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The Economics of Crime: Main Problems and Some Solutions

Ever since Gary Becker (1968) published his famous article on “Crime and Punishment: An Economic Approach”, and especially since Isach Ehrlich carried out his empirical studies of crime in the US in the beginning of the 1970s (in particular Ehrlich 1973), there has been serious, and sometimes fierce, debates about studies of crime based on the assumption that offenders are rational utility maximisers. Becker’s view that resources allocated to the Criminal Justice System should be balanced against what reduction in crime these resources can produce, has not been seriously challenged. What has caused debate, however, is on the theoretical level the manner by which Becker analyses criminal behaviour, and on the empirical level the manner by which Ehrlich (1973) and others interpret their results as demonstration of the deterrent effect of sanctions.

After a summary in section 2 of the characteristic features of the theoretical models of crime in the Becker-Ehrlich tradition, I will in section 3 comment upon the main criticism that has been raised against

this type of theory of criminal behaviour. Some authors, mostly non-economists, do not easily accept various aspects of the assumption of rational choice. Also, they find it strange not to include in a theory of criminal behaviour some of the insights that sociologists and criminologists claim to have. In section 4 I will give a short summary of the empirical studies carried out in the same Becker-Ehrlich tradition. Among the many objections raised against these studies, I will in section 5 concentrate on the three main problems that the panel of the American National Research Council *considered unsolved in their 1978 report.¹ Finally, I will present the main points of an empirical study with solutions to these problems. Rather than presenting a survey of theoretical and empirical studies of crime, I will focus on some of the main problems in this literature, and present solutions to some of them.

Survey of some theoretical results

Becker suggests that “a useful theory of

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1. Blumstein et al. (1978).

criminal behaviour can dispense with special theories of anomie, psychological inadequacies, or inheritance of special traits and simply extend the economist's usual analysis of choice" (1968, p. 170). He argues that criminals are like anyone else, and assuming, as economists usually do, that preferences are stable, that more income is preferred to less, and that people maximize expected utility, he is able to conclude that both the probability and the severity of sanctions have a negative effect on the amount of crime.

In most theoretical models in the Becker-Ehrlich tradition an individual is assumed to maximize the expected utility $E[U]$ of criminal activity according to

$$E[U] = PU(W_u) + (1-P)U(W_s), \quad (1)$$

where

$U(\cdot)$ is the individual's von Neumann-Morgenstern utility function,

P is the subjective probability of being caught and convicted,

W_u is the monetary plus psychic income (i.e. the monetary equivalent) from unsuccessful crime,

W_s is the monetary plus psychic income from successful crime.

Authors have proposed various specifications of the expected utility. Becker (1968) assumes

$$E[U] = PU(W_s - f) + (1-P)U(W_s),$$

where f is a fine. Here, the offender keeps all the benefit of the crime itself, although the fine may be related to the seriousness of the offence. Allingham & Sandmo (1972) and others, inspired by portfolio choice models, assume

$$E[U] = PU[W + G(\chi) - F(\chi)] + (1-P)U[W + G(\chi)],$$

where W is exogenous income (or wealth), χ is the proportion of wealth allocated to criminal activity (e.g. tax cheating), $G(\chi)$ is the gains to crime, and $F(\chi)$ is the loss of crime if convicted. The loss may include a fine and the seizure of (some of) the gains to crime. Heineke (1978) in one of his models assumes

$$E[U] = PU[L(t_L) + G(t_I) - F(t_I)] + (1-P)U[L(t_L) + G(t_I)],$$

where $L(t_L)$ is the legal income, t_L is the time used in legal activities, and t_I is the time used in illegal activities.

Table 1 shows for these specifications the effects of changes in various determinants of crime, as given by comparative statics. The results in Table 1 are obtained in the general case without specific assumptions about attitude towards risk. An increase in the probability of punishment has a negative effect on crime in all models, whereas an increase in the severity of punishment has a negative effect on crime only in Becker's model. The effects of increases in exogenous income, legal income and gains to crime are uncertain.

In the uncertain cases of Table 1, the individual's attitude towards risk is crucial. If decreasing absolute risk aversion is assumed, both the probability and the severity of punishment are found to deter crime in all three models. Furthermore, an increase in either exogenous income, in legal income, or in gains to crime produces more crime.

The same holds true for increasing absolute risk preference, except for the effect of changes in the severity of punishment. Here, two effects obtain: a substitution effect and an income effect. If these effects are of opposite sign, the final result is uncertain (unless one is willing to make assumptions about the size of these effects).

Table 1
Effects on crime of changes in various factors, no restrictions on attitudes towards risk

Studies	Effect on crime of increase in				
	Probability of punishment	Severity of punishment	Exogenous income	Legal income	Gains to crime
Becker (1968)	-	-			
Allingham & Sandmo (1972)	-	?	?		?
Heineke (1978)	-	?	?	?	?

Also for other attitudes towards risk it is in some cases possible to sign the effects on crime of changes in the exogenous variables, whereas in other cases this is not possible without quantitative restrictions on the various effects.²

If several types of sanctions are introduced, the effects on crime of various changes in the environment become more uncertain. If also benefits and costs of legal activities are risky, even more ambiguous results are obtained, although the probability part of the deterrence hypothesis keeps well.

As a whole, one may conclude that the effects of changes in the environment to a large extent depend on the individual's attitude towards risk. If one is willing to stick to the rather common assumption of decreasing absolute risk aversion, and also that psychic effects can be monetized, that there is just one type of sanctions, and that the benefits and costs of legal activities are not risky, the effects are clear: Crime is deterred by increases in the probability and in the

severity of punishment, and enhanced by increases in exogenous income, and in gains from both legal and illegal activities. In a society at large, however, a variety of individual attitudes towards risk may obtain, and our theories cannot produce definite answers about the aggregate effects of various factors that might have an effect on the behaviour of each individual.

Shortcomings of theoretical results – Economists vs sociologists?

Exaggerating somewhat the differences between sociologists and economists, one may say that the first consider crime as deviant behaviour whereas the latter consider it as rational, as explained in section 2. The latter assumption has been vigorously attacked by criminologists and sociologists.³ In my view, the animosity is partly a result of non-economists misunderstanding of what is meant by rational behaviour. I also believe that most theories of criminal behaviour can

2. See Eide (1994), p. 68 for details about various cases.

3. See e. g. Blumstein et al. (1978), Orsagh (1979), Brier and Fienberg (1980), Prisching (1982), and Cameron (1988).

be incorporated in a rational choice framework.⁴

Traditional rational choice

Figs. 1 and 2 illustrate the differences in the two theoretical strands. Fig. 1 shows the main elements characterizing an individual's choice situation according to the theory of rational choice. The individual has a feasible set of courses of action, some of which are illegal. The environment, including sanctions and wages, determines the outcomes of the various courses of action. The individual is assumed to choose the course of action that leads to the particular result in the opportunity set of outcomes that best satisfies its preferences. The threat of sanctions is part of the (uncertain) outcomes of criminal acts. The theory of deterrence is thus regarded as nothing but a special case of the general theory of rational behaviour under uncertainty.

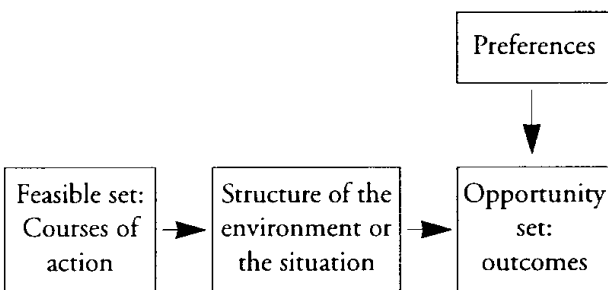


Fig.1 Rational choice

Preferences include not only wants, but also norms. The guilt of acting in conflict with norms is part of the costs of crime. The

traditional rational choice model may thus include norms. Like wants of goods and services, they are usually assumed to be stable. They may, however, differ among individuals, producing more or less law-abiding people.

Norm formation

In theories of economics of crime, norms are seldom studied, or even mentioned. Preferences as a whole are usually assumed to be constant; and authors do not find it necessary, or do not feel competent, to discuss norms. Some criminological theories, on the other hand, suggest that the individual's environment has a significant impact on people's preferences, especially on norms, but also on wants.⁵ Theories about learning, for instance, relate individual preferences to various characteristics of the society, see Fig. 2. Other theories suggest that preferences are inherited or dependent on age, gender, race, intelligence and other personal characteristics. Furthermore, it is sometimes assumed that individual behaviour is completely determined by norms (cf the arrow to the left in Fig. 2). In the literature of economics of crime these various theories are often neglected, and the main question studied is how the environment affects outcomes and thereby produces incentives to commit, or not to commit, crimes. Even if most of those who violate certain laws differ systematically from those who abide by the same laws, the former, like the latter, do respond to incentives, i.e. to sanctions and economic conditions.

4. Carr-Hill and Stern (1979) emphasize that the two types of theory should be seen as complementary rather than conflicting. They maintain that the economic approach isolates the importance of the probabilities and magnitude of reward and punishment, and shows how they can be treated formally. The criminological approach takes these for granted and indicates how different groups might view and react to these probabilities, rewards, and punishments.

5. See e.g. Eide (1994) for a survey of these theories, and of others mentioned below.

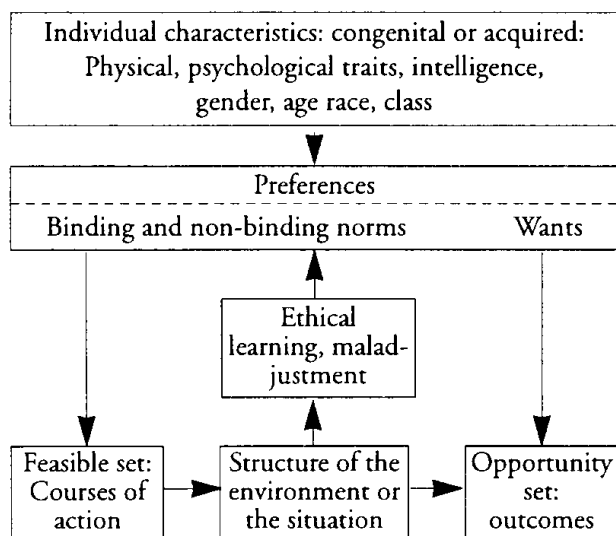


Fig. 2 Rational choice with norm formation

An example illustrating both an incentive mechanism and a norm formation mechanism is the possible effect of a more probable sanction. An increase in the probability of sanctions will not only (according to the models in section 2) represent an incentive to commit fewer crimes, but may also strengthen norms. A breach of those norms will then be given more weight when crimes are considered, and fewer crimes will be committed. Sanctions may thus have an effect on crime either by causing fear or by influencing norms. The combination of these effects is called "general prevention" (Andenaes 1975). In the economics of crime literature one focuses on the effects of law enforcement on the *outcomes* of actions, and thereby on illegal behaviour. This is the deterrence mechanism in the narrow sense. The possibility that law enforcement or other aspects of the environment might affect individual norms and wants, e.g. by conditioned aversion as suggested by the behavioural perspective, is given less attention. Modelling of endo-

genous norms have barely started within the economics of crime literature.

In empirical analyses an increase in sanctions may work through both mechanisms. To distinguish between the two is perhaps not so important for policy makers, but it certainly is for those who want to understand criminal behaviour.

It is difficult not to acknowledge that economic theories of crime that do not include insights of sociologists and criminologists must be meagre, and that this is a problem in the economics of crime literature. One way to give more flesh to our models is to perform specific studies of preferences. This can be carried out through surveys and other studies of empirical social research. Theories in criminology relating norms and wants to factors like age or gender may also be added by including exogeneous variables representing these determinants of crime.

These proposals represent natural extensions of the rational choice theory. The apparent conflict between theories will disappear to the extent that a more general rational choice framework may include complementary criminological knowledge. Becker was right in suggesting that we can produce a useful theory without doing this. His more restricted theory takes account of the fact that both delinquents and law-abiding people have a feasible set of courses of action and that their acts are influenced by benefits and costs. Even if people have particular norms and obtain atypical benefits and costs of various actions, they tend to choose what best satisfies their preferences. There is, however, no reason not to add other important elements of knowledge to this theory.

Other points of criticism

Several authors have discussed whether people have sufficient information about the

environment and about outcomes of actions to make rational choices. Becker and others maintain that even if choices are based on subjective beliefs that are wrong, the choices are meaningful from a subjective point of view, and behaviour can be explained and understood on this basis.

It has also been argued that the simple rational choice theory is inadequate because people's behaviour is determined by procedural rationality, in which an individual is portrayed as a follower of rules established by history or social relations. It becomes a habit to be law-abiding. People do not balance benefits and costs in every situation of choice. They act according to habits (Andenaes 1975). It is, however, difficult to see how habits are established if not by choosing a way of life on the basis of acquired norms and available outcomes. The fact that we do not repeat the balancing at every second can itself be a result of rational behaviour: repetition of similar considerations of benefits and costs would be a waste of time. The crucial question is if habits produce "mistakes" in the sense that we act otherwise than a new evaluation of costs and benefits would suggest. Undoubtedly, this can occasionally happen. But once having decided that mugging or stealing is not your way of life, it is farfetched to surmise that another consideration would give a different result.

The common assumption in rational choice theory that preferences are stable is often criticized.⁶ It is argued that emotional arousal might temporarily change our feelings about the importance of a norm, for instance reduce our inhibitions, or make one outcome especially desirable. Even if this is

true, the rational choice framework does not necessarily become irrelevant. People may still seek the best outcome based on a new preference structure, and incentives may still work.

In some instances, apparently unstable preferences can be assumed to be stable. Our appetite for food or sex may certainly fluctuate during the day. In the very short run these desires vary a lot. In a slightly longer perspective, however, the striking characteristic is stability. Some time after being satisfied, the desires steadily return.

It is often argued that the rational choice theory might be acceptable for property crimes, but not for violent crimes. Let me just cite Ehrlich (1973:532) on this question: "Since those who hate need not respond to incentives any differently than those who love or are indifferent to the well-being of others, the analysis ... would apply ... to crimes against the person as well as to crime involving material gains." Empirical studies, discussed in the following sections, do not seem to undermine this statement.

Even if some of the criticism of the economics of crime models has been refuted, it is easy to give one's support to a proposition for social science research put forward by the Nobel Prize Winner in medicine Nikolass Tinbergen (who should not be confused with his brother Jan Tinbergen who has won the Nobel Memorial Prize in economics) that four levels of analysis should be put together: the biological (genetical), the developmental (how an individual is socialized), the situational (how the environment influences behaviour), and the adaptive (how a person responds to the benefits and costs of alternative courses of action). This ideal

6. Stigler and Becker (1977) have most forcefully claimed that individual preferences are stable over time and fairly invariant among people. Elaborating on adaptive preferences, they ascribe addictions and habits to the accumulation of specific knowledge and skills.

should not, however, refrain scholars from employing simpler procedures on their way to what is still a rather distant goal.

Empirical studies

In a great number of empirical studies the models of criminal behaviour have been tested, and the effect on crime of the probability and severity of punishment, and of benefits and costs of legal and illegal activities has been estimated. The influence of norms, tastes, and abilities, corresponding to constitutional and acquired individual characteristics, has in some cases been studied indirectly by including variables like age, race, gender, etc. A variety of equation specifications and estimation techniques have been used, and the studies have been based on data from countries and states down to municipalities, campuses, and individuals.

There are good reasons to carry out empirical studies of criminal behaviour using data on individuals rather than aggregated data. In the first place it is at best controversial to posit that behaviour is anything but individual. Second, the theoretical models developed so far are based on individual rational choice. Third, as will be discussed below, studies based on aggregated data require a number of additional assumptions of questionable validity. Forth, the statistical identification problem is less serious when individual behaviour is studied.

Unfortunately, empirical tests of these models using information on individuals are few, mainly because of lack of data. The bulk of econometric (or rather criminometric, cf Eide 1994, p. 3) studies consists of cross section regression analyses based on aggregated data. Time series studies are less numerous. A lot of simple correlation studies have also been carried out.

Most cross-section criminometric studies

can be considered as specifications of the general model

$$X = f(P, S, Z_j), \quad (i)$$

$$P = g(X, R, Z_k), \quad (ii)$$

$$R = h(X, Z_l), \quad (iii)$$

where X = crime rate (No. of crimes per population), P = probability of punishment, S = severity of punishment, R = resources per capita of the Criminal Justice System (CJS), and Z_j, Z_k, Z_l = vectors of socio-economic factors. The crime function (i) assumes that the crime rate (in e.g. a police district) is a function of the probability and the severity of punishment. It is usually expected that these factors have a negative effect on crime, although our discussion above casts doubt on the effect of more severe sanctions. Equation (ii) assumes that the probability of punishment is a function of the crime rate and the resources allocated to the CJS. This equation can be interpreted as a behavioural relation of the police. Because of police overloading, a high crime rate is expected to produce a low probability of punishment. More resources are expected to have the opposite effect. Equation (iii) assumes that the resources allocated to the CJS are a function of the crime rate. This equation explains part of the behaviour of the political authority that allocates grants. Various socio-economic factors are included as explanatory variables in all three equations. In (i) these factors are usually considered to be more or less good proxies for the exogenous variables that according to the various theories discussed above have an influence on individual behaviour.

In some studies police resources are included as an explanatory variable in the crime function. In others equation (iii) is not included in the model.

The great majority of these studies show a

clear negative association between punishment variables and the crime rate. Almost without exception the coefficients of the punishment variables (which usually are the elasticities of the crime rates with respect to the punishment variables) are negative, and in a large number of cases significantly so. Furthermore, the estimated elasticities have rather high values. Eide (1994) summarizes such estimates of 21 cross section studies based on a variety of model specifications, types of data and regression techniques. He finds the median value of the 118 estimates of elasticities of crime rates with respect to various measures of the probability of punishment to be about $-.7$, which means that the amount of crime will decrease by $.7\%$ if the probability of punishment increases by 1% . The median of the somewhat fewer severity elasticities is about $-.4$.⁷ The effects of various socio-economic factors are less unambiguous. Only some of the studies give support to the hypothesis that crime increases when gains to crime increases or when benefits of legal activities decreases. One reason might be that it is difficult to find empirical measures that represent the theoretical notions in a satisfactory manner. Another reason might be the (unknown) variety in individual attitudes towards risk.⁸

Main problems of empirical studies

The Panel on research on the deterrent and incapacitative effects of sanctions, organised by the American National Research Council, came to the conclusion that “[t]aken as a

whole the reported evidence consistently finds a negative association between crime rates and the risks of apprehension, of conviction, or imprisonment” (Blumstein et al. 1978:4).

The Panel considered its task to be “to assess the degree to which the observed association is found *because* the higher sanction levels reduced the amount of crime committed” (p. 4). The Panel sees three main obstacles to drawing a conclusion of causation based on cross-section and time-series studies of what they call “natural variation”, i.e. observed data from the real world: “... (1) the error in measuring crimes; (2) the confounding of incapacitation and deterrence; and (3) the possibility that the level of crime affects sanctions in addition to sanctions deterring crime, which is known as a simultaneous relationship”.

Measurement errors are especially important in most studies of crime because only a rather small proportion of crimes committed are reported to the police and included in the data that have been employed. If recording differs between police districts (in cross section studies) or over the years (in time series studies), a spurious negative correlation will appear between the crime rate and the proportion of crimes that are cleared up (see e.g. Blumstein et al., 1978). If, on the other hand, an increase in the number of policemen increases the number of crimes that are formally recorded, but not cleared up, there will be a spurious negative correlation between the number of policemen and clear-up proportion. Thus,

7. In empirical studies the measures used to represent the probability of punishment include the probabilities of arrest, of clearance, of conviction, and of conviction given arrest. The severity of punishment is represented by fines, by the length of sentence, or by time served. (Witte (1980) and Schmidt and Witte (1984), Myers Jr. (1983), Trumbull (1989), and Viscusi (1986)). Studies of tax cheating based on individual data by Clotfelter (1983), Witte and Woodbury (1985), Slemrod (1985) and Klepper and Nagin (1989) all conclude that both the probability and the severity of punishment have negative effects upon crime.

8. See Eide (1994) for a comprehensive discussion of a great number of empirical studies.

underreporting and changes in recording will usually introduce a bias in favour of deterrence, but against the hypothesis that the police produces it (Cameron 1988). These spurious correlations impede the evaluation of criminometric studies that most often confirm that crime increases with a decrease in the clear-up proportion, but that more police does not increase the clear-up proportion.

Deterrence and incapacitation are easily confounded in empirical studies because more severe sanctions may not only deter people from committing crimes, but also make it impossible to commit crimes during (extended) prison terms.

The problem of identifying equations in simultaneous models has been comprehensively studied by Franklin M. Fisher and Daniel Nagin (1978:379) in the volume of the Panel's work. They reject the usual procedure for identifying the crime function, which consists of including in equation (ii) (which explains the probability of punishment) some socio-economic variables that are excluded from equation (i) (the crime function). They state that they know of no variables that may affect the probability of punishment without also affecting the crime rate. For this reason the usual identification procedure is illusory. The equation may be technically identified, but by false assumptions, and we cannot rely on the estimated function as an expression of causation.⁹

The Panel finds these three objections to be so serious that they ask for scientific caution in interpreting the negative associations found between sanctions and crime. It

seems fair to say that these problems have not been satisfactorily solved in most of the studies carried out after the publication of the Panel's work. There are, however, a few studies where the problems to a large extent are avoided. In a study of draft evasion in the US, Blumstein and Nagin (1977) conclude that (1) data are relatively error free, (2) as draft evasion can happen only once, there is no danger of confounding incapacitation effects with deterrence effects, and (3) simultaneity problems caused by over-taxing of the Criminal Justice System are unlikely because draft evasion was given priority in the relatively well staffed federal courts. The authors consider that their results provide an important statistical confirmation of the existence of a deterrent effect. They find, however, that the severity of the formal sanction has a modest effect on draft evasion compared to the stigma effect of being arrested and convicted.

Using the Hausman test Layson (1985) and Trumbull (1989) have for homicide found that simultaneity was not a problem in their data, and the method of ordinary least squares could be applied. There are reasons to believe that police overloading does not affect investigation of high priority offences like homicide, and that the simultaneity problem consequently disappears.

A criminometric study of crime in Norway

Using panel data for police districts Aasness, Eide and Skjerpen (1994) claim to have found solutions to the three main problems

9. It is interesting to note that in the cross-section studies reviewed by Eide (1994) the method of ordinary least squares tends to give smaller estimates of the elasticities of crime with respect to the probability and severity of sanctions than do the methods of 2 stages least squares, full information maximum likelihood, and other more advanced methods. This is what might be expected if a simultaneous equation bias is present. The difference in estimates, however, is not great.

raised by the Panel of the American National Research Council. In their study an equilibrium model of crime is developed and applied on the number of crimes and clear-ups for the 53 police districts in Norway for the period 1970-78. The model consists of behavioural relations of the offenders and the police. The problem of measurement errors is handled by allowing for both systematic and random errors in the registered numbers of crimes and clear-ups. The problem of identification is solved by demonstrating that the structural parameters are explicit functions of the theoretical 2. order moments of the crime and clear-up rates. The problem of incapacitation is considered to be of minor importance for the data employed. The number of man-years in prison is rather low in Norway, and incapacitation can therefore account for only a small percentage of the effect of imprisonment on crime.

The study is presented as a first step in a more comprehensive criminometric research project. When designing the model, simplicity has been emphasized in order to focus on some basic theoretical and empirical issues, in particular the problems of measurement errors and identification. Socio-economic variables have not been explicitly included. Instead, latent police district effects which summarize the effects of socio-economic variables on crimes and on clear-ups have been added, and the distributions of these latent variables across police districts and over time are modelled. The severity of sanctions is not included as a variable, because no perceptible difference in this factor seems to exist between police districts and over time in the period studied.

The model consists of the following three equations:

$$P_{it} = Y_{it} / X_{it} \quad (1a)$$

$$X_{it} = P_{it}^b C_{it} \quad (1b)$$

$$Y_{it} = X_{it}^r U_{it} \quad (1c)$$

X_{it} is the (true) *crime rate*, i.e. the number of crimes per 1000 inhabitants, in police district i in year t . Y_{it} is the *clear-up rate* defined as the number of clear-ups per 1000 inhabitants. P_{it} is the *clear-up proportion* defined in (1a), i.e. the number of clear-ups as a share of the number of crimes. The criminometric model is designed to describe and explain crime and clear-up rates for I ($i=1,2,\dots,I$) police districts in T ($t=1,2,\dots,T$) years.

The crime function (1b) says that the crime rate (X_{it}) is a simple power function of the clear-up proportion (P_{it}). It can be interpreted as a behavioural relation for an average offender with rational expectations on the probability of being caught. The parameter b , which is called the *deterrence elasticity*, is expected to be negative. The variable C_{it} is called the *crime tendency* in police district i in year t . The crime tendency summarizes the effect of the socio-economic environment and other variables not explicitly modelled.

The socio-economic variables used in various studies to explain variation in crime rates have produced mixed results, and it is pertinent to ask if these variables really represent the factors that are relevant for individual behaviour. At this stage, at least, it seems not only acceptable, but perhaps even preferable to substitute latent crime tendencies for socio-economic variables. This procedure is also recommendable when data on relevant explanatory variables are lacking.

The clear-up function (1c) says that the clear-up rate (Y_{it}) is a simple power function of the crime rate (X_{it}). It can be interpreted as a behavioural relation of the police. One may also interpret it as a combined relation of the

behaviour of the police and the political authorities financing the police force. The parameter r is called the *clear-up elasticity*. It is expected that $0 < r < 1$. The variable U_{it} is called the *clear-up tendency*. This latent variable is introduced for reasons that are similar to those mentioned for the crime tendency.

The system of equations (1) has three endogenous variables (P_{it} , X_{it} , Y_{it}), and two exogenous variables (C_{it} , U_{it}), with the following solution:

$$P_{it} = C_{it}^{(r-1)/d} U_{it}^{1/d}, \quad (2a)$$

$$X_{it} = C_{it}^{1/d} U_{it}^{b/d}, \quad (2b)$$

$$Y_{it} = C_{it}^{r/d} U_{it}^{(1+b)/d}. \quad (2c)$$

By specifying a distribution on the crime and clear-up tendencies (C_{it} , U_{it}) across police districts, and how it varies over time, a corresponding distribution of crimes and clear-ups (X_{it} , Y_{it}) is obtained through the reduced form model (2).¹⁰

The statistically significant estimate of the deterrence elasticity (b) for total crime is $-.82$. The estimate of the clear-up elasticity (r) is $.81$. The signs of these estimates are as expected.

The estimates of the variances and the covariance of the errors of measurement are positive and highly significant. This result underscores the importance of allowing the measurement errors to be correlated, an uncommon feature of model specifications in this field.

The variance of the latent district effects in the crime function decreases during the

Table 2
Deterrence elasticity of various crimes

Type of crime	Deterrence elasticity	Standard error
Public disorder	.040	.435
Forgery	-.454	1.650
Sexual offence	-.495	.214
Offence against the personal liberty	-3.748	1.718
Offence of violence against the person	-1.591	.569
Slander and libel	.327	.983
Embezzlement	-.223	.768
Fraud	.200	.758
Offence inflicting damage to property	-.502	.930
Aggravated larcenies	-2.408	.497
Simple larcenies	-.998	.150
Thefts of motor vehicles	-2.480	.532
All crimes	-.824	.353

period studied. This result means that police districts in a relative sense have become more equal as far as the tendency to commit crimes is concerned.

The same parameters for 12 different types of crime have also been estimated. The estimates of the deterrence elasticity are given in Table 2.¹¹ The clear-up proportion is seen

10. See Aasness, Eide, and Skjerpen (1994) for econometric specification of the model.

11. Whole sets of related models have been estimated for each type of crime. Table 2 shows the results for the models that for various reasons are considered to give good estimates. See Aasness, Eide, and Skjerpen (1994) for a comprehensive discussion of the models.

to have a strong preventive effect for both violent crimes and "traditional" economic crimes, such as aggravated and simple larcenies and thefts of motor cars, whereas more "sophisticated" forms, such as fraud, embezzlement, and forgery, are less affected.

The empirical results obtained in this study are not very different from what is found elsewhere in the economics of crime literature. With somewhat more confidence than in many other studies we have concluded that incapacitation cannot be a major factor in explaining the effect on crime of changes in the clear-up probability. A better treatment of measurement errors gives additional support to the hypothesis that a higher clear-up rate has a preventive effect on crime. Our estimates of this effect, however, are somewhat higher than in many other studies. To the extent that our manner of dealing with the problem of simultaneity represents a methodological improvement, this is what might be expected, cf footnote 9.

Final remarks

Those who have criticised the economics of crime literature have certainly pointed to weak aspects in various studies. For instance, one may with good reason question the choice of some theoretical variables (e.g. of variables of punishment, benefits and costs), or the choice of the empirical measures for these variables. The consequence, however, is not necessarily that macro studies should be avoided. Problems of operationalisation do not make a theory irrelevant. Better than to drop such studies is to continue the theoretical discussion about determinants of crime, and to produce more empirical studies, in order to improve the foundation for choosing acceptable measures of theoretical constructs. If various operationalisations produce similar results, there is reason

to believe that the theory is robust to such differences. Then, one might even conclude that the theory is quite good, despite the fact that each and every formal test of significance is of limited value.

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