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CRIME, PUNISHMENT AND DETERRENCE IN AUSTRALIA:
AN EMPIRICAL INVESTIGATION

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CRIME, PUNISHMENT AND DETERRENCE IN AUSTRALIA:
AN EMPIRICAL INVESTIGATION*

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* This paper reflects a long gestation period and equally reflects a substantial list of debt. At the risk of being invidious, particularly valuable help was received from Steven Bardy, Fred Gruen, Muthi Semudram and Bruce Whittingham. Initial research on this topic was funded by the Criminology Research Council. The writer takes full responsibility for the final contents of the paper.

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ABSTRACT

This paper provides empirical estimates of the determinants of crime rates in Australia. It differs from most modern criminological analysis by being aggregative rather than offender-based and by deriving from the economic approach to criminal behaviour. Its major finding is that court committals and imprisonments have operated as major deterrent factors in explaining variations in recorded crime rates. Ethnicity and race are also seen to have had significant effects. At the same time no measurable impact is found for the direct economic influences of poverty and unemployment nor for the attitudinal influences of education and class status.

These results are likely to be controversial. They run counter to certain conventional wisdoms in criminology and they may offend some social values. Nevertheless the deterrence results seem especially strong and robust and those relating to ethnicity and race relatively so. Improved measurement however could alter the findings for the other influences examined. The paper examines the relationship of these research findings to criminal justice policy.

Crime, Punishment and Deterrence in Australia

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CRIME, PUNISHMENT AND DETERRENCE IN AUSTRALIA:
AN EMPIRICAL INVESTIGATION

I. Introduction

The purpose of this paper is to provide empirical estimates of the determinants of crime rates in Australia. The approach adopted here differs from most modern criminological analysis by being aggregative rather than being offender-based i.e. it uses group data (at the state and territory levels) rather than using observations on individuals for a sample of offenders. It also differs by being based on the economic approach to crime, though narrow or exclusive reliance on pecuniary motivation is certainly not assumed, and "non-economic" factors are centrally incorporated into the analysis. Indeed the approach adopted provides a major opportunity for drawing out within the same analysis and in a systematic and controlled way, the relative significance of such contrasting approaches to criminality as incentive/deterrence approaches as compared to social explanations.

It is a major finding of the paper that court committals and imprisonments have operated as major deterrent factors in explaining variation in Australian crime rates. Ethnicity and race have also had significant effects upon recorded crime rates. At the same time direct economic incentive influences, including poverty and unemployment, are found to have had little or no discernible impact upon recorded crime rates. The same applies to such attitudinal influences as education and blue collar working status. Finally police force provision levels have not had any substantial direct effect in themselves in explaining differences in crime rates across jurisdictions or over time in Australia, but may have significant impact indirectly through committals and imprisonment.

Some of these findings are quite contrary to the author's own prior expectations and are also sometimes contrary to certain conventional wisdoms in criminology. To motivate and explain the findings, the paper first develops a methodological and theoretical basis for such an investigation, outlines the data and statistical methods used and then presents and discusses the empirical results obtained. Some speculations on the relationship between this economic research and criminal justice policy are offered by way of conclusion.

II. Methodology and Theory

There are three methodological routes possible for specifying the crime determinants to be investigated. These are: ad hoc or casual specification of relevant influences; ex post derivation from the findings of the previous empirical literature; or ex ante specification from theory. The latter approach is taken here; theory heaving the advantage of imposing consistency and, through the formal process of abstraction, of indicating not only included factors but of helping to understand the role of excluded factors.

The theoretical starting point for this paper is the economic analysis of crime associated with Becker (1968) and Ehrlich (1973). The writings of these Chicago social economists, in the words of Mark Blaug (1980, p.244), "lend themselves all too easily to caricature because they employ a cumbersome apparatus to produce implications that are sometimes obvious, if not banal". Nevertheless, they do form one of the few systematic theoretical expositions of the basis for supply of criminal offences and, when properly interpreted, do so at least in a useful taxonomic way.

The Becker-Ehrlich approach focuses on the decision by individuals to allocate some or all of their time to illegal activities. Using 'utility' as the catch-all to represent well-being, this approach means individual expected utility can be represented as

$$(1) \quad E(U) = p U_a(X_a) + (1-p) U_b(X_b)$$

where $U(X)$ is the utility of wealth function, X is the money value (wealth) of these pecuniary and non-pecuniary benefits from the particular time allocation and p is the probability of being apprehended if engaged in illegal activity.

Both X_a and X_b permit a combination of legal and illegal activities, but the latter reflects the situation where an individual is not apprehended. Thus, for these X_a and X_b terms, if T is total time available, t_1 is the time devoted to illegal activities and t_2 is the time devoted to legal activities, we can write

$$(2) \quad X_a = W + W_1(t_1) + W_2(T - t_1) - F(t_1)$$

$$(3) \quad X_b = W + W_1(t_1) + W_2(T - t_1)$$

where F is the money value of the punishment imposed if the individual is apprehended.

An individual will engage in illegal activity if:

$$(4) \quad E'(U) > 0$$

where ' is the first derivative with regard to t_1 given $t_1 = 0$,

$$\text{i.e. (5) } \frac{W'_1 - W'_2}{W'_1 - W'_2 - F} > - \frac{p U'_a}{(2-p) U'_b}$$

$$\text{i.e. (6) } W_1 - W_2 > p F$$

since at $t_1 = 0$, $X_a = X_b$ so that $U'_a = U'_b$

This simply says that an individual will choose to engage in some illegal activity if the marginal return from crime exceeds the marginal return from legal activity by more than the expected value of punishment.

As such, the theory might be said to have produced results which are "obvious, if not banal": people will engage in crime when they think the benefits exceed the costs. But note the assumption that crime can be a matter of rational calculation and not only the product of random behaviour or of invariant biology or of absolute moral judgement etc. Moreover, within this (testable) perspective, note the taxonomy evident here as a guide to thinking: there are benefits from both legal and illegal activity and those benefits are pecuniary and non-pecuniary. Further the relative benefits are to be compared with the probability of apprehension and the level of punishment. There are at least five sets of conditioning factors thus drawn out. These conditioning factors are compatible with a range of economic, social and deterrence views of crime, since the theory provides no assumption regarding the relative weight of these factors. To ascertain these relative weights requires empirical investigation.

Accordingly a supply of offenses function is now defined for empirical estimation, which takes the general form:

$$(7) \quad C = C [\text{deterrence and punishment variables, pecuniary (incentive) variables, non-pecuniary (socio-demographic) variables}]$$

where C = crimes committed.

A useful particularisation of this structure is given as:

$$(8) \quad C = C(\text{PFS, COM, SENT; MY, LYS; YPOP, MWF, MYU, OSB, EDUC, APOP; TPOP})$$

where PFS = police force strength

COM = committals to court

SENT = sentences passed by courts

MY = median income
LYS = lower income share
YPOP = youth population
MWF = manufacturing work force
MYU = male youth unemployment
OSB = overseas born population
EDUC = education levels
APOP = aboriginal population
TPOP = total population

This says that the level of crimes committed may depend upon the probability of being detected, committed and sentenced - by way of deterrence to crime and punishment for crime. However a pecuniary incentive for crime will also arise from the relationship between general community income levels and those of the least advantaged section of the community, and this too may influence the level of crimes committed. The measures chosen reflect Ehrlich (1973) who argues that these measures are proxies for illegitimate opportunities and legitimate opportunities, respectively. Further, whether individuals will engage in such activity, even given existing levels of deterrence and pecuniary incentive, may be strongly conditioned by non-pecuniary or attitudinal factors, which can be represented by a range of relevant socio-demographic characteristics reflecting attitude formation and the associated variation in attitudes reflected in the population structure. As indicated, the relative strength of these factors and indeed even their actual relevance is not in any way assumed, but rather is a matter for empirical investigation. The actual variables included may seem self-evident once presented in this way and it may be thought that a lot of trouble with formal theorising could have been avoided by stating the obvious. Even if this were true the only cost of such theorising is a little formality. However if all of these factors were not obvious then there is an important gain, since statistical estimation procedures may produce "biased" (i.e. incorrect) results if there are important variables excluded when undertaking such analysis. One can be more confident in proceeding after such a taxonomy has been developed from theory, however tedious the process.

How much is this an "economic" view of crime? Only two of the variables included are monetary in a direct market sense. In a more general sense these monetary variables and also the deterrence variables can be said to reflect a relative incentive structure applicable to the "rational maximising" decision-maker of economic theory. But beyond this the attitudinal variables reflecting the non-pecuniary benefits or costs of illegal activity can reflect a wide range of other theories of crime - sociological, political, psycho-medical or physiological. In fact the particular attitudinal variables incorporated here are basically socio-demographic, so that while the other types of more individual or personal theories can be in principle incorporated in the model, this is not pursued further here empirically. It is considered an important methodological step to do no more than compare "economic" and "sociological" factors within one common systematic framework. Others may wish to pursue further comparisons, most likely using less aggregative data.

Note finally that the classification of this array of variables into "economic" and "socio-demographic" is a loose usage. Even an "economic incentive" variable such as the share of the population with low incomes, can equally permit of a social interpretation derivable from a non-economic theory, e.g. envy, alienation etc. Equally an "attitudinal" variable like occupation can easily be given an "economic" interpretation e.g. reduced income position and limited promotion prospects. The intention here is to offer some interpretations and to claim only that those explanations are consistent, but not necessarily exclusive of other explanations. The more important achievement is to establish which relationships are empirically important, rather than to tell an unchallengeable story of why. Hence the primary task seen for this paper is the empirical one of discerning the relevance and strength of particular variables or effects within the general functional relationship indicated.

III. Measurement and Statistics

The task is to empirically examine which variables seem to be significantly associated with the supply of offenses. This is taken here to mean estimating some variant of equation (8) above and, for this purpose, data on Australian states and territories for the period 1964 to 1976 were compiled and regression estimation of the equation undertaken.

The deficiencies in published Australian criminal justice statistics are well known. Accordingly a comprehensive set of uniform criminal justice statistics was especially compiled for the purposes of this study. This involved reconstruction of state and territory police, court and prison statistics on a uniform definitional basis and sometimes imputation of data where gaps in series existed. This process gave annual data for eight states and territories on a fiscal year basis 1963-64 to 1975-76. This statistical compilation was completed prior to publication of the recent statistical work by Mukherjee, Jacobsen and Walker (1981) and is subject to more explicit researcher adjustment in order to provide data comparability and completeness. Accordingly more detail is available as to the process of compilation and adjustment of the data used (cf. Withers, 1981). In this latter paper each variable is fully defined, units of measurement are made clear, sources are cited and any adjustments made are outlined and justified in detail.

Some major features of the data set relevant to evaluating the results to be presented in this paper still deserve discussion here. The year 1964 was chosen as a starting date since that is the first year for which Selected Crime Statistics were published by the Australian Bureau of Statistics. These were Australia's first published uniform crime statistics. Annual data are used because rarely could more frequent statistics be obtained - certainly not from published sources. The series cease in 1975/76 since more up-to-date court statistics could not be obtained for several states at the time of compilation. Some states have a four year lag in publication of court statistics.

Turning to the individual variables required in the estimation, the rest of this section examines the measurement of each variable in turn.

Crimes Committed (C). This variable is actually represented by several alternative measures in different equations. The most general measure is selected reported crimes against person and property. This covers offences reported or becoming known to the police in the categories of homicide, robbery, rape, motor vehicle theft, fraud, forgery and false pretenses. Breaking and entering is excluded since uniform data prior to 1967 could not be obtained and uniform series could not be compiled for larceny and arson. All other measures of crimes committed used in this paper are subsets of the specified group above viz. crimes of violence (homicide, robbery, rape), property crimes (motor vehicle theft, fraud, forgery and false pretences) or individual crimes of the types just indicated.

Crime variables can be expressed as a level or a rate. In the analysis of this paper, per capita rates were used to control for the differences in population scale in the various states and territories, over time. This meant dividing by total population, thus giving C/TPOP.

Naturally it is recognised that recorded crime neglects a significant part of criminality. This study is specifically concerned to explain recorded crime only.¹

Police Force Strength (PFS). This variable is indicated here by number of officers in police force strength including trainees, cadets, probationary constables and police-women as at the end of each financial year. Again, to allow for scale differences, this is expressed on a per capita basis in relation to total population (PFS/TPOP).

Committals to Court (COM). This deterrence variable is defined as persons committed for sentence or trial to higher courts, all crimes. Various adjustments had to be made to allow for changes in court jurisdictions and to adjust for states which recorded offences and not persons. No sub-division of the data by type of offence could be obtained on a comprehensive basis, nor could comprehensive data on hearings in lower courts be obtained. Nevertheless higher court committals by their nature refer to the more serious offences of most concern for this study. To allow for scale differences, committals are expressed as a ratio of the level of offenses i.e. (COM/C).

Sentences Passed by Courts (SENT). The remaining deterrence variable is represented by all persons serving sentences in Australian prisons, expressed in relation to offenders appearing before the courts. The series is thus convicted prisoners per committal (PRIS/COM). A more precise measure such as average length of sentences and/or value of fines for each year would be preferable; however such data could not be obtained. Indeed it is not even possible to obtain a series for new imprisonments each year, so that the prison "stock" figure had to be employed. Nevertheless this measurement does have the virtue of enabling suppression of concern about whether increased imprisonments may actually reduce completed sentences because of "crowding effects" in relation to prison capacity

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See Baldry (1980) for an economic analysis of unrecorded crime. Some attention is paid below to possible biases from this source. Results for individual crimes covering both reliable reporting and deficient reporting are compared.

(Biles 1982). As measured, the variable examines the effects of achieved prisoner increases from whatever source viz. increased inflows and/or longer sentences.

Median Income (MY). The opportunities for reward from crime are proxied here by net taxable income of the median taxpayer. This was calculated from the income class within which the median taxpayer is located, with median income approximated by the percentage increase in the class lower bound required to make up the median taxpayer number. This slightly cumbersome definition is necessitated by the need for a median measure and for state and territory income statistics which had to be extracted from the Taxation Commissioner's Annual Report, where income data is reported in income groups. Taxable income from all sources is included so that the measure is to be preferred to alternatives such as average weekly earnings, which are also available on a state and territory basis. Moreover a median rather than mean measure is preferred because the mean is unduly affected by the upper extremes of the income distribution. The opportunity set of potential criminals (as defined here) is likely to be more restricted, and hence better measured by the median. Moreover when, as is usual, income is distributed log normally, variation in its level is reflected by an equal proportional variation in its median value. Median Income is deflated by the consumer price index (CPI) for each state in order to allow for the effect of differences and changes in average price levels. South Australian CPI is used for Northern Territory, for which separate figures were not available.

Lower Income Share (LIS). The basis in economic deprivation for committing crime is proxied here as the proportion of persons submitting tax returns receiving net income which is below or equal to half the median income. This does include many people who pay no tax but it still excludes others who do not submit a return. For this reason results using this variable should be interpreted carefully. The measure is calculated by locating the number of taxpayers required to meet such an income level using the proportional method described for median income above, and then expressing this number as a proportion of total taxpayers. Braithwaite (1979) has exhaustively surveyed studies of the relationship between inequality and crime and presents one other preferred type of measure, viz. global indices of income dispersion such as the Gini Coefficient. Such measures have not been calculated yet for Australia on a state basis so that the half median-income:

measure justified by Fuchs (1967) and Ehrlich (1973) is adopted here. Ehrlich shows that this is a good proxy for the mean income of those below the median income. Nevertheless it should be remembered that there are various inequality measures possible and they can result in quite different income distribution rankings (Atkinson 1970).

Male Youth Unemployment (MYU). This variable can be interpreted either as an economic incentive variable (reduced income) or as an attitudinal variable (alienation). Of course insofar as unemployment is of concern because it reduces income, its effect would be captured in the lower income share variable. However the non-work time associated with unemployment means that it could have quite separate significance for participation in illegitimate activities. It is measured to reflect gender as well as unemployment, so that the measure chosen is junior males (under 21 years) registered as unemployed with the Commonwealth Employment Service. This is expressed as a ratio of the male youth population aged 15-21 years (MYU/MYPOP), and is obtained from Department of Employment, Monthly Review of the Employment Situation. The total male youth population base is used in order to eliminate measurement problems associated with changing labour force participation practices. The figures are annual averages of the end-quarter (monthly) totals. An approximation was needed for the Northern Territory figures and the (available) 1977 ratio in relation to South Australia was applied to give a 1964-76 series of estimates.

Completed Schooling (EDUC). This behavioural variable may be assumed to affect attitudes to crime and is represented by the population twenty years and over who have completed level ten of schooling or higher. It is expressed as a proportion of total population of the same age (TPOP) and estimated on an annual basis using linear interpolation from the Australian Bureau of Statistics, Census of Australia (quinquennial).

Manufacturing Work Force (MWF). As a measure of class influence or perhaps also job alienation, the number of male wage and salary earners in manufacturing industry was calculated. This is expressed as a proportion of the total population (MWF/TPOP) in order to avoid problems of changing labour force participation, and is an annual average of the end-quarter figures. The source is ABS, Employment and Unemployment, and some approximation was necessary for the 1964-1969 Northern Territory figures which do not distinguish males and females.

Youth Population (YPOP). This deterministic attitudinal variable is measured as the population of males aged 15-24. It is expressed as a proportion of total population to remove scale effects ($YPOP/TPOP$) and both data series are from Australian Bureau of Statistics (ABS), Demography (annual to 1971) and Estimates of Population Age Structure and Distribution, 1972 to 1976.

British Born Population (BBP). To reflect the possible different attitudes toward crime resulting from different socialisation and to allow for possible effects of re-settlement in a different country, two variables for over-seas born population were constructed. The first variable is Australian residents born in Britain, expressed as a proportion of total population ($BBP/TPOP$). The figure was calculated by linear interpolation for inter-censal years from the census benchmarks of 1961, 1966, 1971, 1976. The source is thus the Census of Australia.

European Born Population (EBP). To acknowledge the possible differences in attitudes and in settlement experiences of British vs non-British settlers in a country of predominantly British heritage, a second ethnicity variable was constructed. This was Australian residents born in Europe, excluding Britain, again expressed in relation to total population ($EBP/TPOP$). Recent years have seen increasing Asian migration and such migrants are excluded here. But their numbers were still relatively small in the period 1964-1976, particularly in terms of the population "stocks" in Australia, as opposed to recent inflows. A more major omission in the analysis, only recognised belatedly, is New Zealanders. A revised analysis should take this into account. For 1976 a state/territory specific figure was not available for European-born, so that 1971 ratios of European to total overseas born were applied in order to distribute the 1976 Australian total of European-born.

Aboriginal Population (APOP). This measure of race was calculated as population aged fifteen years and over who have described themselves as of aboriginal origins in the Census. Changing census definitions of race make pre-1971 comparisons a little difficult, but the Department of Aboriginal Affairs provided unpublished annual estimates on a consistent 1976 census definition for each state and territory. These figures are expressed as a proportion of the total population of the same age in each state and territory ($APOP/TPOP$).

If adjustment in notation is now made for the various conversions to ratios or rates outlined above and for the use of constant price rather than current price values, then the relationship (8) to be estimated can be rewritten as follows:

$$(9) \quad \frac{C}{TPOP} = C \left(\frac{PFS}{TPOP}, \frac{COM}{C}, \frac{PRIS}{COM}, \frac{MY}{CPI}, \frac{LYS}{TPOP}, \frac{MYU}{MYPOP}, \frac{EDUC}{TPOP}, \frac{MWF}{TPOP}, \frac{BBP}{TPOP}, \right. \\ \left. \frac{EBP}{TPOP}, \frac{APOP}{TPOP} \right)$$

IV. Estimation Methods

In order to estimate equation (9) the estimation method adopted had to take account of the data base being a pooled time series of cross-sections for Australian states and territories. Otherwise the estimation method would treat by assumption a difference between states in the same way as a difference occurring in one state over time. This may or may not have been valid and analysis of covariance was used to test for this. This involved estimating equation (9) on all the data supplemented by binary variables to represent each cross-section unit and for each individual state/territory separately over time. These estimations were compared with an unadjusted estimation of equation (9) and an F-test conducted on the residual sum of squares for each type of regression (Johnston, 1972, 192-207). The result indicated that a regression of equation (9) augmented by cross-section intercepts was appropriate. There was a need to distinguish cross-section observations from each other. This was done by adding dummy variables for other states and territories relative to Northern Territory.

Such augmented equation estimation represents a generalised multiple linear regression of the covariance model type (Kmenta, 1971, 516-517), and amounts to adding state/territory dummy variables to equation (9) and proceeding to estimate using ordinary-least-squares multiple regression, assuming that the classical error properties then apply.

Are there any other reasons why estimation might be biased or inconsistent i.e. that the residual errors after estimation are not normally distributed with zero mean? One possibility is that of "simultaneity bias". In this case it could arise because of the possibility of "feedback" relationships such as per capita police levels influencing crime levels per capita, but with these crime levels also influencing police provision levels. Or again, committal rates might not only influence crime levels (through deterrence), but be influenced by crime levels (through court dispositions taking account of crime trends). If such

feedback is major it can lead to inconsistent coefficient estimates. To test for this the crime equation (9), augmented by state dummy variables, was estimated as part of a four-equation model of the criminal justice system covering police demand and supply, crimes, and committals by courts. The crimes equation was not sensitive to this re-estimation so that for simplicity of presentation only the single equation estimates are reported here. Other studies (e.g. Wolpin 1978) have affirmed this coherence of single equation and simultaneous equation results. This result further affirms that feedback through "crowding effects" on courts and prisons is not a problem in Australia (contra Biles 1982).

The single equation estimates are made using ordinary-least-squares on a log-linear specification of the equation. This specification is chosen arbitrarily in order to provide convenience of interpretation of the coefficients. Coefficients in such equations are elasticity estimates. The major results were not sensitive to re-estimation in other standard specifications (viz. linear, log-complement, semi-logarithmic, logit) a result also found by Ehrlich (1977) for U.S. data.

One final comment on technique. The committal rate is measured as committals over crimes and, as such, has an element of regression of the dependent variable upon itself ("spurious regression"). However a regression in absolute levels did not alter the pattern or magnitude of explanation significantly, so that the rate is retained here for convenience in avoiding confounding explanation with scale effects. Certainly, testing this specification for heteroskedasticity using the Goldfeld-Quandt parametric test (Goldfield-Quandt, 1965) supported the hypothesis of homogenous variances i.e. under this specification variance now seemed unrelated to state/territory groupings despite the original diversity in the population and area of the jurisdictions.

Also in relation to the committal rate it should be recalled that the numerator, committals, is not measured in a crime-specific manner, due to data deficiencies, but the denominator is. It is likely that if data on committals in relation to individual crimes could be compiled, explanation would be further improved. The same, of course, applies to imprisonments.

The results reported were obtained on CDC Cyber 7600 computer system using the SHAZAM computation package.

V. Econometric Results

Table 1 presents the basic results obtained from the statistical estimation of equation (9) augmented by state/territory variables and applied to the Australian data as outlined above. Separate equations are reported for the individual crimes of homicide and rape and for selected crime aggregates (selected property crime, selected violent crime, total selected crime). Homicide and rape are selected for particular attention because they are crimes in which it might be thought that "rational calculation" would play little or no role. The two crimes also represent the two extremes in recording bias, with homicide a reliable measure of true offences and rape likely to be a very deficient indicator of true offences. The same explanatory variables are used for each equation.

Overall the equations estimated provide a considerable degree of explanation of variation in crime rates (across Australian jurisdictions and over time). The coefficient of determination (R^2), which indicates the proportion of variation explained by the included variables, ranges from .88 to .97. The unexplained residuals are attributable to other causes of crime. If these omitted variables are not systematically related to the included explanatory variables then the estimates obtained here are a reliable guide for the effect of the included variables. Thus if the unexplained variance is due entirely to random personality factors of the sort emphasized in psycho-medical or physiological theories of crime then the results presented here are quite valid, but need to be supplemented separately if an explanation of absolutely all variations in crime rates is desired. The point is that the two approaches could be quite complementary, but the results here indicate that most crime variation over time and between different states can be accounted for by the variables included in this study. Further it is felt to be sufficient to identify and quantify determinants of variations in crime rates, over the range of Australian experience since 1964. This in itself is interesting and has important policy implications. In the absence of fundamental policy reform or socio-economic structural change, this estimation method can indicate the likely impact of various feasible (i.e. marginal) policy changes.

Turning to the individual explanatory variables and focussing first on the "deterrence" variables it is seen that while increased police force provision is generally associated with crime reduction (as indicated by the negative sign on the coefficients) the associated coefficients are not generally significantly

different from zero - though this is not true for selected violent crime where some possible deterrence effect is observable.

There are two points that should be made in relation to police deterrence. One is that the measure of policing is public police, so that the role of private security services is not acknowledged. In fact over the period 1961 to 1976 in Australia, census data show a 162% expansion in official police numbers as opposed to 155% for private protective services. (Withers 1982, p.43) The difference is sufficiently small that it is likely that the police per capita variable is not substantially biased, but if anything there is a bias to understatement. This is also true in relation to recording practices. In some studies a negative relation between offenses and police numbers has been found, and this is usually attributed to extra police recording more (presumably minor) offences. This could occur either as a result of investigations by those police or as a result of public reporting of such crimes having increased as greater police availability is perceived. Thus the relation of police numbers to true offences cannot be established with the data used here. Of more reliable empirical interest is what happens when offences recorded lead to committals and convictions. The police are naturally contributors to a successful committal and conviction rate, so that if committal and conviction deter and punish this can be said to be an indirect effect of police on (recorded) offences. It is perhaps understandable that it is the ability of the police to produce committals leading to conviction that should have an important effect, as opposed to any independent influence of mere police "presence".

In fact, the committal rate is found in all cases to be a highly significant explanator, as is imprisonment. Both of these variables operate to reduce recorded crime rates, with elasticities varying between -0.5 and -1.0 depending upon the crime and the level of aggregation of crimes. Unfortunately it is not possible to say whether it is increased imprisonments or longer prison sentences that produce the prison effect. The measure adopted incorporates both influences without any possibility here of discriminating between them.

TABLE 1

REGRESSION ANALYSIS OF CRIME RATE DETERMINANTS:
AUSTRALIAN STATES AND TERRITORIES, 1964-1976

(Figures in parentheses are t-statistics.)

Crime Rate Dependent Variable (per capita)	Homicide	Rape	Selected Violent Crime	Selected Property Crime	Selected Total Crime
Constant	-13.544 (- .93)	15.462 (.97)	-2.810 (- 0.45)	1.672 (0.26)	1.070 (0.17)
Police per capita	- .172 (- .32)	- .294 (- .50)	- .480 (- 2.07)	- .228 (- .95)	- .262 (-1.12)
Committal Rate	- .618 (-5.17)	- 1.019 (-7.80)	- .841 (-17.11)	- .598 (-6.70)	- .585 (-6.74)
Prisoners per capita	- .544 (-2.63)	- .863 (-3.82)	- .934 (-10.50)	- .603 (-5.64)	- .623 (-5.99)
Real Median Income	- .374 (-1.21)	- .197 (- .58)	- .148 (- 1.09)	.187 (1.28)	.171 (1.20)
Lower Income Share	- .249 (- .96)	.255 (.90)	.099 (.86)	.175 (1.48)	.175 (1.52)
Male Youth Unemployment Rate	- .146 (-1.38)	- .051 (- .44)	- .063 (- 1.36)	- .083 (-1.77)	- .076 (-1.76)
Male Youth Population Ratio	.577 (1.12)	.700 (1.24)	.116 (.52)	.317 (1.38)	.318 (1.43)
Education Share	- .134 (- .59)	- .018 (- .11)	- .013 (- .13)	- .074 (- .72)	- .058 (- .58)
Manufacturing Workforce Share	- .350 (- .59)	- .770 (-1.19)	- .381 (- 1.48)	- .362 (-1.38)	- .405 (-1.58)
British-born Population Ratio	- 1.148 (-1.51)	1.947 (2.35)	.488 (1.45)	.173 (.50)	.192 (.57)
European-born Population Ratio	.896 (2.66)	.629 (1.71)	.644 (4.26)	.762 (4.97)	.756 (5.06)
Aboriginal Population Ratio	3.019 (2.71)	.694 (.57)	1.258 (2.57)	.290 (.59)	.407 (.85)
New South Wales Effect	- 1.700 (-1.13)	- 2.996 (-1.83)	- 2.163 (- 3.32)	.775 (1.12)	.583 (0.87)
Victoria Effect	.899 (.88)	- 2.944 (-2.65)	-1.434 (- 3.18)	.746 (1.57)	.660 (1.42)
Queensland Effect	- 4.916 (-2.23)	- 2.114 (-0.88)	-2.716 (- 2.86)	.276 (0.28)	.044 (0.05)
South Australia Effect	- 1.727 (-2.53)	- 2.354 (-3.16)	- 1.815 (- 6.15)	.233 (0.75)	.147 (.48)
Western Australia Effect	- 4.994 (-2.71)	- 3.238 (-1.61)	-3.144 (- 3.89)	- .266 (-0.32)	- .498 (- .62)
Tasmania Effect	- 1.075 (-2.06)	1.080 (1.90)	-0.294 (- 1.26)	.599 (2.17)	.564 (2.11)
Australian Capital Territory Effect	-10.304 (-3.25)	- 4.221 (-1.21)	-5.534 (- 3.94)	-1.847 (-1.31)	-2.259 (-1.65)
Coefficient of Determination (R ²)	.885	.888	.971	.919	.924

It is notable that so-called "crimes of passion" such as homicide and rape are seen to be responsive to deterrence, at the margin i.e. an increase in committals and/or imprisonment is associated with reduced violent crime of this sort. This is not to say that all such crime can be reduced to rational calculus - only that at least some of it can. In all these analyses it is important to distinguish variations from "base level propensities" or random occurrences, as already indicated. Thus, for example, it does not follow that to drop police provision to zero will have no effect on crime. Such a system change is outside the range of experienced variations. Also police have crucial indirect effects through the committal and prison variables i.e. committals and imprisonments do not take place without prior police action.

The homicide result is also of interest because it has a high level of reportability and uniformity of interpretation, so avoiding the issue of recorded vs actual crime that can be raised for many other categories of offence. The consistency of qualitative results between homicide and rape would seem to indicate that recording phenomena do not bias the results significantly. Finally, in relation to homicide and in relating the result here to debates regarding capital punishment, there was only one execution in Australia over the data period covered so that no attempt could be made in this analysis to examine the deterrent effects of capital punishment, as opposed to imprisonment.

The deterrence results obtained stand in contrast to conclusions often drawn from evidence obtained regarding recidivism. In these latter studies prison is shown to be not very successful in reforming criminals and it may even increase their criminality (Lipton et al, 1975). However there is also an "incapacitation effect" on crime while offenders are in prison, and there is a "deterrence effect" upon others (Ehrlich, 1981, 1982). A calculation of the size of the prison population and the frequency of offences by ex-prisoners shows how the the major effect of imprisonment comes through these latter effects. For 1981 an increase in per capita imprisonment of 10% (or 1000 prisoners) would correspond to a decrease in even the limited range of offences considered here of around 13,000 recorded crimes or possibly of around 25,000 offenses if serious assault and breaking and entering also respond similarly. There is clearly a major deterrence component in these figures, beyond a simple incapacitation effect.

The results also stand in contrast to the aggregative Australian findings by Biles (1981, 1982). However Biles' results are based on simple bivariate correlations which, by their nature, do not control for the possible influence of the range of other factors considered in the research outlined here i.e. there can be severe omitted variable bias in such simple correlation measures (Rao and Miller, 1971, 29-31). Ehrlich (1975) shows how bivariate lagged correlations between capital punishment and homicide gave positive signs. These signs reversed dramatically with a full multivariate analysis.²

At the same time it is interesting that the "incentive" variables of median income, lower income share and youth unemployment most approach a significant positive effect in relation to property crime. However too much should not be made of this point since basically these factors, as measured, do not produce statistically significant coefficients. The correct interpretation on the evidence available here is that overall they seem basically unrelated to crime rate variations.

It is possible that poverty is not well reflected in the particular measure chosen and constructed (share of taxpayers with below half the median income), but this is less true of the unemployment measure. The unemployment measure may miss the phenomenon of "hidden unemployment" and so be inaccurate as an absolute magnitude, but it would seem a quite reliable indicator of order of magnitude differences across jurisdictions and of changes over time. Thus its insignificance and wrong sign as an explanator of crime is quite telling. Moreover the results are consistent with those obtained in a wide range of studies elsewhere and using other measures. Braithwaite (1979) suggests that a more general income distribution measure that does not focus only on the poor can perform better. Still this finding here is of direct relevance to poverty theories, even if it leaves open the matter of broader distributional arguments.

How can such a finding be reconciled with studies of offenders which show them to be atypically poor or unemployed? The answer is that like the deterrence result this is a reflection of the basic difference between an aggregative study and a micro-study. While many criminals will be from poverty-based backgrounds

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For a bivariate analysis to be at all meaningful it needs to be applied using causality techniques as in the sense of Granger (1969). However the database in the criminal justice area in Australia is too thin for such analysis to be effective as it requires a large number of observations over time.

or be unemployed, not all poor and unemployed are criminals and, particularly, increases in poverty or unemployment may involve different people who do not necessarily resort to crime. Increasing numbers of "flow" analyses of poverty and unemployment show that, when poverty and unemployment increase, these situations are largely temporary phenomena for most people who experience them, though there is a minority of "hard-core" continuing poverty and unemployment (Gregory and Stricker, 1981). It is likely that it is this latter group which is the source of the atypically high representation of the poor and unemployed in offender statistics. Of course, whether they are hard-core poor and unemployed because they are of a criminal inclination, or vice versa, is a controversial issue that cannot be decided on the basis of this study. It does show though that common claims that increased unemployment is to be feared because it will produce more crime are ill-founded. Increases in unemployment (and poverty) are major social problems in this writer's view, but the evidence here is that concern over them should derive from other considerations.

Turning to socio-demographic characteristics that could be associated with particular attitudes toward crime involvement, a possible "paradox" can also be pointed to with regard to the age and sex structure of the population. Contrary to conventional wisdom, in general crime rates were found not to increase substantially with the relative size of the teenage male population. The coefficients obtained do all have a positive sign in relation to this population group, but the statistical significance of the relationship is small. There is however relatively limited variation in the size of this ratio between states and, to a lesser extent, over time. This could be part of the explanation. It therefore leaves open the question of what would happen to crime rates if major changes in age and sex composition of the population were to occur e.g. due to war.

Within the socio-demographic variables, two "behavioural" variables included are education and occupation/class status. These are behavioural in that they are chosen by individuals and are not physical characteristics such as age, sex, race, ethnicity etc. How "free" is such choice is another question not pursued here, but what is relevant is their insignificance in explaining variations in crime rates - despite major differences across states and over time. Some queries are possible as to how appropriate are the proxies for education and occupation/class, especially the latter. But the total insignificance of the

results, especially education levels, is portentous. It is also consistent with some other aggregative results surveyed by Braithwaite (1979). On the other hand the result is inconsistent with offender based studies which show under-representation of the higher educated in offender populations. However differences in behaviour associated with education within a population are not the same as differences between populations in education levels, nor are they the same as increasing education levels over time. Yet it is the latter two effects that matter in analysing crime rate trends. The evidence found in this study, though subject to revision, is that education is neither the civilising influence that liberals would desire nor the socialising influence that radicals would assert.

By contrast quite significant results are obtained for ethnicity and race. British-born population numbers and European-born population numbers each contribute significantly to recorded crime levels, though the pattern of contribution differs. The British-born population had a positive and significant association with rape but not with homicide or other crime aggregates. By contrast, the European-born population is positively and significantly associated with homicide and each of the crime aggregates. These findings on migrants are in contrast with the Australian work by Francis (1981), but again the aggregative methodology here is quite different, and more appropriate for capturing "total" effects. On the other hand this methodology can say little about causes e.g. victimisation, reporting system biases, discrimination etc. In particular it should be stressed that this relationship refers to offences and not offenders. Migrants could easily be atypically the victims of crime rather than the perpetrators. Similarly they could be victims of discrimination in the criminal justice system rather than atypically disposed toward criminality. This complexity in interpretation should be stressed, and it is in this situation that micro-studies of offenders and victims are of especial importance.

This also applies in relation to the aboriginal population findings. There it is indicated that aboriginal numbers are significantly and positively associated with the homicide rate and selected violent crime. These results are nevertheless consistent with the fact that against Australia's proportion of 60 per 100,000 persons imprisoned for the population as a whole, the Aboriginal proportion was 726.5 per 100,000. Clearly aborigines are atypically represented in offenders as well as being atypically associated with offences recorded, whether as

offender or victim. The reasons for this situation are too complex to be examined here (see Clifford 1982), but could include various types of discrimination in the law and the criminal justice system.

The final individual explanatory variables are the state/territory binary variables, which show a mixed pattern of results which vary with the crime or level of aggregation. The coefficients here can be interpreted as state effects once other measured explanatory variables in each state/territory are allowed for. The variables are relative to the Northern Territory which has the highest crime rates in Australia. The signs found for all other states and territories are negative. They are meant primarily to operate as controls to prevent bias in the estimation of coefficients for the other continuous explanatory variables, but it is of interest that, after controlling for these other influences, ACT and Western Australia have considerably lower crime rate levels than the other states and territories. This is particularly interesting for the ACT since, as a result of extensive urban planning the ACT is a control case of absence of urban class segregation, in terms of geography. It might seem that increasing class-mix can help reduce crime rates (Braithwaite, 1979). However other explanations are possible (e.g. the particular occupation mix in the ACT). Nor does this explain the consistently low crime propensity ranking of Western Australia along with, though a little behind, the ACT.

Finally, going beyond individual explanatory variables and looking at the level of aggregation, it is apparent from Table 1 that there are some aggregation problems in crime rate analysis. To simply add up and treat unlike crimes as homogenous means that explanation of the most numerous crimes included may dominate. Thus the total selected crime rate equation in Table 1 is almost identical in appearance to the property crime equation. If simple arithmetic aggregation is used property crime has a large weight in total crimes. Equally the total violent crime rate equation is seen to diverge somewhat from the results for two of its less numerous individual crime constituents. This result is a possible warning where aggregation of crime over different offences takes place e.g. where simultaneous estimation with other criminal justice system equation is adopted with only a single total crime equation. If aggregation of this sort is needed some technique for weighting crimes in the aggregation could be considered. e.g. psychic weights as to public fear of crime à la Akman and Normandeau (1967), or implicit decision-maker's weights could be obtained from a

non-linear estimating technique chosen so as to impute weights by the best fit to explaining politicians' or police or court reactions to the composition of crime. The legislated penalties for different crimes is one guide to weights, but this legislation invariably leaves considerable discretion to the courts. Nevertheless the orders of magnitude in the estimates obtained here do not differ dramatically across the level of aggregation, so that arithmetic summation may still be a reasonable first approximation for work that is explicitly not intended to be directly employed for detailed policy determination. The last section develops this point further.

VI. Positive Economics Research Findings and Criminal Justice Policy

This writer's own prior expectation was to find that direct economic incentives (including poverty and unemployment) were a major determinant of crime and hence to be able to affirm that anti-poverty and pro-employment policies would have the desirable additional effect of reducing crime. A supplementary expectation was that education and occupation/class structure were also important, so that anti-poverty and pro-employment policies that operated through improving education and training levels and through increasing occupational mobility would be especially helpful in controlling crime. These expectataions were sorely disappointed. Instead the major quantifiable determinants of crime rates were found to be committal and imprisonment rates and ethnicity and race.

The potentially controversial nature of these findings, in terms of some social values, dictates that some final clarifying comments should be made on the status of the results. There is a clear danger that findings such as these could be mis-used (Byleveld 1982).

Firstly, there are still some uncertainties in the underlying analysis presented here, and detailed studies for individual states or territories and for other crimes not covered here would help to confirm or qualify the evidence presented using better and more recent data. Studies for individual jurisdictions over time might also permit more analysis of lag effects, an analysis that was difficult for the pooled sample in this study. There is also the important point that the results extend with greater uncertainty to changes (including policy changes) which are outside the range of Australian experience reflected in the data.

Probably the greater empirical uncertainty relates to the role of education, poverty and class in the determination of recorded crime rates. The measures available to test these at the aggregate level for all Australian states and territories together over time are crude and inadequate. Particular attention should be paid to these variables in future analyses, say using a single jurisdiction where greater care and consistency in measurement is possible. For the present I would say the results in relation to these matters are the least reliable results in the analysis presented.

The findings for race and ethnicity seem to have a higher degree of reliability, though improved measurement could still help further. The more important point to stress here is caution in interpretation. In particular the estimated equations do not separate criminals from victims so that, for example, a high correlation between migrant numbers and crime could well mean migrants are atypically victims of crimes. Or it could be that migrants are atypically victims and offenders, a common finding for blacks in U.S. studies of crime determinants. This could apply equally to the aboriginal findings in this paper. It is also important in interpretation to re-emphasize that the crime being explained is recorded crime as processed by the authorities, so that any discrimination and victimisation in the criminal justice process could be the reason for overrepresentation of particular groups. No doubt other aspects of interpretation can be raised. Finally it is clear that policies in the areas of race and ethnicity are likely to be dictated by much broader considerations than relationships to the recorded crime rate, so that to attempt to draw policy implications from these findings would be a disservice at this stage.

Indeed the point regarding drawing policy implications should be made more generally and more strongly. Even for the most robust and reliable results found in this study (viz. the inverse relationship between recorded crime and commitments and imprisonment), it is a very large step from positive economics research findings to policy recommendations. Efficacy and desirability are separate issues, a point that deserves some systematic elaboration.

Continue to consider court committals and prisons. These may be effective deterrents but, even apart from any other considerations, they are also costly ones. If the elasticity of crime to imprisonment is -0.6 , a central estimate obtained in this paper, and if costs of crime exceed costs of prison by $1/.6 = 1.67$ or more, then there is a net benefit from increased imprisonment (Anderson, 1976,

p.32). Ehrlich (1973) estimated that the social loss from offences in the U.S. was 15 times greater than the costs of imprisonment. If such a costing were accurate and carried over to Australia, then social costs could be significantly reduced by increased imprisonment. Of course, the net gains from increased deterrence through committals and imprisonment should be compared with each other and with other options not considered here e.g. the larger fines which a priori economic reasoning says may be even more effective (Becker, 1968) and, in many ways, may also be more just, through relating fines to restitution.

The key trick in these disarmingly simple relationships is to ensure that all truly relevant costs are incorporated in any decision. This means that not only must the obvious costs such as financial outlays by the state be included, but also costs to private individuals (including foregone earnings of offenders themselves), and such intangibles as the fear of crime in society along with any moral concern that imprisonment be very much an instrument of last resort in social control (especially for non-violent offenders). The calculus is clearly complex and is not the simple preserve of accountants or economists (Sutton, 1982).

Having said this it is thus clear that the elements of responsible and informed policy decision are almost (but not quite) as difficult as ever. The decisions involve a range of factual and normative issues, most of which cannot easily, if at all, be reduced to dollars and cents. What is important for empirical researchers is the need to at least ensure that those making decisions in the light of these considerations should be informed by adequate research findings regarding the positive nature of the economic and social determinants of crime where quantification is possible. At least then judgements on that part of the decision can be informed by more than mere hunch or prejudice. Equally it is potentially dangerous for society if social decisions are based on academic or other notions that are simply inconsistent with the evidence thoroughly considered. For instance if deterrence is efficacious but, in ignorance of this, it is replaced with methods of social control that are not (e.g. rehabilitation), then neglect of deterrence or other effective options will mean more crime, including murder and rape.

The burden of this paper has hopefully been to contribute to such positive findings by emphasising and implementing an aggregate methodology, as opposed to examining crime determinants at the individual level. In doing so a

complementary perspective is provided and the tenets of an older criminology associated with the classical economists are more strongly affirmed. Those earlier economists emphasised free will and hence saw deterrence of potential offenders as the primary function of criminal sanctions. Their focus was on the offence not the offender. Nevertheless reformers such as Bentham and Beccaria wanted punishment that would be certain, swift and its severity strictly limited. The emphasis was on a rational and humanitarian approach which may still have much application today.

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