appears the most efficient; however, efficiency in all cities declines with time. For example, we estimate that by 1975 Oakland was spending almost 80% more than necessary for public safety.

3. "Estimating the Costs of Judicial Services," by D. Weller and M.K. Block, Center Technical Report CERDCR-1-79.

Problem/Objective: To evaluate the impact of changes in policy on the criminal justice system, it is desirable to know the incremental cost of increasing or decreasing the judicial caseload. This research provides information in this area by estimating a cost function for the California superior court system.

Data: California superior court data set. Costs are estimated for thirty-two California counties during fiscal years 1974-1976.

Major Results: Estimates of the marginal costs of superior court dispositions of different types have been generated. These costs are found to vary by area of law (for civil cases) and by type of disposition (for criminal cases), as well as by jurisdiction. In particular, cases disposed of by a guilty plea are found to be much less costly (by a factor of seven) than those which require a full trial. However, among completed trials, those in which evidence is presented by both sides, jury trials are not found to be significantly more expensive than trials before a judge. No evidence of scale economies is found; the results, in fact, suggest decreasing returns to scale. If scale is held constant, urban courts do not appear to be more costly than rural ones. The effects on costs of changes in backlogs and in the difficulty of cases are also examined during this project.

D. *Special Topics*

1. "Burglary and Robbery Cases in California 1973: A Statistical Analysis of the Relationship Between the Disposition of Criminal Cases and Selected Social, Economic and Criminal Characteristics of Defendants," by D.A. Lombardero, F.C. Nold and M.K. Block, Center Technical Report ESCD-1-76.

   Problem/Objective: This empirical research is designed to test for demographic determinants of the outcome of trials of individuals charged with burglary or robbery in California. Information about the location of the offense allowed for appraisal of the effect of the "overcrowding" of courts in urban centers on dispositions.

   *Data:*The analysis was performed using the 1973 offender-based transactions statistics (OBTS) for California.

   Major Results: Generally, the hypothesized effects emerge: defendants with prior records are dealt with more severely; younger and female defendants tend to be treated more leniently; and defendants tried in urban courts receive more lenient treatment than their rural or suburban counterparts. Perhaps the most interesting finding is that minorities, especially blacks, appear to be treated more leniently than non-minority defendants. A number of explanations considering correlates of the defendants' race and the nature of the offense charged are postulated.

2. "Public and Private Protection: Substitutability or Complementarity?" by I. Goldberg, Center Technical Report ACBA-2-77.

   Problem/Objective: The relationship between public and private protection is important to local governments in determining the optimal level of public protection expenditures. Therefore, this study considers the effect of the level of expenditures for public protection upon the level of self-protection measures taken by private firms. Some forms of self-protection may be substitutes for public protection and hence will be used less frequently when the level of public protection is high. Other self-protection measures rely upon the availability of public protection and are therefore complementary to it.

   Data: Information on local police expenditures, UCR crime data and 1968 Small Business Administration's survey of crime against business.

   Major Results: Local alarms and, to a lesser extent, central alarms are found to be strongly complementary to public protection. On the other hand, the results of this study show a strong negative relationship between public expenditures and ownership of firearms. A negative relationship is also shown to exist between public protection and the employment of private guards by firms. No significant relationship is found between public protection and the use of self-protection devices such as locks, bars, and window gates.

3. "Individual Offenders Profiles: Pilot Study Code Book," Center Technical Report ESCD-2-76.

   Description: This report provides access to users of the individual offenders profiles data set. The code book gives a brief description of the data set, record layout and coding of variables, and some characteristics of the data.

4. "Pilot Study on Individual Offenders: An Overview of the Data," by Timothy Moore, Center Technical Report ESCD-1-77.

   Description: This research provides a description of the individual offender profiles. The report gives a brief history of the individual offender pilot study project. It describes the methods used to collect the data, assesses their reliability, and provides some simple analysis, such as frequency distributions, for many of the variables.

5. "A Formal Model of Some Aspects of the Supply of Class Action Litigation," by H.G. Demmert and M.K. Block, Center Technical Report ISDDE-1-79.

   Description: This paper develops a simple analytical model of the role of attorneys, representative plaintiffs and other class members in the litigation of class actions. Emphasis is on the search for

litigable class claims and on the decision to litigate, given a known claim. The implications of various exogenous characteristics of the class claim (e.g., class size, magnitude of economic loss, etc.) are examined in the context of the decision to litigate. Also considered are the effects of a proposed modification of current class action procedures (S.3475).

PART THREE:
Center Data Sets

I. BACKGROUND

In the process of performing our empirical studies on crime and crime control, we have created a number of unique data sets. Many of these data sets have utility beyond the specific studies for which they were employed. An annotated list of data sets created at the Center appears below and we welcome inquiries by other researchers about utilizing or expanding the Center's data base. These data sets are available on magnetic tape from the National Criminal Justice Data Archives, at the Interuniversity Consortium for Political and Social Research, at the University of Michigan, Ann Arbor, Michigan.

II. SMSA CRIME AND PUNISHMENT DATA

A. *Property Crime SMSA Data Set*

Nature of Data Set: A cross section time series data set on burglary, robbery, larceny and auto theft offenses, dispositions and sentences: 1966-1972. Selected SMSA's.
Sources of Data: Uniform Crime Reports (UCR); U.S. Department of Commerce, Bureau of the Census; National Council on Crime and Delinquency; Internal Revenue Service; Bureau of Labor Statistics.
Items Included: Income, age distribution, unemployment, labor force participation, crime rates, and sanctions (clearances, guilty as charged, and average length of sentences).

B. *Violent Crime SMSA Data Set*

Nature of Data Set: Selected SMSA and state-wide crime, clearance and sentence data for murder, rape and assault: 1966-1975. Also included are demographic characteristics for relevant geographic areas.
Sources of Data: Uniform Crime Reports, National Council on Crime and Delinquency, Bureau of the Census, Bureau of Labor Statistics.
Items Included: Offense rates, clearance rates, average time served for various offenses, age distribution of population, legal earnings, and local labor force conditions.

C. *General SMSA Data Set*

Nature of Data Set: Aggregation of all relevant reporting agencies into SMSA's and corresponding approximate aggregation of crime rates and dispositions. Coverage indicators included.
Source of Data: Uniform Crime Reports.
Items Included: Crime rates by SMSA by year and seven crimes, clearance, charge, disposition data when available.

III. AGGREGATE CRIME AND PUNISHMENT DATA: GENERAL

A. *Brenner Data Set*

Nature of Data Set: A data set on age-specific murder rates and economic indicators constructed to match data collected, analyzed, and presented in Senate testimony by H.M. Brenner (Johns Hopkins).

Sources of Data: Vital Statistics Rates in the U.S. 1940-1960, U.S. Department of Health, Education and Welfare; *Survey of Current Business, Business Statistics,* Bureau of Economic Analysis; *Statistical Abstract of the U.S.; Historical Statistics of the U.S.,* U.S. Department of Commerce, Bureau of the Census; National Prisoner Statistics; *Selected Manpower Statistics,* Annual Report 1976, U.S. Department of Defense.

B. *City Victimization Rates*

Nature of Data Set: Merged victimization and officially recorded crime rates for a total of twenty-four observations from eighteen cities: 1972-1975.

Sources of Data: The National Crime Panel (NCP) tapes from the U.S. Bureau of the Census and crime rates by city from the Federal Bureau of Investigation Uniform Crime Reports (UCR) tapes.

Items Included: UCR crime rates and clearance rates; NCP victimization rates with and without attempted offenses; NCP "reported" rates; NCP average loss by city.

C. *Sentence Data*

Nature of Data Set: Smoothed sentences by state for all seven crimes indexed in the UCR Index: three-year moving averages smoothed out from 1966-1976; thirty-four states.

Source of Data: National Council on Crime and Delinquency. .

Items Included: Average sentences by crime, year and state.

IV. COST OF CRIME AND CRIME CONTROL DATA

A. *Merged Cost and Crime Data Set*

Nature of Data Set: Combination of UCR crime rate information along with Kansas City data set on police activity.

Sources of Data: UCR, *Annual General Administrative Study* for 1968, 1969, 1971 and 1973, prepared by the Kansas City Police Department; Bureau of Labor Statistics.

Items Included: Wages of policemen, clearance rates, average value of items stolen, intermediate family budget.

B. *California Police Data Set*

Nature of Data Set: Resources and output of selected major California police departments.

Sources of Data: Area wage surveys; *Automotive News;* Statistical Digest for Los Angeles Police Department; Municipal Yearbook 1956-1975.

Items Included: Wages of patrolmen and civilian police employees; costs of automobiles; price levels; crime and clearance rates.

C. ***California Superior Court Data Set***

Nature of Data Set: Disposition, backlog and cost information for California superior court system.

Sources of Data: California Judicial Council; California State Controller's Office; county administrators.

Items Included: Dispositions of various types of cases by superior courts in the fifty-eight counties of California for the years 1974-1976, by month; number of cases of various types awaiting trial in each county for those years, by month; operating expenses for each county and year; results of the 1976 weighted caseload survey; weights; weighted dispositions, based on the survey data for thirty-two counties for each year.

D. ***Cost of Crime Data Set***

Nature of Data Set: Demographic characteristics and earnings for individual workers combined with crime rates for the counties of residence of a subsample of urban workers.

Sources of Data: Panel Income Dynamics and FBI unpublished UCR crime statistics.

Items Included: Detailed individual characteristics for 4,000 individuals and all crime rates for the individual's counties of residence over nine consecutive years: 1968-1976.

V. SPECIAL AREAS

A. ***Antitrust Data Set***

Nature of Data Set: Prices; markups; Department of Justice price-fixing actions; and class actions for the bread industry. All data classified by city for the period 1965-1977.

Sources of Data: U.S. Department of Labor, Bureau of Labor Statistics; American Gas Association; Commerce Clearing House; U.S. Department of Justice; LEXIS: *Class Actions: A Manual for Group Litigations at the Federal and State Levels,* H.B. Newberg; Council on Wage and Price Stability; and various original court documents.

Items Included: Prices for bread, flour, cooking oil, sugar, yeast, milk, gas and electricity; wages for bakers and kindred workers as well as for truck drivers; Department of Justice and class action filing dates and locations, fines, sentences and settlement data.

B. *Individual Offender Profiles*

Nature of Data Set: Life histories and criminal records of ninety-two individuals selected at random from the files of state agencies.

Sources of Data: California Department of Corrections; California Bureau of Criminal Statistics; Los Angeles Parole Department; Social Security Administration.

Items Included: Characteristics such as age, race, IQ and education; arrest, incarcerations, probation and parole records; information, when available, on employment status, income and assets. Data on employment, prices and clearance rates in Los Angeles are also included. A complete description of this data set is available as Center Technical Report ESCD-1-77.

C. *Drug/Crime Data Set*

Nature of Data: Standardized monthly price of heroin purchases by the Drug Enforcement Administration based upon raw price/quantity/purity (of heroin) information by SMSA. Also includes various measures of drug law enforcement and crime rates for income-generating crimes.

Sources of Data: Client—Oriented Drug Abuse Data (CODAP); STRIDE: UCR; Drug Abuse Warning Network (DAWN); Purchase Evidence/Purchase Information (PE/PI) data; state departments of health.

Items Included: Crime rates (burglary, robbery, larceny, auto theft); standardized heroin prices; drug arrests for heroin; serum hepatitis rates.

END