The Economics of Crime in the Republic of Ireland: An Exploratory Paper

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Précis: This paper explores the possibility of applying models developed elsewhere to an analysis of rising crime rates in Ireland. In particular, it seeks to establish optimal levels for expenditure on controlling crime against property, with and without violence. The analysis shows that the necessary conditions for optimality cannot be assumed to hold in the Irish case. All four equations estimated suggest that crime does not pay. However, the analysis also indicates that rising unemployment will be associated with an increase in crimes against property with violence, and with a decrease in crimes against property without violence. It is not inconceivable that rises in unemployment may cause transfers between crime categories.

Introduction

INCREASING crime rates have become a widespread and unwelcome feature of affluent economies in recent years. Not surprisingly the problem has captured the attention of sociologists, psychologists, and other social scientists. Rather more surprisingly, economists appear to have made a rather late entry on the scene, but have been making up for this by producing a rapidly growing literature on the subject.

As yet no attempt appears to have been made to extend such economic analyses to Ireland, although Table 1 shows that the Republic of Ireland has been no exception to the trend of increasing crime rates. This paper explores the extent to which Irish data lend themselves to the types of analysis developed elsewhere as a first step towards an understanding of this growing problem.

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Table 1

Year	*Indictable Crimes**	*Real Expenditure on Law Enforcement†*
	(per thousand population)	
1952	4·98	
1953	5·29	1·37
1954	4·05	1·34
1955	3·90	1·68
1956	4·40	1·58
1957	4·49	1·62
1958	5·80	1·58
1959	6·27	1·62
1960	5·40	1·73
1961	5·26	1·87
1962	5·40	1·88
1963	5·70	1·96
1964	6·18	2·15
1965	5·82	2·27
1966	6·60	2·30
1967	7·20	2·48
1968	7·90	2·29
1969	8·90	2·33
1970	10·40	2·44
1971	12·70	2·47

Source: Garda Síochána, Central Statistics Office, United Nations (various years).

*Indictable crimes include the following categories: offences against the person; offences against property with violence; offences against property without violence; other offences.

†Expenditure on law enforcement includes expenditure on Office of Minister for Justice; Garda Síochána; Prisons; District, Circuit High and Supreme, Courts of Justice. The population estimate is an interpolation from UN Demographic yearbook. (Expenditure deflated by CPI base 1953 = 100.)

The initial examination seeks to establish whether the level of crime is an optimal one. As with any other "bad" or negative good, society would, doubtless, prefer to have a zero level of crime, and if crime prevention or detection were costless activities, this zero level would be the optimal quantity. In practice combating crime is an expensive process and the cost of the resources needed to achieve (or approximate to) a zero crime level would well exceed the benefits gained. The object, then, from an economic viewpoint would be to establish the optimal degree of crime. Economists will be aware that the concept of an optimum is not an unambiguous one and it is usually possible to identify many possible optima. In a more comprehensive analysis it would be useful to explore this aspect more fully, especially to examine the extent to which equity aspects interact with efficiency considerations in the definition of any "optimum".

Thus Shoup (1964), for example, suggests that "equality of crime rates *per capita* is taken to signify equal probability for any person in one district compared

with any person in any other district that he will be the victim of a crime. If every person faces the same probability the service police protection is said to be distributed evenly or equally".

The model chosen for this introduction is one which does not specify any equity dimension. Optimality is defined on the basis of the aggregate relationship between the costs of crime prevention and detection and the benefits to be gained from reductions in the crime rate. Thus, if crime reducing activities are more expensive and/or yield less benefit in, say, the Dublin area than in other districts, then the optimal pattern thrown up by the chosen model would be one which yielded higher levels of crime in Dublin.

The main features of the chosen model are outlined immediately below. The latter part of the paper reports on the first results of applying this model to Irish data.

The theoretical model

The model chosen is that of Becker (1968) in which "The method used formulates a measure of the social loss from offences and finds those expenditures of resources and punishments that minimise this loss".

In this model there are four components which enter into the calculation of the social loss (cost to the community) of criminal activity, namely:

(a) The direct cost (or damages) of crime $= D$

(b) Cost of apprehension and conviction $= C$

(c) Cost of punishment $= R$

(d) The level of criminal activity $= O$

(a) *Direct Cost or Damages:*

The amount of harm or damage done by criminal activity is assumed to increase with the level of activity resulting from the ith criminal activity. Similarly, the value of the gain or benefit obtained by the offenders is also assumed to increase with the activity level. The net direct cost to society would then be the difference between the amount of harm and the value of the gain obtained by the offender. Normally we would expect that the direct cost would have a positive value though there is no requirement for it to be so. Subscribers to the "Robin Hood" principle of involuntary gifts would expect that the benefits derived by the recipients of forcible wealth transfers, would outweigh the loss of utility to the donors (victims). However, even in the cases where crimes are confined to wealth transfers, for example, theft or fraud, there is frequently a significant degree of inefficiency in the transfer mechanism. Property is often damaged or destroyed or the criminals may not be aware of the value of the goods and may not obtain the full market value of many items. The case where crime involves injury to persons, for example, assaults or murders, can give rise to more complex valuation problems, since any estimation of the costs to the

victim and gains to the criminal will involve inter-personal utility comparisons. Nevertheless, as Mishan (1971) points out there would be grounds "especially in cases involving loss of life" for expecting victim costs to outweigh offender gains. It would be expected therefore, that for crime in general there would be positive net damages or costs to society even though this need not be the case for any one crime.

(b) Costs of Apprehension and Conviction

Since the activities, (A), of apprehending criminals and bringing them to trial involve expenditure on policemen, court personnel, buildings and other resources, it is reasonable to conclude that the cost (C) of these will be an increasing function of the level of activity so that

$$C = C(A) \qquad C' > O \qquad (1)$$

Becker discusses several possible ways of specifying the activity level, the most appropriate of which appears to be.

$$A = h(p, O, a) \qquad (2)$$

where p represents the ratio of convictions (or detections) to all offenses, i.e., the probability that a crime is detected and that a conviction is made, O is the level of criminal activity and is measured by the number of offences, while *a* stands for other determinants of activity by the police. All of these elements are expected to show increasing costs with increasing activity.

(c) Punishments

"The costs of different punishments to an offender can be made comparable by converting them into their monetary equivalent or worth" (Becker, 1968). Thus in the case of imprisonment, the cost to the offender could be represented by the discounted sum of his earnings foregone, plus the value placed on the restrictions in his freedom and consumption patterns.

To estimate the social costs involved it is necessary to take account of the costs or gains accruing to others. In the case of punishments which take the form of fines, the loss to the offender is offset by a gain to the rest of the community, so that the net social cost approximates to zero. (It does not necessarily equal zero, both because of administrative costs and because of the valuation problems, mentioned earlier, associated with involuntary gifts.) In the case of punishments which take the form of prison sentences, probation periods, etc., there will be a social cost in addition to offender costs, resulting from the provision of prison staffs, welfare officers, etc.

Becker expresses total social costs in terms of their relationship to offender costs.

$$f^1 = bf \qquad (3)$$

where f^1 is social cost, f is offender costs and b is a coefficient expressing the relationship between the two, thus $b \simeq O$ for fines and $b > 1$ for imprisonment.

(d) The Supply of Offences

Becker's approach to the supply of offences is to treat them as part of the general choice pattern of individuals and assumes that "a person commits an offence if the expected utility to him exceeds the utility he could get by using his time and resources at other activities".[1]

The specific function which Becker uses to express this choice pattern is:

$$O_j = O_j(p_j, f_j, u_j) \tag{4}$$

where: O_j = number of offences j would commit in any given period

p_j = the probability of conviction (or apprehension) per offence

f_j = his punishment per offence

u_j = "A portmanteau variable representing all other influences" (cf. Becker, 1968).

An increase in either p_j or f_j would reduce the expected utility of an offence and hence would tend to reduce the number of offences. In effect the probability of "paying" a given price or the "price" itself would be increasing. The response of offenders to compound changes, such as a rise in p_j accompanied by a fall in f_j, or vice versa, is a more complex issue with the outcome depending on relative preference or aversion to risk; but these aspects need not be explored here.

Non-economists in particular might be sceptical of, or reluctant to use, a theory which regards crime as just another component in the preference set of the rational, utility maximising consumer and will doubtless wish to point out that many crimes are irrational acts, committed on impulse or in a moment of passion. It would be a far remove from the present purpose to discuss these aspects in an adequate manner here. However, it can be stated that many of the specific points associated with crime are dealt with in Becker's paper, while the reader interested in a more general treatment of the impact of irrational behaviour on the economic analysis of choice may also wish to refer to the earlier paper of Becker's (1962). For present purposes we need only assume that many crimes may be consistent with rational economic behaviour and enquire whether a model treating crimes in these terms may yield empirically useful results.

Optimality conditions

Having outlined the components which enter into the calculation of the social costs associated with crime we may now proceed to describe Becker's derivation of the conditions for an optimum level of crime in the community.

1. This particular assumption crucial to the analysis was not tested for the Irish case because of the absence of relevant statistics. Such a test was performed in the United States by Sjoquist (1973) and the findings confirm Becker's assumption.

Bringing together the separate cost components discussed above Becker expresses the social loss in the form

$$L = D(O)+C(p,O)+bpfO \tag{5}$$

with D(O) indicating the direct social loss or damages, $C(p,O)$ representing the social costs of conviction and apprehension and $bpfO$ to the social cost resulting from the punishment of offences.

The two decision variables in the function are taken as being p and f, implying that society by altering the resources allocated to police work, or by altering its laws can affect the probability of conviction (or apprehension), p, and the costs of punishment, f.

The first order optimality conditions are obtained by differentiating (5) with respect to p and f[2] to give, after some manipulations and rearranging

$$D' + C' = -bpf\left(1 - \frac{1}{\epsilon f}\right) \tag{6}$$

$$D' + C' + \frac{\delta C}{\delta p}\frac{1}{Op} = -bpf\left(1 - \frac{1}{\epsilon p}\right) \tag{7}$$

where

$$Op = \frac{\delta O}{\delta p}$$

$$\epsilon f = -\frac{f}{O}\frac{\delta O}{\delta f} \tag{8}$$

$$\epsilon p = -\frac{p}{O}\frac{\delta O}{\delta p} \tag{9}$$

Thus, the terms on the left hand side of equations (6) and (7) give the MC of increasing O—the level of criminal activity, through a reduction in f (punishment) in the case of equation (6), and through a reduction in p in the case of equation (7). Becker (1968) continues "Since $C' > O$ and O_f is assumed to be in the region where $D' < O$ the MC of increasing O through f must be positive. A reduction in p partly reduces the cost of controlling crime so the MC must be less when p rather than f is reduced. Since the loss is minimised where $MC = MR$ the optimal values of ϵ_f must be less than unity and that of ϵ_p could only exceed unity if $\frac{\delta C}{\delta P}$ were sufficiently large. Since the MC of changing O through changes in p

2. Becker uses p rather than c out of analytic convenience.

is less than that of changing O through f the equilibrium MR from p must also be less than that from f but equations (6) and (7) indicate that this is only possible if $\epsilon_p > \epsilon_f$".

This latter requirement that $\epsilon_p > \epsilon_f$, would be satisfied, Becker shows, if offenders show preference for risk.

The Becker model, accordingly, provides the necessary conditions which should hold in situations where there is an optimal level of crime, namely, that

$$\epsilon_f < 1$$
$$\epsilon_p < 1 \quad \text{provided} \quad \frac{\delta C}{\delta p} \text{ is not sufficiently large}$$
$$\epsilon_p > E_f$$

The Econometric Model: Variables and Data used

An econometric model must now be developed to establish whether or not these conditions hold in Ireland. Recall equation (4): The supply of offences

$$O_j = O_j(p_j, f_j, u_j) \tag{4}$$

If this is specified in the following way

$$O_j = \beta_o p_j^{\beta'} f_j^{\beta_2} u_j^{\beta_3} \phi \tag{10}$$

where ϕ is an error term, then the exponents of p_j, f_j and u_j can be shown to be elasticities or taking logs and writing (10) as

$$l_n O_j = l_n \beta_o + \beta_1 l_n p_j + \beta_2 l_n f_j + \beta_3 l_n u_j + \phi' \tag{11}$$

it can be said that $\beta_1 = \frac{p}{O}\frac{\delta O}{\delta p}$ and $\beta_2 = \frac{f}{O}\frac{\delta O}{\delta f}$ which are the values required by equations (8) and (9). However, specifying a relationship in this form means that the measured elasticities will be constant over the range of observation. This amounts to saying that criminals will keep the subjective probability of their being apprehended, convicted and punished constant. In other words, if the probability of being convicted doubles the criminal is assumed to reduce his activities by half. This assumption of constant elasticities has found to be an adequate approximation in much empirical economic work and in the absence of any evidence to vitiate its use in the present case it was decided to estimate (11), using a sample of 20 years data from 1952 to 1971.

To carry out the study meaningfully for all offences would have been extremely complex since statistical tests revealed that the various categories of crime were not in constant proportion through time. Changes in the overall probability of being apprehended would in part be attributable to changes in the relative

frequency of the crime and not to judicial decisions. On this account two categories of crime were chosen for study, namely, "Offences against property with violence" and "Offences against property without violence". These crimes would seem to be most likely motivated on a gains-cost basis (an underlying assumption of the Becker model). And since the two categories represent 9·2 per cent of all indictable offences (see Garda Síochána) they are highly relevant to any discussion of optimal resource use.

Since the reliability of econometric results will, in large part, depend upon the quality of the estimators of the variables used, some discussion of these variables is appropriate at this point.

The Variables

(*a*) *The Dependent variable.* The total number of offences committed against property with and without violence, henceforth Y_1 and Y_2 respectively, would be the appropriate statistic for the regression analysis. As the total number of offences committed is not known, the statistic "number of offences reported or known" (see appendix for source) was used as an estimator of the true variable. It is worth considering some of the possible consequences of using this estimator. Specifically, what offences are not reported, and how significant a proportion of the total are they?

One can think of a number of situations where an offence would go unreported: First, the persons involved may not realise an offence has been committed. Second, those involved may be aware that an offence has been committed but are willing partners. Third, the offender may know that he has committed an offence but the victim may not. Finally, even if a victim is aware that an offence has been committed against him, the offence may not be reported for a variety of reasons. There is reason, therefore, to believe that over all categories of offences, the reported figures are an understatement of the true level of crime. For obvious reasons it cannot be ascertained how serious is the understatement. A survey conducted by the National Opinion Research Centre (NORC) of Chicago University and described by Ennis (1967) indicates that it can be considerable, for example, for larceny (under $50) the police were not notified in 63 per cent of cases. In conclusion the statistic used to estimate the number of offences for each of the two categories of crime chosen is likely to be a biased (downward) estimator though the extent and significance of the bias cannot be ascertained.

A second problem in using reported crime statistic was illuminated by Greenwood and Wadyski (1973). Here it was suggested that: "Given the distribution of total crime between reported and unreported and given the efficiency of additional policemen in detecting crime, additional policemen result in an increase rather than a decrease in measured crime rates." The consequences of this for the present study is that an increase in the reported crime statistics, rather than indicating an increase in actual crime, may simply mean a decrease in the bias of our estimator, or some mixture of the two phenomena. On this account Y_1 and Y_2 must be treated with caution.

(*b*) *The Independent Variables—Risk and Punishment.* Following Sjoquist (1973) it was decided to be more flexible than Becker and three possibilities were considered for the risk variable:

X_1: The ratio of convictions to reported offences. The problem with using "convictions" is that the statistics available relate to the number convicted in the year, regardless of when the offence was committed. To the extent that some convictions will relate to offences of the previous year(s) the ratio overstates. But since there will be some offences of the year which will not have been decided by the courts the ratio will also understate and there will be a cancellation effect. It is hoped that the ratio will not err seriously on this account. A more serious problem exists in that the denominator of the ratio is an understatement since reported offences appear on both sides of the equation and as a result the ratio is biased upward.

X_1': The ratio of detections to reported offences is biased upward for the same reason as X_1.

X_1'': The ratio of convictions to detections suffers from the problem that while detections relate to a given year the convictions may not relate solely to those detections. As with X_1 there will be a cancellation effect and it is hoped that the ratio will not be seriously biased.

X_2: The punishment variable would seem to be most aptly described by the average prison sentence or fine for the various categories of offences. This statistic, regrettably, is not available as it is for other countries. Consequently, a rather crude approximation was made using the ratio of committals to prison to convictions for the two categories of offences.[3] If one makes the assumption that fines are no more deterring than prison sentences then an upward movement of the ratio should cause offences to fall (i) because it deters future crimes (ii) because it implies more offenders are temporarily unable to commit crimes since they are resident in penal institutions.

(*c*) *The Structural Variables*

Becker is not very precise on what structural variables are relevant, or on how relevant they might be. The following four variables were chosen for this introductory study on grounds of being (i) potentially relevant on *a priori* reasoning, (ii) on their availability. However, there is no existing evidence to show that these might be relevant in explaining crime in Ireland.

3. The year of the Garda report ends on the 30th September, while the prisons report is compiled on a calendar year basis. Some discrepancies may arise in the ratio on this account but these should not affect the general direction of the trend.

X_3: *The level of unemployment:* This was chosen because the utility to be derived from criminal activity would be marginally greater for those out of work than for those who were paid a wage. Unemployment would also facilitate crime prospecting, because of the time resource available. On these accounts a positive relationship is expected.

X_4: *The population of Dublin:* High crime rates are usually associated with urbanised societies. In the five-year period 1968–1972 an average of 60 per cent of all indictable offences per annum took place in the Dublin Metropolitan area, while the population of Dublin consisted of 20 per cent of the total population over the same period. A positive relationship is again expected.

X_5: *The ratio of secondary and vocational schoolgoers to primary schoolgoers:* An increase in the ratio is tantamount to a lengthening of the school-leaving age. The variable was included on the grounds that more education would develop a sense of law abidingness and that in the period 1967–1971 only 1·7 per cent of prison inmates were described (Prison Board) as having a "good education" which may simply reflect sentencing policies rather than differences in crime rates as between educated and non-educated groups. A negative relationship is therefore expected.

X_6: *Real* per capita *income:* The argument here is that the lower the level of income the greater the utility to be derived from committing a crime so that an inverse relationship is to be expected. On the other hand, if the growth of income is not equitably distributed, the demonstration effect could cause a positive relationship with crime.

The empirical findings

Since it was not known to what extent, if any, the chosen structural variables would add to the explanatory power of the model it was decided to proceed as follows:

the model was estimated using only the risk and punishment variables. Having decided on the best fitting variant of the risk variable a "fuller" specification of the model was attempted by introducing the structural variables.[4] However, autocorrelation presented some difficulties in estimating the model. In some instances the *DW* statistic rose above U_l but following Harrison (1972) the fact that it remained in the inconclusive region made them unacceptable. A generalised least squares (*GLS*) regression, estimated for all the equations, removed the distortion which the autocorrelation causes in the *OLS* estimates. (These latter are available on request.)

Another problem encountered in estimating the model was that of multicollinearity, for example, $R\ (X_6X_5) = 0{\cdot}99\quad R(X_6X_2) = -0{\cdot}91$. The problem

4. Regrettably there does not exist a sufficiently large volume of comparable statistics to use independent samples for this operation, on this account only the 20-year sample 1952–71 is used.

was not as pervasive as the autocorrelation but proved acute in some of the regressions, particularly the larger ones. Haitovsky's measure of multicollinearity is provided with the estimated equations, along with the appropriate test statistic, so that the reliability of the results may be assessed on this count.

Using a double log form of regression three variants of the risk variable, viz., X_1, X_1' and X_1'', were combined with the punishment variable, X_2, to determine which gave the best explanation of violent offences against property, i.e. Y_1. The results are given below.

TABLE 2: *Alternative formulations of the risk variable in a double log regression*

	$l_n X_1$ and $l_n X_2$		$l_n X_1'$ and $l_n X_2$		$l_n X_1''$ and $l_n X_2$	
t	−5·02	−11·44	−6.06	−10·71	1·92	−4·38
$\bar{R}^2$	0·87		0·90		0·74	

Table 2 shows that both $l_n X_1$ and $l_n X_2$ are highly significant at the one per cent level as indeed are $l_n X_1'$ and $l_n X_2$, while $l_n X_1''$ and $l_n X_2$ are significant at the five and one per cent levels respectively. With such little difference between $l_n X_1$ and $l_n X_2$, and $l_n X_1'$ and $l_n X_2$ the former pair were chosen as giving the closest approximation to Becker's risk variable.

The DW of 0·95 gives cause for concern, however, and with the reliability of both t and $\bar{R}^2$ values in doubt a *GLS* estimate was made giving

$$l_n Y_1 = \underset{}{3{\cdot}64} - \underset{(5{\cdot}01)}{1{\cdot}64 l_n X_1} - \underset{(5{\cdot}50)}{0{\cdot}77 l_n X_2} \qquad (12)$$

$$\bar{R}^2 = 0{\cdot}81 \quad F = 38{\cdot}48 \quad DW = 2{\cdot}08 \quad |X'X| = 0{\cdot}93 \quad \underset{\nu=1}{\chi^2 = 43{\cdot}19}$$

which appears to be statistically satisfactory.

For crimes against property without violence the same process was carried out. In this instance, however, $l_n X_1'$ and $l_n X_2$ gave a notably "better fit" than either $l_n X_1$ and $l_n X_2$ or $l_n X_1''$ and $l_n X_2$. Again the low DW of 1·23 was unsatisfactory. The GLS resulted in:

$$l_n Y_2 = \underset{}{4{\cdot}71} - \underset{(7{\cdot}90)}{1{\cdot}26 l_n X_1'} - \underset{(8{\cdot}41)}{0{\cdot}68 l_n X_2} \qquad (13)$$

$$\bar{R}^2 = 0{\cdot}85 \quad F = 52{\cdot}16 \quad DW = 1{\cdot}83 \quad |X'X| = 0{\cdot}92 \quad \underset{\nu=1}{\chi^2 = 42{\cdot}35}$$

with the DW considerably improved the results obtained in equation (13) were also accepted.

At this juncture a few comments might be made. First, for both categories of crime the attitude of offenders is revealed to be preference for risk and hence that "crime does not pay". This follows from the fact that criminals are more responsive to changes in the risk variable than to changes in the punishment variable (i.e. $\epsilon p > \epsilon f$).[5] Another interesting point is that $l_n X'_1$ (i.e., the ratio of detections to offences) gives a more significant t value than either of the other two variants of the risk variable when applied to crimes against property without violence. No conclusion can be given as to why this is so. One possibility was than the offender against property without violence, might be a more timid criminal than the offender against property with violence, and the thought of his crime being detected, let alone of being convicted, is sufficient to deter him. The problem does not fall within the economists' range of competence; the phenomenon is merely noted.

Having selected the risk variable for each of the chosen categories of crime a full specification of the model was made using all four structural variables to see if the explanatory power of (12) and (13) could be improved. Initially, an attempt was made to extend (12). However, the degree of multicollinearity was very severe for all of the multiple regressions using more than three independent variables. And, only in one multiple regression of three independent variables did $|X'X|$ differ significantly from zero at the five per cent level. This was the case when $l_n Y_1$ was regressed on $l_n X'_1$ and $l_n X_2$ and $l_n X_3$. However, the DW of 1·26 was unsatisfactory and a GLS regression was made giving

$$l_n Y_1 = \underset{}{2{\cdot}14} - \underset{(5{\cdot}11)}{1{\cdot}59 l_n X_1} - \underset{(11{\cdot}3)}{1{\cdot}40 l_n X_2} + \underset{(3{\cdot}17)}{0{\cdot}75 l_n X_3} \qquad (14)$$

$$\bar{R}^2 = 0{\cdot}87 \quad F = 42{\cdot}00 \quad DW = 1{\cdot}43 \quad |X'X| = 0{\cdot}67 \quad \underset{\nu=3}{\chi^2 = 17{\cdot}98}$$

The DW, acceptable at the one per cent level, is still not entirely satisfactory, and some autocorrelation may persist possibly of a higher order than unity. On this account equation (14) must be treated with caution.

In view of the severe multicollinearity encountered with large multiple regression of Y_1 it was decided not to carry out multiple regression of more than three independent variables for Y_2. While none of these were entirely satisfactory on grounds of both autocorrelation and multicollinearity, the OLS equation of $l_n Y_2$ on $l_n X_1'$ and $l_n X_2$ and $l_n X_3$ appeared to be the most promising and was chosen for GLS regression which yielded:

$$l_n Y_2 = \underset{}{6{\cdot}75} - \underset{(8{\cdot}30)}{1{\cdot}66 l_n X'_1} - \underset{(9{\cdot}73)}{0{\cdot}62 l_n X_2} - \underset{(2{\cdot}48)}{0{\cdot}53 l_n X_3} \qquad (15)$$

$$\bar{R}^2 = 0{\cdot}91 \quad F = 64{\cdot}02 \quad DW = 2{\cdot}07 \quad |X'X| = 0{\cdot}26 \quad \underset{\nu=3}{\chi^2 = 4{\cdot}95}$$

5. For a final exposition of this, see Becker's footnotes 15 to 17.

Although DW of 2·07 is quite satisfactory the low $|X'X|$ is indicative of the continuing presence of some multicollinearity so that equation (15) must be treated with caution. The negative coefficient of l_nX_3 is somewhat surprising since it implies that a rise in unemployment is accompanied by a fall in crimes against property without violence. It must be borne in mind that l_nY_2 refers to one category of crime and not to the aggregate of all offences. It is not inconceivable that increases in X_3 could cause a transfer out of Y_2; perhaps with violence.

The econometric analysis thus yields two equations for each of the two chosen categories of crime. These are now brought together:

$$l_nY_1 = \underset{}{3{\cdot}64} - \underset{(5{\cdot}01)}{1{\cdot}64}l_nX_1 - \underset{(5{\cdot}50)}{0{\cdot}77}l_nX_2 \qquad (12)$$

$$\bar{R}^2 = 0{\cdot}87 \quad F = 38{\cdot}48 \quad DW = 2{\cdot}08 \quad |X'X| = 0{\cdot}93 \quad \underset{\nu=1}{\chi^2 = 43{\cdot}19}$$

$$l_nY_1 = \underset{}{2{\cdot}14} - \underset{(5{\cdot}11)}{1{\cdot}59}l_nX_1 - \underset{(11{\cdot}30)}{1{\cdot}40}l_nX_2 + \underset{(3{\cdot}17)}{0{\cdot}75}l_nX_3 \qquad (14)$$

$$\bar{R}^2 = 0{\cdot}87 \quad F = 42{\cdot}00 \quad DW = 1{\cdot}43 \quad |X'X| = 0{\cdot}67 \quad \underset{\nu=3}{\chi^2 = 17{\cdot}98}$$

$$l_nY_2 = \underset{}{4{\cdot}72} - \underset{(7{\cdot}90)}{1{\cdot}26}l_nX'_1 - \underset{(8{\cdot}40)}{0{\cdot}68}l_nX_2 \qquad (13)$$

$$\bar{R}^2 = 0{\cdot}85 \quad F = 52{\cdot}16 \quad DW = 1{\cdot}83 \quad |X'X| = 0{\cdot}92 \quad \underset{\nu=1}{\chi^2 = 42{\cdot}35}$$

$$l_nY_2 = \underset{}{6{\cdot}75} - \underset{(8{\cdot}30)}{1{\cdot}66}l_nX_1 - \underset{(9{\cdot}73)}{0{\cdot}62}l_nX_2 - \underset{(2{\cdot}48)}{0{\cdot}53}l_nX_3 \qquad (15)$$

$$\bar{R}^2 = 0{\cdot}91 \quad F = 64{\cdot}02 \quad DW = 2{\cdot}07 \quad |X'X| = 0{\cdot}26 \quad \underset{\nu=3}{\chi^2 = 4{\cdot}95}$$

While equations (14) and (15) have increased the explanatory power of both (12) and (13) they are not entirely satisfactory on statistical grounds. Nevertheless something substantive can be said in regard to the necessary conditions for an optimal crime rate for the two chosen categories of crime. In all four cases ϵp is greater than ϵf, implying that criminals are risk preferrers and that crime does not pay (see p. 30). In the two equations describing crimes against property without violence ϵf is less than one and thus two of the necessary conditions are fulfilled. In both equations ϵp is greater than one which causes some doubt

about the optimality condition holding, but without some estimate of the magnitude of $\frac{\delta c}{\delta p}$ nothing conclusive can be said at this juncture. For the equation describing crimes against property with violence ϵp also exceeds unity. Whilst the doubts about the necessary conditions holding are reinforced, nothing definite can be said in the absence of an estimate of $\frac{\delta c.}{\delta p}$ There is also some reason to be suspect that for this category of crime ϵf exceeds one which would indicate that the optimal conditions do not hold for this category.

Summary of conclusions

The analysis has shown that the necessary conditions for an optimal crime rate, as expounded by the Becker model, cannot be assumed to hold in the Irish case. More research is clearly warranted. The next step requires specifying the precise form of both the *MC* and *MR* curves, though with the present availability of data this will prove a formidable prospect. It would also be desirable to extend the analysis to more complex models, such as those of Ehrlich (1973) and Carr-Hill and Stern (1973). It will then be possible to make comparisons with the position of other countries, which would facilitate the development of policy prescription.

Ehrlich's (1973) work on the US uses a model similar to the one adopted here but is more comprehensive in that it (*a*) incorporates in the concept of opportunities both punishment and rewards rather than cost of punishment alone, and (*b*) formally links the theory of participation in illegitimate activities with the general theory of occupational choices. The absence of adequate data in Ireland prevents such an analysis at present. Only then will it be possible to put forward an analysis in a form which is more immediately relevant to policy formulation in this area. The purpose of the present paper, as befits an exploratory foray into this field, is the more modest one of demonstrating that there are important economic dimensions associated with a social "bad" such as crime, and that economic analysis can have a useful rôle to play, along with other social sciences, in explaining society's understanding of and responses to criminal activity.

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Data used for the Regressions

	Dependent		*Risk and Punishment for* Y_1				*Risk and Punishment for* Y_2				*Structural*			
Year	Y_1	Y_2	X_1	X'_1	X''_1	X_2	X_1	X'_1	X''_1	X_2	X_3	X_4	X_5	X_6
1952	2,728	11,301	0·36	0·61	0·60	0·40	0·21	0·44	0·49	0·25	9·1	696·8	0·29	147
1953	3,032	11,813	0·36	0·61	0·60	0·36	0·20	0·43	0·48	0·24	9·6	701·4	0·30	150
1954	2,538	8,753	0·37	0·64	0·58	0·37	0·22	0·47	0·47	0·27	8·1	705·1	0·30	152
1955	2,325	8,555	0·41	0·78	0·52	0·36	0·21	0·53	0·40	0·25	6·8	705·8	0·31	153
1956	2,695	9,365	0·42	0·77	0·54	0·32	0·23	0·53	0·43	0·20	7·7	705·8	0·31	147
1957	3,061	10,334	0·41	0·67	0·54	0·33	0·20	0·46	0·43	0·20	9·2	709·1	0·31	144
1958	3,645	12,219	0·33	0·73	0·46	0·37	0·16	0·42	0·39	0·22	8·6	707·7	0·32	146
1959	3,824	13,270	0·39	0·70	0·55	0·30	0·16	0·42	0·39	0·23	8·0	712·4	0·33	155
1960	2,982	11,470	0·44	0·77	0·57	0·28	0·21	0·53	0·39	0·19	6·7	715·4	0·34	167
1961	3,186	10,623	0·35	0·77	0·46	0·28	0·25	0·61	0·40	0·14	5·7	778·3	0·36	176
1962	3,466	10,666	0·39	0·75	0·52	0·24	0·27	0·60	0·45	0·12	5·7	733·0	0·38	181
1963	4,006	10,823	0·43	0·75	0·58	0·19	0·30	0·63	0·47	0·10	6·1	750·1	0·38	185
1964	4,282	11,972	0·43	0·73	0·58	0·20	0·28	0·57	0·49	0·13	5·7	765·7	0·40	194
1965	4,213	11,014	0·46	0·75	0·60	0·17	0·31	0·65	0·48	0·13	5·6	780·8	0·41	193
1966	4,957	12,631	0·43	0·73	0·58	0·16	0·29	0·60	0·49	0·11	6·1	795·0	0·41	194
1967	5,575	13,452	0·45	0·71	0·64	0·15	0·28	0·58	0·47	0·11	6·7	803·2	0·44	204
1968	6,469	15,091	0·44	0·69	0·64	0·14	0·31	0·55	0·57	0·09	6·7	814·4	0·49	219
1969	7,563	16,764	0·44	0·67	0·65	0·14	0·31	0·55	0·56	0·07	6·4	823·6	0·53	230
1970	9,577	19,557	0·36	0·55	0·66	0·16	0·25	0·44	0·58	0·11	7·2	836·2	0·54	234
1971	10,654	24,929	0·37	0·51	0·73	0·16	0·23	0·40	0·58	0·12	7·2	852·2	0·56	241

Sources: (1) Annual Report of the Commissioner of the Garda Síochána on Crime.
(2) Annual Report of the prisons board.
(3) Trend of employment and unemployment.
(4) Statistical abstract.
(5) National income and expenditure.
(6) CPI from Statistical bulletin.
(7) Population interpolated from UN Demographic yearbook.

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