IDENTIFYING THE SUPPLY OF OFFENCES EQUATION: AN EMPIRICAL INVESTIGATION ON AUSTRALIA

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Abstract

An individual's inherent behavior is to maximize utility within a budget constraint. But how the budget or income is earned, was not the concern of economists a few decades ago. Adam Smith (1776) gave little attention by saying that crime and the demand for protection from crime are both motivated by the accumulation of property. Until 1960s economic theory and analysis evolved around legal means of earning. Gary S. Becker's (1968) paper on "Crime and Punishment: An Economic Approach" strike the intellectuals to find out what actually is going on. Following empirical studies provide the impetus for conducting more theoretical and empirical research. Our objective of this paper is to find out the determinants of crime in Australia. Our model is similar to the model of Bodman and Maultby (1997). Only excess variable is included in our model is the one-year lag of unemployment rate. From the econometrics analysis, it is found out that rather than economic variables, deterrence variables are important determinants of crime in Australia. In the model deterrence variables are probability of detection (in the model proxied by CLR) and severity of punishment (proxied by MS).

INTRODUCTION:

"Economics is the study of mankind in the ordinary business of life" This quotation from Alfred Marshall reminds us the pervasiveness of economics. An individual's inherent behavior is to maximize utility within a budget constraint. But how the budget or income is earned, was not the concern of economists a few decades ago. Adam Smith (1776) gave little attention by saying that crime and the demand for protection from crime are both motivated by the accumulation of property. Until 1960s economic theory and analysis evolved around legal means of earning.

Gary S. Becker's (1968) seminal paper on "Crime and Punishment: An Economic Approach" was a breakthrough in Economics. In his paper he analyzed the causes of crime and also delineated the cost of crime for the economy as a whole. In brief, his deterrence hypothesis is that "an increase

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in a person's probability of conviction or punishment, if convicted would generally decrease, perhaps substantially, perhaps negligibly, the number of offences he commits" (Becker 1968). He said that people are involved with criminal activity if their net benefit is higher than any other activity, it is not for their different attitude. So a person commits a crime when the expected utility by doing the crime is greater than the utility he could have gained by using his time and resource in other activities. His paper increases concern over the public cost of crime along with the relationship between economic variables and crime. In the USA public cost of crime is increasing alarmingly which is presented in the table below.

Table-1

Economic cost of crime in USA in 1982-2001

Year	Police	Judicial	Corrections
1982	19.022	7.770	9.048
1987	28.767	12.555	17.548
1992	41.326	20.988	31.461
1997	57.753	28.528	43.511
2001	72.406	37.571	56.956

Source: www.ojp.usdoj.gov/bjs/glance/tables/exptyptab.htm

Table shows that during 1982 to 2001 public cost of crime in the U.S.A. is rocketing. Police expenditure increased four times higher in 2001 than it was in 1982. Public expenditure on judiciary and corrections in the year 2001 increased more than six times higher than that was in 1982. With respect to population Australia is a very small country but cost of crime is not negligible.

A summary of public cost of crime in Australia is presented here.

Table-2

Year 2001-2002

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Type   expenditure ($billion)

Police Expenditure………………….. 4.8 66

Court administration……………….. 1.01 11

Corrective services…………………. 1.59 23

Total……………………………7.40 100

Source: Criminal Justice Resources (AIC)

The above table helps to understand the cost of crime in Australia in recent times. This alarming figure provides the impetus for finding out the economic factors that affect crime.

Ehrlich's (1973) empirical investigation of crime in USA also contributed much to the study of law and economics. In his 1996 paper Ehrlich gave the idea of 'market model' that offers a comprehensive framework for studying the problem. He said that two sets of incentives motivate potential offenders to do crime. These are negative and positive incentives. Such as negative incentives are the 'decreased probability of conviction', 'decreased severity of punishment' and the reduction of punishment what prevent would-be or actual offenders from entering or actively pursuing illegitimate activity. On the other hand, positive incentives encourage people to participate in legitimate alternatives to crime. An increase in labor force participation rate or decrease in unemployment rate or fair distributions of income in the society is the examples of positive incentives.

This paper will do the empirical analysis on Australia. There are not too many study on the investigation of crime, punishment and deterrence in Australia. D. Biles's (1981) paper on "Crime and the use of imprisonment" was published by the Australian Institute of Criminology in 1981.But his results are based on simple bivariate correlations. Ehrlich (1975) shows how bivariate lagged correlation results dramatically changes with multivariate analysis. Satyanshu K. Mukherjee also calculated correlation matrix of long-term correlates of crime in Australia, like age-structure, male population, unemployment, GDPP, police expenditure etc. The Australian Institute of Criminology published his book on "Crime trends in twentieth-century Australia". The first significant study with pooled cross sectional and time series data, on the determinants of crime in Australia was done by Glenn Withers (1984). One of his important results is that, aggregate unemployment is an insignificant determinant of crime in Australia. He also showed that the aboriginal population, whose economic condition is not good, did not increase crime rate in Australia. Another important paper on this topic is the paper of Philip M. Bodman and Cameron Maultby (1997) on "Crime, punishment and deterrence in Australia: A further empirical investigation" which updates and extends Wither's paper. He estimates the supply of offences (property crime rates) equation using a three equation simultaneous system. The system of equations shows different inter-relationships between property crime rates and the criminal justice system, economic and demographic factors. His results are consistent with modern theory of law and economics. Unemployment rate

has positive impact on crime. Labour force participation rate and education both have negative effect on crime.

In this paper our main objective is to estimate the supply of offences equation. Our calculation and explanation will be on property crime in Australia. So our research question is "What are the factors which influence property crime in Australia?" Then we want to compare the effects of different factors of property crime with the help of statistical analysis. Thus our motive is to find out "What is the effect of deterrence variable to reduce crime?" and "What is the effect of demographic and economic variables on the crime rate".

In this paper in section-2, related theories are discussed. Becker and Shavell's explanations concerning supply of offences equation are presented here along with some other theories. In section-3 a thorough literature review is presented so that one can compare our model with others. In section-4 methodology and model specification is illustrated. There is the description of two equations simultaneous system, which is estimated. In section-5 a brief overview of crime in Australia and its economic trends are given. In section-6 empirical analysis and results are given. In section-7 suggestions and conclusion are given.

Section-2

Theoretical Background: The main focus of this study is on the determinants of the number of offences. Becker's (1968) theory on supply of offences is presented here. Number of offence by a person is function of the probability of conviction, severity of punishment and some 'other variables'. These 'other variables' can be income level, willingness to commit an illegal act etc. The function is (with slight elaboration)

$O_j = O_j (p_j, f_j, u_{j1}, u_{j2} \ldots u_{jn})$

Where O_j is the number of offences committed by person j during a particular period p_j is his probability of conviction per offence. F_j is his punishment per offence and $u_{j1}, u_{j2} \ldots u_{jn}$ are all other influences.

If p_j or f_j increases this will reduce the utility expected from an offence, so the offender will reduce the number of offences for the probability of paying the higher price or the price itself would increase. So the theory says,

$$Opj = \frac{\delta Oj}{\delta pj} < 0$$

$$Ofj = \frac{\delta Oj}{\delta fj} < o$$

These are the generally accepted conditions. Effect of uj is also understandable. Such as, an educated person will have less incentive to do crime rather than an illiterate person. Here value of the derivative will be negative. Becker also explained the impact of change of pj and fj on risk neutral, risk preferred and risk averse individuals. So if j is a risk preferred individual then an increase in pj will have more effect than an equal percentage increase in fj and this will be reverse in case of a risk averse individual. Again if j is a risk neutral individual then increase in pj or fj will have the same effect on the number of offences.

Becker's paper did not analyze much on 'other variables'. Ehrlich gave attention on p (probability of conviction) and f (severity of sentence) along with positive incentives, which allows a broader analysis on supply of offences. Becker's pj and fj (if decreases) are termed as negative incentives in Ehrlich's paper and if pj and fj increases then these are termed as positive incentives. Ehrlich's (1996) theory of supply of offence is based on two assumptions 1) potential offenders are risk neutral 2) A person will do criminal activity only if the net payoff from criminal activity exceeds some threshold level.

Steven Shavell (2000) also explained about individual involvement in harmful activity. It could be criminal activity or it could be a matter of tax evasion. Shavell's explanation is on a broader sense. He explained on the basis of different liability rules. If it is a criminal activity and rule of strict liability prevails then a risk neutral individual will commit a crime if his gain exceeds the sum of expected fine and expected disutility of the imprisonment term. He explained people's involvement in criminal activity in a definitive way. Here

$g > p\ (f + \lambda t)$

where g = gain from criminal activity

p = probability of detection

f = fine

t = length of the imprisonment term

λ = disutility born by a prisoner per unit of imprisonment term

A risk averse individual in fine or imprisonment would be involved in crime if his gain is more than g (i.e. the gain of a risk neutral person). The reverse is true for a risk preferred individual.

Section-3

Literature Review: Before describing the methodology and model specification, literature review is essential, as it would help to compare our model with other models. There are lots of studies on developed countries, on finding out the determinants of crime. Empirical studies have been done with different objectives, different set of variables and different econometric processes. Most of the literatures on U.S. have shown that day-by-day crime rate is increasing and higher number of people is imprisoned. Crime rate in U.S. tripled between 1960 to 1991 (Imai et.al.2001). The arrest rate in U.S. has more than tripled during 1971 to 1993 and an interesting fact is that during the same period when incarceration rate is more than tripled, then reported violent crime per capita doubled and property crime per capita rose 25% (Levitt, 1995). So these figures create growing concern for the economist, as crime is a negative externality for the economy. (Ehrlich, 1973).

In single period choice model, crime is an economic activity, which requires time and produces income. These models are known as "crime as work" models. (Witte et. al. 1994). In these models (Heineke, 1978; Schmidt and Witte, 1984;Cook and Larkin, 1986) crime rate was the aggregate crime rate (i.e. of all offences together). These models were criticized for aggregation bias, poor data etc. In 1980s researchers used cross sectional data to estimate economic models of crime[1].

At first we review the literature about the deterrence variable of crime. In early 1980s some studies were done without deterrence variable (e.g. Rossi et. al, 1980; Thornberry and Christenson, 1984). At the time of using deterrence variables, care is needed to separate deterrence effect from incapacitation effect[2]. This is essential for estimating supply of offences equation .In some studies deterrence and incapacitation effect were not separated. In the paper of Raphael & Ember (2001) they say that if more unemployment causes more crime, then there should be positive correlation between unemployment and prison population. So more imprisonment or incapacitation reduces crime via both incapacitation and deterrence effect, which proposition is supported by Steven D. Levitt

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[1] See for example (e.g. Good, Pirog-Good and Sickles, 1986; Monlamarquette and Merlove, 1985; Myers, 1983; Viscusi, 1986a, 1986b; Schmidt and Witte, 1984; Witte, 1984)

[2] Incapacitation is "The affect of isolating an offender from the rest of the society, thereby preventing him from committing crimes in that society." (Bodman 1997).

(1996). Ann Dryden Witte and Helen Tauchen (1994) gave a different idea about the actions of criminal justice system. They said that, a person's probability of arrest varies according to the level of criminal activity. Thus an individual does not always face a single probability of arrest rather face a schedule of probability of arrest. Referring from Cook (1979) Poterba (1987), they say that, if there is an exogenous shift in the schedule then effect of probability schedule can be estimated. These exogenous shifts could be differences in individual abilities to avoid arrest, differences in police resources etc. They called these as 'general deterrence' variables. They used real police budget per offence and real police budget per capita as measure of general deterrence variables. Glenn Wither's (1984) work is the first in Australia using deterrence variables like imprisonment rate and committal rate. He shows that property crime is negatively related to committal rate and imprisonment rate. Similar type of model was followed by Bodman and Maultby (1997), which includes 'clearance rate' by police and 'expected sentence length' as the deterrence variables. Their 2SLS results also show that deterrence variables are negatively related to crime, which the theory says.

The unemployment rate is the most popular variable for the researchers to be included in the models of crime rate estimation[3]. There are many articles examining the relationship between unemployment and crime rate. Criminal activity is one kind of employment, which requires time and generates income. (Witte et. al, 1994). So a 'rational offender' should compare the opportunity cost of devoting time to legal and illegal activities (Raphael et. al., 2001). Raphael and Ember estimated property crime rates (of burglary, larceny and automobile theft) and violent crime rates (of murder, rape, robbery, assault). They found unemployment as a strong determinant of property crime, which is consistent with the theory. They got significant positive relationship in case of all three offences. In case of violent crime they get negative relationship with unemployment rate, which indicates that violent crime is not related to the employment status of offenders. They used OLS and 2SLS (2SLS for semi-elasticity's of specific crimes) and did not use lagged effects of unemployment rate on crime. Lagged effect of unemployment rate on crime rate behaves counter-cyclically over the business cycle (Yamada et. al., 1991). A study by Corman

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[3]   Unemployment is particularly related to property crime rate. Most of the studies did not get strong relation between violent crime and unemployment rate.

et. al. (1987) explicitly focuses the lagged effects of unemployment on property related crimes for New York City from 1970 to 1984. Yamada et. al. (1991) examined the relationship between unemployment and crime rate, using a vector autoregressive model. In their model they included exogenously given unemployment allowance. They proved that criminals have very high risk-loving attitude and they have strong preference for leisure. They have shown the allocation of labor between legal and illegal activities and the influence of market wage rate on this allocation. Many researchers viewed that crime and business cycle are linked. Philip Cook and Gary Zarkin (1985) say that four types of factors may empirically link the business cycle and crime. These are 1) legitimate employment opportunities, 2) Criminal opportunities, 3) Consumption of criminogenic commodities (alcohol, drugs, guns) and, 4) the response of criminal justice system.

Current criminal activity also has negative effects on future legal earnings. Witte (1980) uses variables like 'the length of time required for released prisoners to get a job' and 'the wage on the first job after release' to reflect their work activities (Witte et.al, 1994). If there is existing rules and regulations that after doing a crime and getting conviction someone has less probability to get a job or his employment payoffs would be adversely affected, then these policies (rules) act as "dynamic deterrence" to crime (Imai et.al, 2001). They showed strong dynamic deterrence effects and suggested those policies, which strengthen "dynamic deterrence", would be highly effective in fighting crime.

Some researchers explained criminal activity within the framework of human capital approach (e.g. Lochner, 2004). Lochner says that investment on human capital increases human capital levels as well as market wage rates. Many studies showed that higher wage is negatively related to crime (e.g. Freeman 1996,Gould, et.al.2002, Grogger 1998, Machin and Meghir 2000, and Viscusi 1986). It should be mentionable that in Ehrlich's equation of determining 'expected net return per offence' if wage from legal activity increases then it reduces the net return and thus raises the cost of planning and engaging in crime.

Lochner (2004) says that opportunity cost of devoting time to criminal activity increases with educational attainment. He also mentions that white-collar crimes (like forgery, fraud and embezzlement) might not be negatively correlated with education. He develops a life cycle model of work, crime and human capital investment and argues that young uneducated man with their low skill level have low opportunity and incarceration cost for committing crime. He also describes effective

policies for crime prevention such as tax and wage subsidy policy. Witte and Tauchen (1994) have the similar kind of view. Education or schooling increases the level of human capital. So it increases the probability of getting a better job. Although their findings do not indicate that human capital development has significant impact on crime. Contradicting Lochner, Witte and Tauchen have a different view about wage and income (also Long and Witte, 1981 and Freeman 1983). In their findings wage and income do not have significant effect on crime. Rather employment and education has a significant effect on crime.

Age is a very important factor for analyzing criminal behavior. Age structure of population has an important impact on crime. "Crime is a young man's game." In 1990, seventy percent of the individuals arrested in U.S. were between the age of 16-34. (Witte & Tauchen, 1994). Raphael & Ember (2001) included in their model seven ages structure variables ranging from 'under 15' to '55-64'. They got the same result as previous studies. Violent and property crimes are higher in those states of U.S. that have higher proportion of teenagers and young adults. Many researchers have worked on the relationship between age and crime. (David F. Greenberg; Travis Hirshi & Michael Gottfredson etc). Age-crime profile can also be explained within the framework of human capital approach. Human capital accumulates with age, so opportunity cost of engaging in illegitimate activity is very high. At this time cost of imprisonment for the aged offender is also higher. So as age increases working individuals do not engage themselves in crime. But criminal activity increases by the young unemployed. Because these people do not start work and due to lower age human capital accumulation is low or negligible. For them opportunity cost of doing illegal activity is low. At lower age returns to investment in human capital is lower than returns to crime. Thus single peaked age-crime profile can be shown with the peak at or before the age of labor market entry. (Lochner, 2004). Furthermore criminal activities have many advantages such as flexible hours, immediate earning rather than weekly earnings, independence, excitement, flashy life style etc. (Witte & Tauchen, 1994). In Australia both Withers (1984) and Bodman & Maultby (1997) included age variable in their models. Withers variables were male youth unemployment (age under 21) and male youth population (age 15-24). Bodman and Maultby chose age variable as the percentage of population between the age of 18-24.

All over the world crime statistics show that male people do more crime than female. In Australia in 2001-2002 out of 100000 population, there are on average 3033 male offenders, while there are on average 753

female offenders. If the percentage of male people increases in a country then it will increase more crime. So this variable is more important than total population. Some researchers used this variable such as Withers (1984) and Bodman & Maultby (1997).

Some of the developed countries (and also some developing countries) have indigenous population or backward group of population whose economic conditions on average are not as good as the main stream population. Red Indians and the black people of USA and aboriginal in Australia belong to this group. Economists are interested to analyze their attitude towards crime and whether it has any positive or negative impact on the economy. Raphael and Ember (2001) includes black population as a control variable in their model. Statistics shows that average economic condition of black are lower than that of white with respect to employment, education etc. Glenn Withers (1984) and Bodman and Maultby (1997) both include indigenous population in their model.

Section-4

Methodology and Model Specification:

This paper focuses on the supply of offences equation. The model has the objective of examining the empirical support for deterrence hypothesis as well as finding out the relationship between economic variables, demographic and socio-economic characteristics of population and property crime. Here empirical analysis will be done for three categories of property crime. These are robbery, burglary (break, enter, steal) and motor vehicle theft. Following supply of offences equation will be estimated in the model. Here property crime rate,

CR   =   F (CLR, MS, UMP, LPAR, AGE, MALE, LYS, EDU, ABOR, MIGR)–1

Clearance rate

CLR   =   F (PPC, DEN, CR, ABOR, MIGR, MS) – 2

Where CR	=	crime rate
CLR	=	clearance rate
PPC	=	number of police per capita
MS	=	median sentence length
UMP	=	unemployment rate
UMP1	=	one year lag rate of unemployment
LPAR	=	labor force participation rate
AGE	=	percentage of population between 18 and 24
MALE	=	percentage of population that is male

EDUC = percentage of population with a bachelor degree, post graduate diploma or higher degree.

ABOR = percentage of the population that is Aboriginal or Torres-Strait Islander

MIGR = percentage of population born abroad

DEN = population density.

The model contains two endogenous variables. These are CR, CLR. The rest are the exogenous variables. Equation 1 is the supply of offences equation. Here CLR and MS are the variables to prove the deterrence hypothesis of Becker. CLR is proxied for the probability of punishment i.e. pj in the model of Becker. CLR is equal to the number of offences cleared divided by the number of offences reported to the police during a particular period. Here it is calculated for a year. MS is proxied for the severity of punishment i.e. fj in the model. The median sentence length for each crime category at time was calculated by taking weighted average of the median sentencing group. Median sentence lengths, for each property crime category, were calculated separately. Here it is noted that the variable MS is more appropriate than any other proxy variable for severity of punishment used by some researchers. This variable does not have the incapacitation effect of punishment. Such as "average time served by released prisoners" might suffer from incapacitation effect. Using this variable in the model, if negative relation comes out between crime rate and severity of punishment, then this could happen due to incapacitation effect[4] rather than deterrent effect. So median sentence length is an appropriate variable for the severity of punishment. CLR or clearance rate helps us to understand the activity of police. It is shown here as an endogenous variable. It depends on police per capita, population density, crime rate, median sentence length, percentage of aboriginal population etc. If police per-capita decreases and crime rate increases then police will take more time to detect offenders. In that case probability of detection will decrease.

Age and Male are two demographic variables. Different researcher used different age ranges to represent crime prone age group. Some researcher suggests it from 18-24 (Bodman & Maultby, 1997) and some from 18-34

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[4] Here it should be mentioned that Median sentence is actually representing the median of sentences ordered by magistrates or judges. In reality the offender could serve a sentence of shorter length due to some kind of exemptions. So median sentence reflects the deterrence effect not the incapacitation effect.

(Witte and Tauchen, 1994). In 2003 in Australia 61.9% prisoners (both male and female) are between the age of 18-34. In this paper similar to Bodman, age range 18-24 is chosen. In 2003 in Australia 290.8 male people were imprisoned per 100000 population, while only 20.4 female people were imprisoned per 100000 population. (ABS, 2003). So percentage of male population is an important variable that we include in the model

Unemployment rate is an important variable in the model. There are many studies to find out the relationship between crime rate and unemployment rate on structural model and Vector Autoregressive Model. Most of the models do not include lagged variable of 'unemployment', but it is included here to reduce the effect of autocorrelation. Just after a man become unemployed he does not think to do crime instantaneously. If his unemployment continues for a longer period then (when autonomous savings are exhausted) he commits crime. So one period lagged variable of unemployment is included in the model.

Labor force participation rate is the percentage of total population who are part of the labor force (employed or unemployed). Increase in labor force participation rate increases labor market prospects in the long run. Theory suggests a negative relationship between crime rate and labor force participation rate.

Like many other researchers we include here education variable. Our model distinguishes the proportion of more educated people of the society. Within the framework of human capital approach and also from many empirical evidences, negative relationship between educational attainment and crime is well established. Here EDUC variable measures the proportion of total population with a bachelor degree, post-graduate diploma or higher degree.

The variable ABOR is a special case of Australia (also in US Red Indians). In the crime statistics of Australia criminal behavior of indigenous population is easily distinguishable. If percentage of this population increases, then crime rate might increase. Nothing we can guess about migrated people. There is no established theory to comment.

This variable is included to find out the impact of migrants in Australia. Most of the countries do not need to include these two variables (ABOR, MIGR) in their model. People normally don't migrate to a developing country. Migration phobia is towards developed country. In developing (also developed countries like Britain, France etc.) countries people are indigenous people.

Equation 2 of the model estimates the clearance rate. There are six explanatory variables including two new variables police per capita (PPC) and population density (DEN). Here PPC and CLR variables express a production function type relation where PPC is like input and CLR is like output. Increasing police per capita, ceteris paribus, could increase the clearance rate (Ehrlich, 1973).

For explaining the reason of including CR as an explanatory variable in equation-2, let us define the 'system strain' effect. System strain is said to occur when, the clearance rate (a measure of criminal justice system production) is affected by the number of crimes committed. So if crime rate increases and PPC is unchanged then clearance rate will decrease due to the fixed amount of resources of the criminal justice system.

In this equation we also include two demographic variables ABOR and MIGR. These are included to find out the existence of racism in police ranks. Positive relationship between these variables and clearance rate suggest the evidence of racism. The hypothesis is that racist police will be more eager than otherwise to apprehend and convict indigenous people and migrants (Mathur, 1978).

The variable DEN of equation 2 is obtained by dividing the population by the relevant geographic area. So the number of people living in per square kilometer is DEN. Increasing population density reduces the ability of the justice system to apprehend criminals. Frost (1976) says that in densely populated area criminal can "blend into the crowd" although Mathur gives squarely opposite explanation. He says that if people are cooperative then in a densely populated area offenders will find it difficult to "blend into the crowd". So the relationship between CLR and DEN is an empirical matter.

ESEN is included in equation 2 as an explanatory variable in order to find out the hypothesized negative relationship between the probability of punishment (proxied by clearance rate) and the severity of punishment (proxied by expected sentence length) as suggested by Bentham (1843).

So far we specified two equations and we described their relevance with economic theory. It is our task to apply the appropriate econometric techniques to get the parameter estimates. For getting reliable parameter estimates, in the presence of endogeneity, equations must be identified. We know that if the number of moment conditions exceed the number of parameters to be estimated then coefficient of the structural parameters will be 'over identified' because there is more information than is necessary to obtain a consistent estimator. In the model the endogenous variable

CLR has six instruments and variable PPC has two instruments. Model identification indicates that all two equations are over identified. A two-equation simultaneous equation model is presented here to solve the problem of simultaneity between the variables of criminal justice system, if the problem exists. So our model of interest is given by Crime rate CR=F (CLR, ESEN, UMP, LPAR, AGE, MALE, LYS, EDU, ABOR, MIGR)...1

Section-5

Australian Economy and Crime

At present unemployment rate in Australia is lower than many years. In April 2004 unemployment rate (trend) of Australia was 5.7%. During the last twenty years unemployment rate never exceeded 11%. Labour force participation rate (trend) is 63.7% in April 2004. During the last twenty years labour force participation rate was between 60- 64%. Population of Australia is 20,105,928 (29th May 2004). During the last 20 years male population of Australia always remained near 50% but it does not exceed 50%. In case of police per-capita a decreasing trend is seen. In the year, 2003 it is only 0.002 while in some years it was 0.006.

For crime prevention Australian government's policy is to work collectively which situation can be referred to as 'organizational fusion'. Government's crime prevention policy is called the "Whole of government approach". In USA it is called "network government" and in UK it is known as "Joint-up government." In Australia some crimes are gradually increasing and some are decreasing. In 2002, in whole Australia 363 events of homicide and 17,850 events of sexual assault happened, which are violent crimes. In this study property crime rates will be estimated. Compiled data of three property crimes will be used. These are robbery, unlawful entry with intent (UEWI) and motor vehicle theft (for definition of robbery, UEWI, and theft-see appendix). Robbery is a property crime and it is of violent nature. In 2002, 20961 robbery incidents were reported to police, which is 28% higher than that of 1996.So victims of robbery were 107 per 100000 population in that year. In 2002 number of victims of unlawful entry with intent (UEWI) and motor vehicle theft decreased by 2% and 8% respectively. In 2002 there were 394, 374 incidents of UEWI recorded by the police in Australia. Victims of UEWI were 2006 per 100,000 population. In case of motor vehicle 113,389 incidents of theft happened i.e. 884 vehicles stolen per 100,000 registered cars. From the data it is found out that motor vehicle thefts averaged one every five minutes across Australia in 2002. The majority of motor vehicle theft occurred in community locations (57%), particularly streets, footpaths and car parks.

Twenty three percent of motor vehicle theft occurred in residential locations. It should be mentioned here that most of the stolen cars are recovered in Australia. In 2002 a total of 87,011 stolen cars were recovered resulting in a national recovery rate of 80%. In 2002, 86% of total offences were property related offences, which declined since 1996, when it was 89% of total offence.

In general indigenous people are in low-income level and their employment and education scenario is not as good as non-indigenous population. In 2001 only 18% of the aboriginal people of concerned age group completed year 12 while 41% non-indigenous people completed year 12. Aboriginal people are more likely to attend the college of TAFE, while non-indigenous people are more likely to attend the university education. In the census of 2001 unemployment rate was very high for indigenous population than the overall unemployment rate. In 2001 census, unemployment rate for indigenous person is 20% compared with 23% in 1996. Unemployment rate is higher for men (22%) than women (18%). In the labor force 20% of the indigenous people are unemployed compared with 7% non-indigenous people. Average household income of the indigenous people is lower than non-indigenous people. In 2001, the mean 'average' gross household income for indigenous person was $364 per week, while for non-indigenous person it was $585 per week. From the above definition it is easily perceivable that economic condition of indigenous population is inferior. Now let us see the crime scenario of aboriginal people. At 30 June 2000, 19% of the total prison population of Australia, were indigenous people although only 2.4% of total population of Australia are indigenous population. This gives a birds eye view that this 'low income group' of the economy does more crime.

From both developed and developing countries many people migrate to Australia. In 2002-03, 52% of Australia's total population growth was due to net overseas migration. 125300 people migrated to Australia from around the world and the number of total natural growth was 115200. (ABS) Migrated people are from diverse educational and economic backgrounds. Australia accepts migrants because migration affects both demand and supply side of the economy. Migrants spend here on food, housing and leisure activities thus creating investment demand to produce extra goods and services. At the same time, demand for government services increase such as health, education and welfare. Again on the supply side migrants supply labor, skills and capital. New business opened by migrants and contributions to technology are helpful for the economy. So if the number of migrants increases, then it should enhance the economic

growth. But it is a matter of contemplation whether migrants are skilled or not, whether they get a job or not etc. Because after coming from a foreign country, it takes some time to adjust with the new situation due to difference in language, culture, race etc. According to 2001 Census composition of overseas born population are as follows (DIMIA).

UK and Ireland 26%

Europe (excluding UK and Ireland) 26%

North Africa and the Middle East 12%

Asia 12%

Oceania 11%

Americas 4%

Sub-Saharan Africa 3.5%

The data shows that 52% of the migrants came from Europe. So above 50% people are not facing cultural barrier. From Middle East and Asia normally rich or skilled people come. Thus the above explanation says that migration rate should not be positively related to crime.

Section-6

Empirical Analysis and Result: Our empirical analysis is based on time series data of twenty-two years ranging from 1982 to 2003. Some data of crime rate and clearance rate of some states were not available. In such cases considering the data of larger states we approximated the overall crime rate. Such as some data on Northern territory and Tasmania were not available. Intercooled STATA 8.0 was used to estimate the value of the coefficients. For the potential endogeneity between the variables of criminal justice system (CJS) OLS regression is not suitable for the model. OLS will produce inconsistent parameter values because of the relationship between endogenous variable and disturbance term. So in this paper 2SLS method is used which is suitable for an over identified model.

It should be mentioned here that due to the low degrees of freedom, most of the coefficient values were not significant at 5% level of significance. But the coefficients are still representing the nature of relationship (positive or negative).

Results: The results from the estimation are given in table 3

Table-3

	Robbery	Motor Vehicle Theft	Unlawful Entry With Intent
CLR	-2.595	-12.623	-147.258
	(-2.32)	(-0.86)	(-1.78)
MS	-2.748	-12.318	108.429
	(-0.55)	(-0.65)	(0.79)
UMP	-5.473	27.638	-31.508
	(-1.08)	(1.07)	(-0.62)
UMP1	.489	-5.521	-18.929
	(0.18)	(-0.28)	(-0.49)
LPAR	-6.832	87.085	-63.219
	(-1.00)	(1.78)	(-0.55)
AGE	1632.059	-19155.59	-26952.28
	(0.71)	(-1.62)	(-0.70)
MALE	-60095.53	-19207.55	-391942
	(-2.44)	(-0.13)	(-1.34)
EDUC	-2.579	-281.509	687.966
	(-0.06)	(-0.84)	(1.03)
MIGRANT	-2095.897	-8991.007	-39147.7
	(-1.94)	(-1.18)	(-2.12)
ABOR	78.785	142.266	825.766
	(1.58)	(0.45)	(1.21)
Constants	30777.9	9702.282	212313.5
	(2.51)	(0.13)	(1.46)
Adjusted R^2	0.9367	0.3841	0.8032

Note: The number in parentheses are t-statistics

Table-3 shows significant negative relationship between crime rate and clearance rate in case of robbery but not significant for other two offences. Increasing clearance rate decreases the crime rate, which is consistent with theory of deterrence. In case of median sentence negative relationship is shown for robbery and motor vehicle theft although for UEWI it is positive. This negative relationship supports the result of Withers (1984) and Bodman and Maultby (1997).

In the model unemployment and 'one year lag unemployment' variable are included. In case of robbery lag effect of unemployment is positive indicating that violent crime is the result of continuous unemployment. Positive relationship between Motor vehicle theft and current unemployment indicating that people do not take too much time for doing motor vehicle theft. In case of UEWI we did not get consistent result with theory. Bodman gets positive relationship between of UMP in case of robbery and burglary.

LPAR is negatively related to crime rate of robbery and UEWI, which has the consistency with theory although in case of MVT the relationship is positive. Our result is similar with Bodman in case of robbery and UEWI. In case of MALE we got negative relationship with crime rate for three types of crime which is not consistent with Bodman and many other empirical studies. We got consistent result in case of robbery but not in case of other two offences for variable AGE. We got negative relationship in case of EDUC for robbery and MVT but not in case of UEWI. Bodman also got same kind of relationship in case of robbery and MVT. The variable ABOR is positive in all three cases, which is consistent with our explanation. In all three cases the variable migrant is negative, indicating that increasing number of migrants do not increase crime.

So far our calculation is on marginal effects. Economists are sometimes interested in elasticities rather than marginal effects. Elasticity measures the relative change in dependent variable due to the relative change in exogenous variables. In our model there is no dummy variable so logarithm has been taken of all the variables. Elasticity's can be estimated directly from such log-linear regression model. Our previous estimate of linear model implies that elasticities are nonconstant and vary with the exogenous variables while loglinear estimates show constant elasticities.

Table-4

	Robbery(log)	Motor Vehicle Theft	Unlawful Entry With Intent
CLR	-0.837	-0.283	-0.498
	(-3.28)	(-0.67)	(-1.66)
MS	-0.315	0.014	.042
	(-1.16)	(.19)	(0.31)
UMP	-0.402	0.123	-0.051
	(-1.15)	(0.43)	(-0.29)
UMP1	0.097	-0.159	-0.063
	(0.36)	(-0.54)	(-0.37)
LPAR	-5.723	5.730	-0.772
	(-1.15)	(1.13)	(-0.22)
MALE	-258.07	-114.180	-91.477
	(-2.22)	(-1.02)	(-1.34)
AGE	1.067	-0.331	-0.363
	(0.43)	(-0.14)	(0.21)
EDUC	0.723	-1.074	0.734
	(0.61)	(-0.76)	(0.81)
ABOR	1.316	1.245	.468
	(1.57)	(1.29)	(0.86)
IMIGRANT	-5.296	-5.874	-3.332
	(-1.85)	(-2.01)	(-1.75)
Constants	-154.463	-104.457	-58.036
	(-2.02)	(-1.35)	(-1.23)
Adjusted R^2	0.9612	0.4349	0.8577

Notes: The numbers in parenthesis are t-statistics (significance level 5% level)

From the table - 4 it is seen that coefficient of CLR is negative for all three variables which is consistent with Bodman study. Here the coefficient of robbery explains that a 10% increase in clearance rate can decrease crime rate by 8.367%. The coefficient is significant at 5% level of significance although other two coefficients are not significant at 5% level of significance.

In case of median sentence CR is negatively related to MS in case of robbery although not significant. The positive relationship with other two offences is not also significant.

In case of UMP we did not get significant negative relationship in case of robbery but we got a positive relationship with the lag effect of UMP.

This means that if the unemployment rate of the previous year were 10% higher, then it would increase the crime rate of robbery only 0.97% which is negligible. In case of motor vehicle theft current effect of UMP is positive but in case of UEWI both effects are negative. There is reasonable background on this result. From our data it is seen that crime rate of robbery and UEWI increasing at a higher rate although the crime rate of MVT does not have a stable trend. The graphs in the appendix help us for a better understanding. Crime rate is negatively related to labor force participation rate in case of robbery and UEWI while it is positive in case of MVT. The variable MALE shows that it is negatively related to all three crimes. In case of AGE relationship is positive in case of robbery but for MVT and UEWI we got negative relationship with crime rate. Data shows that people of this age group decreases over time. We got negative value of education variable only in case of MVT. This says that if 1% more people accomplish the degree of higher education then it will reduce crime rate of MVT by 1.07%. The coefficient of ABOR is positive in all three offences showing their participation in criminal activity. In all three offences coefficient of MIGRANT is negative showing that migrants are not highly involved in crimes in Australia.

From empirical results it is seen that relatively lower unemployment rate is not a significant determinant of crime rate in Australia. In this respect it should be mentioned that during the period unemployment rate never exceed 11%. And in most of the years unemployment rate is less than 10%. So this determinant is not significant in Australia.

Section-7

Conclusion: This study is showing very interesting results about the factors responsible for crime in Australia. Although due to low degrees of freedom, in most of the cases, we did not get significant result, but still the sign of the coefficients are representing the relationship between the independent and dependant variable. Here it is found out that rather than economic variables, deterrence variables are important determinants of crime in Australia. From the empirical result, it is suggested that probability of detection and severity of punishment should be higher. So criminal justice system can play the pivotal role for combating crime. In fact, in a country like Australia unemployment rate hardly exceeded 10%. Also there are some provisions of unemployment benefits. So we did not get positive relationship between crime and unemployment. Aboriginal peoples' economic condition should be made better for reducing crime in Australia as we got positive relationship between aboriginal people and crime rate. Results show that migrated people do not increase crime in Australia. In

case of robbery, lag effect of unemployment is positive indicating that violent crime is the result of continuous unemployment. We do not get consistent result in case of variable AGE except robbery. For variable MALE we do not get consistent result for all three offences.

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Appendix-1

Definitions of the offences are given below.

Robbery

Robbery as defined by ABS, is the unlawful taking of property, without consent, accompanied by force or threat of force. Robbery victims can be persons and organizations.

Types of Robbery

We can classify robbery in the following two categories. These are:

Armed Robbery: This robbery is conducted with the use of a weapon. A weapon is any object used to cause fear or injury. It also includes imitation weapons; for example, where a weapon is not seen by the victim but offender claims to possess one.

Unarmed Robbery: This robbery is conducted without the use of a weapon.

Unlawful entry with intent

Unlawful entry with intent (UEWI) is defined by the ABS as the unlawful entry of a structure with the intent to commit an offence. UEWI offences include burglary, break and enter and some stealing.

Types of UEWI

There are two types of UEWI.

UEWI-property: This is UEWI where property is taken from a structure

UEWI-other: This is UEWI where no property is taken from a structure.

Motor Vehicle Theft

Motor vehicle theft is the taking of a motor vehicle unlawfully or without permission. It includes damaging and tampering or interfering with the motor vehicles. The theft of motor vehicle parts or contents is included under the offence category 'other theft'. The term motor vehicle refers to cars, motorcycles, campervans and trucks.

Appendix-2 (Definition of variables and Data Source)

The Crime Rate (CR): The crime rate for each crime category examined was obtained by average no. of offences reported to police per 100,000 population.

Data Source: Year book Australia and ABS.

The Clearance Rate (CLR): The clearance was compiled from state data. We aggregated the number of offences reported to police and the number of offences cleared by police of all the states of Australia. It is true that some data were not available but it is representative. Clearance Rate = no of offences cleared by police/no. of offences reported to police.

Data Source: Books from AIC (Australian Institute of Criminology) library and calculated by myself.

Median Sentence Length (MS): We got the different group of sentence length. Such as 3-4 years, 4-5 years etc. First we located the group of median sentence length. Then we calculated the weighted average in this group.

Data Source: AIC, ABS, and Calculation by myself

Police per capita (PPC): Police per capita is obtained by dividing the number of police officers employed in Australia at time t by the population of Australia at time t.

Data Source: Year book Australia, various issues.

Unemployment Rate (UMP): Average annual unemployment rate of a particular year.

Data Source: Reserve Bank of Australia, Table G7.

One-year lag rate of unemployment (UMP1): Average annual unemployment rate of the previous year.

Data Source: Reserve Bank of Australia, Table G7.

Labor Force Participation Rate (LPAR): Average annual rate of labor force participation.

Data Source: Reserve Bank of Australia, Table G7.

Percentage of population between 18 and 24(AGE): This is obtained by dividing the no. of population aged between 18-24 at time t by the total population at time t.

Data Source: ABS catalogue no.3201.0

Percentage of population that is male (MALE): This was obtained by dividing the male population at time t by the total population at time t.

Data Source: ABS catalogue no.3101.0

EDU: Percentage of population with TAFE, bachelor, post graduate or higher degree.

Data Source: ABS catalogue no.4230.0, Education and Training Indicator Australia-2002 Data cubes and various yearbook of Australia.

Percentage of population that is Aboriginal or Torres Straight Islander (ABOR): This is obtained by dividing the total no. of indigenous people by the total population of Australia at time t.

Data Source: Various issues ABS

Percentage of Population born abroad (MIGRANT): This is obtained by dividing the total migrant population at time t by total population at time t.

Data Source: Various issues ABS

Population Density (DEN): This variable was obtained by dividing the total population at time t by the geographic area in square kilometer. We used total geographic area as 7692024 sq/kilometer. It was calculated by taking the population data of different years.

Data Source: ABS and calculation by myself.