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AN ECONOMIC ANALYSIS OF SENTENCING AND RECIDIVISM
IN THE MICHIGAN CRIMINAL JUSTICE SYSTEM

By

Jan Scott Palmer

A DISSERTATION

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ABSTRACT

AN ECONOMIC ANALYSIS OF SENTENCING AND RECIDIVISM
IN THE MICHIGAN CRIMINAL JUSTICE SYSTEM

By

Jan Scott Palmer

This thesis presents two models. The first, Ehrlich's, generates hypotheses about individual participation in crime. The second model generates hypotheses about how judges and parole boards respond to crime. Both models are tested using data on felons released from Michigan prisons.

The first model is tested using non-linear regression with the probability of a felon's recidivism, the probability of a felon's being white, and the probability of a felon's committing a skilled crime as dependent variables. The results generally support the model. For example, persons who commit more skilled crimes are, ceteris paribus, better educated than persons who commit less skilled crimes. Also because of racial discrimination in lawful occupations, non-white criminals are, ceteris paribus, better educated than white criminals.

The second model is tested using data on four crime categories: robbery, burglary, assault-murder, and auto-theft. Sentencing is a function of race, education, age, marital status, number of dependents, previous type of record, type of plea, and being tried in Detroit. There is evidence of judicial discrimination against non-whites, persons

who plea bargain, and persons who insist on having their cases tried. There is interaction between the parole board and the judges with the parole board sometimes agreeing and sometimes disagreeing with the judges' determination of optimal sentences.

This thesis is consistent with several recent works by economists in showing that economic theory can generate useful hypotheses about criminal behavior and about society's response to crime.

TO MY FAMILY

ACKNOWLEDGEMENTS

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CHAPTER I.

1.1 INTRODUCTION

This thesis deals with criminal behavior. It uses economic analysis to develop models of criminal behavior and of society's response to crime. These models are then tested by using data from the Michigan Department of Corrections.

There are in criminology two schools of thought about crime. The Classical school, which is basically a creation of Bentham, believes that crimes are committed by those persons for whom the disutility of the expected punishment is less than the utility of the criminal act. Crime can be stopped by increasing the disutility. Therefore, punishment is a deterrent to crime.[1]

The other school believes that people commit crimes because they have not "internalized the norm," or their values are substantially different from that of the greater society. Therefore, crime can be stopped by rehabilitating the criminal -- in economic terms -- by changing the utility function of the criminal such that he no longer "needs" or "wants" to commit crimes. These theories are not necessarily competitive. Indeed, most scholars in the field do not deny punishment deters some crime. They are, however, much more concerned with rehabilitation than deterrence.[2]

Until very recently economists have ignored crime either because they considered it unworthy of consideration or because they

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felt the tools of economic theory could not explain criminal behavior.
Recently Becker,[3] Ehrlich[4] and others have shown that neither of these
reasons is correct. Crime is as important as any of the issues tra-
ditionally considered by economists. In 1965 the economic cost of
crime was at least four percent of the reported national income. In
contrast the economic cost of unemployment was about two percent.[5]
Crime touches the daily lives of millions of Americans. It forces
them to stay in at nigh*, to avoid large sections of cities, to shun
strangers, and to spend millions of dollars on self-protection.
Ehrlich has shown that Benthamite theories of human behavior generate
testable hypotheses regarding crime. Criminal behavior is not sub-
stantially different from non-criminal behavior, and just as economic
theory can explain decisions about labor force participation, con-
sumption, etc., it can also explain criminal behavior.

1.2 ANALYTICAL FRAMEWORK

Chapter II presents two models. The first is a summary of a
model of individual participation in criminal activity developed by
Isaac Ehrlich in his doctoral thesis.[6] The second is a model of how
society responds to criminal activity with particular emphasis on
the role of the sentencing judge. These models interact in two ways:
(1) The sentencing judge considers the effect of his sentencing on
the future criminal behavior of both the convict and those who are
deterred by the convict's sentence. (2) The potential criminal,
when deciding whether or not to commit a crime, considers his expected
sentence if he is caught and convicted. In other words, (1) The
expected sentence is an element the individual considers when deciding

how many and what types of crimes to commit. (2) The amount and types of crimes a person committed are an element in the sentence the judge imposes. (3) The sentencing of the judge influences the future criminal activity of the convict.

This thesis also considers two additional sets of testable hypotheses. The first set, which is generated by the Ehrlich model of criminal behavior, deals with the relationship between lawful and unlawful skills. The second set, which is generated by the model of the judge's sentencing role, deals with disparity in sentencing: (1) Judges discriminate against blacks, (2) judges discriminate against persons who have plea bargained.

Chapters III and IV use the criminal histories of persons released from Michigan prisons to test these hypotheses by measuring the relationships between demographic background and crime; between crimes and demographic backgrounds and sentencing; between sentencing and demographic backgrounds and recidivism. Chapter V discusses the policy implications of the results of Chapters II through IV.

Although these topics have already been researched by criminologists and sociologists, this thesis is unique for the following reasons: It treats the criminal justice system as a system by allowing for interaction between the decision makers. By the use of a simultaneous equation model, it measures the effect of both judicial sentencing and parole board decision making on prison sentences. It then measures the effect of prison sentences on recidivism. Finally, this thesis contains the first use of non-linear regression analysis to predict parole success. Although there is a voluminous literature

on predicting probation and parole success, the quality of the statistical methods used is so low that the results are of very questionable value.[7]

Footnotes Chapter I

1   Jeremy Bentham, <u>Theory</u> <u>of</u> <u>Legislation</u>, (edited by C.K. Ogden),

    (New York: Harcourt, 1931) p. 239-472.

    Herbert L. Packer, <u>The</u> <u>Limits</u> <u>of</u> <u>the</u> <u>Criminal</u> <u>Sanction</u>, (Stanford:

    Stanford University Press, 1968).

2   See Donald R. Taft and Ralph W. England, Jr., <u>Criminology</u>, (4th ed.),

    (New York: Macmillan, 1964).

    Edwin H. Sutherland and Donald R. Cressey, <u>Principles</u> <u>of</u> <u>Crim-</u>

    <u>inology</u>, (7th ed.), (Philadelphia: Lippincott, 1966) Chapters 4, 5.

    For a possible explanation for the wide acceptance of non-deterrence

    theories see I. Ehrlich, "The Deterrent Effect of Criminal Law

    Enforcement," Journal of Legal Studies, Vol. 1 (June, 1972) p. 259-

    276; especially footnote 7 page 260.

3   Gary S. Becker, "Crime and Punishment: An Economic Approach,"

    <u>Journal</u> <u>of</u> <u>Political</u> <u>Economy</u>, Vol. 76, no. 2 (March/April, 1968)

    p. 526-536.

4   Isaac Ehrlich, "Participation In Illegitimate Activities: A

    Theoretical and Empirical Investigation," <u>Journal</u> <u>of</u> <u>Political</u>

    <u>Economy</u>, Vol. 81, no. 3 (May/June, 1973) p. 521-565.

5   Isaac Ehrlich, "Participation In Illegitimate Activities: An

    Economic Analysis" (unpublished Doctor's dissertation, Columbia

    University, 1970) p. 1.

6   Ibid.

7   For example see Dean V. Babst and others, "Comparison of Multiple

    Regression and Configural Analysis Techniques For Developing Base

    Expectancy Tables," <u>Journal</u> <u>of</u> <u>Research</u> <u>in</u> <u>Crime</u> <u>and</u> <u>Delinquency</u>,

Vol. 5, no. 1 (January, 1968) p. 72-80.

Don Gottfredson, "Assessment of Methods," Crime and Justice:
Vol. 3: The Criminal In Confinement, (Radzinowicz and Wolfgang
editors), (New York: Basic Books, 1971) p. 342-375.

CHAPTER II

2.1 INTRODUCTION

This chapter presents the hypotheses which are tested in Chapters III and IV. These hypotheses are derived from Ehrlich's model (Sections 2.2, 2.3) and from a model of society's response to crime (Sections 2.5, 2.6, 2.7). Both of these models use one of the traditional assumptions of economics: rational behavior. It is assumed that an individual's criminal acts and society's response are based on attempts to maximize relevant utility functions.

2.2 THE EHRLICH MODEL OF CRIMINAL BEHAVIOR

The following is a summary of the conclusions of the Ehrlich model. A more detailed summary is presented in Appendix A.

Assume a person has a finite amount of time to allocate among leisure, legitimate labor, and criminal activities, C_i. There is a wage for lawful labor, $W_1 (T_1)$, a wage for unlawful labor, $W_i (T_i)$, a probability of capture and conviction, P_i, an expected sentence given conviction, $F_i (T_i)$, and a probability of unemployment in the legal market, $U_1 (T_1)$.

The model shows that the decision to engage in criminal activity is a function of

(1) the wage for lawful market activities,
(2) the wage (pecuniary and nonpecuniary) for unlawful market activities,

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(3) the expected sentence given conviction,
(4) the probability of conviction,
(5) attitude towards risk.

In mathematical form the behavioral relation is[1]

$$C_{ij} = \phi_j \ (P_{ij}, \ F_{ij}, \ W_{ij}, \ W_{1j}, \ U_{1j}, \ e) \tag{2.1}$$

(i is the crime, j is the individual). ϵ is a portmanteau which includes the discrepancy between the actual and planned time spent in criminal behavior.

$$\frac{\partial \phi}{\partial W_1} \leq 0, \ \frac{\partial \phi}{\partial P} \leq 0, \ \frac{\partial \phi}{\partial W_i} \geq 0, \ \frac{\partial \phi}{\partial U_1} \geq 0, \ \frac{\partial \phi}{\partial F} \lessgtr 0 \ . \tag{2.2}$$

The expected punishment, $F_i \ (T_i)$, is not fixed but varies depending upon the individual. The sentence given to a black, un-employed teenager would not be the same, _ceteris paribus_, as that given to a white, employed, middle-aged father. Therefore when an individual calculates his utility function he estimates $F_i \ (T_i)$ by observing the sentences given to others with the same demographic characteristics he has.

2.3 CRIME AND EDUCATION

Ehrlich postulates a strong and positive relationship between lawful and unlawful skills.[2] He lists two sets of crimes: Type I crimes (robbery, burglary, larceny, and auto theft) require little skill and/or education; Type II crimes (fraud, forgery, embezzlement, trade in illegal merchandise, and illegal commercial practices) re-quire more skill and/or education and are complementary to lawful market activities. By combining this hypothesis and the results of his model Ehrlich generates the following hypotheses:

(1) Groups with low levels of schooling or training have a higher propensity to engage in Type I crimes. Groups with higher educational achievement and higher incomes have a greater propensity for Type II crimes.

(2) Groups which commit Type I crimes enter criminal activity at a younger age because lack of training does not limit entry into such crimes. The age of entry into Type II crimes will be higher. "In fact, because higher skilled occupations may involve intensive on-the-job training during the initial period of the working career, entry into related illegitimate activity may lag somewhat behind their entry into the labor market."[3]

(3) "A general implication of this analysis concerns the educational attainment of offenders belonging to different racial groups. To the extend that occupational and wage discrimination against nonwhite workers is greater in legitimate relative to illegitimate activities, a critical 'wage differential' $(W_i - W_1)$ which is sufficient to induce all workers of equal preferences to enter an illegitimate activity (i), would be associated in the case of nonwhites with a relatively high educational attainment of the worker. Consequently, one expects the average educational attainment of nonwhite offenders to exceed that of whites in many illegitimate activities."[4]

2.4 RECIDIVISM

A person released from prison expects a larger F_i (T_i) if he is convicted of a subsequent offense. The prison experience may have increased or decreased the expected disutility of spending time

in prison. The individual faces job discrimination and may have suffered skill losses while in prison, both of which reduce $W_1 (T_1)$. On the other hand, while in prison he may have participated in some type of trade training which increased $W_1 (T_1)$, or he may have acquired criminal skills which increased $W_i (T_i)$.

It is therefore impossible to tell a priori whether prison sentences increase or decrease the propensity for criminal behavior. The optimal mix of criminal and noncriminal labor for those persons who have already been convicted and punished for crimes depends on the same factors as for those persons never convicted of a crime: the wage for lawful activities, the wage for unlawful activities, the expected sentence, the probability of conviction, and attitude towards risk.

The next chapter measures the impact of prison time on recidivism for various types of offenders. Section 2.6 shows, however, that because prison sentences can deter others, the optimal sentence with respect to recidivism is not necessarily the optimal sentence with respect to crime reduction.

2.5 THE SOCIAL VIEW OF CRIME

The previous section presents a model of individual participation in crime. This section presents a model of how society responds to this criminal behavior. Assume a society of Q individuals all of whom have interrelated utility functions of such a form that the actions of one person influence the options and the utility of other persons. Criminal activity can reduce the utility of an individual in one of three ways: (1) directly if the individual

is the crime's victim, (2) indirectly if the individual is frightened by the crime, (3) indirectly if the individual is not and does not expect to be a victim, but is disgusted by the criminal act. In this society there is some person or persons (King, Congress, and courts, etc.) having the power and/or responsibility to sum these individual functions into a social welfare function. This social welfare function is of such a form that some actions, which give certain persons positive utility, have a negative utility in the social welfare function. These actions are defined as crimes if they are of such a type that the person(s) in control of the social welfare function is willing to allocate resources in order to discover and punish their perpetrators. This is a positive, not a normative definition of crime. The combining of the Q individual welfare functions need not give equal weight to each person's preferences. It can ignore some individuals' utilities completely. In the limit, the social welfare function may include only the preferences of the dictator. Therefore this analysis does not assume that crimes are evil or socially unacceptable. In addition, there is no distinction made between crimes which do or do not have "victims". If no one suffered disutility from an action, it would not -- in this model -- be illegal. Sodomy between consenting adults may have no victim but it may so disgust those who calculate the welfare function that it is made an unlawful activity. Similarly, drug addiction may harm only the addict directly, but the fact that addicts often become wards of the state and therefore a financial drain on society may be sufficient reason to make drug use illegal. Obviously, there are many other ways of discouraging undesirable behavior such as

taxes, licensing, etc., but criminal sanctions are the most common.

Equation 2.3 is an implicit function of the relationship between the number of crimes, C_t, the various punishments of criminals, X_{t1}, the various methods of reforming criminals, X_{t2}, and the various techniques for catching criminals, X_{t3}. (The first subscript represents time and there are M time periods.)

$$H_t(X_{t,1}, X_{t+1,1} \cdots, X_{t,2} \cdots, X_{t,3} \cdots C_t) = 0 \qquad (2.3)$$

Assume that the social welfare is increased by X_{t1}, X_{t2}, X_{t3}, and decreased by C_t. In other words, even if punishing criminals has no effect on crime, "society" still receives utility from criminals' suffering.

Assume that the long-run social welfare function is of the form shown in equation 2.4. The various X's are consumption goods, or investment goods. Equation 2.4 can be rewritten as 2.5.

$$U'[X_{14} \cdots X_{MN}, H_1 \cdots H_M] \qquad (2.4)$$

$$U[X_{11} \cdots X_{MN}, C_1 \cdots C_M] \qquad (2.5)$$

Assume that society sells all of its output of time period t for Y_t dollars. Therefore the market value[5] of society's output period t is

$$Y_t = G_t[X_{t1} \cdots X_{tN}, \overline{P}_{t1} \cdots \overline{P}_{tN}, C_t] \qquad (2.6)$$

$\overline{P}_{tn}$ is the price of the nth good in the tth period. Assume that expenditures in the tth period are

$$E_t = \sum_i P_{ti} X_{ti} \qquad (2.7)$$

Therefore, the long-run social welfare is maximized by finding the saddle point of

$$\Lambda = U[X_{t1} \cdots C_t] - \lambda[\sum_t^M (Y_t - \sum_i^N \bar{P}_{ti} X_{ti})D_t] \qquad (2.8)$$

D_t is the value used to discount prices to time period 1.

For consumer goods (goods whose consumption in one period do not influence output in future periods) the usual conditions hold, i.e., they are consumed until the ratio of marginal utility to discounted price is equal to λ,

$$\lambda = (\partial U/\partial X_{tN})/\bar{P}_{tN} D_t \qquad (2.9)$$

More of X_{tn} is consumed if either the marginal utility of X_{tn} increases or $\bar{P}_{tn}$ falls.

For X_{t1}, X_{t2}, X_{t3}, however, the first order conditions are more complicated. Equation 2.10 shows the case of punishment.[6]

$$\lambda = (I + J)/(K + L) \qquad (2.10)$$

Where

$$I = \partial U/\partial X_{t1} \qquad (2.11)$$

$$J = \sum_{\theta=t}^M [(\partial U/\partial C_\theta)(\partial C_\theta/\partial X_{t1})] \qquad (2.12)$$

$$K = \bar{P}_{t1} D_t \qquad (2.13)$$

$$L = \sum_{\theta=t}^M [(\frac{\partial Y_\theta}{\partial X_{t1}} + \frac{\partial Y_\theta}{\partial C_\theta} \frac{\partial C_\theta}{\partial X_{t1}})D_\theta] \qquad (2.14)$$

In the numerator, I is the marginal utility the social welfare function receives from "consuming punishment", i.e., from knowing that criminals suffer; J is the marginal utility society receives from the change in crime in this and in future periods caused by a change in punishment in this period.

In the denominator, L is the discounted marginal product of punishment in present and future periods; this is both the direct impact of punishment on output as well as the indirect (through changing the level of crime and therefore the supply of non-criminal labor) impact on output. K is the discounted price of punishment.

The ratio (λ) is positive but the signs of the first three components of the ratio can be positive or negative. The suffering of the criminals may be so great that society takes pity and I falls below zero. But the increase in utility caused by the reduction in crime may be strong enough to offset the negative I so that the suffering continues. Conversely the prison system may be so brutal that it increases rather than reduces crime ($J < 0$), but the society may so enjoy the suffering of criminals that it is willing to keep the prison system. With regard to L, $\partial Y_t / \partial X_{t1}$ can be either positive or negative. In Michigan it is negative. Prisoners do little meaningful labor and are generally consumers who do not produce. But in other places prison labor is at least as productive as non-prison labor. Indeed if the purpose of the prison system is to work the prisoners to death, the convicts can become producers who do not consume.[7] $\dfrac{\partial Y_t}{\partial C_\theta} \dfrac{\partial C_\theta}{\partial X_{t1}}$ is probably positive because a reduction in crime would cause an increase in legal

activities. But it may be negative if criminal activity is a complement to certain legal activities.

The responsibility for summing the individual welfare functions into a social welfare function is shared by several institutions: the police, the prosecutor, the courts, etc. Together they form the criminal justice system which is a chain of decision making (see Figure 2.1). Each institution gives greater weight to its own utility when it sums the individual utility functions into a social welfare function. In addition the training and experience of the various groups differ -- the police, judges, and probation officers may see the same offenders in entirely different perspective. Therefore, there is not one unique social welfare function, but rather a series of similar but not identical welfare functions.

2.6 THE JUDICIAL ROLE

> There is no decision in the criminal process that is as
> complicated and difficult as the one made by the sen-
> tencing judge. A sentence prescribes punishment, but
> it also should be the foundation of an attempt to re-
> habilitate the offender, to insure that he does not
> endanger the community, and to deter others from
> similar crimes in the future. Often these objectives
> are mutually inconsistent, and the sentencing judge
> must choose one at the expense of the others. A man
> who has committed murder in a moment of extreme emotion
> may require no correctional program and may present no
> significant threat to the general safety, but few judges
> would be likely to respond to an offense so heinous by
> suspending the offender's sentence or granting him
> parole.
>
> -- The Challenge of Crime In A
>   Free Society, p. 141.

Once a person is convicted it is the judge's function to impose some penalty. The judge usually can impose, individually or in some combination, a jail term, a fine, probation, a prison

FIGURE 2.1

Criminal Justice System Model
(With estimates of flow of offenders for Index Crimes in the United States in 1965)

Population

Index crimes
committed
2,780,140

Unapprehended
offenders
1,953,000

Arrest
by police
727,000

Juvenile
processing
260,000

(Other sources
refer an additional
200,000 juveniles
for processing.)

No complaint filed
or charge reduced
290,000

Formal
accusation
and
detention
177,000

Dismissed
9,000

13,000   25,000

| Acquitted 3,000 | Jury trial 10,000 | Guilty plea 130,000 | Bench trial 20,000 | Acquitted 5,000 |

Sentencing
160,000

Unsupervised
sentence
(fine, etc.)
6,000

Probation
56,000

Jail
35,000

Probation
violators
21,000

Prison
63,000

Release
39,000

Release

Parole
45,000

Souxct: Adapted from the President's Commission on Law Enforcement and Administration of Justice, *The Challenge of Crime in a Free Society* (Washington, D. C.: Government Printing Office, 1967), pp. 262-263.

SOURCE: <u>Crime and Justice American Style</u>, Clarence Schrag, U. S. Government Printing Office, 1971, p 3.

sentence. The sentencing options of the judge vary considerably between states. In Michigan the maximum sentence is usually fixed by law and the minimum is always set by the judge.[8] The judge's sentencing decision depends upon the four elements of equation 2.10.

I -- The utility from knowing criminals suffer. Society will receive more pleasure from the suffering of a criminal and the judge will therefore impose a more severe sentence, ceteris paribus, the more serious the individual's previous criminal record, the more offensive the individual's behavior in court, the more the judge dislikes the particular crime the individual committed, i.e., the more suffering generally caused by this type of crime, the more suffering actually caused by the criminal in the act of committing the crime. Because of interrelated utility functions society will receive less utility from the criminal's suffering if it will be shared by innocent people. Therefore, the judge will be more lenient, ceteris paribus, with convicts who have dependents and or families if it appears that they will share in the convict's suffering. Judges will be more lenient with persons who are physically disabled and would suffer more from imprisonment.

J -- This reflects two distinct effects: (1) recidivism, the reduction in crimes committed by the convict, (2) deterrence, the reduction in crimes of others who will be deterred by the convict's punishment. (1) The judge will be more lenient the less committed to criminal behavior the individual is. For persons with a low level of commitment to crime, long periods of prison time may increase the propensity for criminal behavior. Therefore, the sentence will be more severe, ceteris paribus, the longer the individual

has engaged in crime, the worse the criminal record, the fewer non-criminal job skills and the worse the work record of the criminal. (2) When the judge considers the deterrent effect of a sentence he is concerned primarily with those individuals who have demographic backgrounds similar to the convict's. The sentence will be more severe, ceteris paribus, the more risk averse the group, i.e., the more of a deterrent effect a long sentence has, the higher the propensity of the group to commit the particular crime the individual was convicted for, the stronger the members of the group identify with each other. Therefore, the sentence given to persons with dependents, jobs, work skills, etc., may be longer if these characteristics make people more risk averse. Also, because parental influence is believed to be a major determinant of criminal behavior, the deterrent effect of sentencing fathers, plus the reduction of the father's corrupting influence may cause the sentences of persons with families or dependents to be longer.

Assume for a moment that the society is interested solely in minimizing crime. C_i are the crimes of a person (i) after release from prison. C_j are the crimes of others in i's demographic group. f_i is the sentence given to i. Then, ceteris paribus, $C_i = H (f_i)$ and $C_j = K (f_i)$. Society wants to minimize $C_i + C_j$, or $H (f_i) + K (f_i)$. The vast majority of writers in criminal justice have ignored $K(f_i)$ and been concerned with recidivism or C_i exclusively.[9] But the optimal sentence with respect to C_i is not necessarily the same as the optimal sentence with respect to $C_i + C_j$. There is no problem if the optimal sentence with respect to recidivism is greater than the optimal sentence in terms of

deterrence (except in those cases where an increase in expected sentence reduced deterrence).[10] But for those cases where the optimal sentence with respect to deterrence is greater than the optimal with respect to recidivism the problem is more difficult. If long sentences have a great deterrent effect it may be in society's interest to keep convicts in prison for very long periods even if recidivism is greatly increased. On the other hand, the deterrent impact of prison sentences may be so small that society can safely ignore it and concern itself solely with recidivism. In any case proper decision making requires some knowledge of the relationship between sentencing and recidivism. See Tullock[11] for an extensive survey of the deterrent effect of punishment.

L consists of the two parts in brackets behind the summation sign in the denominator of equation 2.10. The change in output caused by imprisonment is of two parts: (1) The loss or gain from the individual's being in prison, (2) the loss or gain because of a reduction in crimes of others who are deterred by the criminal's punishment.

The first part can have either a positive or negative sign, but it is probably negative. It is the loss in production caused because prisoners are nonproductive and because time in prison probably reduces work skills. Society would like to minimize this loss; therefore, the sentence will be more severe, _ceteris paribus_, the less skilled or the less productive the individual.

The second part is the change in production caused by a change in the level of crime. A reduction in crime would cause a substitution of leisure and non-criminal labor for criminal labor.

It would also cause a substitution of resources (such as police, etc.) away from crime prevention towards other types of production.

$K -- \overline{P}_{11}$ This is of two parts. It is the sum of the direct costs of running a prison (guards' pay, etc.) plus the indirect cost of supporting on welfare, etc., the families of the prisoners. Because society wants to minimize $\overline{P}_{11}$, the judge will be more lenient, ceteris paribus, with those individuals with families or dependents.

In conclusion the above model predicts that, ceteris paribus, judges are more lenient with persons who are better educated, have better work habits, are physically disabled, are married, and have shorter and less serious criminal histories. The model is ambiguous about the effect of several variables: (1) Age; (2) Occupation: persons who have occupations other than professional criminal but still engage in crime may disgust the judge more or less, and may be more or less risk averse than persons who have no other occupation; (3) Number of dependents: persons with families may receive shorter sentences because their punishment is shared by others, but they may receive longer sentences if persons with families are more risk averse and if judges believe that criminal fathers are a bad influence on their children; (4) Drug addiction: drug addicts might evoke pity or contempt from judges, addicts are less risk averse but are probably more hardened criminals; (5) Rural-Urban.

Appendix B contains quotations from the literature on sentencing which are nonquantitative support for this sentencing model.

2.7 JUDICIAL DISCRIMINATION

The sentencing model of the previous section generates three testable hypotheses about possible judicial discrimination in

sentencing: in order to achieve his perception of the optimal sen-
tence a judge may discriminate against persons who have plea bar-
gained, against persons who insist on having their cases tried,
against persons who are not white.

2.7.1

For a variety of reasons prosecutors many times charge a
person with a lesser offense than the one actually committed. Often
these reduced charges are the result of "plea bargaining" between
the defendant and the prosecutor. In Michigan a bargain for a
lesser charge has no effect on the minimum sentence, which is set
by the judge. It does usually determine the maximum which for
most offenses is fixed by statute. Because the judge knows both
the real and the bargained offense, when determining the optimal
sentence he may attempt to offset any gain made by the defendant by
sentencing for the more serious offense. Therefore, bargains for
lesser offenses may only benefit the convict if the maximum of the
lesser offense is less than the minimum the judge would have given
for the greater offense. The available data include only the offense
convicted for, which may not be the offense actually committed.
However, the data do distinguish between substantive (completed)
and attempted crimes (i.e., robbery, attempted robbery; arson,
attempted arson; etc.). The maximum penalty for an attempt is five
years or one half the maximum, whichever is less. It is rare for a
person to be convicted for an attempt when that was indeed the actual
crime. Convictions for attempts are almost always the result of a
bargain down from a completed crime. Unfortunately, it is impossible
to measure the effect of bargains to lesser substantive crimes, i.e.,

a bargain from robbery to larceny from a person.

Figure 2.2 shows an example of an individual who the judge would sentence to a minimum of one year for the crime of Larceny From A Person. The maximum for this sentence is ten years. Therefore the judge expects the individual to serve between one and ten years with the actual time in prison determined by the parole board. The horizontal axis is time in prison, the vertical axis measures the probability associated with each time as perceived by the judge.

The expected time in prison, $E(T)$, is four years. If this person bargains to Attempted Larceny From A Person the maximum is reduced to five years which in turn reduces $E(T)$, Figure 2.3.

In order to increase $E(T)$ the judge must increase the minimum sentence, Figure 2.4.

The net result is (1) a lower variance, (2) a higher minimum. The effect upon $E(T)$ is unknown. It depends upon (1) whether or not the judge "charges" the defendent for the reduction in variance by increasing the minimum beyond the point where $E(T)$ is the same for both the substantive and attempted crimes, (2) the ability of the judge to estimate properly the probability associated with each T. Even if $E(T)$ is increased, to the extent that defendents in criminal trials are risk averse, bargaining is rational behavior.

2.7.2

Table 2.1 was taken from <u>Federal Offenders in United States District Courts 1970</u>. It shows the average weighted sentence for persons depending upon how their "guilt" was determined.[12] In 1970 a conviction by a jury carried an average sentence almost three times as long as the average sentence for those who plead guilty at

PCT

FIGURE 2.2

ECT

1yr.   5yrs.   1o yrs.

PCT

FIGURE 2.3

ECT

1   5   1o

PCT

FIGURE 2.4

ECT'

1   5   1o
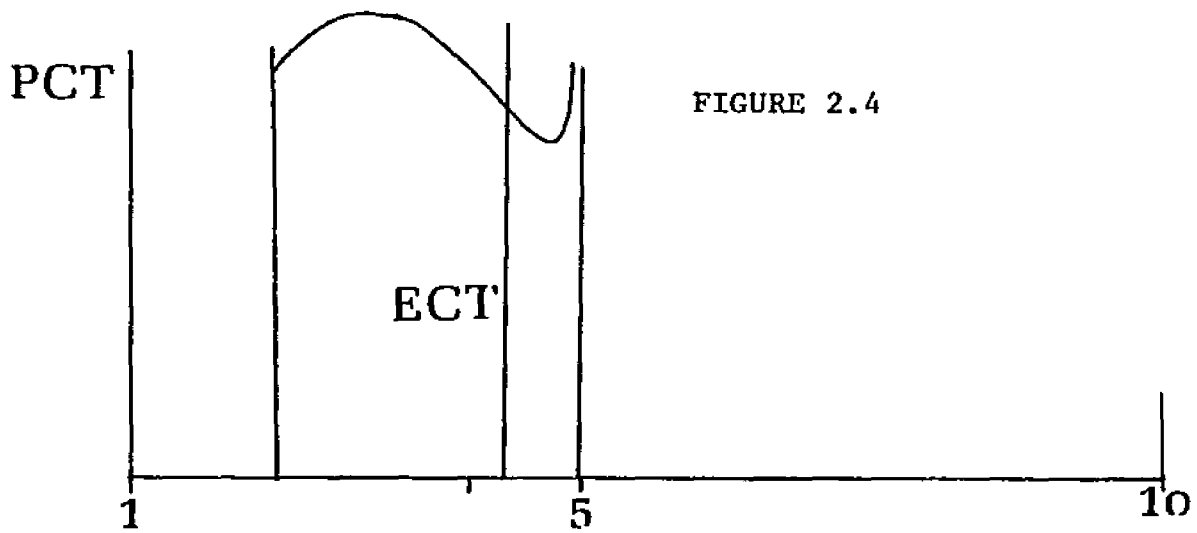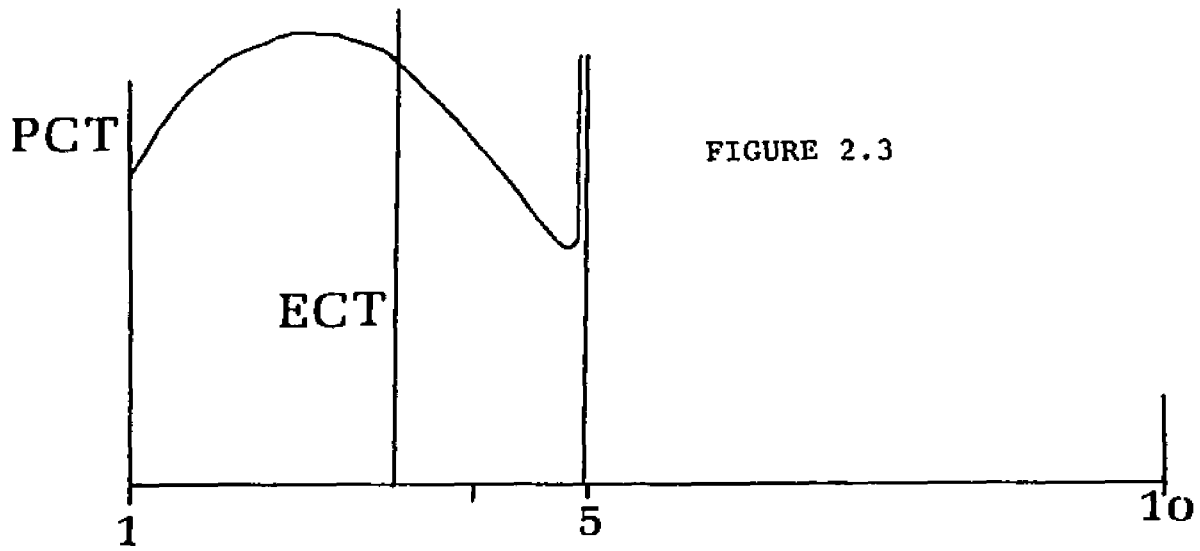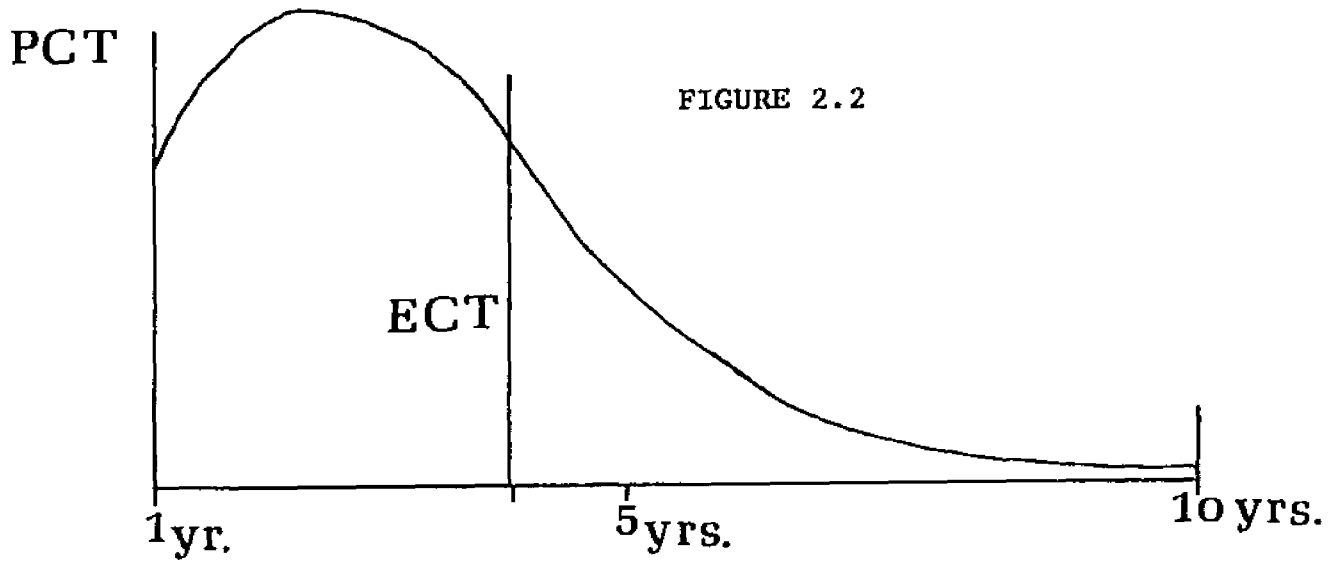
Table 2.1

Average Sentence Weight

Offense	Plea of guilty at arraignment	Convicted after jury trial
Immigration laws	1.4	4.4
Federal regulatory statutes	1.6	5.7
Embezzlement	2.9	6.1
Postal fraud	4.5	10.7
Forgery	5.1	10.2
Burglary	7.5	17.8
Marihuana	4.6	15.7
Narcotics	10.3	24.8

arraignment. It is impossible to tell exactly how much of the difference was caused by factors such as previous record, etc., but judges obviously do charge for court time. The price of court time should increase as the case load per judge increases. Therefore, the sentence differentials between bargaining and insisting on a trial will be greatest in those courts with backlogs and heavy loads.

2.7.3

The criminal justice system has often been charged with systematically discriminating against non-white people.[13] No judge would publicly admit to sentencing non-whites more harshly than whites. But it is possible that judges do discriminate either because they receive more pleasure from the suffering of non-whites or because they feel that the utility functions of non-whites are such that a severe sentence has a greater deterrent effect if it is given to a non-white. The data will be used to test the hypothesis that, ceteris paribus, the expected sentence of a non-white person is different from that of a white person.

2.8 THE MICHIGAN COURTS

All felony cases outside of the City of Detroit are handled by the Circuit Courts shown in Figure 2.5. Within the City of Detroit, felong cases are handled by the Detroit Recorder's Court. The Recorder's Court is unique in two ways: (1) it is the only court with effective non-white participation; nine of the nineteen current judges are black; (2) it is extremely dependent upon plea bargaining to control the flow of cases. Until recently the Recorder's Court was burdened with a backlog which was only eliminated

FIGURE 2.5

THE MICHIGAN JUDICIAL SYSTEM

COURTS	LOCATION	JUDGESHIPS
Supreme Court	Lansing	7
Court of Appeals	Detroit - 1st District Lansing - 2nd District Grand Rapids - 3rd District	12
44 Circuit Courts	County Seats	116
83 Probate Courts	County Seats	102
Recorders Court	Detroit	13
Recorders Court (Traffic & Ordinance Division)		3
Common Pleas Court	Detroit	9
District Courts		150
Municipal Courts		32

LEGEND

① Circuit Number
(3) Number Circuit Judgeships
• County Seat
I 1st District - Court of Appeals
II 2nd District - Court of Appeals
III 3rd District - Court of Appeals

OFFICE OF THE STATE COURT ADMINISTRATOR
January 1, 1969

SOURCE: Supreme Court of Michigan: 1968 Annual Report, p 5.

by making Circuit Court judges from the rest of the state visiting judges in the Recorder's Court.[14]

Plea bargaining is institutionalized to the point that certain Assistant Prosecuting Attorneys specialize in bargaining while others specialize in trying cases, etc. The rules and procedures of bargaining are well-known and strictly followed. These conditions generate two hypotheses: (1) Because of its dependence on plea bargaining, the minimum sentences for attempts, ceteris paribus, should be lower, and the minimum sentences for substantive crimes higher, in Detroit than in the rest of the state. (2) Because of the black participation in the Recorder's Court, minimum sentences for non-whites, ceteris paribus, should be lower in Detroit than in the rest of the state.

2.9 THE ROLE OF THE PAROLE BOARD

Once a person is sent to prison it is the parole board's function to decide where, between the minimum and the maximum, the actual sentence will fall. Like the judge's the parole board's decision depends upon the four elements of equation 2.10. Unlike the judge, the parole board gives more consideration to the convict's behavior in prison and less consideration to his actions in court. The parole board, like the Detroit Recorder's Court, has effective black participation and therefore may attempt to offset any sentencing discrimination against non-whites.[15] Assume two persons, identical in all ways except race, receive sentences of ten to twenty years for the white, and twelve to twenty years for the black. If the optimal sentence according to the parole board's conception of the social welfare function is fifteen years then the

parole board can offset the court's discrimination by releasing both persons at fifteen years, i.e., holding the white person in for a longer time period beyond the minimum. If, however, the optimal sentence is ten years, the parole board cannot offset the racial discrimination without giving the white person a non-optimal sentence. Nevertheless, the parole board will be less inclined to reward plea bargaining, etc., and to condone discrimination against blacks.

2.10 CONCLUSION

This chapter presents theories of

(1) How much and what type of crimes an individual will commit.

(2) What factors influence the judge's sentencing decision:

    A. Crime

        1. the actual crime convicted for
        2. the crime the individual actually committed

    B. Previous Criminal Record

        1. previous sentences
        2. previous convictions
        3. age criminal career began
        4. drug addiction status

    C. Demographic Background

        1. age
        2. race
        3. education
        4. number of dependents
        5. occupation
        6. work skills

    D. Behavior in Court

        1. amount of the judge's time used
        2. "attitude"

(3)   How the sentence influences the individual's pro-
      pensity to return to crime.

In addition, the following testable hypotheses have been

presented:

(1)   Judges discriminate against persons who have plea
      bargained.

(2)   Judges discriminate against blacks.

(3)   An individual's crime is related to his education
      and/or skill level.

Footnotes Chapter II

1   Isaac Ehrlich, "Participation In Illegitimate Activities: An Economic Analysis" (unpublished Doctor's dissertation, Columbia University, 1970) p. 33.

2   Isaac Ehrlich, "On the Relationship Between Education and Crime," (unpublished manuscript).

3   Ibid., p. 13.

4   Ibid., p. 13.

5   Y_t is not a production function.

6   $$\Lambda = U[X_{t1} \ldots C_t] - \lambda[\overset{M}{\underset{t}{\Sigma}} (Y_t - \overset{N}{\underset{i}{\Sigma}} \bar{P}_{t1} X_{t1})D_t] \qquad (2.8)$$

Maximizing

$$0 = \frac{\partial \Lambda}{\partial X_{11}} = \frac{\partial U}{\partial X_{11}} + \frac{\partial U}{\partial C_1}\frac{\partial C_1}{\partial X_{11}} + \frac{\partial U}{\partial C_2}\frac{\partial C_2}{\partial X_{11}} + \frac{\partial U}{\partial C_3}\frac{\partial C_3}{\partial X_{11}} \ldots +$$

$$\lambda[(\frac{\partial Y_1}{\partial X_{11}} + \frac{\partial Y_1}{\partial C_1}\frac{\partial C_1}{\partial X_{11}})D_1 + (\frac{\partial Y_2}{\partial X_{11}} + \frac{\partial Y_2}{\partial C_2}\frac{\partial C_2}{\partial X_{11}})D_2 +$$

$$(\frac{\partial Y_3}{\partial X_{11}} + \frac{\partial Y_3}{\partial C_3}\frac{\partial C_3}{\partial X_{11}})D_3 + \ldots \bar{P}_{11}D_1]$$

Solving for λ gives equation 2.10.

7   Albert Speer, Inside The Third Reich, (New York: Macmillan, 1969), Chapter 25.

8   For a detailed discussion of the sentencing options available to judges in various states see "Statutory Structures For Sentencing Felons To Prison," Columbia Law Review, Vol. 60, no. 8 (December, 1960) p. 1134-1172.

9   For a discussion of the various arguments for and against deterrence made by non-economists see Johannes Andenaes, "The General Preventive Effects of Punishment," University of

Pennsylvania Law Review, Vol. 114, no. 7 (May, 1966) p. 949-983.

Jackson Toby, "Is Punishment Necessary," _Journal of Criminal Law_,
Criminology and Police Science, Vol. 55, no. 3 (September, 1964)
p. 332-337.

Almost none of the articles which evaluate the effectiveness of
new penal methods discuss the deterrent impact of these new pro-
grams. See for example Norman Johnson and others (editors),
The Sociology of Punishment and Corrections, (2nd edition),
(New York: Wiley, 1970) Sections IV, V.

10 Isaac Ehrlich, "Participation In Illegitimate Activities: A
Theoretical and Empirical Investigation," _Journal of Political_
Economy, Vol. 81, no. 3 (May/June, 1973) p. 530.

11 Gordon Tullock, "Does Punishment Deter Crime?" _The Public_
Interest, no. 36 (Summer, 1974) p. 103-111.

12 _Federal Offenders In The United States District Courts 1970_
(Washington: U.S. Government Printing Office, 1972), Exhibit
VII, p. 15. The weight is a scale of severity where 1 = (1 to
12 months), 50 = (over 120 months), etc., see page 57.

13 For example see Andrew Overby, "Discrimination In The Administra-
tion of Justice," _The Sociology Of Punishment And Corrections_,
Second Edition, (Norman Johnson and others editors), (New York:
Wiley, 1970) p. 261-270.

14 _Annual Report: The Recorder's Court, 1972_, p. 1,2.

15 One of the five current members is black.

CHAPTER III

3.1 INTRODUCTION

This chapter is concerned with two decision points in the criminal justice system: judicial sentencing, and parole board decision making. A third decision point, recidivism, is analyzed in the next chapter. These decisions are highly interrelated. The crime, CR, an individual commits depends upon his demographic background, Z. The minimum sentence imposed by the judge, S, depends upon the felon's demographic background, Z, and the crime, CR. The maximum, Max, is fixed by statue and depends upon the crime the individual is convicted of, CR*. (Note that CR* need not equal CR.) Time in prison, T, depends upon the individual's background Z, the crimes, CR and CR*, and the sentence, S and Max. Finally the released felon's decision about future criminal activity, C, depends upon T, CR, and Z. This system is a set of four simultaneous equations:

$$CR = f_1 \ (Z) \tag{3.1}$$

$$S = f_2 \ (Z, \ CR, \ CR*) \tag{3.2}$$

$$T = f_3 \ (Z, \ CR, \ CR*, \ S, \ Max) \tag{3.3}$$

$$C = f_4 \ (T, \ CR, \ Z) \tag{3.4}$$

This model of course greatly understates the actual complexity of the system. Among other things it ignores the previous decisions made by the police, prosecutor, and others.[1]

3.2 THE DATA

The data are from a tape containing the records of all persons
released from Michigan Prisons between Jaunary, 1968 and December,
1972. The records include numerous demographic variables (age, race,
education, occupation, marital status, county, etc.), the crime the
individual was convicted of, the minimum^2 and maximum sentences,
when and how the individual was released from prison, and when and
how the individual was returned to prison (if he was returned). Un-
fortunately such desirable information as race of victim, how guilt
was determined (plea, bench trial, jury trial) and the name of the
sentencing judge are unavailable. The data are further limited in
that they contained only those persons who were given prison sen-
tences. In addition, because many of the older records were in-
complete or inaccurate and have to be discarded, there is underrepre-
sentation of persons who served long terms (i.e., ten years or more).
Although the data do not indicate how guilt was determined or whether
a guilty plea was the result of a bargain, they do distinguish be-
tween attempted and substantive crimes. Because conviction for an
attempt is almost always the result of a bargain between the de-
fendant and the prosecutor, they allow some estimation of how plea
bargaining is perceived by the judge and parole board.

The model is tested on four crime categories: Robbery,
Burglary, Auto-theft, Assault-Murder. Tables 3.1 through 3.4 list
the crimes and their maximum sentences.^{3} The left-most column is
an abbreviation which hereafter represents the crime. Because of
their limited number, no females are used in any of the samples.
For these regressions the data are all the usable records of persons

TABLE 3.1 ROBBERY

	Crime	Maximum Sentence	Statute Number
R1	Armed Robbery	Life	750529
AR1	Attempted Armed Robbery	5 years	750529
R2	Assault with intent to commit Armed Robbery	Life	75089
AR2	Attempted Assault with intent to commit Armed Robbery	5 years	75089
R3	Unarmed Robbery	15 years	750530
AR3	Attempted Unarmed Robbery	5 years	750530
R4	Assault with intent to commit Unarmed Robbery	15 years	75088
AR4	Attempted Assault with intent to commit Unarmed Robbery	5 years	75088
R5	Larceny from a Person	10 years	750357
AR5	Attempted Larceny from a Person	5 years	750357

For R1 and R2 the judge sets the maximum as well as minimum sentence.

TABLE 3.2 <u>BURGLARY</u>

	Crime	Maximum Sentence	Statute Number
B1	Breaking and Entering	10 years (unoccupied) 15 years (occupied)	750110
AB1	Attempted Breaking and Entering	5 years	750110
B2	Entering Without Breaking	5 years	750111
AB2	Attempted Entering without Entering	$2\frac{1}{2}$ years	750111
AB3	Larceny From a Mobile Vehicle	5 years	750356A
AB3	Attempted Larceny From a	$2\frac{1}{2}$ years	750356A
B4	Larceny From a Building	4 years	750360
AB4	Attempted Larceny From a Building	2 years	750360

TABLE 3.3 <u>AUTO-THEFT</u>

	Crime	Maximum Sentence	Statute Number
C1	Auto Theft	5 years	750413
AC1	Attempted Auto Theft	$2\frac{1}{2}$ years	750413
C2	Taking Auto Without Intent to Steal	2 years	750414

TABLE 3.4 MURDER-ASSAULT

	Crime	Maximum Sentence	Statute Number
M1	First Degree Murder	Life	750316
M2	Second Degree Murder	Life	750317
AM2	Attempted Second Degree Murder	5 years	750317
M3	Assault With Intent to Commit Murder	Life	75083
AM3	Attempted Assault With Intent to Commit Murder	5 years	75083
M4	Manslaughter	15 years	750321
AM4	Attempted Manslaughter	5 years	750321
M5	Assault With Intent Less Than Murder	10 years	75084
AM5	Attempted Assault With Intent Less Than Murder	5 years	75084
M6	Felonious Assault	4 years	75082
AM6	Attempted Felonious Assault	2 years	75082

For M2 and M3 the judge sets the maximum as well as minimum sentence.

released during 1969, '70, '71 whose last conviction was for one of the crimes listed in Table 3.1 through 3.4.

3.3 TECHNIQUE

For each crime category, least squares regressions are run with Minimum Sentence in months as the dependent variable.

$$S = \beta_1 + \beta_2 \text{ MAX} + \beta_3 C + \beta_4 Z_1 + \beta_5 Z_2 + \ldots \epsilon \tag{3.5}$$

Next, for each category, least squares regressions are run to estimate time served in months as a function of the Z's, CR, S, and Max.

$$T = \theta S + \gamma_1 + \gamma_2 \text{ MAX} + \gamma_3 C + \gamma_4 Z_4 + \ldots \epsilon^* \tag{3.6}$$

Because this is a triangular recursive system it can be re-written as

$$T = \theta[\beta_1 + \beta_2 \text{ MAX} + \beta_3 C + \ldots] + \gamma_1 + \gamma_2 \text{ MAX} \ldots + \epsilon^* \tag{3.7}$$

In order to use this technique it is necessary to assume that $E(\epsilon_i, \epsilon_i^*) = 0$. There is no a priori reason not to expect this. If, however, there exists some unknown variable which is considered by both the judge and the parole board, it is possible that $E(\epsilon_i, \epsilon_i^*) \neq 0$. If this is the case, the results of equation 3.5 are still consistent even though other techniques would yield parameters with more desirable characteristics.

The definitions of the variables are listed below. Their expected signs as predicted by the model in Chapter II are in parentheses with the expected sign of β first.

1. (+,)   Detroit (1 = Detroit, 0 = otherwise)

2. (-,)   Detroit and Attempt (1 = both Detroit and
            conviction of an attempt, 0 = otherwise)

3. (+,)   Not Detroit and Not White (1 = both not
            Detroit and not White, 0 = otherwise)

4. (-,)   White (1 = White, 0 = otherwise)

5. ( )   Percent Rural (percent of the county the
            felon resides in which was rural in the 1970
            census)

6. ( )   Age (in months at sentence date)

7. ( )   Age squared

8. (-,-)   Education (number of years of education)

9. (-,-)   Work Record (1 = unstable, 2 = adequate,
            3 = highly dependable)

10. ( )   Occupation (1 = occupation other than pro-
            fessional criminal, 0 = otherwise)

11. (-,-)   Disabled (1 = physical disability, 0 = other-
            wise)

12. (-,-)   Married (1 = married, 0 = otherwise)

13. ( )   Dependents (number of dependents)

14. ( )   Drug addiction status (1 = none, 2 = experi-
            mented, 3 = occasional, 4 = sustained, 5 =
            addicted)

15. (-,-)   Age at first attention of authorities (1 = 8-10
            years old, 2 = 10-12 years old, 3 = 13-14 years
            old, 4 = 15-16 years old, 5 = 17-18 years old,
            6 = 19-20 years, 7 = 21 years -- open)

16. (+,+)   Total number of previous convictions

17. (+,+)   Total time in months served (in jail or prison
            for all previous convictions)

Note that work record and drug addiction status are qualitative

variables. They are not converted into series of binary variables

because the number of such binary variables would be prohibitive.

3.4 RESULTS

Table 3.5 contains the results of the decision making of judges and the parole board for robbers. The dependent variables (S, T), are in months. The first column lists the β's, the second column the γ's; t-statistics are beneath in parenthesis. One or two-tailed tests are used depending upon the expected signs as listed above. Significance is defined at the ten percent level, i.e., t-statistics of 1.282 and 1.645 respectively. As stated in equation 3.5 the β's determine S, the γ's determine T. In order to obtain the total effect of variable j upon T, multiply β_j times θ and add γ_j. θ is the coefficient of S in the second regression.

In Table 3.5 the following variables are significant and increase minimum sentence: Detroit (7.759 months), not Detroit and not white (6.152 months), number of dependents (1.250 months), total number of previous convictions (1.868 months), total time served for previous convictions (.1880 months). All of the crimes except R3 are significant and increase S. Note that the coefficients of the attempted crimes are larger than the coefficients of the substantive crimes. The following variables are significant and reduce the minimum sentence: Detroit and attempt (-5.583 months), disabled (-3.355 months). The relationship between minimum sentence and age is $S = \text{Age} (-.6214) + \text{Age}^2 (.0007522)$. This relationship decreases until its minimum at 34.5 years after which it increases. The relationship between minimum and maximum sentences is $S = \text{Max} (.2828) + \text{Max}^2 (-.0001784)$. This relationship is positive until it reaches its peak at 66 years, after which it decreases.

TABLE 3.5   ROBBERS

Sample Size	R Squared	R Squared
867	.5476	.8963
Constant	92.31 (10.607)	23.19 (5.102)
Detroit	7.759 (2.662)	.2319 (.167)
Detroit and Attempt	-5.583 (-1.491)	-1.491 (-.811)
Not Detroit and Not White	6.152 (1.928)	-.2806 (-.179)
White	1.948 (.958)	.06670 (.067)
Percent Rural	-.0404 (-.644)	-.03667 (-1.192)
Max	.2828 (11.525)	-.07645 (-5.895)
Max Squared	-.0001784 (-7.815)	.00007299 (6.295)
Age	-.6214 (-21.156)	-.0408 (-2.290)
Age Squared	.0007522 (18.589)	.00005763 (2.444)
Education	-.2911 (-.518)	-.7041 (-2.556)
Work	.9723 (1.304)	-.4361 (-1.191)
Occupation	-.5987 (-1.483)	3.203 (1.616)
Disabled	-3.355 (-1.804)	-.1129 (-.124)
Married	.9233 (.480)	-1.401 (-1.486)
Number of Dependents	1.250 (2.155)	.0555 (.194)

TABLE 3.5 (Cont)

Sample Size 867	R Squared .5476	R Squared .8963
Drug Addict	.5929 (1.197)	-.6497 (-2.672)
Age First Attention of the Authorities	.5294 (1.298)	-.0568 (-.284)
Total Previous Convictions	1.868 (5.703)	.3340 (2.040)
Total Time Served Previous Terms	.1880 (7.274)	.0718 (5.496)
R1	13.13 (2.784)	-1.882 (-.810)
R2	11.32 (2.474)	-3.648 (-1.620)
R3	.9062 (.192)	-1.702 (-.737)
R5	11.19 (2.233)	-2.778 (-1.127)
AR1	25.21 (4.095)	-6.835 (-2.242)
AR2	24.39 (3.617)	-5.765 (-1.730)
AR3	23.31 (3.674)	-6.926 (-2.208)
AR4	23.44 (1.867)	-6.911 (-1.121)
AR5	20.27 (2.229)	-8.895 (-2.872)
Minimum Sentence		.9254 (54.629)

The following variables are significant and increase time in prison: minimum sentence (.9254 months), total number of previous convictions (.3340 months), total time served for previous convictions (.0718 months). The following variables are significant and decrease time in prison: education (-.7041 months), married (-1.401 months), drug addiction (-.6497 months), AR3 (-6.926 months), AR5 (-8.895 months). The relationship between age and time in prison is $T = \text{Age}((-.6214) (.9254) - (.0408)) + \text{Age}^2 ((.0007522) (.9254) + (.00005763))$. Figure 3.1 shows this relationship relative to that for minimum sentences. The relationship between maximum sentence and time in prison is $T = \text{Max} ((.2828) (.9254) + (.0745)) + \text{Max}^2 ((-.0001784) (.9254) + (.00007299))$. Figure 3.2 shows this relationship relative to that for minimum sentence.

Table 3.6 is the same model except that the individual crimes have been replaced with the differences between substantive and attempted crimes such that $D1 = R1 - AR1$. This is done by making each crime one variable with a value of 1 is the substantive crime, -1 is the attempted crime, and 0 otherwise.[4] The β associated with each difference is expected to be negative, i.e., judges discriminate against persons who bargain. All of the β's for the differences are negative; i.e., attempts bring longer minimum sentences. All of the γ's for the differences are positive. Holding maximum sentence constant, the parole board attempts to offset the judges' actions.

The fact that the β for Detroit is positive and the β for Detroit and attempt is negative shows that the price of court time for a defendent (the sentence differential between pleading and

TABLE 3.6   ROBBERS

Sample Size 867	R Squared .5398	R Squared .8960
Constant	108.8 (15.255)	17.72 (4.517)
Detroit	8.010 (2.750)	.3560 (.250)
Detroit and Attempt	-6.795 (-1.811)	-1.566 (-.856)
Not Detroit and Not White	5.613 (1.757)	-.1808 (-.116)
White	2.085 (1.031)	.0702 (.071)
Percent Rural	-.0509 (-.813)	-.0328 (-1.073)
Max	.2836 (12.051)	-.0704 (-5.672)
Max Squared	-.0001781 (-8.017)	.00006833 (6.089)
Age	-.6188 (-20.960)	-.04062 (-2.290)
Age Squared	.0007506 (18.439)	.00005728 (2.439)
Education	-.3406 (-.604)	-.6910 (-2.514)
Work	.9638 (1.288)	-.4713 (-1.292)
Occupation	-6.432 (-1.585)	3.275 (1.655)
Disabled	-3.172 (-1.702)	-.1543 (-.170)
Married	1.214 (.630)	-1.390 (-1.481)
Number of Dependents	1.341 (2.302)	.07358 (.259)

TABLE 3.6 (Cont)

| Sample Size	R Squared	R Squared
867	.5398	.8960
Drug Addict	.5328 (1.074)	-.6696 (-2.769)
Age First Attention of Authorities	.5565 (1.361)	-.04869 (-.244)
Total Previous Convictions	1.849 (5.642)	.3180 (1.956)
Total Time Served Previous Terms	.1867 (7.180)	.0721 (5.526)
D1	-5.957 (-2.571)	2.183 (1.927)
D2	-5.946 (-2.533)	.7752 (.676)
D3	-13.09 (-5.587)	2.431 (2.092)
D4	-15.56 (-3.373)	4.056 (1.794)
D5	-5.060 (-2.255)	2.871 (2.620)
Minimum Sentence		.9252 (55.130)

FIGURE 3.1

ROBBERY

FIGURE 3.2

ROBBERY
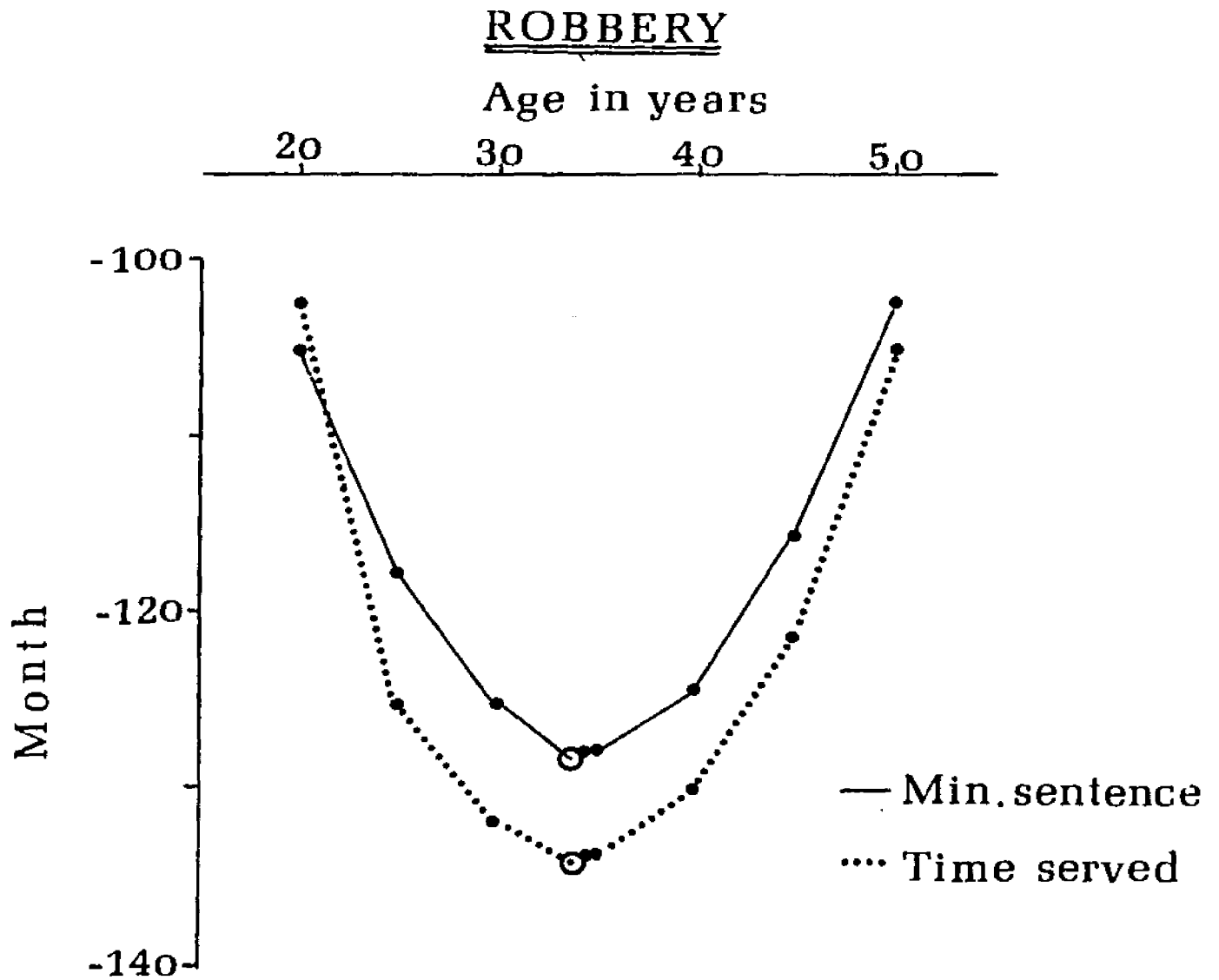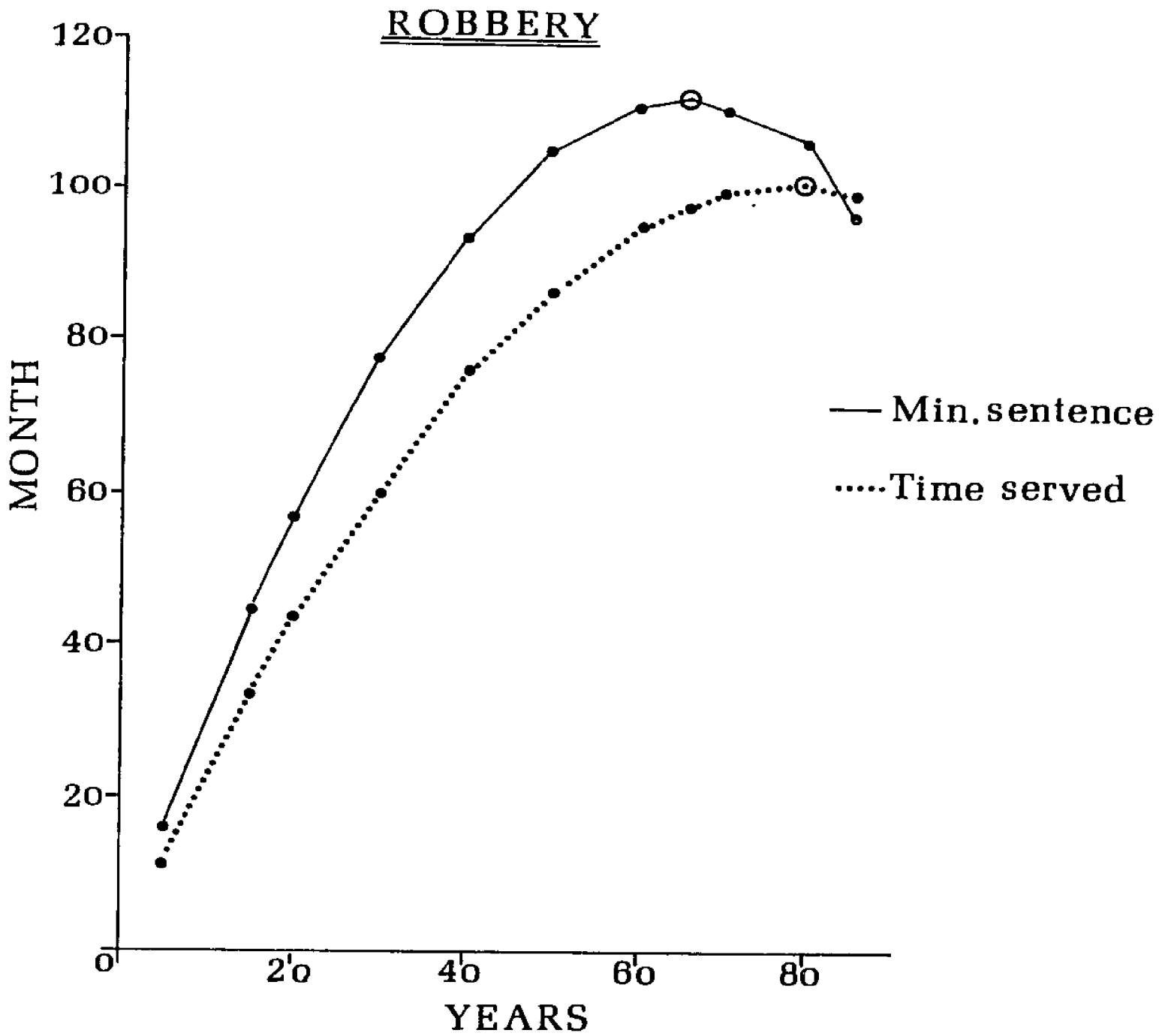
trying a case) is greater in Detroit, as predicted by the model.
The positive β for not Detroit and not white is also predicted by
the model and shows racial discrimination outside of Detroit.

Table 3.7 contains the results of the regression for burglars.
The β's of the following variables are significant and increase the
minimum sentence: number of dependents, drug addiction, total number
of previous convictions, total time served, previous convictions,
and AB2. Education is significant and reduces minimum sentence.
The γ's of the following variables are significant and increase
time served: Minimum sentence, and total time served for previous
convictions. The γ's of the following variables are significant
and decrease time in prison: Detroit and attempt, percent rural,
physical diability, B2, B3, B4, AB1, and AB3. The relationship be-
tween minimum sentence and age is $S = \text{Age} \, (.7848) + \text{Age}^2 \, (.0009191)$.
Until the age of 35.5 years an increase in age causes a reduction in
minimum sentence, after that point an increase in age causes an in-
crease in minimum sentence, see Figure 3.3.

Table 3.8 is based on the same data rerun with the differences
between substantive and attempted crimes as variables. The β for
D3 is significant. None of the γ's is significant, indeed the
γ's for D2 and D4 are close to being significant with the wrong
sign.

Table 3.9 presents the results for assault-murder. The follow-
ing variables are significant and increase minimum sentence: total
time served for previous convictions, and M1. The following vari-
ables are significant and decrease minimum sentence: white, physical
disability, age first attention of the authorities, M2, M3, M4, and

TABLE 3.7   BURGLARS

Sample Size 751	R Squared .6004	R Squared .9849
Constant	153.5 (16.859)	1.157 (.548)
Detroit	.4605 (.150)	.1598 (.265)
Detroit and Attempt	-3.234 (-1.267)	-1.148 (-2.034)
Not Detroit and Not White	.7446 (.246)	-.6562 (-1.104)
White	-1.379 (-.579)	-.1031 (-.220)
Percent Rural	-.0370 (-.829)	-.0152 (-1.727)
Max	.4732 (1.643)	.04915 (.866)
Max Squared	-.002434 (-1.590)	-.0001796 (-.596)
Age	-.7848 (-31.788)	-.005536 (-.737)
Age Squared	.0009191 (29.542)	.00000962 (1.059)
Education	-.8364 (-1.492)	-.04646 (-.421)
Work	1.984 (2.270)	.3798 (2.203)
Occupation	-5.191 (-1.172)	1.225 (1.406)
Disabled	1.145 (.723)	-.4617 (-1.484)
Married	1.054 (.600)	-.3864 (-1.118)
Number of Dependents	2.001 (3.493)	.04828 (.425)

TABLE 3.7 (Cont)

Sample Size 751	R Squared .6004	R Squared .9849
Drug Addict	1.382 (3.395)	.05040 (.625)
Age First Attention of the Authorities	.7877 (2.074)	.02877 (.384)
Total Previous Convictions	.9859 (4.232)	.04334 (.935)
Total Time Served Previous Terms	.0861 (3.964)	.02180 (5.053)
B1	24.30 (.996)	1.239 (.259)
B2	1.068 (.152)	-2.961 (-2.141)
B3	-.8843 (-.109)	-2.801 (-1.761)
B4	1.067 (.216)	-1.943 (-1.998)
AB1	2.480 (.495)	-1.841 (-1.871)
AB2	7.921 (1.703)	-.1432 (-.156)
AB3	3.773 (1.454)	-1.049 (-2.053)
Minimum Sentence		1.000 (136.932)

FIGURE 3.3

BURGLARY
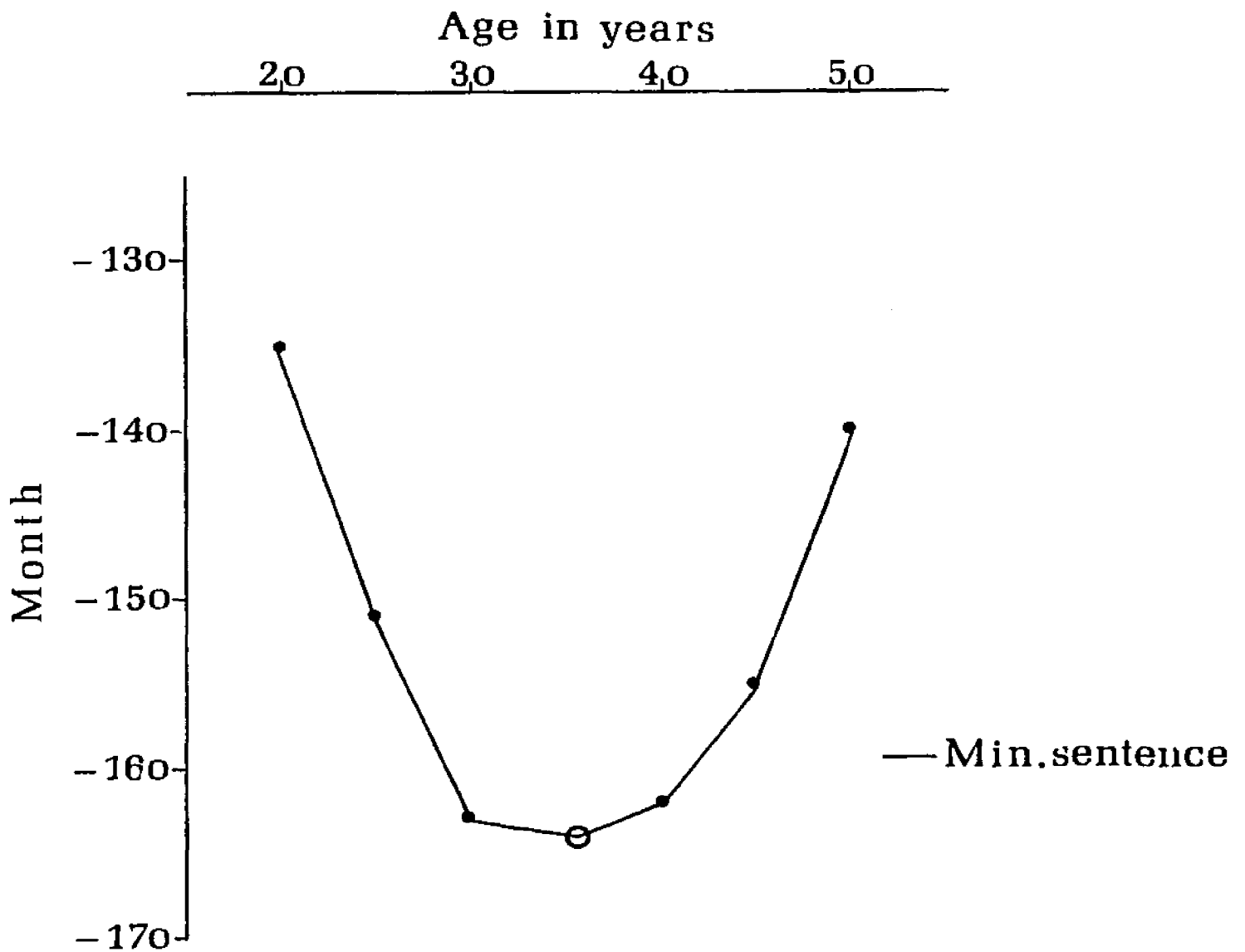
TABLE 3.8   BURGLARS

Sample Size 751	R Squared .5990	R Squared .9849
Constant	149.3 (15.621)	1.652 (.761)
Detroit	.4270 (.139)	.1906 (.316)
Detroit and Attempt	-3.193 (-1.116)	-1.219 (-2.166)
Not Detroit and Not White	.5675 (.188)	.6456 (-1.089)
White	-1.373 (.577)	-.1089 (-.233)
Percent Rural	-.03855 (-.867)	-.01563 (-1.787)
Max	.6096 (2.581)	-.002719 (-.058)
Max Squared	-.002673 (-2.141)	.00008549 (.347)
Age	-7.828 (-31.758)	-.005812 (-.776)
Age Squared	.0009174 (29.520)	.00001007 (1.112)
Education	-.8455 (-1.509)	-.05031 (-.456)
Work	2.044 (2.351)	.3557 (2.074)
Occupation	-4.928 (-1.115)	1.223 (1.406)
Disabled	.9893 (.627)	-.4413 (-1.422)
Married	1.229 (.701)	-.4186 (-1.214)
Number of Dependents	1.971 (3.447)	.05709 (.504)

TABLE 3.8 (Cont)

Sample Size	R Squared	R Squared
751	.5990	.9849
Drug Addict	1.360	.05154
	(3.350)	(.641)
Age First Attention of	.7708	.02106
Authorities	(2.038)	(.282)
Total Previous Convictions	.9871	.04321
	(4.242)	(.933)
Total Time Served Previous	.08652	.02142
Terms	(3.996)	(4.978)
D1	-.1465	.4980
	(-.049)	(.851)
D2	-4.006	-1.113
	(-1.141)	(-1.612)
D3	-3.807	-.02687
	(-1.522)	(-.055)
D4	-.8633	-.6069
	(-.405)	(-1.449)

TABLE 3.9 ASSAULT-MURDER

Sample Size 378	R Squared .8211	R Squared .8611
Constant	9.091 (1.707)	25.08 (2.984)
Detroit	2.230 (.705)	2.661 (.535)
Detroit and Attempt	-5.360 (-.942)	-.07885 (-.009)
Not Detroit and Not White	2.603 (.745)	2.010 (.366)
White	-3.404 (-1.406)	-.216 (-.057)
Percent Rural	-.001906 (-.036)	.002888 (.034)
Max	.4628 (15.027)	-.1866 (-3.002)
Max Squared	-.0003577 (-13.121)	.0003046 (5.815)
Age	-.03189 (-2.495)	.01182 (.584)
Age Squared	.00002952 (1.748)	-.00002873 (-1.078)
Education	-.6157 (-1.100)	-1.857 (-2.107)
Work	-.8168 (-1.016)	2.714 (2.145)
Occupation	-1.763 (-.393)	8.688 (1.228)
Disabled	-4.106 (-1.883)	1.242 (.360)
Married	1.592 (.726)	.1628 (.047)
Number of Dependents	.4673 (.907)	-.4073 (-.502)

TABLE 3.9 (Cont)

Sample Size 378	R Squared .8211	R Squared .8611
Drug Addict	-.07713 (-.068)	-2.301 (-1.285)
Age First Attention of the Authorities	-.7578 (-1.613)	-1.023 (-1.380)
Total Previous Convictions	-.05826 (-.145)	.3418 (.540)
Total Time Served Previous Terms	.1118 (3.568)	-.01486 (-.296)
M1	75.11 (4.952)	-93.33 (-3.784)
M2	-14.58 (-2.733)	15.13 (1.785)
M3	-27.83 (-3.859)	22.04 (1.904)
M4	-32.65 (-8.078)	12.21 (1.764)
M5	-15.39 (-4.405)	11.91 (2.111)
AM2	4.287 (.272)	2.727 (.110)
AM3	3.488 (.220)	-7.668 (-.308)
AM4	4.574 (.425)	-1.782 (-.105)
AM5	1.839 (.293)	-1.386 (-.140)
AM6	7.801 (1.486)	-5.723 (-.692)
Minimum Sentence		.9626 (11.425)

M5. Note that the minimum sentences for substantive crimes are shorter than those for attempted crimes. The following γ's are significant and increase time in prison: Minimum sentence, M2, M3, M4 and M5. The following γ's are significant and reduce time in prison: education, age at first attention of the authorities, and M1. The relationship between minimum and maximum sentences is $S = Max \ (.4628) - Max^2 \ (.0003577)$. The relationship is positive until its peak at 53.9 years after which it declines. The relationship between time in prison and maximum sentence is $T = Max \ ((.4628) + (.9626) \ (-.1866)) + Max^2 \ ((-.0003577) + (.9626)(.0003046))$. This relationship is increasing at a decreasing rate over the entire relevant region, see Figure 3.4. The relationship between age and minimum sentence is, $S = Age \ (-.03189) + Age^2 \ (.00002952)$. This relationship is negative until its minimum at 45 years, after which it increases, see Figure 3.5.

Table 3.10 presents the results for the same data with the difference between substantive and attempted crimes as independent variables. There is no attempted first degree murder, so D1 is identical to C1. Note that the β's for D3, D4, and D5 are negative and significant. The γ's for D3 and D5 are positive and significant. Once again judges discriminate against persons who plead to attempts, and the parole board attempts to offset this discrimination.

Table 3.11 presents the results for auto-theft. The following variables are significant and decrease the minimum sentence: white and education. The γ associated with age at first attention of the authorities is negative and significant. Minimum sentence and total time served for previous convictions are significant and increase prison
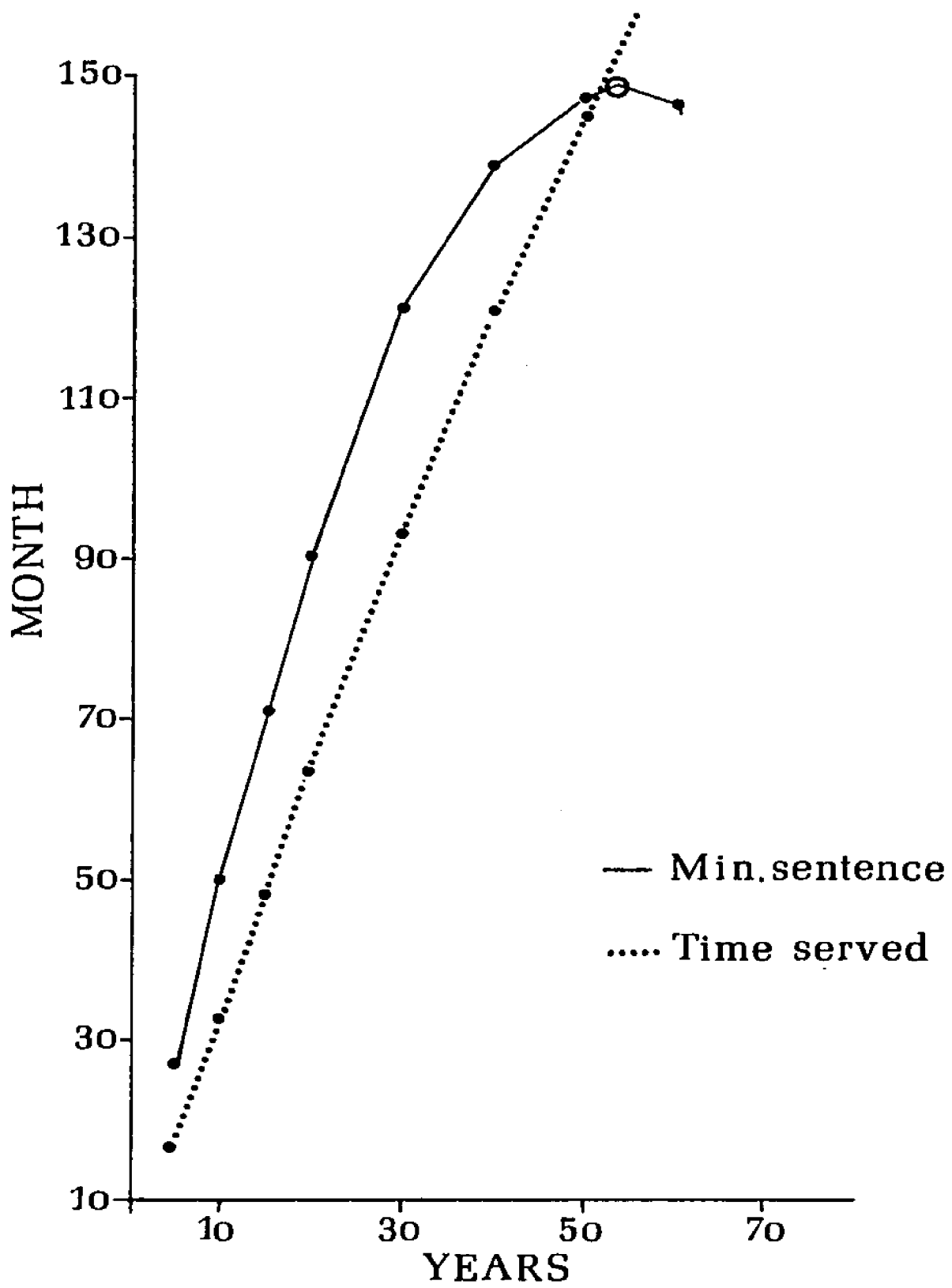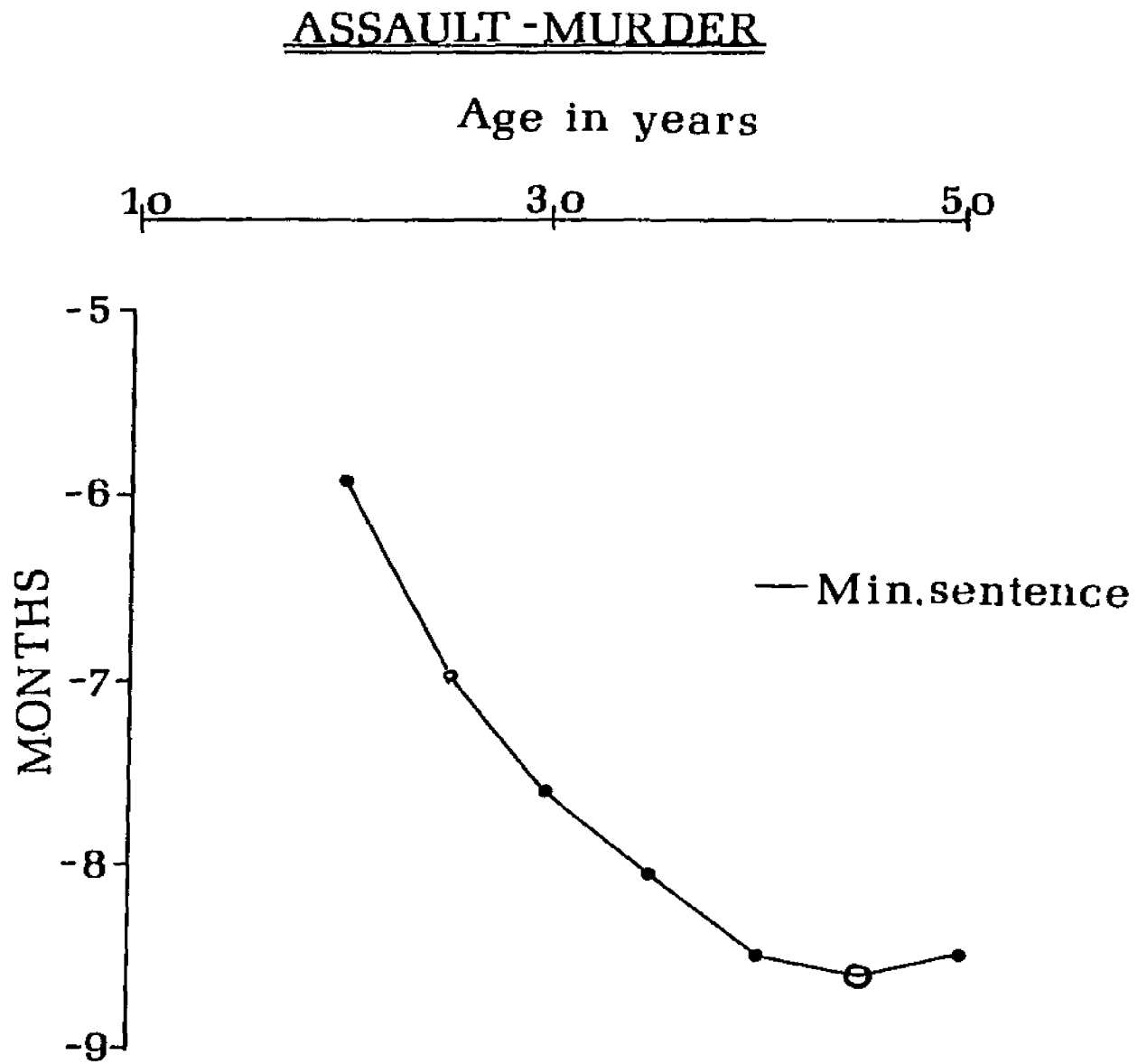
FIGURE 3.4

FIGURE 3.5

ASSAULT -MURDER

Age in years

TABLE 3.10 ASSAULT-MURDER

Sample Size 378	R Squared .8139	R Squared .8601
Constant	10.20 (1.860)	24.14 (2.834)
Detroit	1.911 (.599)	3.072 (.622)
Detroit and Attempt	1.571 (.307)	-3.938 (-.498)
Not Detroit and Not White	2.665 (.754)	2.278 (.416)
White	-2.822 (-1.154)	-.5670 (-.150)
Percent Rural	-.01367 (-.255)	.01045 (.126)
Max	.4079 (15.314)	-.1382 (-2.598)
Max Squared	-.0003139 (-12.823)	.0002664 (5.809)
Age	-.03187 (-2.460)	.01091 (.540)
Age Squared	.00002767 (1.617)	-.00002689 (-1.012)
Education	-.5731 (-1.015)	-1.904 (-2.178)
Work	-.7071 (-.868)	2.650 (-2.102)
Occupation	-1.253 (-.276)	8.183 (1.165)
Disabled	-4.057 (-1.851)	1.132 (.332)
Married	1.512 (.684)	.1138 (.033)
Number of Dependents	.4663 (.896)	-.3769 (-.468)

TABLE 3.10 (Cont)

Sample Size 378	R Squared .8139	R Squared .8601
Drug Addict	.1548 (.134)	-2.402 (-1.347)
Age of First Attention of Authorities	-.8191 (-1.722)	-.9935 (-1.345)
Total Previous Convictions	-.1233 (-.305)	.3300 (.528)
Total Time Served Previous Terms	.1181 (3.747)	-.01440 (-.290)
C1	77.28 (5.005)	-92.98 (-3.762)
D2	-4.799 (-1.013)	8.380 (1.143)
D3	-16.95 (-2.627)	14.90 (1.479)
D4	-28.83 (-6.752)	6.715 (1.111)
D5	-9.364 (-3.085)	7.659 (1.610)
D6	.1995 (.087)	.3160 (.089)
Minimum Sentence		.9387 11.388

TABLE 3.11   AUTO-THEFT

Sample Size 334	R Squared .2934	R Squared .7157
Constant	23.88 (1.507)	-9.499 (-.851)
Detroit	-.6465 (-.626)	-.4234 (-.584)
Detroit and Attempt	.2690 (.190)	1.466 (1.472)
Not Detroit and Not White	-1.512 (-1.220)	1.130 (1.297)
White	-1.132 (-1.358)	.5638 (.962)
Percent Rural	.004599 (.266)	-.004920 (-.405)
Max	-.3543 (-.436)	.2715 (.476)
Max Squared	.005686 (.588)	-.003145 (-.463)
Age	-.007056 (-.341)	.03146 (2.165)
Age Squared	-.00000019 (-.007)	-.00003295 (-1.802)
Education	-.4154 (-1.924)	-.05239 (-.344)
Work	.1026 (.352)	.1959 (.958)
Occupation	.2711 (.159)	1.706 (1.426)
Disabled	-.3980 (-.576)	-.3841 (-.792)
Married	-.2831 (-.331)	-.3192 (-.532)
Number of Dependents	.03274 (.115)	-.2618 (-1.315)

TABLE 3.11 (Cont)

Sample Size	R Squared	R Squared
334	.2934	.7157
Drug Addict	.1893	.08841
	(.745)	(.496)
Age First Attention of the Authorities	.2165	-.1695
	(1.331)	(-1.481)
Total Previous Convictions	.07019	-.1748
	(.553)	(-1.963)
Total Time Served Previous Terms	.009725	.04336
	(.844)	(5.356)
C1	.1805	1.198
	(.065)	(.615)
C2	-1.920	1.278
	(-.977)	(.925)
Minimum Sentence		.8484
		(21.362)

time. The relationship between age and time in prison is

$T = Age \ (.03146) + Age^2 \ (-.00003295)$, see Figure 3.6. Table 3.12

shows that the differences between attempted and substantive crimes

are insignificant.

These four crime categories represent distinct types of

criminal behavior: because they have a victim (i.e., they are crimes

against persons) robbery and assault-murder are viewed as more serious

offenses than burglary and auto-theft which are property crimes.

Robbery and burglary are more "professional" in that they are less

impulsive and emotional crimes than assault-murder and auto-theft.

Note that the R^2 of the regressions for auto-theft are lower than

those for the other categories. Auto-theft is much less homogeneous

an activity than the other crimes. Some auto-thefts are the actions

of highly skilled criminals who plan their activities like any

businessman, others are the actions of persons who simply cannot

resist driving a new car.

Table 3.13 presents a summary of the previous eight tables.

For each crime category, the β's and γ's of all the significant

independent variables are represented by their signs.

Only robbery clearly shows a sentencing differential between

pleading and not pleading in the Detroit Recorder's Court. But

three of the crime categories show judicial discrimination against

non-whites, either by a positive β for not Detroit and not white

(robbery), or a negative β for white (assault-murder and auto-

theft). Note that the total effect of race on S and T is con-

tained in two coefficients: (white), (not Detroit and not white).

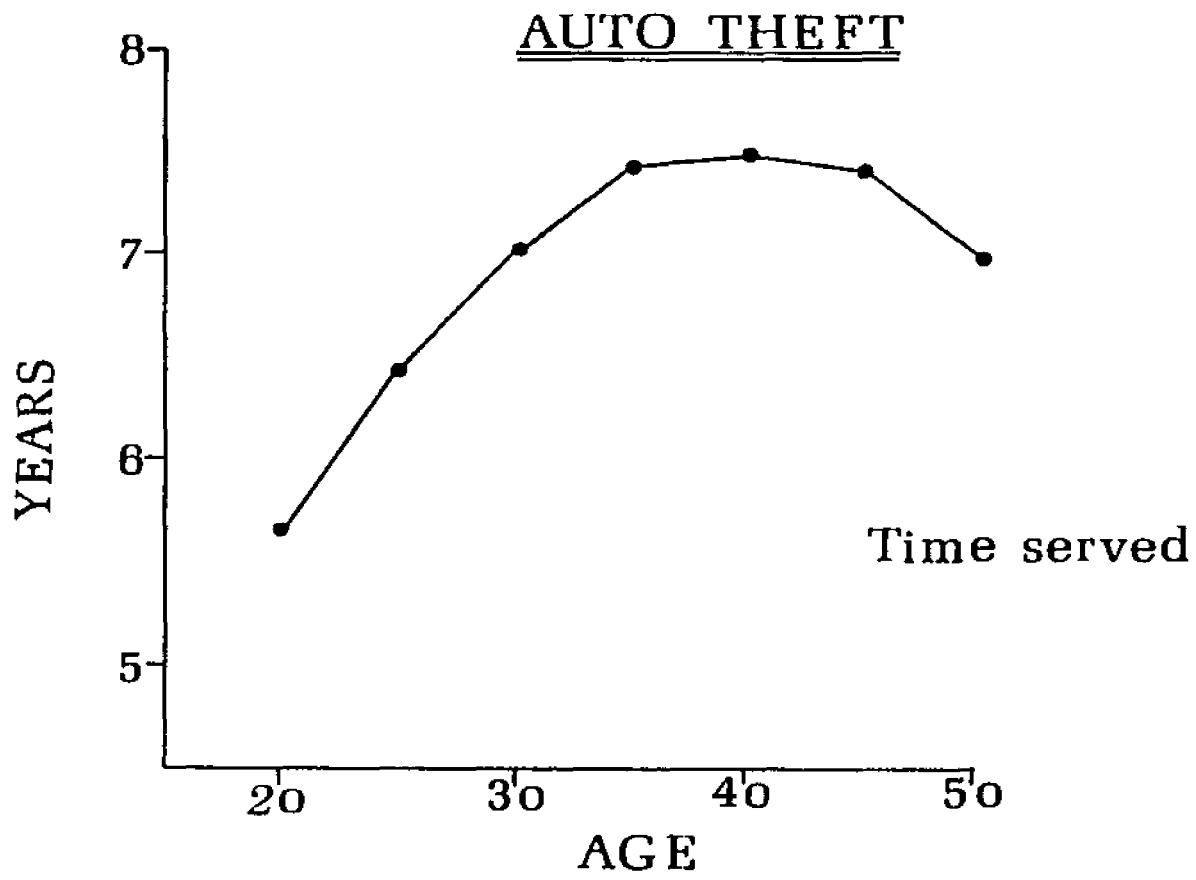It is possible to infer from these results the effect of (not

FIGURE 3.6

AUTO THEFT

TABLE 3.12   AUTO-THEFT

Sample Size 334	R Squared .2934	R Squared .7157
Constant	23.97 (1.576)	-8.900 (-.831)
Detroit	-.6465 (-.626)	-.4234 (-.584)
Detroit and Attempt	.2690 (.190)	1.466 (1.472)
Not Detroit and Not White	-1.512 (-1.220)	1.130 (1.297)
White	-1.132 (-1.358)	.5638 (.962)
Percent	.004599 (.266)	-.004920 (-.405)
Max	-.3543 (-.436)	.2715 (.476)
Max Squared	.005686 (.588)	-.003145 (-.463)
Age	-.007056 (-.341)	.03146 (2.165)
Age Squared	-.00000019 (-.007)	-.00003295 (-1.802)
Education	-.4155 (-1.924)	-.05239 (-.344)
Work	.1026 (.352)	.1959 (.958)
Occupation	.2711 (.159)	1.706 (1.426)
Disabled	-.3980 (-.576)	-.3841 (-.792)
Married	-.2831 (-.331)	-.3192 (-.532)
Number of Dependents	.03274 (.115)	-.2618 (-1.315)

TABLE 3.12 (Cont)

Sample Size 334	R Squared .2934	R Squared .7157
Drug Addict	.1893 (.745)	.08841 (.496)
Age First Attention of the Authorities	.2165 (1.331)	-.1695 (-1.481)
Total Previous Convictions	.07019 (.553)	-.1748 (-1.963)
Total Time Served Previous Terms	.009725 (.844)	.04336 (5.356)
D1	.09023 (.065)	.5992 (.615)
C2	-2.011 (-1.232)	.6785 (.591)
Minimum Sentence		.8484 (21.362)

TABLE 3.13

	Robbers		Burglars		Assault		Auto Theft	
	β	γ	β	γ	β	γ	β	γ
Constant	+	+	+		+	+		
Detroit	+							
Detroit and Attempt	-			-				
Not Detroit and Not White	+							
White					-		-	
Percent Rural				-				
Max	+	-			+	-		
Max Squared	-	+			-	+		
Age	-	-	-		-			+
Age Squared	+	+	+		+			-
Education		-	-			-	-	
Work								
Occupation								
Disabled	-			-	-			
Married		-						
Number of Dependents	+		+					
Drug Addict		-	+					
Age First Attention of the Authorities					-	-		-
Total Previous Convictions	+	+	+					
Total Time Served Previous Convictions	+	+	+	+	+			+
Minimum Sentence		+		+		+		+

Detroit and white). This effect is insignificant in each regression for all crime categories.[5]

Percent rural is significant only for time in prison for burglary. Perhaps some rural districts deal more severely with burglars which causes the parole board to be more lenient with burglars from these areas.

Note the consistency of the relationship between minimum and maximum sentences. For both robbery and assault-murder (two categories with long maximums, i.e., 99 years), the β for maximum is positive while the β for maximum squared is negative. There is no a priori reason to expect the relationship between maximum and minimum sentences to take the form shown in Figures 3.2 and 3.4. Therefore two-tailed tests are used. If one-tailed tests are employed or if one-tailed tests are adopted after the results of the first crime category analyzed (robbery) then the relationship for burglars is significant and of the same form: $S = Max \ (.4732) + Max^2 \ (-.002434)$. Note that in both cases the parole board reacts to the judges' sentencing in the same way by shifting the curve to the right and (for most of the relevant region) down, see Figures 3.2 and 3.4.

For all of the crime categories, except auto-theft, the relationship between S and age is significant and has the same shape, see Figures 3.1, 3.3, 3.5. Interestingly, although the β's for auto-theft are insignificant, the γ's are significant and the relationship has the inverse shape with age first increasing and then decreasing time in prison, see Figure 3.6.

Education is significant for every crime category but never for both β and γ. It appears that the parole board attempts to

lower time in prison for better educated persons only if the judge has not already done so.

Work and occupation are anomalies. The model in Chapter II predicted that work would reduce S and T. In these results these variables are never significant. If, however, the model is changed and two-tailed tests are used (i.e., work and occupation are expected to increase S and T because persons with good work habits are more risk averse) then the β for work is significant and positive for burglars and the γ's for work are significant and positive for both burglars and assault-murder.

The model does not predict the sign of the coefficients of occupation. If the model is further changed so that the sentences are expected to be longer, ceteris paribus, for persons who are part-time criminals, then a one-tailed test can be used and the γ for occupation is significant for robbery, burglary, and auto-theft.

The number of dependents increases minimum sentence for robbery and burglary. This supports the hypothesis that in the judges' minds the deterrent effect of sentencing outweighs the suffering of the fatherless families.

The β for drug addiction for burglary is significant and positive white the γ for drug addiction for robbery is significant and negative. This suggests that the judges and the parole board differ on the proper response to addiction.

The final three variables (age at first attention of the authorities, total previous convictions, total time served for previous convictions) are the felon's previous criminal record. For all crimes, total time served for previous convictions increases

time in prison by either a positive β, a positive γ, or both. Age at first attention of the authorities is significant for the less professional crimes of assault-murder and auto-theft, while total previous convictions is more important for robbery and burglary.

3.5 CONCLUSION

This chapter tests the sentencing model presented in Chapter II. Except for the expected effects of work and occupation, the model displays considerable predictive power. The non-linear relationships usually keep the same form for each of the crime categories. The expected judicial discrimination discussed in Section 2.7 exists in at least some categories. There is interaction between judicial and parole board decision-making, with the parole board sometimes agreeing and sometimes disagreeing with the judges' determination of optimal sentences.

Footnotes Chapter III

1 For example (CR-CR*), the difference between the crime committed and the crime charged by the prosecutor, is an important decision which cannot be handled by this model.

2 Minimum sentence is the actual minimum, i.e. the minimum given at the actual judicial sentencing minus the potential time off for good behavior. This actual minimum is called the "special good-time date," or SGD. Judges can if they wish reduce sentences after the initial judicial sentencing. They sometimes reduce sentences on the request of the parole board. This is a complicated and relatively infrequent procedure. In addition, the parole board has standing agreements with some judges allowing for release of all offenders sentenced by these judges ninety days before SGD. For this reason, if a person is released anytime in the interval between SGD and ninety days before SGD, the true minimum sentence is reduced further by ninety days. This presents an error in measurement because the minimums for persons who receive sentences from these same judges and who are kept in beyond the coded SGD are ninety days longer than the true minimum. There is, however, no way of eliminating this error because the data do not include the name of the sentencing judge.

3 <u>Michigan Compiled Laws</u>: <u>Annotated</u>, (St. Paul, Minn.: West, 1967), Vol. 38, 39, 40.

4 Let the five element array C represent the substantive crimes, and the five element array A represent the attempted crimes. The actual crime convicted for has the value one, all other crimes have the value zero (only one of the ten elements in the two arrays

is one, all others are zero.) The array D is the subtraction

of A from C, see examples 1 and 2.

example 1

$$
\begin{array}{ccccc}
\text{C} & & \text{A} & & \text{D} \\
\begin{vmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{vmatrix} & - & \begin{vmatrix} 0 \\ 0 \\ 1 \\ 0 \\ 0 \end{vmatrix} & = & \begin{vmatrix} 0 \\ 0 \\ -1 \\ 0 \\ 0 \end{vmatrix}
\end{array}
$$

example 2

$$
\begin{array}{ccccc}
\text{C} & & \text{A} & & \text{D} \\
\begin{vmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 1 \end{vmatrix} & - & \begin{vmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{vmatrix} & = & \begin{vmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 1 \end{vmatrix}
\end{array}
$$

The first set of regressions uses nine of the ten elements of C

and A as binary variables (one of the elements is dropped because

of singularity). The second set of regressions uses the five

elements of D. Note that the elements of D are not binary:

they can take on three values (-1, 0, +1).

5 Note that the total effect of race on S and T is contained

in two coefficients: white, Not Detroit and not white. For

example equation 3.5 can be rewritten as

$$
S = \beta_0 + \beta_j X_j + \beta_i X_i + \beta_k X_k \cdots \tag{3.8}
$$

where X_j = Detroit, X_i = Not Detroit and not white, X_k = white.

Equation 3.8 can be rewritten as equation 3.9.

$$S = \beta_0 + \beta_j X_j + \beta_i(1-X_j)(1-X_k) + \beta_k X_k \dots \qquad (3.9)$$

$$\frac{\partial S}{\partial X_k} = -\beta_i(1-X_k) + \beta_k = \beta_k + \beta_i(X_j-1) \qquad (3.10)$$

The variance of $\partial S/\partial X_k$ is $\mathrm{Var}[\beta_k + \beta_i(X_j-1)] = \mathrm{Var}\,\beta_k +$

$(X_j-1)^2\mathrm{Var}\,\beta_i - 2(X_j-1)\,\mathrm{Cov}(\beta_k,\beta_i)$ (3.11)

Since X_j is a binary, equation 3.10 can be evaluated for only

two values of X_j: zero and one. If X_j equals one, equation

3.10 equals β_k and equation 3.11 equals $\mathrm{Var}\,\beta_k$. This is the

case presented in Tables 3.5 through 3.12 above. If X_j equals

zero (i.e. not Detroit), then equation 3.10 equals $\beta_k - \beta_i$

(which is effectively "Not Detroit and White") and equation 3.11

equals $\mathrm{Var}\,\beta_k + \mathrm{Var}\,\beta_i + 2\,\mathrm{Cov}(\beta_k, \beta_i)$

$$\beta_k - \beta_i /\!/\overline{\mathrm{Var}\,\beta_k + \mathrm{Var}\,\beta_i + 2\,\mathrm{Cov}(\beta_k, \beta_i)} \qquad (3.12)$$

Equation 3.12 yields a t-statistic which is insignificant for

both regressions for each of the crime categories.

CHAPTER IV

4.1 INTRODUCTION

This chapter deals with three hypotheses developed in Chapter
II: Hypothesis (1) relates time in prison and recidivism. This
relationship is ambiguous because it is impossible to predict, a
priori, either its sign or size. Section 3.5 shows that previous
convictions and previous time in prison increase expected punish-
ment for a released offender. But the disutility associated with
this punishment could have either been increased or decreased by
time in prison. While in prison, an individual may have received
psychological and medical aid along with trade-training so that his
lawful wage increased and his unlawful wage decreased. On the other
hand, he may have associated with hardened criminals while losing
lawful skills so that his lawful wage decreased and his unlawful
wage increased. Hypothesis (2) is implied in the Ehrlich model pre-
sented in Section 2.3 which predicts that in many crime categories
non-whites will be better educated than whites. The Ehrlich model
also implies Hypothesis (3), namely, that offenders convicted of
Type II (skilled) crimes will be better educated and more likely to
have a skilled occupation than offenders who commit Type I crimes.

These hypotheses can be restated as (1) the probability an
individual recidivates is a function of his background, including
time in prison; (2) the probability an offender is white is a

function of his background, especially his education with an increase in education decreasing the probability; (3) the probability an offender committed Type II crimes is a function of his background, especially his education, his age at entry into criminal behavior, and his lawful occupation.

4.2 THE DATA

The data used are the records of all male persons released in 1970 whose current conviction is for one of the relevant crimes: robbery, burglary, assault-murder, auto-theft as defined in Tables 3.1 through 3.4; and the more skilled crimes listed below in Table 4.1. The crimes in Table 4.1 are hereafter referred to as Type II crimes. Any person who was returned to prison by the end of 1972 is treated as a recidivist. There are potential problems with the data: Recidivism is not necessarily the same as being convicted of a subsequent crime. The results are biased to the extent that the probability of committing a crime and not being caught is a function of the independent variables, i.e., better educated persons are less likely to be caught. Mobility is also important because persons caught and sentenced in other states are not counted as recidivists. In addition, released prisoners who are subsequently convicted but not sentenced to prison are not counted as recidivists. A check of two hundred criminal histories in the Data Section of the Michigan Department of Corrections revealed only one case of a subsequently convicted person not being returned. Therefore this second problem should not significantly bias the results.

The definition of variables used to estimate the three probabilities are

TABLE 4.1   Type II Crimes

Crime	Maximum	Statute Number
Writing Checks with no Account	2 years	750131A
Larceny by Conversion	5 years	750362
Larceny by False Personation	5 years	750363
Receiving Stolen Property	5 years	750535
Forgery	14 years	750248
Uttering and Publishing Bad Checks	14 years	750249

1. Detroit SMSA (1 = Detroit SMSA, 0 = otherwise).

2. Percent Rural (percent of the country the felon resides in which was rural in the 1970 census).

3. Age at Release (in months).

4. Education (number of years of education).

5. I.Q. (score in I.Q. test with $u = 100$, $\sigma = 15$).

6. Grade Reading (1 through 12).

7. Skilled Occupation (1 = Farmer, skilled trade, Own Business, Professional, Clerk, Student, Business Mgt., Office Work, Sales, 0 = otherwise).

8. Married (1 = Married, 0 = otherwise).

9. Number of Dependents.

10. Drug Addiction Status (1 = None, 2 = Experienced, 3 = Occasional, 4 = Sustained, 5 = Addicted).

11. Alcohol (1 = None, 2 = Moderate, 3 = Moderate with Low Tolerance, 4 = Problem, 5 = Chronic).

12. Age -- First Attention of the Authorities (1 = 8-10 years old, 2 = 10-12 years, 3 = 13-14 years, 4 = 15-16 years, 5 = 17-18 years, 6 = 19-20 years, 7 = 21 years-open).

13. Total number of Previous Convictions.

14. Total time in months served (in jail or prison for all previous convictions).

15. Seriousness (the maximum sentence associated with the substantive crime that the individual was convicted of).

16. Time served present term (in months).

Note that the drug and alcohol variables are qualitative. They are not converted into series of binary variables because the number of such binary variables would be prohibitive.

4.3 TECHNIQUE

The problems inherent in estimating probabilities is well documented in the literature. A binary dependent variable violates

the assumptions necessary to use linear regression successfully (or any other type of analysis that assumes a normally distributed error term). Various techniques have been suggested by Goldberger,[1] Tobin,[2] Nerlove,[3] and others. The method employed in this thesis is the one developed by Nerlove: Multivariate Logistic Models.

This method has several advantages, one of which is that it allows for simultaneous estimation of up to four probabilities and includes the interaction of the various probabilities. Generally the model is as follows:

$$P = 1/(1 + e^{-\Sigma \alpha_i Z_i}) \quad .$$

Where P is the probability, the Z's are the variables, and the α's are the coefficients. As $-\Sigma \alpha_i Z_i$ approaches negative infinity, $P = 1/1 + 0 = 1$. As $-\Sigma \alpha_i Z_i$ approaches positive infinity, $P = 1/1 + \infty = 0$. Therefore P is bounded by 0 and 1. The error term does not have a linear relationship with the dependent variable and therefore maximum likelihood methods are used to estimate the Z's.

The Nerlove approach allows for simultaneous testing of Ehrlich's hypotheses and estimating the probability of recidivism. Table 4.2 presents the results for all individuals. The values of the coefficients are listed in columns under each of the three relevant dependent variables: Recidivism, White, Type II crime. Below each coefficient in parentheses are the t-statistics.

4.4.1 RECIDIVISM

The following variables are significant and increase the probability of recidivism: grade reading, number of dependents,

TABLE 4.2

	Recidivism	White	Type 2 Crime
	Sample Size = 1051	Log of likelihood function = -1571.95165	
Constant	-.2632 (.768)	-3.134 (8.003)	-1.262 (3.517)
Detroit SMSA	.03640 (.212)	.1309 (.672)	-.08060 (.501)
Percent Rural	-.0001622 (.049)	.02382 (5.202)	.007415 (2.426)
Age at Release	-.002740 (4.058)	-.0003226 (.491)	.00009292 (.154)
Education	.004639 (.138)	-.09301 (2.412)	.06528 (1.714)
I.Q.	.0002844 (.110)	.03282 (10.634)	.006245 (2.289)
Grade Reading	.03797 (2.293)	.05675 (2.919)	-.03586 (1.978)
Skilled Occupation	-.2811 (2.583)	.2032 (1.845)	.1266 (1.275)
Married	-.2347 (2.213)	.08443 (.737)	.1123 (1.078)
Number of Dependents	.07203 (2.276)	.02249 (.616)	-.009852 (.289)
Drug Addict	.03447 (1.321)	-.1917 (5.479)	.03082 (1.133)
Alcohol	.04972 (1.537)	.1190 (3.254)	-.01591 (.467)
Age First Attention	.0008989 (1.727)	-.0008933 (1.583)	-.0001857 (.370)
Previous Convictions	.01385 (.894)	.04516 (2.681)	-.01032 (.649)
Time Served Previous Terms	.004513 (3.080)	-.001644 (1.013)	.001589 (1.106)

TABLE 4.2 (Cont)

	Recidivism	White	Type 2 Crime
Seriousness	.0004562 (.374)	-.001808 (1.245)	-.02239 (5.137)
Time Served Present Term	.004362 (1.960)	.001429 (.698)	.002929 (1.550)
Recidivism		-.04743 (1.001)	.09107 (2.151)
White	-.04743 (1.001)		.08349 (1.763)
Type 2 Crime	.09107 (2.151)	.08349 (1.763)	

age first attention of the authorities, tot/ ι time served previous convictions, time served present term, type II crimes. If one-tailed tests are used, drug and alcohol addiction are significant and increase the probability of recidivism. These results are some-what surprising in that there are no a priori reasons to expect persons who read better or who enter criminal careers at a later age to have higher probabilities of recidivism. The important variable in terms of policy is time served for present conviction. The positive co-efficient shows, that ceteris paribus, an increase in prison time increases the probability of returning to prison. Therefore shorter sentences are optimal in terms of recidivism.

The following variables decrease the probability of recidivism: Age at release, skilled occupation, and married. It is interesting that number of dependents increases and being married decreases the probability of recidivism. Note also that skilled occupation de-creased and skilled crime (Type II) increases the probability.

4.4.2 WHITE

The Ehrlich model (see Section 2.3) predicts that non-whites in many crime categories will be better educated than whites. The coefficient for education is negative (i.e., ceteris paribus, the better educated a person the less likely he is to be white). This supports the Ehrlich hypothesis. But the results also show that, ceteris paribus, the higher the I.Q. the more likely the person is to be white. I.Q. tests may, however, be culture bound and there-fore underestimate the intelligence of non-whites. Note that the coefficient for skilled occupation is significant and positive, i.e.,

whites are more likely to have a skilled occupation. This also

supports the thesis of Ehrlich and others that non-whites are more

likely to engage in crime because they are denied equal entry into

other occupations. The results which support the Ehrlich thesis

are in spite of the fact that the expected sentence, $F_i(T_i)$, for

non-whites is greater than for whites. To the extent that this

greater $F_i(T_i)$ deters non-whites, the results in Table 4.2 under-

estimate the "Ehrlich discrimination effect". White is also

positively related to percent rural and number of previous convic-

tions. Interestingly, ceteris paribus, non-whites are more likely

to be drug addicts while whites are more likely to be alcoholics.

4.4.3 TYPE II CRIMES

The Ehrlich model (see Section 2.3) also predicts that persons

who commit Type II crimes are better educated, are older when they

enter into criminal careers, and are more skilled in lawful occupa-

tions. The results in Table 4.1 show that, ceteris paribus, they are

better educated and have higher I.Q.'s, but that their grade reading

is lower. The coefficient associated with skilled occupation is

positive but it just barely misses being significant. Age at first

attention to the authorities is insignificant. Ceteris paribus,

persons who commit Type II crimes are also more likely to be white

and from rural areas. Finally the recidivism rate is higher,

ceteris paribus, for persons who commit Type II crimes. (This may in

part explain why the results of Tables 3.5 - 3.12 show that persons

with occupations (not necessarily skilled occupations) received longer

sentences.) Table 4.3 presents two-way contingency tables of the

independent variables.

TABLE 4.3

RECIDIVISM

		No	Yes
	No	505	193
WHITE	Yes	263	90

RECIDIVISM

		No	Yes
	No	566	193
TYPE II CRIME	Yes	202	90

WHITE

		No	Yes
	No	546	213
TYPE II CRIME	Yes	152	140

4.5 INDIVIDUAL TYPE I CRIMES

Tables 4.4 through 4.7 contain the results for the four Type I crimes: robbery, burglary, assault-murder, auto-theft separately. Only Table 4.4 satisfies the convergence criteria of the Nerlove computer program. Although the likelihood functions for the other three crime categories do not converge, the coefficients are stable and the logs of the likelihood functions change very little during the last several iterations. These tables follow the format of Table 4.2, except that only two dependent variables are used: recidivism, white.

Table 4.4 shows that grade reading, number of dependents, and time served for previous convictions increase the probability of recidivism for persons convicted of robbery. Age at release and married decrease the probability. The probability of a convicted robber being white is increased by Detroit SMSA, percent rural, I.Q., grade reading, skilled occupation, alcohol, and number of previous convictions; and is reduced by education, drug addiction, and time served for previous terms.

Table 4.5 shows that for persons convicted of burglary, drug addiction and time served for previous convictions increase the probability of recidivism. Age at release reduces this probability. The probability that a burglar is white is increased by age at release, I.Q., grade reading, number of dependents; and is decreased by drug addiction, age at first attention of the authorities, and time served for previous convictions.

Table 4.6 shows that for assault-murder, age at release, and alcohol reduce the probability of recidivism. Number of previous

TABLE 4.4 ROBBERY

	Sample Size = 270	Log of Likelihood Function = -233.571746
	Recidivism	White
Constant	-.02599 (.031)	-6.136 (5.245)
Detroit SMSA	.06814 (.137)	1.166 (1.822)
Percent Rural	-.002986 (.237)	.03670 (2.556)
Age at Release	-.004238 (2.607)	.001143 (.631)
Education	-.06301 (1.018)	-.1733 (1.938)
I.Q.	.003534 (.714)	.04036 (5.434)
Grade Reading	.1197 (2.332)	.1686 (2.648)
Skilled Occupation	-.05904 (.229)	.4677 (1.374)
Married	-.3977 (1.691)	.3011 (1.035)
Number of Dependents	.2467 (3.057)	-.002065 (.019)
Drug Addict	-.002901 (.051)	-.2766 (2.371)
Alcohol	.006622 (1.003)	.2513 (2.794)
Age First Attention	.001620 (1.369)	.0005918 (.417)
Previous Convictions	.02479 (.713)	.1505 (3.458)
Time Served Previous Terms	.008722 (2.569)	-.006872 (1.511)

TABLE 4.4 (Cont)

	Recidivism	White
Seriousness	-.0007626 (.438)	-.0008121 (.320)
Time Served Present Term	.004540 (1.250)	.003852 (.841)
White	-.09428 (.855)	
Recidivism		-.09428 (.855)

TABLE 4.5 BURGLARY

	Sample Size = 257	Log of Likelihood Function = -245.341208
	Recidivism	White
Constant	.6408 (.846)	-2.958 (3.672)
Detroit SMSA	.07839 (.213)	-.2701 (.734)
Percent Rural	.003013 (.384)	.01342 (1.556)
Age at Release	-.004248 (2.751)	.002610 (1.927)
Education	-.1078 (1.538)	.04348 (.515)
I.Q.	-.0007902 (.150)	.03063 (4.960)
Grade Reading	.002015 (.068)	.8609 (2.663)
Skilled Occupation	.1078 (.554)	-.1133 (.525)
Married	-.1194 (.637)	.02953 (.138)
Number of Dependents	.06003 (.999)	.1109 (1.590)
Drug Addict	.07732 (1.670)	-.2070 (3.447)
Alcohol	.06461 (.899)	.1688 (2.174)
Age First Attention	.0008543 (.853)	-.005329 (3.349)
Previous Convictions	.003488 (.114)	-.01083 (.334)
Time Served Previous Terms	.005726 (2.020)	-.002284 (.729)

TABLE 4.5 (Cont)

		White
Seriousness	.05397 (1.152)	.05570 (1.074)
Time Served Present Term	.0001162 (.007)	-.03183 (1.801)
White	.08492 (.952)	
Recidivism		.08492 (.952)

TABLE 4.6 ASSAULT-MURDER

	Sample Size = 107	Log of Likelihood Function = -74.7894427
	Recidivism	White
Constant	-1.257 (.863)	-5.506 (3.179)
Detroit SMSA	.07322 (.104)	1.731 (1.507)
Percent Rural	-.0003608 (.023)	.05910 (2.564)
Age at Release	-.003809 (1.792)	-.002251 (1.124)
Education	.08166 (.557)	-.2046 (1.718)
I.Q.	.005386 (.468)	.04703 (3.950)
Grade Reading	.09995 (1.348)	.06187 (.587)
Skilled Occupation	-.08205 (.220)	.6572 (1.866)
Married	-.4563 (.982)	.7663 (1.611)
Number of Dependents	.1171 (1.368)	-.07550 (.703)
Drug Addict	.07877 (.367)	-.1195 (.549)
Alcohol	-.2516 (1.931)	.1259 (.945)
Age First Attention	.001441 (.723)	.0006221 (.345)
Previous Convictions	.2085 (2.938)	.04436 (.646)
Time Served Previous Terms	.00005504 (.009)	.0008178 (.119)

	Recidivism	White
Seriousness	-.0009543 (.181)	.01099 (2.093)
Time Served Present Term	.008657 (1.154)	-.008888 (1.142)
White	-.1010 (.470)	
Recidivism		-.1010 (.470)

TABLE 4.7 AUTO-THEFT

	Sample Size = 125	Log of Likelihood Function = -98.9886102
	Recidivism	White
Constant	-1.019 (.569)	-3.898 (2.585)
Detroit SMSA	-1.473 (1.330)	.9490 (.918)
Percent Rural	-.01484 (.700)	.07371 (2.873)
Age at Release	-.004802 (.974)	.001280 (.458)
Education	.1841 (1.167)	-.1520 (1.425)
I.Q.	.008364 (.851)	.02673 (3.084)
Grade Reading	.1385 (1.790)	-.07099 (.825)
Skilled Occupation	-.9103 (1.697)	.2505 (.740)
Married	-.4101 (.785)	-.5810 (.970)
Number of Dependents	.2032 (1.095)	.008761 (.061)
Drug Addict	.02697 (.227)	-.2266 (1.234)
Alcohol	.009365 (.065)	.1389 (1.040)
Age First Attention	.0001930 (.055)	-.0001422 (.047)
Previous Convictions	.01849 (.211)	.1176 (1.945)
Time Served Previous Terms	-.006146 (.637)	-.01326 (1.399)

TABLE 4.7 (Cont)

	Recidivism	White
Seriousness	.03342 (.333)	.01464 (.154)
Time Served Present Term	.04470 (1.238)	-.007565 (.240)
White	-.3563 (1.633)	
Recidivism		-.3563 (1.633)

convictions increases the probability. Obviously, there is no a priori reason to expect alcoholics to be better risks. The probability of being white is increased by percent rural, I.Q., skilled occupation, and seriousness. Education reduces the probability of being white.

Finally Table 4.7 shows that for auto-theft, white and skilled occupation reduce the probability of recidivism. Grade reading increases the probability. Percent rural, I.Q., and number of previous convictions increase the probability of being white. Education and recidivism reduce the probability of being white.

4.6 CONCLUSION

This chapter tests several of the hypotheses developed by the Ehrlich model. Although not all of these hypotheses are supported by the data, the results show that the Ehrlich model has considerable predictive power. Specifically, the predicted relationships between race, education, and crime are accurate. This chapter also presents the first use of non-linear regression to estimate the probability of recidivism.

Footnotes Chapter IV

1 Arthur S. Goldberger, <u>Econometric</u> <u>Theory</u>, (New York: Wiley, 1964)
   p. 248-255.

2 James Tobin, "Estimation of Relationships for Limited Dependent
   Variables," <u>Econometrica</u>, Vol. 26, no. 1 (1958) p. 26-36. The data
   was used in a tobit analysis with time out of prison before return
   as the dependent variable. If a person had not returned by the
   end of the time period (December, 1972) he is at the limit. The
   results from these analyses are very similar to those obtained
   using the Nerlove method.

3 Marc Nerlove and James Press, <u>Univariate</u> <u>and</u> <u>Multivariate</u> <u>Log-</u>
   <u>Linear</u> <u>and</u> <u>Logistic</u> Models, (Santa Monica: Rand, 1973). This book
   contains an extensive bibliography dealing with binary dependent
   variables.

CHAPTER V

SUMMARY AND CONCLUSIONS

Chapter II presents two models. The first, Ehrlich's generates hypotheses about individual participation in crime which are tested in Chapter IV. The second model generates hypotheses about judges' and the parole board's response to crime which are tested in Chapter III.

Chapter III (especially Table 3.13) shows that the model of judicial sentencing and parole board decision making has considerable predictive power. Except for work and occupation, all the variables affect sentencing and/or parole board decision making in at least one crime category. There is evidence in the robbery category of a sentencing differential between pleading and trying a case in the Detroit Recorder's Court which is the State's most crowded. In three of the four crime categories, (robbery, assault-murder, auto-theft) there is evidence of racial discrimination against non-whites. For the categories of robbery, burglary, and assault-murder, the relationship between sentence and age is non-linear with an increase in age first decreasing and then increasing minimum sentence and time in prison. For robbery and assault-murder, the relationship between maximum and minimum sentences is also non-linear with an increase in maximum increasing minimum at a decreasing rate. In all of the crime categories, education reduces time served. Number of dependents

increases minimum sentence for robbery and burglary. For assault-murder and auto-theft, people who began their criminal careers at a younger age spend more time in prison. In the categories of robbery and burglary, the total number of previous convictions increases time in prison. For all categories the total time served for previous convictions increases time served for the present conviction.

Chapter III also shows that there is interaction between judicial and parole board decision making. This is especially true in those categories where pleading to attempts brings longer minimum sentences. For robbery and assault-murder, the parole board attempts to offset the judges' actions.

Chapter IV shows that recidivism is increased by grade reading, number of dependents, age first attention of the authorities, time served for previous terms, time served for present term, and Type II (skilled) crimes. The Ehrlich hypothesis that in many crime categories, non-whites are better educated than whites is supported by the data. In addition, whites are more likely to have skilled occupations, to be from rural regions, to have more convictions, and to score higher on I.Q. tests. Persons who commit Type II crimes are better educated, more likely to be white, to be from rural regions, and to return to prison.

These results are consistent with many recent works in showing that economic analysis generates testable and useful theories of both criminal behavior and of society's response to crime. This result is gratifying. Economic theory assumes rational behavior and is capable of simultaneously handling numerous causes and effects. This allows for much more realistic theories in what has been a

sterile area where many researchers are convinced that criminals are somehow different from the rest of mankind and that if this difference can be discovered and eliminated crime will stop.

The evidence in certain crime categories of judicial discrimination against non-whites and against persons who plead to attempts is in conflict with the supposed equal protection of the law. Sentencing a person more harshly because he is not white is unconstitutional (although not necessarily irrational). Likewise, punishing persons for making perfectly legal deals with prosecutors is in effect making a lawful action unlawful without revealing its illegal status. Unfortunately, it is judges who are charged with both sentencing and protecting constitutional rights. This creates a conflict of interests between judges' desires to keep cases moving and their desires to protect the constitutional rights of the accused One possible solution would be to remove the sentencing function from the trial judge and give it to another judge or judges who would not know either the race of the defendent or how his guilt was determined.

Table 4.2 shows that in terms of recidivism, sentences appear to be longer than optimal. But there is considerable evidence that longer sentences deter crime. Therefore, it is impossible to evaluate the quality of judicial sentencing in terms of crime reduction. It is clear that because sentencing has several objectives, the optimal sentence will be very difficult to discover.

The results of Table 4.2 also support the Ehrlich hypothesis that racial discrimination increases criminal activity among non-whites and that an increase in lawful opportunities reduces Type I

crimes. To the extent that society desires equal opportunity for all its members, any attempts to achieve this goal will probably yield the additional benefit of a reduction in Type I crimes.

Finally, whatever its shortcomings, this thesis is the first use of economic analysis to both explain and measure judicial and parole board decision making. It is also the first use of non-linear regression to look at recidivism. Although it borrows heavily from Ehrlich, most of this thesis is an extension -- not a restatement -- of what is known about human behavior.

APPENDICES

APPENDIX A

THE EHRLICH MODEL[1]

There are three types of activities an individual can engage in: (c) consumption or non market activity, (1) legal market activity, (i) illegal market activity. The individual has a limited amount of time (T_o) to allocate between the three activities: $T_o = T_c + T_1 + T_i$.

Legal activity involves no risk and has a net return of $W_1 (T_1)$. Illegal activity involves risk. There is a probability (P_i) of capture and conviction. If the criminal is not captured and punished he receives $W_i (T_i)$. If he is captured and punished he receives $W_i (T_i) - F_i (T_i)$ where $F_i (T_i)$ is the pecuniary and non-pecuniary loss due to punishment.

The individual maximizes the expected utility of U_s where s is a given state of the world.

$$U_s = U(X_s, T_c)$$

X_s is the stock of some composite good necessary for the existence of state s. It includes assets, earnings, and the non-pecuniary gains from both legal and illegal activities. In this model there are two states of the world.

$$X_b = W' + W_i (T_i) + W_1 (T_1)$$

$$X_a = W' + W_i (T_i) + W_1 (T_1) - F_i (T_i)$$

W' is wealth.

Expected utility $EU(X_s, T_c)$ is $(1 - P_1) U(X_b, T_c) + P_1 U(X_a, T_c)$. The individual maximizes expected utility subject to a time constraint $(T_o - T_c - T_1 - T_i)$ with $T_c \geq 0$, $T_1 \geq 0$, $T_i \geq 0$. The maximization gives the following first order Kuhn-Tucker conditions

$$\partial EU/\partial t - \lambda \leq 0$$

$$(\partial EU/\partial t - \lambda) t = 0$$

t represents T_c, T_1, and T_i.

Given that T_c is at the optimum level $(dW_i/dT_i - dW_1/dT_1)/(dW_i/dT_i - dF_i/dT_i - dW_1/dT_1)$ is the slope of the opportunity curve or the transformation curve of X between the two possible states of the world. The slope of the indifference curve between the two states of the world is $(P_1 U'(X_a))/((1 - P_1)U'(X_b))$. If the individual engages in both i and 1, at equilibrium the slope of the indifference curve must equal the slope of the transformation curve. This will happen if the indifference curve is strictly convex to the origin and the opportunity curve is linear or strictly linear.

Graphically let point 1 represent the quantity of X associated with a certain amount of criminal activity, see Figure A.1.

FIGURE A.1
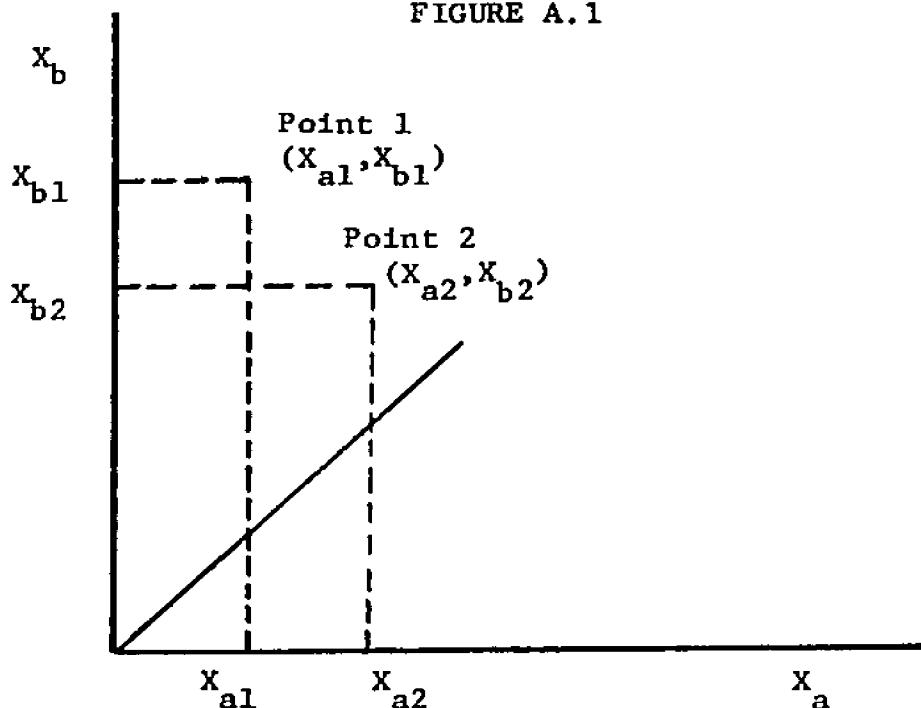
X_{b1} represents the amount of X consumed if the individual is not captured and punished. X_{a1} represents the amount if he is captured and punished. Point 2 (X_{a2}, X_{b2}) is the amounts of X associated with a lesser amount of criminal activity. Compared to point 1 the individual receives a smaller return if he is not captured and punished, $X_{b1} > X_{b2}$, and a greater return if he is captured and punished, $X_{a2} > X_{a1}$. If X_a's and X_b's for all levels of criminal activity are plotted they may take the form shown in Figure A.2.

FIGURE A.2
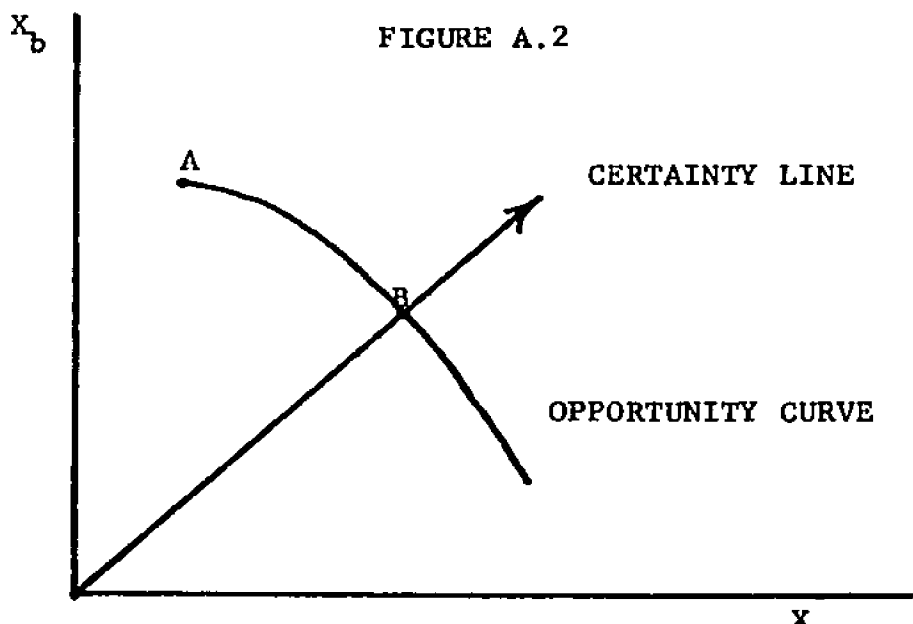
At point B, $X_a = X_b$, i.e., the individual knows with certainty the amount of X he can consume. At points below the certainty line the individual has a greater return if he is captured and punished than if he escapes. Therefore a person will engage only in legal activities to the right of the certainty line unless he loves risk. At point A the individual engages in criminal activity exclusively because $(dW_i/dT_i) - (dW_1/dT_1)$ is greater than (dF_i/dT_i), i.e., even if he is captured and punished the criminal gains from the crime.

The following can be proven:

(1) If the indifference curve is strictly convex to the origin and the opportunity curve is linear or strictly concave then the individual will engage in both i and 1, see Figure A.3.

FIGURE A.3
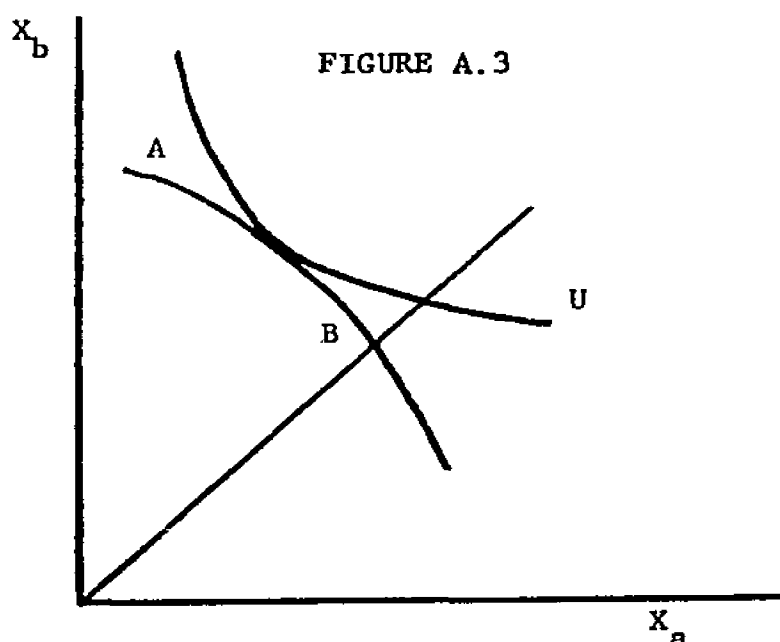
(2) For people who are risk neutral or risk avoiders necessary and sufficient conditions for engaging in both i and 1 are that the absolute slope of the opportunity curve is greater than the absolute slope of the indifference curve at point B. For risk lovers these are sufficient conditions.

(3) If W_i (T_i) and W_1 (T_1) are not related to attitude towards risk then <u>ceteris</u> <u>paribus</u> a risk lover will engage in more i than a risk neutral person who will in turn engage in more i than a risk avoider.

(4) An increase in either P_i or (dF_i/dT_i) <u>ceteris</u> <u>paribus</u> reduces i. If the potential criminal is risk neutral, equal percentage changes in P_i or (dF_i/dT_i) have the same negative impact on i. If the individual is a risk avoider an increase in (dF_i/dT_i) has a greater impact than an equal percentage increase in P_i. The converse is true for risk avoiders.

(5) If the individual is a risk lover but is not at point A, an increase in the average penalty might not deter i, it could even increase it. "This result is not inconsistent with an assertion often made by writers on criminal behavior regarding the low, or even the positive effect of punishment of the criminal propensities of <u>some</u> offenders. Such behavior is here found to be consistent with preference for risk and need not be interpreted as evidence of an offender's lack of response to incentives."[2]

(6) An increase in W_i (T_i) relative to W_1 (T_1) because of a change in one or both of the wage rates increases i.

(7) If wealth in all states of the world increases by an equal proportion (for example if there is an equal percentage increase in W_1 (T_1) and W_i (T_i)), and if the individual has increasing relative risk aversion, there will be a substitution of 1 for i. This implies that the rich have a lower propensity for i than the poor.

(8) This model can be expanded by dropping the assumption that there is no risk of unemployment associated with 1. "The basic implications

of the preceding analysis hold with some modifications in this more general case as well."[3]

Footnotes Appendix A

1 Isaac Ehrlich, "Participation In Illegitimate Activities: A
   Theoretical and Empirical Investigation," Journal of Political
   Economy, Vol. 81, No. 3, (May/June, 1973) p. 521-565.

2 Ibid., p. 530.

3 Ibid., p. 529.

APPENDIX B

The following quotations from the literature on sentencing

is non quantitative support for the sentencing theory of Chapter II.

(A) Crime:

Guides For Sentencing,[1] which was written by a panel of judges for

the National Council on Crime and Delinquency contains in Chapter 4

a discussion of factors a judge should consider. The first is

entitled:

"THE OFFENSE

. . . .
Was this an offense against a person? Was violence used? ...
    If the offense was one of violence, was the defendant armed or
unarmed? ...
    Was this an offense against property? Was it a violation of
trust?
    Was the offense committed as a result of unusual circumstances,
or rather as part of an established behavior pattern?" (pp. 33, 34)

Sentencing Alternatives and Procedures,[2] which was written by the

American Bar Association Project on Minimum Standards For Criminal

Justice gives three reasons for total confinement (imprisonment).

One of these reasons is the seriousness of the offense:

"It would unduly depreciate the seriousness of the offense to impose
a sentence other than total confinement." (Sec. 2.5, (C), (iii))

The Model Penal Code,[3] written by the American Law Institute states

the following:

"Section 7.01 . . . .
(1) The Court shall deal with a person who has been convicted of a
crime without imposing sentence of imprisonment unless,... it is of
the opinion that his imprisonment is necessary for protection of the
public because:

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....
(C) a lesser sentence will depreciate the seriousness of the
    defendant's crime.
(2) The following grounds,... shall be accorded weight in favor of
withholding sentence of imprisonment:
   (a) the defendant's criminal conduct neither caused nor threatened
       serious harm;
   (b) the defendant did not contemplate that his criminal conduct
       would cause or threaten serious harm;
       ....
   (d) there were substantial grounds tending to excuse or justify
       the defendant's criminal conduct, though failing to establish
       a defense,..."

(B) Previous Criminal Record

The Model Penal Code, Section 7.01, (2) gives the following justifica-

tion for lenient sentences:

"....
(g) the defendant has no history of prior delinquency or criminal
    activity or has led a law-abiding life for a substantial period
    of time before the commission of the present crime.

Section 7.03 ....

"The Court may sentence a person who has been convicted of a felony
to an extended term of imprisonment if it finds....
(1) The defendant is a persistent offender whose committment for an
extended term is necessary for protection of the public.

(2) The defendant is a professional criminal....

(3) The defendant is a dangerous, mentally abnormal person....

Guides For Sentencing (p. 38) says:

"More significant than age itself may be the date when criminal be-
havior first began... An early pattern of truly criminal behavior
and associations which has persisted despite constructive community
efforts to alter it may suggest the need for a committment which will
produce the necessary change in a controlled setting."

(C) Demographic Background

Guides For Sentencing list (pp. 37-41) the following as legitimate

considerations of the sentencing judge:

"AGE
The vast majority of ordinary offenses are committed by persons under
twenty-five years of age... The less time there has been for the
offender to develop bad habits, the better his chances for rehabilita-
tion....

FAMILY BACKGROUND AND RELATIONSHIP
The defendant whose parents, brothers, and sisters have respected
society's demands of law and order,... and whose family members are
eager to help him, is a better probation risk than one who does not
have these advantages....

SOCIAL ADJUSTMENT
Social adjustment may be measured in several areas -- education,
employment, church activities, social group activities, military
service, management of money....

Educational record may be a pertinent measure of adjustment if the
school experience has been fairly recent. A record of reasonably
successful school adjustment and educational achievement generally
represents positive traits.

A history of stable, steady employment, with job changes made primarily
for improvement, usually indicates good social adjustment....

His military service record should be examined to ascertain whether
it shows evidence of disciplinary problems....

MARITAL STATUS
...."

The Model Penal Code, in Section 7.01, (2) gives the following justifica-

tion for leniency:

"....
(i) the character and attitudes of the defendant indicate that he is
     unlikely to commit another crime.
(j) the defendant is particularly likely to respond affirmably to
     probationary treatment.
(k) the imprisonment of the defendant would entail excessive hard-
     ship to himself or his dependents."

(D) The individual is offensive in court if he is not repentant or

if he forces the courst to try the case when his guilt is obvious.

The staff of the Yale Law Journal sent questionnaires to 240 federal

district judges from which it concluded that "The predominant basis

for a court's considering a defendant pleading guilty less culpable

than one denying guilt is the belief that a guilty plea demonstrates

the readiness of the accused to accept responsibility for his criminal

act. Judges feel that such a confession of wrongdoing evinces a

repentant attitude.... The view was expressed that a defendant faced with overhwelming evidence of guilt who presented a frivolous defense in a desperate gamble to sway a jury deserved additional punishment.[4]

The fact that retribution as an element in sentencing is so often condemned by some judges shows at least some other judges consider it proper. The following is part of a speech, entitled The Need For Sentencing Reform,[5] given by Thomas Kavanaugh, Chief Justice of the Michigan Supreme Court:

"There are those who seriously contend that this 'eye for an eye' philosophy fulfills a very basic need in the individual and that part of our criminal law sentencing theory should reflect this all too human need for revenge. 'Let the punishment fit the crime,' we are told. That the law should cater to such base instincts I find indefensible and the idea that a criminal 'owes a debt to society' is no longer advanced by enlightened penologists."

Guides For Sentencing, (p. 45) takes a more sympathetic view of retribution:

"The community's attitude towards crime and criminals is a factor the judge must weigh in determining a sentence. It varies according to the nature and circumstances of an offense; the background of the offender; the volume of criminality, especially recent criminality; its atmosphere of security or its fears and prejudices; its local history and traditions; and even its size."

Footnotes Appendix B

1   Guides For Sentencing, (New York: National Council on Crime and Delinquency, 1968).

2   Sentencing Alternatives and Procedures, (New York: American Bar Association, 1968).

3   Model Penal Code, (New York: American Law Institute, 1962).

4   "The Influence of the Defendant's Plea On Judicial Determination of Sentencing," Yale Law Journal, Vol. 66, No. 2, (December, 1956) p. 204-220.

5   Conference Proceedings From Conference On Sentencing, (Lansing: (Michigan Crime and Delinquency Council, Michigan Corrections Commission, 1966) p. 3, 4.

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