On the Impact of the NSW Criminal Justice System on Crime*

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Introduction

- Crime, originating from the root of Latin cernō ("I decide, I give judgement") is the behaviour judged by the State to be in violation of the prevailing norms of society.

- For offences deemed to be serious, criminal justice systems have historically imprisoned those responsible in the hope that a combination of deterrence and incapacitation may lower the crime rate.

- More than 9.8 million people in the world are institutionalised for punishment, half of which are held in the U.S., China and the U.K. (Walmsley, 2000).

- Over the past 30 years the U.S. prison population has more than quadrupled, mainly due to an increase in punitiveness rather than an increase in the rate of crime (Raphael and Stoll, 2009).

NSW

- The incarceration rate in NSW has increased over 23% in the last 10 years and is currently higher than that of Germany.
- The NSW prison system costs taxpayers more than $1 billion per year.
- At the same time crime rates have fallen or remained relatively stable, leading some to declare such high rates of incarceration a policy failure.
- How effective is the criminal justice system in deterring crime?
- To what extent do changes in law enforcement rules influence the motivation of individuals to engage in illegal pursuits?
- To address these questions in a constructive way and assist in formulating policies to deter crime, one needs to understand the causes for such behaviour.
- During the early part of the 20th century, criminal behaviour was viewed as a type of "social illness".

The economic model of crime (Becker 1968)

- ◆ Becker (1968) argued that criminals are rational individuals who engage in illegal activity because the subjective benefit exceeds the expected cost of doing so

- ◆ The key concepts/ingredients in his theory are:
  - The probability of conviction (p_i)
  - The 'income' or benefit flowing from illegal activity (Y_i)
  - The collateral 'costs' associated with criminal charges (C_i)
  - The cost to the individual of the sanction imposed as punishment (S_i)
  - The income from legal activity (I_i)
  - The subjective value of the benefits from illegitimate activity (U^{NL}) and legal activity (U^L)

- ◆ Expressed in mathematical terms, Becker's (1968) theory implies that an individual commits a crime whenever:

$$p_i U_i^{NL}\left(Y_i - \left(C_i + S_i\right)\right) + \left(1 - p_i\right) U_i^{NL}\left(Y_i\right) > U_i^{L}\left(I_i\right)$$

The economic theory of crime (Ehrlich 1975)

◆ Ehrlich (1975) later expanded this theory, arguing that the probability of punishment should be decomposed into its three component parts:

 ▪ the **probability of arrest** (P_A),

 ▪ the **probability of conviction** given arrest, ($P_{C|A}$) and

 ▪ the **probability of imprisonment** given conviction ($P_{P|C}$)

◆ Expressed in mathematical terms Ehrlich's (1975) model implies that the expected utility (benefit) from crime $E(U^{NL})$ can be expressed as follows:

$$E\left(U_i^{NL}\right) = \left(1 - P_{A_i}\right)U_i^{NL}\left(Y_i\right) + P_{A_i}\left(1 - P_{C|A_i}\right)U_i^{NL}\left(Y_i - C_i\right) + P_{A_i}P_{C|A_i}P_{P|C_i}U_i^{NL}\left(Y_i - C_i - S_i\right)$$

$$+ P_{A_i}P_{C|A_i}\left(1 - P_{P|C_i}\right)U_i^{NL}\left(Y_i - C_i - S_i'\right)$$

Key implications of the theory

◆ The model just described has two very important implications:

◆ (1) Increases in the probability of arrest (P_{Ai}), the probability of conviction given arrest ($P_{C|Ai}$) and the probability of imprisonment given conviction ($P_{P|Ci}$) should decrease the expected utility (benefit) from criminal activity.

◆ (2) The marginal deterrent effects of the criminal justice system are ordered, such that the effect of $P_{Ai} > P_{C|Ai} > P_{P|Ci}$.

◆ In other words, increasing the probability of arrest should have a larger impact on crime than increasing the probability of conviction given arrest; AND

◆ Increasing the probability of conviction should have a larger impact on crime than increasing the probability of imprisonment.

Testing the theory (1)

◆ If the theory has some empirical relevance, one should be able to predict crime behaviour and test the implications of theory using a statistical model containing terms reflecting

- The likelihood of arrest;
- The likelihood of conviction given arrest;
- The likelihood of imprisonment given conviction;
- The expected length of the prison term;
- Other factors likely to affect crime (e.g. unemployment & income)

◆ Indeed, a large empirical literature has emerged, trying to inform public policy on the effect of the criminal justice system on crime.

◆ This is well justified given the adverse effects that crime has on economic activity, as well as on the quality of one's life in terms of a reduced sense of personal and property security.

Existing evidence

◆ There is no research consensus on the impact of the criminal justice system on crime.

- For example, Hirsch (1998) argues: "Estimates of the deterrent effect vary… Further empirical investigation is necessary to gain a more accurate estimate of its magnitude…"

- Cornwell and Trumbull (1994) conclude: "The ability of the criminal justice system to deter crime is much weaker than previous results indicate… A fundamental flaw in each of the [previous] studies is an inability to control for unobserved heterogeneity…"

◆ We argue that this lack of consensus is mainly due to the inability of previous studies to overcome effectively a number of problems encountered with statistical modelling of crime. The most important of these are:

- Simultaneity

- Dynamic mis-specification

- Omitted variable bias

Simultaneity

- Simultaneity arises when two factors, x and y influence each other.

- Typically, we think of crime = a function of arrest rate

- Or, crime = function of imprisonment rate

- In both cases, there is an implicit assumption that there exists a uni-directional "cause-and-effect" relationship between crime and the deterrence variables.

- Standard estimation techniques, such as Ordinary Least Squares, are not designed to deal with this issue.

- We deal with this problem using a special statistical method of analysis called the GMM approach (the details of which don't matter here).

Dynamic mis-specification

◆ Past research has often assumed that the full effects of law enforcement policies occur almost instantly

◆ This is unrealistic as it may take some time for people to realise any changes in enforcement activity in a particular area, and of course humans often form their decisions based on habit formation and costs of adjustment.

◆ If we are to fully capture the effects of the criminal justice system, we need to formulate a dynamic model that allows these effects to be distributed over time.

Omitted variable bias

- Omitted variable bias occurs when there exist factors omitted from the model, which are correlated with those incorporated into the model.

- The result of this is that the true impact of the omitted factors is likely to then be absorbed by those included into the model, leading to biased inferences with respect to the effect of the criminal justice system on crime.

- It is rarely the case with previous studies that all variables prescribed by theory are included into the model.

- Our paper shows that exclusion of relevant deterrence variables can practically lead to under-estimating the true effect of policing.

The model (don't panic)

$$\ln\left(\frac{crm_{it}}{pop_{it}}\right) = b_0 \ln\left(\frac{crm_{it-1}}{pop_{it-1}}\right) + b_1 \ln\left(\frac{arr_{it}}{crm_{it}}\right) + b_2 \ln\left(\frac{conv_{it}}{arr_{it}}\right) + b_3 \ln\left(\frac{impr_{it}}{conv_{it}}\right)$$

$$+ b_4 \ln avsen_{it} + b_5 \ln income_{it} + b_6 \ln unemp_{it} + e_{it}, e_{it} = a_i + d_t + u_{it}$$

- ◆ The term 'ln' just means the term in brackets is logged
- ◆ The equation basically says the crime rate at time t = b_0 (crime rate at t-1) + b_1 (probability of arrest at t) + b_2 (probability of conviction at t) + b_3 (probability of imprisonment at t) + b_4 (average sentence at t) + b_5 (income) + b_6 (unemployment) + e.
- ◆ The $b's$ are called 'coefficients' and measure the size and direction of the expected impact of the probability of arrest, conviction, imprisonment, sentence length, income and unemployment on crime, all other things remaining constant.
- ◆ b_0 measures "persistence", i.e. the extent to which habit formation and costs of adjustment influence current behaviour.

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Our expectations

◆ We expect b_1, b_2, b_3 and b_4 to be negative and significant (*) because as the level of the deterrence variables increases, crime is likely to decrease.

◆ We expect $|b_1| > |b_2| > |b_3|$ because our theory suggests changing the risk of arrest should have a larger impact on crime than changing the likelihood of conviction, which in turn should have a larger effect than changing the likelihood of imprisonment.

◆ We expect the coefficient of unemployment to be positive and significant (*) because as unemployment increases, crime should go up.

◆ We expect the coefficient on income to be negative and significant (*) because as income goes up, crime should go down.

Testing the theory (2)

◆ To test the theory we obtained annual data on violent and non-violent crime in each of the 153 Local Government Areas in NSW over the 13 year period from 1995/96 – 2007-08.

◆ We supplemented these data with information over the same period in the same areas on:

- The proportion of people arrested
- The proportion of those arrested who were convicted
- The proportion of those convicted who were imprisoned
- The average prison term imposed on those who were imprisoned
- The unemployment rate
- The average wage for full-time workers

◆ We then fitted our model to these data.

Results: descriptive statistics

Variable	Type of Crime	Mean	Standard deviation	10th percentile	90th percentile
Crime rate	Total Non-violent Violent	.133 .100 .034	.088 .070 .024	.064 .043 .016	.218 .176 .049
Probability of arrest (b_1)	Total Non-violent Violent	.313 .308 .344	.117 .124 .128	.169 .156 .198	.466 .471 .505
Probability of conviction (b_2)	Total Non-violent Violent	.489 .506 .340	.144 .177 .140	.325 .301 .200	.673 .739 .500
Probability of imprisonment (b_3)	Total Non-violent Violent	.071 .071 .159	.040 .046 .129	.031 .031 .060	.118 .119 .290
Sentence length (days) (b_4)	Total Non-violent Violent	280.1 37.9 608.1	4767.9 1013.6 9672.3	5.7 4.5 2	15 11.6 25.6

Results: model effects

	Total Crime		Non-violent Crime		Violent Crime	
Estimated Marginal Elasticities						
Coefficients	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Prob. of arrest (b_1)	-.865***	-1.33***	-.920***	-1.45***	-.258***	-.720**
Prob. of conviction (b_2)	-.575***	-.885***	-.581**	-.916***	-.273***	-.763***
Prob. of imprisonment(b_3)	-.218**	-.335**	-.179**	-.282**	-.002	-.005
Sentence length (b_4)	-.251***	-.386**	-.210***	-.331**	-.008	.023
Income (b_5)	-1.03**	-1.58***	-1.12***	-1.76**	-.268	-.748
Unemployment (b_6)	. 626***	.962***	.305***	.481***	.198***	.554**
"Persistence"	.350***		.366***		.642***	
H0: $b_1 > b_2 > b_3$	YES		YES		NO	

The entries tell us the size and direction of the effect. The value of -.865 in the third row of the first column, for example, means that a 1 per cent increase in the likelihood of arrests, **is expected to reduce** total crime by 0.87 per cent in the short term and 1.3 per cent in the long-term. The value of .626 at the bottom of that row means that a 1 per cent increase in unemployment **is expected to increase** crime by 0.626 and 0.96 per cent in the short- and long-term respectively.

Summary of main results: Total Crime

- All estimated coefficients are significant and have the expected sign (- or +).

- The coefficients associated with the risk or apprehension and conviction are much larger than those associated with the likelihood and severity of punishment.

- Changing the likelihood of imprisonment (given conviction) appears to have a similar effect with that of changing sentence length, suggesting that criminals respond to the expected length sentence as a single factor: e = prbimpr   avsen.

- The effects of income and unemployment are large and statistically significant. The magnitude of these effects differ substantially, suggesting that in formulating the crime-no crime decision individuals may consider more the level rather than the certainty of their income.

- b_0=.35 implies that it takes 2.5 periods for 90% of the total impact of a change in a law enforcement activity to be realised.

- Restrictions implied by theory are supported by the data.

Summary of main results: Non-violent & Violent Crime

♦ There are stark differences in the results obtained for non-violent and violent crime. The former resembles more closely the model for total crime, which is not surprising given that about ¾ of total crime is non-violent.

♦ The hypothesis of sequential ordering of the deterrence coefficients is supported only for non-violent crime. This indicates that rational behaviour may apply only to this type of crime.

♦ This is also manifested through the estimated coefficients; for example, the effect of punishment, both in terms of likelihood and severity, is statistically significant only for non-violent crime and even so it appears to be small compared to the effect of increasing the risk of apprehension and conviction.

♦ Income and unemployment appear to have an appreciably smaller effect on violent crime.

Persistence (speed of adjustment)
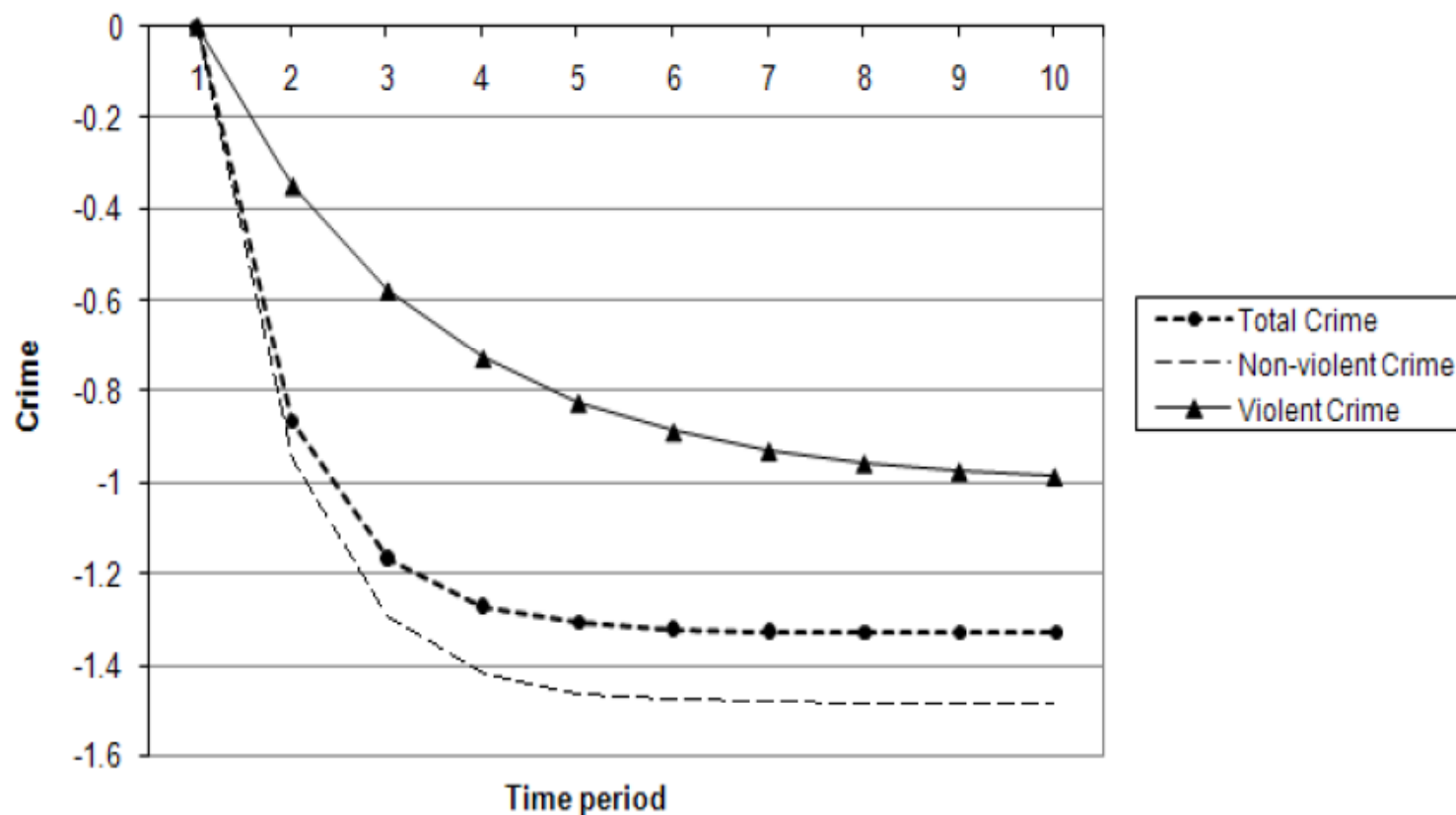
Violent crime is characterised by higher persistence. While it takes about 2.5 periods for 90% of the total impact to be realised for non-violent crime, violent crime requires about 6 periods for the same effect to occur

Concluding remarks

- Our findings suggest that the criminal justice system can potentially exert much greater influence on crime than past estimates suggest.

- From a policy perspective, it appears that targeting the risk of apprehension and conviction are more effective strategies than increasing the severity of punishment.

- Violent crime appears to be more persistent and relatively less responsive to changes in law enforcement policies compared to non-violent crime. This is to be expected since violent crime is often committed by people under the influence of alcohol or strong emotions such as anger or jealousy.