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Abstract

This paper provides empirical estimates of the economic model of crime using New South Wales Local Court data. The results as a whole, suggest that neither deterrence nor pecuniary and attitudinal variables exclusively explain variations in the crime rate. This conclusion differs from previous testing of the economic model in Australia using crime data for more serious offences. The results in this study, nevertheless, have to be viewed with caution and are subject to revision with better data and further research in other Australian jurisdictions. The paper reviews the policy implications of the results and makes some suggestions for further research using both aggregate and individual data.

1. INTRODUCTION

Empirical testing of the economic model of crime is well advanced in the United States, but so far has largely been neglected by Australian researchers. Withers' (1984) study using pooled cross-sectional and time series data for Australian states and territories is the only paper to test the theoretical model with Australian data. This paper seeks to at least partially address the lack of empirical research in the economics of crime in Australia by testing the economic model using data for a single Australian jurisdiction. The study is cross-sectional. It tests the economic model using crime data for New South Wales Local Courts and socio-economic data from the 1991 National Census. The sample observation points are twenty five Australian Bureau of Statistics (ABS), statistical divisions for New South Wales and subdivisions for Sydney.

The paper is organised into five sections. Section two sets out the crime function and discusses the explanatory variables used in the study. Section three examines the appropriate functional form and looks at potential problems posed by heteroscedasticity and multicollinearity. The fourth section presents the empirical results and explores the reasons for similarities and differences with the results in previous studies. Section five concludes the paper with a review of the policy implications of the results and some suggestions for further research.

2. THE MODEL

2.1 The Crime Equation

The behavioural function has the following form:

$$C = f(APP,CONV,MY,LYS,UNEMP,EDUC,NZB,AREA) \quad (1)$$

Equation (1) hypothesises that the number of crimes committed depends on the probability of apprehension, the probability of conviction given apprehension and a range of other socio-economic and socio-demographic characteristics which reflect differences in people's attitudes towards crime and relative economic standing. Table 1 contains a description of the symbols and definitions of the variables used in this study. The variables are discussed in section 2.2.

TABLE 1

SYMBOLS AND DEFINITIONS OF VARIABLES

Symbol	Variable	Definition
C	Crime Rate	Total Local Court offences in a statistical region as a percentage of the population in that statistical region.
APP	Apprehension	The number of people residing in a statistical region who are charged with a Local Court offence as a percentage of the number of Local Court offences committed in that statistical region.
CONV	Conviction	The number of people residing in a statistical region who are convicted of a Local Court offence as a percentage of the number of people residing in that statistical region who are charged with a Local Court offence.
MY	Median Income	Median household income (in 1991 dollars)
LYS	Lower Income Share	The percentage of households below one half median household income.
UNEMP	Unemployment	Male youth unemployment as a percentage of the male youth population
EDUC	Education	Secondary school graduates as a percentage of the total population.
NZB	New Zealand Born	New Zealand born population as a percentage of the total population
AREA	Population Density	Population density (in square kilometres).

2.2 The Explanatory Variables

The Deterrence Variables

Ideally, in a study of this sort, we would include separate variables to measure the probability of apprehension and the severity of punishment (the length of sentence imposed, or the magnitude of the fine). There are, however, a number of studies "within states" which do not try to expressly measure the severity of the sentence (see, *e.g*, Mathieson and Passell, 1976, and Liu and Bee, 1983). This study also does not include a variable purporting to measure differences in the severity of punishment across statistical regions. The reason for this is that the court system is the same across New South Wales and therefore, Magistrates are required to apply the same principles in sentencing irrespective of where they are sitting and irrespective of where the individual resides. Where there are differences in the severity of punishment, on a case by case basis, in different parts of New South Wales, it is likely that they are purely random reflecting different judicial personalities rather than ingrained judicial attitudes peculiar to a specific geographic area. The situation of course, would be completely different if we were comparing variations in crime rates across states where there are substantial differences in sentencing legislation and therefore, the courts quite naturally apply different sentencing principles.

The relationship between the certainty of apprehension and the severity of punishment is nevertheless an important issue which needs to be addressed. The question of whether the certainty of apprehension or the severity of

sentence is a more significant deterrent to criminal behaviour carries fundamental implications for the way we allocate the law enforcement budget. There is therefore, a need to include some sort of proxies to measure apprehension and punishment. Consequently, the model has both a deterrence variable designed to measure the probability of apprehension (APP) and a punishment variable designed to measure the conditional probability of conviction given apprehension (CONV). The latter is, at best, only an imperfect proxy for punishment, but it does have the advantage that it allows us to avoid making arbitrary and, in many cases, misleading judgments concerning differences in the severity of punishment across statistical regions.

Median Household Income

Median household income (MY) represents a proxy for illegitimate opportunities. The reasoning is that, at least as far as property crime (such as theft, burglary or robbery) is concerned, opportunities to engage in illegal activities primarily depend on the level of transferrable assets in the community. The higher the median value of transferrable assets (shown by median household income), the more opportunity potential criminals have to engage in illegitimate activity (Ehrlich, 1973). Sesnowitz and Hexter (1982: 492) make the point that "a high median household income may reflect the presence of individuals who provide good targets for thieves and thus may lead to a high gain component for the crime". This view has some problems though when we consider crimes other than property offences. When offenders commit crimes against the person for

example, which have psychic or non-monetary motives such as hate or revenge, then the level of transferable assets in the community is not necessarily a good indicator of the pay-off to illegal activity.

There is no doubt that there are offences against the person which are a mere extension of a related property offence and certainly where property crime is the real motive for committing the offence, median household income represents a good proxy for opportunity to engage in illegitimate activity. There are, however, many crimes where there is seemingly no pecuniary motive and in such situations the limitations of median household income as a proxy for illegitimate opportunity have to be recognised. The limitations of median household income in these circumstances are unfortunately not acknowledged by Ehrlich (1973) or in subsequent studies (see, *eg*, Mathur, 1978) which employ median income as a proxy for illegitimate activities. Having said this, median income remains the best proxy we have, given that psychic elements cannot be accounted for explicitly in an empirical investigation.

Lower Income Share

There are three variables which are designed to measure opportunities to engage in legitimate activities. The main proxy is the lower income share (LYS) which depicts the percentage of households with incomes below one-half the median household income. The rationalisation for the lower income share is that individuals whose legitimate returns are well below the median will have a higher

differential return from crime than individuals whose incomes are in excess of the median. Hence, individuals with incomes below one-half the median will have more incentive to participate in illegal activities relative to individuals with incomes well above the median (see Ehrlich, 1973).

Lower income share is limited as a proxy in two ways. Firstly it is not a good proxy for non-pecuniary motivated crime. Secondly, it seems inconsistent with the existence of white collar crime. Many white collar crimes are committed by individuals with high incomes who, because of the very fact that they hold an elevated place in the work force, have more opportunity to engage in illegal activity. These limitations though, do not seriously impinge the validity of the lower income share as a proxy in this study. The first limitation is certainly endemic in empirical research. The problem arises simply because it is impossible to acquire data which is a reliable measure of psychic motivated crime. The best we can do is to recognise the existence of the problem and make the most of the data available. The second limitation does not seriously affect the study given that most white collar crimes (such as embezzlement and certain offences under the *Company's Act*) are tried in the higher courts such as the District Court rather than the Local Court with which this study is concerned.

Unemployment and Education

The unemployment (UNEMP) and education (EDUC) variables are also proxies for legitimate opportunities. We can consider the unemployment variable first. We might expect that to the extent unemployment reduces income, that 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 (Withers, 1984) When an individual is unemployed he/she will have more time available and therefore, in a time allocation sense, more opportunity to engage in illegitimate activities. We would therefore expect a direct relationship between the level of unemployment and the crime rate.

The education variable is also a proxy for legitimate opportunities. The more educated an individual is the more opportunity that individual will have to engage in legitimate activity. The effect of the education variable is, in this sense, likely to be indirect and to some extent its effect will be captured in the lower income share and unemployment variables. The advantage of the education variable though is that in addition to reinforcing the interpretation of the lower income share and unemployment variables, it also provides some sort of measure of society's attitude to crime. To this extent it allows us to capture certain intangible externalities which may influence the crime rate such as the level of tolerance of other human beings and the level of respect for the property rights of others.

New Zealand Emigrants

The percentage of the population which was born in New Zealand (NZB) was included to reflect the large number of New Zealanders living in the Sydney statistical division relative to the rest of New South Wales. Visa free movement between Australia and New Zealand has led to a sharp increase in the number of New Zealanders migrating to Australia and particularly to New South Wales. There has, at times, been a perception in the popular press that the upturn in migration from New Zealand has been associated with an increase in the crime rate (Withers, 1984). Withers' (1984) study for Australia as a whole, found there was no significant relationship between crime rate variations and the New Zealand born share of the population. A further reason for including the New Zealand variable in this study therefore, was to see whether this was also the case for New South Wales considered in isolation, given the concentration of New Zealand emigration in that state.

Population Density

The population density variable (AREA) was included to reflect demographic differences between statistical divisions and subdivisions. There is previous research which suggests that crime is positively related to population density (see Hoch,1974). The argument is that the higher the population density the more people will be forced to interact and therefore the more opportunities there are to commit crime. Moreover, as the population density increases, the larger

the stock of criminals and therefore, the greater the likelihood that individuals can acquire the information necessary to commit crime (see Sjoquist, 1973 and Buck *et. al.*, 1983).

3. METHODOLOGICAL ISSUES

3.1 Functional Form

The log-linear format is the preferable functional form. There have been a variety of specifications tried in the past. These have included linear, log-complement, semi-logarithmic, logit and probit. However, most researchers have used a log-linear specification of the model and have found that for testing the supply of offences function it is the most appropriate format. There are three, well publicised studies by Bowers and Pierce (1975), Passell and Taylor (1977) and Klein, Forst and Filatov (1978) which argue that results obtained with a log-linear specification are sensitive to re-estimation with a linear specification.

This, however, was not the case in this study. The results (with the exception of the AREA variable which is discussed below) were not sensitive to re-estimation with a linear functional form. This result is supported by Ehrlich (1977) and Layson (1985) using U.S. data and Withers (1984) using Australian data. The results of a Box-Cox (1964) test also strongly suggested that the log-linear specification was the optimal functional form. This finding is consistent with the results of Ehrlich's (1977) Box-Cox test using cross-sectional data and is corroborated by Layson's (1985) Box-Cox test using time-series data.

3.2 Heteroscedasticity

There are a variety of tests for heteroscedasticity which include White's t statistic and Spearman's rank correlation co-efficient. However, because of it's wide use in studies of this sort the Goldfeld-Quandt (1965) parametic test was used to test for heteroscedasticity. The results of a Goldfeld-Quandt test rejected the hypothesis that there is heteroscedasticity in the error variance. This suggests that variance in the APP variable is unrelated to ABS statistical groupings. This is in spite of the substantial diversity that exists in population size and area, particularly between ABS statistical divisions of New South Wales outside of Sydney and statistical subdivisions of Sydney. The finding of homogenous variances, though, is quite consistent with the Goldfeld-Quandt test conducted by Withers (1984). Where the sample observation points are statistical divisions within a state, as they are in this study, this result may be due largely to the fact that the state has a single police force and most likely either an implicit or explicit single policy on crime.

3.3 Multicollinearity

A number of approaches were employed to measure the extent of multicollinearity in the sample. These included "informal" methods such as examining the pairwise correlations between explanatory variables and "formal" methods such as calculating the condition index and variance inflation factors. Overall the results of the tests for multicollinearity were mixed. The pairwise

correlations and the mean variance inflation factor suggested that multicollinearity may be a problem. The value of the condition index, on the other hand, suggested it was not strong enough to impair the results. Given these conflicting results it was decided to run further regressions, excluding those variables that may be causing collinearity. The additional estimates are considered in section 4.2 in conjunction with the interpretation of specific variables.

4. THE EMPIRICAL RESULTS

4.1 Empirical Findings

Overview using Ordinary Least Squares

The third column of table 2 presents the empirical results using a log-linear functional form and classical ordinary least squares (OLS). The predicted signs of the co-efficients are, in the general case, ambiguous. However, if the monetary equivalents of the psychic costs of time spent in criminal and legal activities are independent of an offender's level of wealth, and if the utility function is characterised by decreasing absolute risk aversion, then the signs on most of the co-efficients become unambiguous (Avio and Clarke 1978). The expected signs on the co-efficients of each of the explanatory variables are shown in the second column of table 2. The signs on APP, LYS, UNEMP and AREA conform with prior expectations, but APP is the only variable statistically different from zero at the 10% level. The signs on CONV, MY and EDUC, at first glance, seem inconsistent with the predictions of the model. MY is the only one

of these variables, though, which is statistically different from zero at all reasonable levels of significance.

TABLE 2

EMPIRICAL RESULTS

Explanatory Variable	Expected Sign	OLS Estimates	TSLS Estimates
APP	-	-.47* (-1.79)	-.5* (-1.97)
CONV	-	.209 (1.17)	.308 (1.65)
MY	+	-1** (-2.25)	-1** (-2.37)
LYS	+	.308 (1.17)	.35 (1.34)
UNEMP	+	.503 (1.69)	.486 (1.58)
EDUC	-	.501 (1.33)	.553 (1.64)
NZB	?	.386 (1.15)	.44 (1.39)
AREA	+	.244 (1.09)	.076 (.41)
INTERCEPT		5.315 (.772)	-.638 (-.09)
ADJUSTED CO-EFFICIENT OF DETERMINATION		.586	.6
F STATISTIC		5.246	5.496

* statistically significant at the 10% level

** statistically significant at the 5% level

The dependent variable is the crime rate. t statistics in parenthesis

The other explanatory variable with a positive sign is NZB, but it is also statistically insignificant at the 10% level. The model though, makes no prior assumption as to the sign of this variable so that it is purely an empirical question. The results for specific variables are discussed in detail in section 4.2.

A surprising and somewhat disappointing aspect of the results was the relatively low adjusted co-efficient of determination. For the OLS estimates it was only .586 which is substantially lower than many of the previous studies. Withers, for example, obtained an adjusted co-efficient of determination which ranged between .61 and .92. Moreover, only two variables (APP and MY) were statistically significant at the 10% level. This latter finding, though, is quite consistent with other studies which also have found many of the pecuniary and attitudinal variables to be either statistically insignificant or sensitive to the specification of included variables (see Pyle 1983). More controversial is the positive, but statistically insignificant, co-efficient for the CONV variable. Most of the previous studies have found it to have a negative sign (see Lewis 1986).

Sensitivity of the Results to Estimation Technique and Assumptions of Causality

The OLS estimates will be inconsistent if there is a "feedback" effect occurring where the APP variable is not only influencing the crime rate (through deterrence) but is in turn being influenced by the level of crime (through, for example, the allocation of resources to law enforcement activity). To allow for

this possibility, in this study, two-stage least squares (TSLS) estimates were constructed as part of a simultaneous model of crime and law enforcement where the APP variable was endogenised as the dependent variable in a production function of the criminal justice system. The TSLS estimates are presented in the last column of table 2. The results are not sensitive to estimation technique. The TSLS co-efficients all have the same signs and are similar in magnitude to the OLS estimates. The only difference is that the adjusted co-efficient of determination and F statistic is slightly higher for the TSLS estimates than for the OLS estimates. The compatibility of the OLS and TSLS techniques conform with prior expectations and is affirmed in a number of other studies (see *e.g.* Ehrlich, 1973 and Wolpin, 1978).

4.2 Interpretation of Specific Variables

Apprehension

The co-efficients on the apprehension variable are both negative and statistically significant at the 10% level for both the OLS and TSLS estimates. The results in this study are consistent with previous studies which have used data taken from

the higher courts. The results presented here suggest that at the Local Court level, the level of crime is responsive to the number of people charged. This is consistent with the economic approach to crime that sees the criminal as a rational individual who carefully weighs up the benefits and costs of participating in legitimate and illegitimate activities.

Conviction

The co-efficients on the conviction variable are positive, but statistically insignificant at the 10% level. The theoretical and empirical literature suggests that the deterrent effect of an increase in the level of punishment is considerably less than the deterrent effect of an increase in probability of apprehension (see Ehrlich, 1973). Therefore, the finding that CONV is statistically insignificant is not surprising and is corroborated in many of the previous studies (see *e.g.* Howsen and Jarrell, 1987).

There is an economic justification for a positive, but statistically insignificant sign on CONV. Most scholars distinguish between (i) the deterrent effect, (ii) the rehabilitation effect, and (iii) the incapacitation effect of punishment (see Lewis,

1986). Most of the debate in the literature centres on whether the relationship between longer sentences and lower crime rates, which most researchers have found, is due to the incapacitation effect or the deterrent effect. Greenberg (1975) and Wolpin (1978) have both argued that the incapacitation effect is very large for most types of crime. Ehrlich (1981) on the other hand, argued that the incapacitation effect is exaggerated and that the deterrent effect probably accounts for more than 90%.

With Local Court offences, the incapacitation effect is going to be fairly small. This is because, compared with higher court offences the number of offenders who receive prison sentences is relatively low and the length of the sentence which they receive will not be as long, given that the offences are typically not as serious as those tried in the higher courts. Table 3 sets out the penalties for selected total crime as a whole in New South Wales Local Courts in 1991. It can be seen that 65% of offenders received fines while only 6% received prison terms. Table 4 gives details on the length of prison sentences imposed. The figures show that 64% of individuals who did receive a prison sentence were sentenced to less than 6 months, and 95% received sentences which were less than 12 months.

TABLE 3

PENALTY FOR PRINCIPAL OFFENCE PERSONS FOUND GUILTY OF LOCAL COURT OFFENCES - 1991

PENALTY	%
PERIODIC DETENTION	0.9
COMMUNITY SERVICE ORDER	4.8
IMPRISONMENT	5.68
RECOGNISANCE	19.11
FINE	64.69
LICENCE DISQUALIFICATION (DRIVING OFFENCES)	0.11
COMPENSATION	0.15
NOMINAL SENTENCE	0.46
NO RECORDED CONVICTION	4.11
T O T A L	100

Source: N.S.W. Bureau of Crime Statistics and Research *N.S.W. Criminal Courts Statistics 1991* (1991, Attorney General's Dept.: Sydney).

TABLE 4

PERSONS RECEIVING A FIXED TERM OF IMPRISONMENT FOR LOCAL COURT OFFENCES - 1991

LENGTH OF PRISON TERM	NUMBER
Less than 1 month	254
1 month to under 2 months	472
2 months to under 3 months	495
3 months to under 4 months	1231
4 months to under 5 months	512
5 months to under 6 months	60
6 months to under 7 months	1406
7 months to under 8 months	5
8 months to under 9 months	20
9 months to under 10 months	124
10 months to under 11 months	6
11 months to under 12 months	2
12 months and over	256
Total Imprisoned	**4845**

Source: N.S.W. Bureau of Crime Statistics and Research *N.S.W. Criminal Courts Statistics 1991* (1991, Attorney General's Dept.: Sydney).

The statistically insignificant values for CONV therefore gives some support to the view that the strong inverse relationship between punishment and crime found in some studies using data sets on more serious offences may be due largely to the incapacitation effect rather than the deterrent effect. While any conclusions along these lines are, of course, subject to reservations about measurement clarity in the study (particularly using CONV as a proxy for punishment), if this was indeed the reason for the statistically insignificant co-efficients on CONV then the policy implications are potentially far reaching.

Median Income

Median Income (MY) was included as a proxy for illegitimate opportunities. Thus, we would expect the co-efficient for MY to have a positive sign. However, in each of the regressions it has a negative sign and is statistically significant at the 10% level. These results at first seem a little odd, but on reflection can be readily explained. The thinking behind including MY was that areas with high median income would have larger amounts of property available for illegal transfer than areas with relatively low median income.

The problem with this reasoning though is that areas with high median income also offer greater access to legitimate earning activities, and as such are likely to have a relatively high opportunity cost of crime. Therefore, it is likely that median income in this study is not reflective of illegitimate opportunities at all.

Instead, it probably captures the effect of legitimate opportunities. Alternatively the legitimate effect simply dominates the illegitimate effect. If this is the case, then the negative relationship between income and crime is understandable and conforms with *a priori* reasoning. Some researchers have obtained better results using insurance claims as a proxy for illegitimate opportunities. It is unfortunate though that data on insurance claims is not available at ABS statistical division and subdivision levels.

Lower Income Share

The lower income share (LYS) is one of three variables which are designed to measure opportunities to engage in legitimate activities. We would expect there to be a positive relationship between LYS and the crime rate. The results conform with this prior expectation, but are statistically insignificant at the 10% level. The relatively poor performance of LYS may be due to collinearity between income and education and between poverty and unemployment (Withers, 1984). To test this hypothesis, two further regressions were run. UNEMP was omitted in both instances. Additionally, in the first regression, EDUC was also omitted and in the second regression MY was omitted.

When UNEMP and EDUC were omitted, LYS was still not statistically different from zero with OLS estimates, but became statistically significant at the 10% level with TSLS estimates. This contrasts with the situation when UNEMP and MY were omitted. LYS was statistically insignificant at the 10% level for both

OLS and TSLS estimates and in addition, the adjusted co-efficient of determination fell to .158 and .187 respectively. These results imply that the values for LYS are probably affected by collinearity between LYS and EDUC.

Unemployment

The UNEMP variable has a positive sign but is statistically insignificant with both OLS and TSLS estimation techniques. However, as with LYS, it was thought that the statistically insignificant co-efficient for UNEMP may be due to collinearity between unemployment and poverty and between income and education. To test this view, a regression was run which omitted LYS and MY. With OLS and TSLS estimate techniques, UNEMP became statistically significant when LYS and MY were omitted. This suggests that collinearity between UNEMP and LYS is causing problems with the overall results. With this in mind, the results in this study are consistent with the majority of previous studies using aggregate data. They support the consensus that there is a positive relationship between crime and unemployment, but probably unemployment is not as important in explaining variations in the crime rate as the deterrent effect of apprehension. However, to get a better indication of the relationship between crime and unemployment, it may be necessary to use a richer model with an individual data set (see Good and Pirog-Good, 1987).

Education

The model predicts that EDUC will have a negative sign. The education variable though consistently has a positive sign. This result at first seems hard to explain. It seems inconsistent with the predictions of the model and is contrary to the findings of most previous studies which have employed an education variable. Trumbull (1989) though, is an exception, and he also has this result in his aggregate study using data on North Carolina counties.

The most plausible explanation for the behaviour of the EDUC variable is possibly that the gains from criminal activity are greater in statistical areas with better educated populations. In this sense EDUC appears to be acting as a substitute proxy for MY. Recall that we expected to have MY to have a positive sign, but it ended up with a negative sign. Interestingly, Trumbull (1989) also obtained a negative sign for MY. It must be said that at first glance it seemed that the EDUC results may have been affected by collinearity between EDUC and MY. However, a further regression which omitted MY suggested that this was not the case. The co-efficient on the EDUC variable was similar for both the OLS and TSLS estimates to the original results. It retained its positive sign and continued to be statistically insignificant in both instances.

New Zealand Born Share

The model makes no prediction about the expected sign for NZB. Withers' (1984) OLS estimates of selected total crime found that NZB had a positive, but statistically insignificant co-efficient. The results in this study using a log-linear functional form are consistent with Withers' findings. The value for NZB however, is sensitive to functional form and as we might expect also to the inclusion or exclusion of the LYS and MY variables.

Indeed, in a separate regression where NZB was omitted, MY, LYS and EDUC were all shown to carry some of its influence. Thus, it is perhaps not surprising that overseas studies examining the relationship between crime and ethnicity have obtained mixed results for their race variables (see Sample and Philip, 1984). Certainly, given the uncertainties surrounding NZB, there is a lot to be said for Withers' (1984: 181-182) suggestion that on these issues there is much to be learned from the criminologists micro-studies. In addition, if the data was available, we could learn more about the causal link between crime and specific minorities or ethnic groupings by more focused studies which used choice explanatory variables that are directly pertinent to the issues we wish to examine. There has been some success with studies of this kind in the U.S. (see *e.g.* Gyimah-Brempong, 1986), but in Australia the data sets may not be available.

Population Density

The population density variable (AREA) did not perform very well. It was statistically insignificant at the 10% level in both regressions. It had a positive sign using a log-linear functional form and was the only variable to change signs with a linear specification. The consensus in the theoretical literature is that there is a positive relationship between population density and crime and there is also strong empirical support for this view. The results in this study though, are fairly ambiguous. The positive sign attained with a log-linear specification is consistent with the orthodox view that the higher the population density the more opportunities there are to participate in illegitimate activities. On the other hand, the negative sign with a linear specification might be explained on the basis that the higher the population density, the greater the probability of being detected while committing a crime, and therefore, the higher the probability of apprehension. If this latter scenario is correct then the rational individual would reduce his/her illegal activities in densely populated areas. Irrespective of which is the more correct explanation, given that the co-efficients were statistically insignificant, regardless of functional form, the results in this study are inconsistent with the view that population density is an important variable in explaining crime rates.

5. POLICY IMPLICATIONS AND SUGGESTIONS FOR FURTHER RESEARCH

5.1 Policy Implications

The results using data for N.S.W in isolation are generally consistent with Withers' (1984) study for Australia, although there are some important differences. Withers' (1984:182) conclusions were that (1) the committal and imprisonment rates were the most reliable determinants of variations in crime and (2) the pecuniary and attitudinal variables were either statistically insignificant or highly sensitive to the specification of included variables. The results in this study, though suggest that neither deterrence nor pecuniary and attitudinal variables exclusively explain the crime rate.

The results in the study instead suggest that that to reduce the level of crime we need to develop both criminal justice and economic policies. This means that we need to re-evaluate not only how the law enforcement budget is allocated, but also the most appropriate way to generate legitimate earning opportunities for low income individuals. Clearly a medium to long term perspective is required. Thus the fact that the median income variable has a negative sign and is statistically significant at the 5% level does not necessarily mean that the best policy is to instigate income maintenance programs or further increase spending on social welfare. This sort of policy is essentially a stopgap measure and is not going to actually create legitimate earning opportunities in the medium to long term. Instead the results in this study, taken as a whole, suggest that the best way to raise income levels is through (1) removing the barriers to legitimate

employment and (2) improving the education opportunities available to low income individuals.

These policy insights are nevertheless, far from conclusive. The results in this study need to be viewed with caution and are subject to revision with better data and further research for other jurisdictions. Most of the areas where research is needed, though, suffer from difficulties with data availability. Therefore any real inroads from a policy perspective requires the support and co-operation of those bodies and departments which have the relevant data.

5.2 Suggestions for Further Research

Aggregate Studies

Further research is needed to verify or qualify the results in this study, hopefully using better data. There is certainly plenty of scope for further research at an aggregate level in Australia. Studies examining other jurisdictions such as South Australia and Western Australia, where crime statistics are available, would help to confirm or qualify the tentative conclusions drawn in this study. There is also some scope for time series analysis. The N.S.W. Bureau of Crime Statistics and Research has crime statistics at the necessary degree of disaggregation from 1989. There may be some problems in getting data on some of the socio-economic variables (such as Education) in non-census years, but these difficulties are not insurmountable and there are substantial benefits. For example, a time series study for N.S.W. would take account of fluctuations in

the performance of the data (such as variations in the unemployment rate) over time, as well as permit some analysis of lag effects. There is also a need to update Withers' (1984) study at the national level using post-1976 data. Without further research of this sort, the policy insights suggested by this study can at best be regarded as presumptive.

Individual Data

Studies using individual data can offer some valuable insights into the relationship between variations in the crime rate and various socio-economic variables. There has, for example, been quite a lot of success in the United States using Tobit and Probit models to investigate the relationship between crime and unemployment (see *e.g.* Good and Pirog-Good, 1987) and crime and socio-economic status (see *e.g.* Myers and Sabol, 1987). Where the sample data is available (either from the ABS or a relevant government department), studies of this sort using Australian data would clarify the results for the lower income share and unemployment variables in this study. There also have been studies in the United States using sample data looking at the relationship between education and criminal activity (see *e.g.* Tauchen, Witte and Griesinger, 1994). Similar studies for Australia would not be hindered by the measurement and methodological problems which have plagued this study and therefore, would greatly assist in clarifying the true relationship between education and crime.

Micro models of criminal behaviour offer opportunities to investigate the inter-relationship between economic variables and demographic variables in influencing the crime rate which are not as available at the aggregate level. Studies using sample data have been widely used in the United States to model the effects of black and white youth unemployment on the crime rate (see Freeman, 1987). These sorts of studies would be useful in an Australian context to clarify the relationship between the New Zealand born population and the crime rate which is not conclusive in this study. They could also be used to investigate the relationship between the aboriginal population and variations in the crime rate which is not conclusively decided in the Withers study.

Studies using individual data are also better able to capture the effects of social and cultural values on the crime rate than studies using aggregate data. Some studies in the United States for example, have found religion to have an important influence on variations in the crime rate (Gyimah-Brempong, 1987). While a study of the effect of religion is perhaps more suited to the American south than it is to Australia, there are other social/cultural influences (such a family ties and neighbourhood stability) which could usefully be investigated with sample data. This would increase our understanding of the diverse influences on the crime rate and therefore, supplement studies such as this at an aggregate level when it comes to policy formulation.

APPENDIX: DATA SOURCES

(1) Crime Data

(a) *Crimes Committed* (C) - constructed from 1991 crime statistics in New South Wales Bureau of Crime Statistics and Research *NSW Recorded Crime Statistics 1992* (1993, Attorney General's Dept.: Sydney) using ABS *Australian National Classification of Offences* (Cat. No. 1234.0) and the following Acts of the NSW Parliament: Bail Act, Crimes Act, Firearms Act, Gaming and Betting Act, Liquor Act, Summary Offences Act and Drug Misuse and Trafficking Act.

(b) *Apprehension* (APP) - New South Wales Bureau of Crime Statistics and Research *NSW Criminal Courts Statistics 1991* (1991, Attorney General's Dept.: Sydney) and data on crimes committed *supra*

(c) *Conviction* (CONV) - New South Wales Bureau of Crime Statistics and Research *NSW Criminal Courts Statistics 1991* (1991, Attorney General's Dept.: Sydney).

(2) Median Income (MY) - ABS *CDATA91* (CD ROM package)

(3) Lower Income Share (LYS) - ABS *CDATA91*

(4) Unemployment (UNEMP) -The number of unemployed males aged 15-24. The source is ABS *The Labour Force of NSW* (Nov. 1991 Cat. No. 6201.1).

(5) Education (EDUC) - The number of people who responded, in the 1991 census that they had left school aged 17, 18 or later. The source is ABS *CDATA91*

(6) New Zealand Born Population (NZB) - ABS *CDATA91*

(7) Population Density (AREA) - ABS *NSW Regional Crime Statistics 1991* (Cat. No. 1304.1)

(8) Population Statistics used in various empirical proxies - ABS *Estimated Resident Population by Age and Sex in Statistical Local Areas of NSW 30 June 1991 Final and 1992 Preliminary* (Cat. No. 3120.1).

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