Journal of Quantitative Criminology, Vol. 5, No. 4, 1989

An Economic Model of Social Sensitivity: The Case of Individual Criminal Behavior

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In general, economists have modeled criminal behavior as a problem in time allocation under uncertainty. Their Friedman-Savage utility models have been based on the binomial probability distribution and then tested using aggregate data on crime rates and neglect the nonpecuniary aspects of crime. This paper overcomes the shortcomings of previous work. Specifically, criminal activity is modeled with an underlying geometric probability process and explicitly accounts for the moral and social compromise involved in becoming a criminal. The empirical model enables the quantification of the criminal's moral and social sensitivity using data based on a consolidated file of police records and a cohort survey of criminals and noncriminals. On the basis of this unique data set, it is found that the included individual criminals are risk averse and that gang membership reduces social sensitivity.

KEY WORDS: moral sensitivity; social sensitivity; individual criminal behavior; risk aversion and crime; crime in an age cohort.

1. INTRODUCTION

Economists analyzing the phenomenon of criminal behavior have long recognized the problem of incorporating noneconomic factors into their analysis. There is general agreement that criminal activity is indeed affected by such variables as education (formal and informal) which generate sets of social values (Palmer, 1977). These values could motivate or inhibit criminal activity, depending on the source and framework in which the education was acquired. Thus criminal activity is not determined merely by gain and loss considerations. Nonpecuniary variables affect the level of criminal activity, and the question is how they can be introduced in models of economic behavior and/or be incorporated in empirical work. This is the core of this paper.

Most economic tests[4] bypass the need to introduce explicitly non-

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[4]See Becker (1968), Ehrlich (1973), Sjoquist (1973), Hakim *et al.* (1978), and Balkin and McDonald (1981).

0748-4518/89/1200-0353$06.00/0

pecuniary elements into their analysis by defining a monetary equivalent to these elements. One could then proceed to analyze criminal activity through traditional utility functions based on income or wealth. Breaking with this tradition, Block and Heineke (1975) formulated a model in which utility is determined by the level of wealth and by the time spent on legal and illegal activities, separately. By doing so they were able to analyze what they call "ethical costs."

Another approach to this same issue is presented by Sagi and Weinblatt (1982), in which it is assumed that an individual's utility is not directly affected by the level of criminal activity but, rather, by two possible variables of a dichotomous nature: the once-and-for-all decision to break the law and the consequence of this activity, i.e., possible apprehension and recognition by the community as a criminal.

The theoretical model in Section 2 is inspired by the Sagi and Weinblatt approach and focuses on the role of moral and social sensitivity in determining the level of criminal activity. The theoretical model also corrects a long-standing error in formulations of criminal behavior, most of which are based on the early work of Becker (1968) and Ehrlich (1973). In these models it is assumed that there are only two possible states of the world, unapprehended and apprehended. In fact, in a time allocation problem, the time to apprehension is of more than passing interest to the criminal. Similarly, the crime on which first arrest occurs is of concern to the criminal. In either case there are more than two possible states of the world for the determination of expected utility. Namely, the criminal can be apprehended after one crime, after two crimes, or after n successful crimes. The utility from one crime is less than that of n successful crimes. In the model presented here, expected utility is computed using weights from the geometric probability distribution, which is used to compute the probability of k successive successful trials in k repetitions.[5]

[5]Becker's specification is based upon the Friedman–Savage (1948) expected utility model. That model explains lotteries and other models of risk bearing which include monetary losses and for which there are only two outcomes (win and lose). Furthermore, the sequence of gains and losses does not matter.

With specific reference to the issues at hand, the Beckerian assumption is that the returns to crime depend on the time devoted to that activity. In specifying a Friedman–Savage expected utility model, there is the implicit assumption that the probability of apprehension is constant and independent of the time allocated to crime. In fact, the returns to crime are directly related to the time devoted to crime, which is in turn directly related to the number of crimes committed. While the probability of apprehension on any given crime is constant, the probability of remaining free decreases with the number of crimes, and hence the time allocated to crime.

To put it as plainly as possible, the probability of obtaining exactly three heads on four flips of a fair coin is quite different from the probability of observing a tail only on the fourth flip.

The theoretical model is empirically investigated with data on individual criminals and noncriminals of the same age cohort. An index of moral and social sensitivity is defined and empirically estimated. Further relationships between this index and selected socioeconomic variables (gang membership, fear, and income) are evaluated. This analysis is performed both separately for violent and property crime and combined for all crimes. The purpose is to identify differences (if they exist) in the levels of inhibition that criminals overcome when they decide to commit various types of crime.

In this study we correctly specify the expected utility model, adjust for the psychological, nonpecuniary returns to crime, and estimate the parameters of the theoretical model from individual data.[6]

2. THE MODEL

Any individual is confronted with the choice between a life of crime and a life as a law-abiding citizen for the appropriate planning horizon. It is assumed that all agents know the monetary returns to legal activity, $X(0)$, with certainty and that the associated utility, $V[X(0)]$, is easily calculated.

The monetary returns to a planned number of crimes, $X(C_I)$, are uncertain because one may be apprehended on or before the C_Ith crime. An individual must overcome a certain moral barrier when planning and executing the first crime. If he is subsequently apprehended, then there is also the disutility of incarceration and the opprobrium of being recognized in the community as a criminal. Thus, the marginal utility of the nth dollar of illicit income may not be as great as that for the nth dollar of legal income.[7] For these reasons, the calculation of the expected utility of crime is not as straightforward as the Becker–Ehrlich calculations.

In making his choice of life-style, the individual first determines the maximum expected utility, $W[X(C_I)]$, from a planned number of crimes,

[6]Witte (1980) investigates the standard Becker model using individual criminal cases. The recent book of Schmidt and Witte (1984) summarizes several criminological and economic studies which used individual criminal data (e.g., Chapter 3). However, none of these studies quantifies the above factors. Other more recent studies using individual criminals as the unit of analysis are Phillips and Votey (1987), Good and Pirog-Good (1987), Good *et al.* (1986), and Pirog-Good (1986). All of these papers present maintained hypotheses made plausible by economic disputation and use some statistical techniques to validate their hypothesis.

[7]As pointed out by a referee, if criminals are risk lovers, then obviously the marginal utility of the nth dollar of illicit income could exceed that of the nth dollar of legal income. This, however, would be a different model, with analytic results of a different nature. Furthermore, it would be at variance with the weight of empirical evidence to make such an assumption.

C_{I}. Of course there is some upper bound, $\bar{C}$, on the number of planned crimes which is determined by the length of the "work week." This expected utility is then compared with the utility from legal activity, $V[X(0)]$, and the individual embarks on the appropriate course of activity. The binary choice is not difficult to justify if the length of the period in question is short enough. True, the decision of an individual to be involved in criminal activity does not imply that he will do so along his whole lifetime. Nevertheless, this type of illegal activity could keep him busy in the short run, namely, during weeks, months, or possibly years.[8]

With these considerations in mind, the model of choice may be formalized[9] as

$$\mathrm{Max}\left\{ V[X(0)], \max_{C_{\mathrm{I}} \leq \bar{C}} W[X(C_{\mathrm{I}})] \right\} \tag{1}$$

where the expected utility from criminal activity is given explicitly by

$$W[X(C_{\mathrm{I}})] = \beta \left\{ (1-P)^{C_{\mathrm{I}}}_{V[X(C)]} + \alpha P \sum_{j=1}^{C_{\mathrm{I}}} (1-P)^{j-1} V[X(j-1)] \right\} \tag{2}$$

In Eq. (2), P denotes the probability of apprehension on any one of C_{I} independent trials. The parameter $\beta \in [0,1]$ measures moral sensitivity. Values close to one indicate little or no moral compromise in deciding to be a criminal; values close to zero suggest great moral compromise. That is, when $\beta = 1$, the crime branch of the utility function receives great weight.

[8]It has been pointed out to us that the model does not permit a criminal to commit crime and earn legal income. In this regard, criminal activity behaves much like spells of unemployment. While valid, the comment is not empirically important. See Wolfgang *et al.* (1972, 1985).

Furthermore, the model could be extended to accommodate the employment possibility. Equation (1) would be rewritten as

$$\max\{ V[X(0)] + W[X(C_{\mathrm{I}})]\}$$

subject to

$$X(0) = wt_1$$
$$t_2 = f(C_{\mathrm{I}})$$
$$T = t_1 + t_2$$

The criminal now chooses a planned number of crimes, which determines the time devoted to illegal activity (t_2) and the time to devote to legal activity. While this is a more "realistic" specification, it greatly complicates the algebra without changing the nature of the theoretical results.

[9]This approach is similar to that of Allingham and Sandmo (1972), who analyzed the incidence of tax evasion. However, this was just a deviation from their main theme and was not investigated in depth.

The parameter $\alpha \in (0,1)$ measures the opprobrium of being apprehended in a crime and may be termed the social sensitivity parameter. Values of α close to one suggest little social sensitivity; values close to zero suggest great sensitivity. That is, when $\alpha = 1$ there is little loss in utility resulting from apprehension.

If we neglect the parameters α and β, Eq. (2) is the expected utility from planning and executing C_I crimes. The terms in curly braces represent the possible states of the world which may prevail; being successful in all planned crimes or being apprehended on the first through C_Ith crime. The Becker-Ehrlich models admit only two possible outcomes, success and failure, implicitly assuming that one is apprehended only after committing the number of crimes corresponding to the optimal time allocation. The distinction here is very important. The model in Eqs. (1) and (2) takes explicit account of the possibility that one's life as a criminal may be shorter than planned in the Becker-Ehrlich models based on Friedman-Savage expected utility.

Under the geometric distribution in Eq. (2), the likelihood of arrest increases as the string of successful crimes increases. Or, put differently, the probability of remaining at large for $C_\mathrm{I}-1$ crimes is greater than the probability of remaining at large for C_I crimes. In the Becker-Ehrlich model the criminal is concerned not with this declining probability, but only with being apprehended after his planned number of crimes as though he were planning only one big crime or buying a lottery ticket.

Our objective is to find conditions for maximum utility and to analyze the properties and implications of the optimal solution. However, C_I is a discrete variable and so W is not differentiable. Thus, it is more convenient to write W in its continuous form:[10]

$$W[X(C_\mathrm{I})] = \beta\left\{e^{-PC_\mathrm{I}}V[X(C_\mathrm{I})] + \alpha\int_0^{C_\mathrm{I}} Pe^{-Ph}V[X(h)]dh\right\} \qquad (3)$$

Maximizing with respect to C_I gives the following first-order condition:

$$P(1-\alpha)V = V_X X_C \qquad (4)$$

[10]Under certain assumptions, the discrete and continuous models give the same result. The probability distribution in Eq. (3) is a geometric distribution, which gives the probability of failure on the (C_I)th trial. Equation (4) uses the continuous analogy. Note that

$$e^{-PC_\mathrm{I}} + \int_0^{C_I} Pe^{-Ph}\,dh = 1$$

and that P is the probability of apprehension in a very short time interval and is therefore also very small.

where subscripts denote derivatives with respect to that variable.[11] Note that V, V_X, and X_C are evaluated at the expected utility maximizing number of crimes, C_I^*.

The two sides of the first-order conditions, plotted in Figure 1, can be used to demonstrate the effect of a decrease in social sensitivity, i.e., an increase in α. As α increases, the left-hand side of Eq. (4) increases and the curve labeled $Y(C_I)$ in Figure 1 rotates clockwise. The result is that the optimal number of crimes increases, perhaps to C, as one becomes less concerned about the consequences of apprehension.

The parameter β measures the moral sensitivity of an individual; it reflects the conscience barrier one has to cross when first deciding to embark on a career of crime. Comparative statics involving β are best analyzed with reference to Figure 2. The first quadrant plots expected utility, $W[X(C_j)]$, against income. Utility from legal income is plotted as the curve labeled $V(X)$. The quadrant labeled II plots income as an increasing function of the number of crimes. The shape of this curve is determined by the assumptions necessary to guarantee a stable and unique solution to

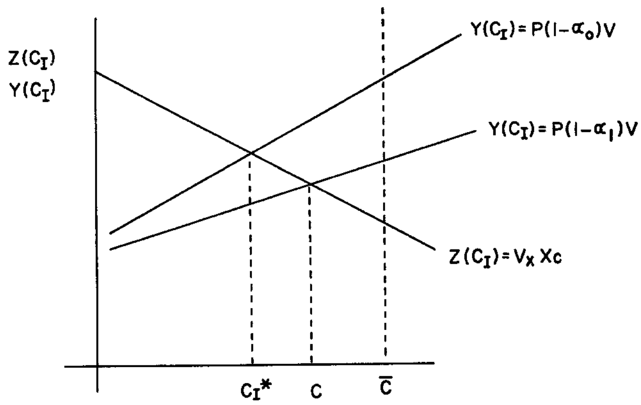

Fig. 1. The two sides of the first-order conditions.

[11]Checking the second-order condition, if $V_{XX}X_C + V_X X_{CC} < P(1-\alpha)V_C$, then

$$\frac{d^2w}{dC_I^2} = e^{-PC_I}\left[\left(\frac{\partial Z}{\partial C_I} - \frac{\partial Y}{\partial C_I}\right) - P(Z - Y)\right] < 0$$

where $Z = V_X X_C$ and $Y = P(1-\alpha)V$. That is, there is a unique global maximum.

Actually, this result is a bit stronger than we need. It implies that the return from any crime is the same, regardless of on-the-job opportunities. It is possible that a higher wage indicates a better job, which provides opportunities for committing crimes with greater return. That is, $X_{CC} > 0$. As long as $X_{CC} > 0$ is small, it is possible to find a global maximum.

Note also that β drops out of the equilibrium condition. As we show below, β has the effect of changing the α necessary to tip an individual into a life of crime.

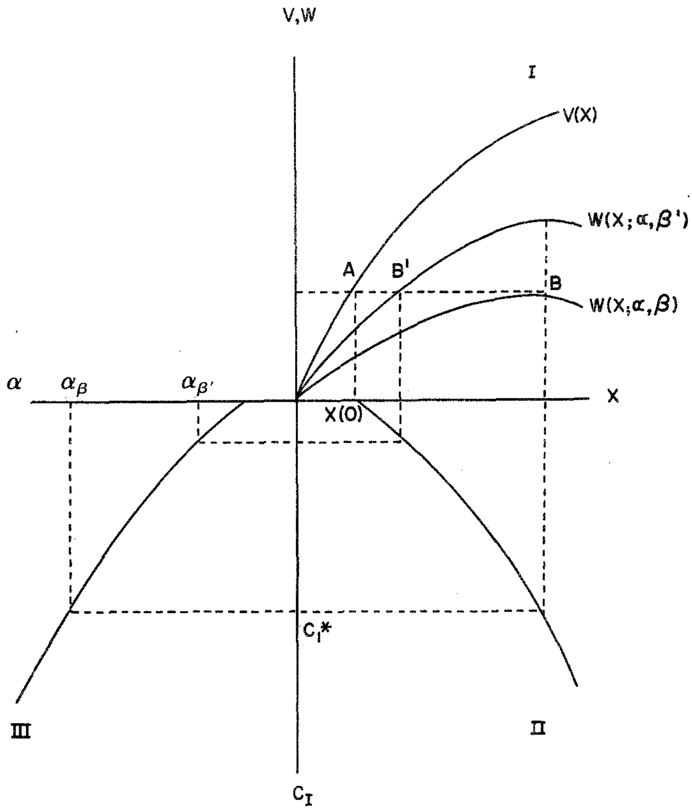

Fig. 2. Comparative statics involving β.

the maximization problem. The quadrant labeled III plots intended crimes against the social sensitivity parameter, α, and is derived from the first-order conditions plotted in Figure 1.

Suppose that the individual's legal income is $X(0)$ so that his utility corresponds to the point A. If initially he has parameters α and β, then he is indifferent between committing no crime, point A, and committing C_I^* crimes, point B, provided his α is less than or equal to α_β. Now, suppose that β increases, i.e., he is less morally sensitive. The effect is to shift the expected utility curve counterclockwise. The point above which his α must lie in order to induce the individual to commit crime has now been reduced to $\alpha_{\beta'}$. Thus, if initially the individual had an α equal to α_β, he would have been indifferent between committing crime and committing no crime. But increasing his β to β' puts him over the threshold into a life of crime. Note that the number of intended crimes corresponding to the maximum of $W[X(C_I)]$ has not changed but increasing β had the effect of switching the individual from 0 to C_I^* planned crimes and results in expected utility D, greater than the utility associated with no crime.

There is an important question with regard to the individual's reaction to changes in $X(0)$. The answer has socioeconomic implications as to whether and to what extent an individual would be willing to participate in illegal activity as he becomes wealthier.

In order to find the reaction of C_I^* to a change of $X(0)$, we differentiate both sides of the first-order condition, Eq. (4), and rearrange it to yield

$$[P(1-\alpha)V_X - V_{XX}X_C]\,dX(0)$$
$$=[-P(1-\alpha)V_XX_C + V_XX_C^2 + V_XX_{CC}]\,dC_I^* \qquad (5)$$

The expression in the parentheses on the left-hand side is obviously positive. The second-order condition assures us that the expression in the parentheses on the right-hand side is negative. Thus, if the first- and second-order conditions for a maximum are met, then $dC_I^*/dX(0)<0$. This argument implies that the greater the legitimate income, the fewer the number of crimes one plans to commit.

While a higher legal income, $X(0)$, induces a lower C_I^*, it remains to be seen what happens to total income, which is the sum of income from both legal and illegal sources.

One may write

$$dX(C_I^*) = dX_0 + X_C\,dC_I^* \qquad (6)$$

Substituting (6) into (5) yields

$$[P(1-\alpha)V_X - V_{XX}X_C]\,dX(C_I^*) = V_XX_{CC}\,dC_I^* \qquad (7)$$

The expression in brackets on the left-hand side is positive, hence

$$\text{sign}\,[dX(C_I^*)/dX_0] = -\text{sign}\,(X_{CC})$$

$$\text{sign}\,(dX/dC_I^*) = \text{sign}\,(X_{CC})$$

This implies, for example, that if $X_{CC}=0$, (constant "marginal revenue" of criminal activity), the individual will end up with the same expected income in spite of a possible change in $X(0)$.

3. AN EMPIRICAL APPLICATION

The model may be formulated so that it can be used for the empirical testing of the relationship among crime levels, income, and those variables which might be expected to affect moral and social sensitivity. This will require some specific assumptions about the utility function and adaptation to observable data.[12]

The theoretical framework determined the level of C_I^*, which is the planned number of crimes in a certain period of time. The empirically observed variable is the actual number of crimes, rather than the planned number. Therefore, it is necessary to find a relationship between *actual* and *planned* crime occurrences.

Denote the actual number of crimes C_A, which is a stochastic variable that lies between 0 and C_I^*. The expected value of C_A, $E(C_A)$, is given by Eq. (8):

$$E(C_A) = C_I^* e^{-PC_I^*} + \int_0^{C_I^*} Pe^{-Ph} h\, dh \tag{8}$$

where $C_I^* e^{-PC_I^*}$ is the event of committing C_I^* crimes without being apprehended multiplied by its probability. In the expression Pe^{-Ph}, h stands for the event of committing h crimes and being apprehended on the hth, multiplied by its probability. The manipulation of (8) yields the following:[13]

$$E(C_A) = \frac{1 - e^{-PC_I^*}}{P} \tag{9}$$

By rearranging (9) we get

$$C_I^* = -\frac{1}{P} \ln\,[1 - PE(C_A)] \tag{10}$$

Now define a new variable,

$$d = 1 - PC_A$$

where d is a stochastic variable with the expected value of

$$E(d) = 1 - PE(C_A) \tag{11}$$

[12]Simultaneous relationships are likely to exist between planned crimes and other variables like social and moral sensitivity, various family, and environmental attributes. Our OLS model is, in this sense, only partial. However, any simultaneity bias is slight because of the homogeneity of our sample and the very slow, long-run feedback effects in such a simultaneous relationship.

[13]
$$\int_0^{C_I^*} he^{-Ph} dh = \int_0^{C_I^*} -\frac{\partial}{\partial P}(e^{-Ph})\, dh = \frac{\partial}{\partial P}\int_0^{C_I^*} -e^{-Ph}\, dh = \frac{\partial}{\partial P}\left\{\left[\frac{1}{P}e^{-Ph}\right]_{C_I^*}\right\}$$
$$= \frac{\partial}{\partial P}\frac{[e^{-PC_I^*} - 1]}{P} = \frac{1}{P}\left(-C_I^* e^{-PC_I^*} - \frac{e^{-PC_I^*}}{P} + \frac{1}{P}\right)$$

By substituting the last expression in (9) we get

$$E(C_A) = C_I^* e^{-PC_I^*} + P\left[\frac{1}{P}\left(-C_I^* e^{-PC_I^*} - \frac{e^{-PC_I^*}}{P} + \frac{1}{P}\right)\right] = \frac{1 - e^{-PC_I^*}}{P}$$

d can be expressed as follows:

$$d = E(d) \cdot u \tag{12}$$

where u is also a stochastic variable for which $E(u) = 1$. Substituting (12) into (10) yields

$$C_I^* = -\frac{1}{P} \ln d + \frac{1}{P} \ln u \tag{13}$$

It is important to recall that P is the probability of apprehension in any given criminal undertaking so that $d = 1 - PC_A$ is always positive. We add to the model the following simplifying assumptions: the utility of money income is given by

$$V(X) = X^a \qquad \text{where} \qquad a < 1 \tag{14}$$

and the relationship between crime and income is given by

$$X = X(0) + mC_I \qquad \text{where} \qquad m > 0 \tag{15}$$

Thus, the utility function V has a constant income elasticity given by a. Furthermore, the income generation function exhibits constant marginal revenue of crime, m. Furthermore, m in Eq. (15) represents one of two concepts: either a constant marginal revenue of crime or the average per crime revenue. In both cases, the expression in Eq. (15) holds, since it is nothing other than an identity showing the composition of income generated by criminal and noncriminal activity. Thus, Eq. (15) is not a behavioral function, and therefore assuming a constant m is just an empirical measurement technicality that does not alter the substance of the model. We substitute (14) and (15) into the first-order condition, Eq. (4), to get

$$C_I^* = \frac{a}{P(1-\alpha)} - \frac{X_0}{m} \tag{16}$$

Combining (13) and (16) yields

$$\ln d = -\frac{a}{1-\alpha} + \frac{P}{m} X(0) - \ln u \tag{17}$$

Equation (17) can be empirically tested. d is a variable that can be calculated from available information about both actual numbers of committed crimes and the probability of apprehension. Therefore, (17) can be regarded as a regression equation of $\ln d$ on $X(0)$ (the legitimate income). The intercept in (17), where $(1-a)$ is the Arrow–Pratt relative risk aversion measure, indicates the degree of aversion from illegal activity combining both risk and social sensitivity.

The data for this part of the study were collected and managed by the Center for the Study of Criminology and Criminal Law located at the University of Pennsylvania.[14] The data are based on individual males, both criminals and noncriminals, who were all born in 1945. Two sources of data were used—personal interviews and matching police records when appropriate. The interviews were conducted in three stages, the last in 1976. We have used the results from the third survey. The 975 cases in the sample were drawn from a master sample of 9975 cases. All included individuals satisfy the requirement of having lived in the city of Philadelphia between the ages of 8 and 18 and at the time of the interview. The number of offenses resulting in arrest ranged from 0 to a high of 81. Five hundred fourteen of the individuals in the sample had been arrested.[15]

In principle one could fit the model in (17) to the data on individuals for each of the crime groups contained in the arrest data. Missing data forced the aggregation from some 14 possible groups to only 3: property crime, violent crime, and all crimes. Results are reported for each category.[16]

In the following, we describe the construction of the dependent variable, $\ln(1 - PC) = \ln d$. The lifetime probability of apprehension[17] in the ith type of crime may be thought of as the ratio of arrests to the number of crimes for which the individual admits culpability. But recall that the probability of apprehension in the continuous specification of the model is for a short time interval. If the probability of apprehension in any short interval is independent of and equal to that in all other intervals, then the ratio of

[14]This study is based upon the original data collected on 10,000 young men in Philadelphia in the 1945 cohort. That study challenged traditional notions about delinquent careers which were based upon cross-sectional data. It first identified the chronic juvenile offenders which were responsible for most crime. The first cohort study was summarized by Wolfgang *et al.* (1972). Two subsequent studies followed the above. The first includes a 10% sample of the original cohort where the individuals were followed through adulthood to the age of 30. That data base was used for our study. The second study was a replication of the original cohort design, involves a 1958 Philadelphia birth cohort, and extended the analysis to females as well as males.

[15]There are two shortcomings to the data. First, the survey summarizes the criminal activity of the respondents over a period of 15 years. However, the responses to questions about employment income, and the number of times married refer to the time of the final interview. Second, some of the criminals were quite young at first arrest so were without alternative legal employment.

[16]The totals do not add to 975 due to missing data.

[17]An interesting question is the interpretation of P: Is it the actual probability of apprehension or the criminal's perceived probability of apprehension? In this model, as in all neoclassical models, the two are assumed to be the same. This assumption is consistent with the formation of rational expectations, where experience is used as the basis for forecasting. Also, as we note in the text, the perceived probability derived from the empirical model is quite close to clearance rates for Philadelphia.

arrests to actual crimes should be divided by the number of weeks at risk in the criminal labor force.[18] In the dependent variable, this ratio is then multiplied by the actual number of crimes for which the criminal was responsible, thus returning the number of arrests so that PC is the number of arrests per week and is always less than one.

The subjects in the cohort survey responded to several different questions about income and employment. Thus, we were able to construct legal income as the sum of the respondent's annual income and his spouse's annual income from all sources (labeled Income in the tables).

The data set used to confront the theoretical model is unique in the extent to which it accommodates a central issue of the paper. In the cohort survey, the respondents were asked a series of questions about their postarrest concerns vis-à-vis family, friends, job, and the prospect of incarceration. Their responses were coded as 1 if they reported fear with respect to the reaction of family, friends, employer, etc., and 0 otherwise. Fear, as a measure of moral and social sensitivity, was then constructed as the sum of these binary responses.

Fear of being arrested represents a personality trait which is compatible with risk aversion, and its existence reduces the commission of crimes or eliminates it entirely. We may hypothesize that the stronger the fear of arrest, ceteris paribus, the lower the number of crimes committed by one individual.

From other questions in the survey we were able to construct three additional independent variables: age at first arrest (Age),[19] years of education (Education), and a dummy variable for gang membership (Gang). Each of the above four variables is likely to be related to the phenomenon we define as moral and social sensitivity.

The age at first arrest affects the criminal's behavior during his entire active life in crime. It may determine how fearful of being arrested he will be in the future and, thus, how many crimes he commits (Figlio, 1986).

Important policy implications emerge from the analysis of this variable regarding the kind of treatment that police ought to give to juvenile criminals. We refer to these issues later and present a somewhat surprising result.

Schools are one place where an individual can be taught moral and social responsibilities. Therefore, years of education was included as an explanatory variable. We expect social sensitivity or a related variable to

[18]The number of weeks in the criminal labor force was estimated as 31, the age at the time of the survey, minus the age at the time of first arrest multiplied by 52. Note that the number of weeks has not been reduced by the period spent in jail, those data being unavailable. Recall that P is the probability of apprehension in a short time interval. It was implicitly assumed that P is constant and independent over time.

[19]This variable is expressed as the chronological age of the criminals on their first arrest.

be positively correlated with education. The conventional interpretation of education is that it serves as a proxy for investment in human capital. Our interpretation is not at variance with this. Increased human capital does two things: it raises the opportunity cost of crime and the risk of incarceration, and it gives one a greater understanding of the terms of the social contract for human behavior. In either case, it increases social sensitivity.

Gang membership is an important characteristic in determining the individual's attitude toward crime and possible arrest, the kind of crimes he would commit, the methods he might use, and the income he might earn. Clearly, this variable is essential in shaping the type of criminal an individual may become. As we show below, gang membership has a meaningful effect on social sensitivity, and this raises important implications for the ways that policing ought to be directed in controlling crime (Klein and Maxson, 1987).

Table I presents Pearson correlation coefficients for a selection of relevant variables. The unit of analysis is the individual for crime of a particular type, e.g., property crimes committed by John Doe. All the coefficients are significant at the 5% level. $\ln d$ is the dependent variable in Eq. (17) ($d = 1 - PC$). Bear in mind that the larger d, the lower the crime level it represents. For all types of crime, $\ln d$ is positively correlated with

Table I. Pearson Correlation Coefficients

	Income	Fear	Gang
	(a) All crimes		
Gang	−0.296	−0.240	1.000
Education	0.266	0.341	−0.195
Age	—	0.767	−0.342
$\ln d$ (dependent variable)	0.226	0.532	−0.346
	(b) Property crime		
Gang	−0.285	−0.287	1.000
Education	0.281	0.334	−0.150
Age	0.280	0.691	−0.382
$\ln d$	0.216	0.543	−0.345
	(c) Violent crime		
Gang	−0.232	−0.327	1.000
Education	0.280	0.264	−0.147
Age	0.260	0.579	−0.363
$\ln d$	0.206	0.787	−0.364

Income and Fear and negatively correlated with Gang. This is consistent with the hypothesis of the theoretical model in Section 2. The higher the income from legal sources, the lower the level of criminal activity. Moreover, the Fear variable is apparently related to social sensitivity, and the greater the fear of arrest, the lower the number of committed crimes. A possible interpretation of this finding is that the reluctance to commit crimes is strongly related to the fear of being arrested. Thus, social sensitivity is clearly generated, inter alia, by the deterrent effect of law enforcement. The implication of this finding is that the deterrence hypothesis, which is widely discussed in the literature of the economics of crime, is valid.[20]

Gang members tend to commit more crimes. This is true for all types of crime. Thus, gang membership is a characteristic that reduces social sensitivity. Indeed, we find a negative correlation of the Gang and Fear variables. This indicates that gang members are less afraid of being arrested. The group to which they belong is probably a source of power and courage and possibly provides the individual with some "protection" for himself and his family in case of arrest.

Gang members face their first arrest at a younger age than other criminals. Moreover, the Fear variable shows a high and positive correlation with the age of first arrest. Combining these two findings with the fact that gang members are less fearful of being arrested than other criminals leads to the following conclusion: some gang members' lack of fear of arrest is associated with the fact that they encounter the law enforcement authorities at an early age. As pointed out above, being arrested for the first time at a young age creates a kind of insensitivity toward possible subsequent arrest.

The strong and positive correlation (0.767) between the Fear and the Age variables is somewhat surprising. Assuming that law enforcement authorities function also as rehabilitating agencies, we would have expected people who were arrested at a young age to be more socially sensitive and more fearful of additional arrests. The findings indicate that the opposite is true and it suggests that the arrest and incarceration of juveniles may be an ineffective mechanism in turning them away from crime. Another interesting finding from Table I is that Education has a significant effect in generating social sensitivity: it is positively correlated with Fear. Thus, fear of arrest is stronger among the more educated criminals and those who were first arrested at a later age.

Table II presents estimates of Eq. (17). The model parameters were estimated using a maximum-likelihood estimator under the assumption that the error term in Eq. (17), $\ln(U)$, has a normal distribution.

[20]See Buck *et al.* (1983), in which they posit long-run and short-run deterrent effects, or Schmidt and Witte (1984, Chap. 9.8) or Andremo and Siegfried (1980, pp. 418–421).

Table II. Regression Equations for all Respondents: Estimates of Eq. (17)

	Total crime			Property crimes			Violent crimes		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Intercept	−0.0597	−0.0872	−0.0265	−0.0237	−0.0526	−0.0367	−0.01546	−0.0519	−0.0441
	(−2.852)[a]	(−5.042)	(−1.059)	(−3.241)	(−5.167)	(−2.846)	(−3.484)	(−6.690)	(−4.620)
Income	0.226×10^{-3}	0.174×10^{-3}	0.953×10^{-4}	0.993×10^{-4}	0.771×10^{-4}	0.479×10^{-4}	0.678×10^{-4}	0.429×10^{-4}	0.354×10^{-4}
	(2.686)	(2.069)	(1.101)	(2.594)	(1.871)	(1.220)	(2.975)	(1.951)	(1.574)
Fear		0.0090	0.0106		0.00653	0.00592		0.00730	0.0066
		(3.411)	(2.671)		(3.974)	(2.670)		(5.579)	(4.166)
Gang membership			−0.0664			−0.0205			−0.00946
			(−4.401)			(−2.652)			(−1.964)
F	7.212	9.517	9.840	6.730	11.439	7.602	8.853	20.536	11.334
df	407	406	404	278	277	275	244	243	241

[a]The numbers in parentheses are t values.

Recall that the income coefficient is the ratio of the probability of apprehension (P) to the marginal return to criminal activity (m). The income coefficients are numerically very small, indicating either large m or small P. The average value of thefts, in dollars, in the whole sample is only \$163.70. Since we have assumed constant marginal returns to crime, this implies, for the total sample, a probability of apprehension in any working week of approximately 4% ($0.226 \times 10^{-3} \times 163.70 = 0.0369$).

It is important to understand that this probability is not necessarily a realistic number but, rather, the perceived magnitude as reflected in the respondents' answers. Actually, it does not differ by much from the clearance rates of the Philadelphia police, which should be considered an objective probability of apprehension.

The intercept of these equations is equal to $-[a/(1-\alpha)]$ where a is the constant elasticity of the utility function (V) with respect to income changes, and α is a measure of social sensitivity (no sensitivity implies $\alpha = 1$; high sensitivity implies $\alpha = 0$). The value $-(1-a)$ is, as mentioned above, the Arrow–Pratt relative risk aversion index. Risk aversion prevails when $-(1-a)<0$. As shown in Table II [especially the base model equivalent to Eqs. (1), (4), and (7)], all the intercepts are negative and significant, implying that, on the average, criminals are risk averse. Thus, they do not commit crimes because they enjoy the risk it involves. This finding reinforces, once again, the deterrence hypothesis, which is based on the assumption that criminals are risk averse (Schmidt and Witte, 1984, Section 9.8). Indeed, if we assume that $\alpha = 0.9$, namely, that criminals are only slightly socially sensitive, the value of $(1-a)$, the risk aversion index, as measured in the total crime equation (1), is 0.994. This suggests that criminals in the sample are significantly risk averse and become less so as they become more socially sensitive.

The trade-off between social sensitivity and risk aversion, which stems from the model, is obvious. The model explicitly distinguishes between the two individual characteristics. From the analytical point of view, risk aversion is a general character trait which is measured on the utility function and is related to the level of income. Social sensitivity is directly related to criminal behavior, namely, to the possibility of being apprehended as a result of committing crime. It is true that social sensitivity and risk aversion do not always have a clear-cut relationship. For example, a law-abiding individual, who is highly socially sensitive, might be either risk averse or a risk lover. His social sensitivity stems from one value system, and his attitude toward risk (financial or other) is generated by a different system.

In the case of a criminal, social sensitivity and risk aversion both refer to the same potential unpleasant consequence: arrest and punishment. Thus, we may conclude that they both represent the same phenomenon. Hence, the implied trade-off, mentioned above, is a result of our inability, in this model, to measure each of the two characteristics separately. Since the model enables the measurement of only $-[a/(1-\alpha)]$ all we can say is that for a constant value of this ratio, we are able to measure the implied trade-offs between a and α.

From the conceptual point of view, the analysis of criminal behavior does not really call for the measurement of both risk aversion and social sensitivity. They both refer to the potential incarceration of a criminal, and the numerical value of $a/(1-\alpha)$ is sufficient to indicate the combined magnitude of both features.

To reinforce this argument, observe Eqs. (2), (5), and (8) and compare them, respectively, with Eqs. (1), (4), and (7). In the former three equations, the Fear variable is introduced in addition to the income variable. The introduction of Fear clears out the effect of fear of arrest from the relationship between income and crime. We find that for all three crime levels the inclusion of Fear increased the absolute value of the intercept and reduced the income coefficient. The larger intercepts in Eqs. (2), (5), and (8) imply a lower risk aversion and/or a lower social sensitivity. The interpretation of this finding is that once the fear element is eliminated from the analysis, criminals exhibit less risk aversion and less inhibitions generated by social sensitivity. Thus, the phenomena of risk aversion and social sensitivity are partly (however significantly) motivated by the fear of being arrested.

Moreover, the fall of the income coefficients in these three equations compared with Eqs. (1), (4), and (7) indicates that, once the fear element is controlled, the perceived probability of apprehension falls. Thus, without fear, criminals perceive their chances of success in criminal activity as improved. Fear is therefore an essential element in generating both a reluctance to commit crime and a less optimistic attitude toward potential success.

As stated in the discussion on the Pearson correlations, fear is a phenomenon that might be generated or strongly influenced by three other variables: education, age at first arrest, and gang membership. Due to the high and significant correlation of both the education and the age variables with fear, their introduction in the regression equation does not yield significant results. However, the introduction of the Gang dummy variable does indeed provide important insights. Comparing Eqs. (3), (6), and (9) with Eqs. (2), (5), and (8), respectively, shows that for the three crime equations, the introduction of gang membership significantly reduces the absolute value of the intercept. Thus, the lack of social sensitivity and risk aversion among criminals may be attributed to gang membership. In short, gang members are less risk averse and less socially sensitive than criminals who are not gang members. Judging from the relative size of the coefficients, the corrupting group effect of the gang on the individual criminal is very strong. It drives the criminal to be willing to take more risks and to be less reluctant to break the law.

4. SUMMARY AND POLICY IMPLICATIONS

While recognizing the need to model explicitly the nonpecuniary aspects of illegal activity, the literature has generally finessed the problem by using monetary equivalents. The model presented here incorporates the one-time, binary, morally compromising decision to commit crime and an index of the moral opprobrium associated with apprehension.

Also, we have respecified the Becker–Ehrlich resource allocation model to reflect more correctly the criminal decision maker's calculus. Namely, we have used the geometric probability distribution to capture the criminal's interest in the declining probability of remaining at-large as the number of crimes before first arrest increases.

The theoretical model is validated using individual criminal data based on a cohort survey of Philadelphia males and corresponding police records.[21] It is found that moral and social sensitivity increases with income. Further, under plausible parametric assumptions it is found that the survey respondents are risk averse and that risk aversion increases as they become more socially sensitive. The real probability of apprehension in any given week was calculated and appears very low (about 4%). Social sensitivity seems to be positively related to the fear of arrest and negatively to gang association.

Three important policy implications emerge from the results of this study. The strong correlation that was found between the age at first arrest and the Fear variable and the strong effect that Fear has in reducing criminal activity are important insights in determining policies related to juvenile criminals. It seems that exposing young criminals to police treatment (i.e., arrest) reduces their future fear from encountering the law and, thus, makes them less socially sensitive. Thus, mechanisms other than arrest should be emphasized in treating young criminals.

Nevertheless, as shown above, the study reveals that criminals are indeed risk averse. This finding supports the deterrence hypothesis, implying that success in police performance and an increase of clearance rates would

[21] Note that this feature of our study is a marked improvement over other empirical studies of crime. Previous studies have relied upon the Becker–Ehrlich model of the decision to be a criminal but have used data on the frequency of crime. The implied assertion in extrapolating from such data to the Becker–Ehrlich model is that all criminals commit the same number of crimes and that a reduction in crime means thast some individuals have left the criminal labor force. Included in our data base are individuals who have not committed crime and are measured along the same dimensions as criminals.

effectively reduce criminal activity, even among criminals whose social sensitivity is quite low. This outcome does not necessarily mean that other crime prevention techniques, such as rehabilitation, should not be sought. Nevertheless, it emphasizes once again, the importance of policing and punishment in controlling crime.

The study indicates that when criminals are members of a gang, their risk aversion and social sensitivity are reduced. In other words, the most active criminals are those operating in gangs. This finding suggests that a "crackdown" on gangs and the prevention of gang formation, if possible, could be an efficient way to reduce crime. If criminals would be forced to operate as "lone wolves," it might reduce their criminal activities.

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