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Unemployment duration, schooling and property crime

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It is well known that there is no clear consensus with respect to the relationship between unemployment and crime. As well, there is very little aggregate-level research on the linkages between crime and the educational experiences of young people. In this paper we argue that a better way of thinking about the property crime - unemployment nexus involves modeling the role of unemployment duration, and we show a very strong positive relationship between criminal activity and the extent of youth male long-term unemployment. We also produce evidence of a negative association between criminal activity and high school completions, and positive associations between criminal activity and unsuccessful senior high school participation. The analysis suggests that labour market and education policies have the potential to significantly reduce property crime. However, increased high school participation of the long-term unemployed only seems to decrease crime if it results in graduation. This suggests that the effectiveness of education policy is a significant influence on property crime activity, a unique finding.

INTRODUCTION

Research into the relationship between unemployment and crime has a long history but has not produced a consensus. Aggregate-level studies generally yield inconsistent results. As Chamlin and Cochran so eloquently point out:

> It has become almost obligatory to begin any macro-level discussion of the unemployment - crime relationship with the observation that extant research findings are varied, complex, and/or equivocal. Typically, this lament serves as a segue into a recapitulation of the numerous, and often countervailing, theoretical processes that are thought to mediate the effects of unemployment and crime, sophisticated methodological critiques of recent efforts to estimate the unemployment - crime association, and ultimately, the development of alternative statistical techniques and modelling strategies better to take into account the intricacies of the causal linkages between unemployment and crime (Chamlin and Cochran, 2000:443).

Chamlin and Cochran contend that mismeasurement of unemployment is the principal reason for the failure to observe a consistent association between unemployment and crime. This bulletin provides support for their conclusion. We argue, however, that the measurement problems they identify are symptomatic of more general theoretical weaknesses in the literature on unemployment and crime. In particular, too little attention has been paid to the interrelationships between property crime, unemployment duration and education.

Just as the term 'crime' denotes a wide variety of types of criminal activities that can respond differently to changes in unemployment, so too unemployment is a heterogenous construct, varying in terms of age, gender, the duration of unemployment and the educational qualifications of those who find themselves unemployed. Given that engagement in criminal activity is a choice made by individuals in the context of the relative attraction of illegitimate and legitimate activities (such as employment), these are very important distinctions. Each is highly pertinent to an individual's future expectations of legitimate employment and earnings prospects. Yet, the fact remains that unemployment is mostly treated as an homogenous entity with direct and uncomplicated linkages to crime.

This study, therefore, aims to investigate the impact of unemployment duration and school participation on aggregate rates of property crime. In particular, we analyse data on one type of crime only (household break, enter and steal) and from one State of Australia (New South Wales (NSW)) over the period January 1989 to December 1999. We focus on a particular aspect of unemployment composition generally overlooked in time series analysis of links between unemployment and crime: the duration of unemployment of young people. In addition, and for the first time in this literature, we explore the links between the level of property crime activity and both high school enrolments and completions.

The plan of the paper is as follows. Section 2 provides a brief review of the literature on the link between unemployment and crime, on the one hand, and participation in post-compulsory education and crime, on the other hand. Section 3 presents a model of the relationship between unemployment duration, schooling and property crime and describes the data used to test the model. Section 4 presents empirical tests of the model. Section 5 illustrates the meaning of the results through consideration of the effectiveness of a number of hypothetical policy scenarios concerning targeted labour market programs and educational participation with respect to their impact on property crime levels. Section 6 summarises the results of preceeding sections.

THE LITERATURE

AGGREGATE-LEVEL STUDIES ON UNEMPLOYMENT AND CRIME

In his seminal review of aggregate-level research on unemployment and crime more than a decade ago Chiricos (1987) argued that the balance of evidence favours the existence of a positive and frequently significant relationship between unemployment and crime. And yet, nagging doubts remain. Fourteen per cent of the time series tests Chiricos examined showed evidence of a significant *negative* relationship between unemployment and crime (Chiricos, 1987:194). Many found no significant relationship at all.

This pattern of inconsistency in time series studies of unemployment and crime has continued in studies conducted since the Chiricos review. Land, Cantor and Russell (1995) found a (lagged) positive relationship between unemployment and crime in post-War United States. Kapuscinski, Braithwaite and Chapman (1998) found a strong positive relationship between unemployment and trends in homicide in Australia between 1917 and 1987. Weatherburn, Lind and Ku (2001), however, found no evidence of any relationship between unemployment and crime in a study of the effect of the last Australian recession on break, enter and steal, and motor vehicle theft. Field (1990, 1999) found no effect of unemployment on post-War British crime trends.

The leading explanation for these inconsistent results remains that put forward by Cantor and Land (1985). In essence they argued that unemployment increases the motivation to offend but reduces the opportunities for offending. Changes in the supply of opportunities for offending occur contemporaneously with changes in rates of unemployment. However changes in the motivation to offend are lagged because 'institutional and social support systems' temporarily cushion the effect of unemployment on those who become unemployed (Cantor and Land, 1985:322). Tests of Cantor and Land's theory (Cantor and Land, 1985; Land, Cantor and Russell, 1995) have generally produced mixed results, with some offences showing the expected contemporaneous negative and lagged positive relationship, some offences showing only a negative association, and other offences showing no association at all.

Not surprisingly, consensus on the relationship between unemployment and crime remains elusive. Some have questioned whether there is any causal relationship between the two variables. Field (1990), for example, expressed serious doubts about the relevance of unemployment to an understanding of British crime trends. Gottfredson and Hirschi (1990) have argued that the relationship between unemployment and crime is 'too small to be of theoretical import' and 'tends to be in the wrong direction'. Pyle and Deadman (1994) have suggested that unemployment may be less important to crime than other indicators of economic activity.

Some have suggested that the inconsistent effects obtained in time series studies on unemployment and crime might be due to the fact that the effect of unemployment on crime is not the same for all offences. Paternoster and Bushway (2001), for example, suggested that joy-riding should be more common during upswings in the business cycle and commercial auto theft more common during downswings in the cycle. They provided evidence that supported this hypothesis. In a similar vein, Chamlin and Cochran (1998) have argued that changes in economic activity should exert different effects on domestic and commercial burglary. Their results also supported this hypothesis.

Others have argued that the variables chosen by Cantor and Land to test their theory (concerning the lagged effect of unemployment on crime) were conceptually flawed. Greenberg (2001), for example, suggested that Cantor and Land were probably on the right track in suggesting that long-term unemployment may be a more powerful motivator of crime than short-term unemployment. He argued, however, that examining the link between unemployment duration and crime, rather than measuring the lagged effect of the percentage unemployed on crime, would have better tested the Cantor-Land theory. Greenberg (2001) in fact replicated Cantor and Land's (1985) regressions with an updated dataset and included a measure of unemployment duration. He found no contemporaneous positive relationship between unemployment and crime and significant negative coefficients for unemployment duration for five of the six offences he examined.

Similar results were obtained by Chamlin and Cochran (2000). Using time-series models developed through ARIMA modelling (Box and Jenkins, 1976) they found no relationship between the conventional Bureau of Labour Statistics measure of unemployment, and monthly trends in property crime in the United States between 1982 and 1996. They found a strong positive relationship, however, between monthly numbers of property crimes reported to police and the number unemployed for 15 weeks or more. They also found a strong negative relationship between the demand for labour and trends in property crime. This is significant because one might expect a downturn in the demand for labour to signal increases in unemployment duration. Chamlin and Cochran's study provides further evidence that past studies of unemployment and crime may have used a flawed indicator of the role of unemployment.

SCHOOL PARTICIPATION, SCHOOL RETENTION AND CRIME

The transition between school and work is a critical one for young people. For those who succeed in school and can look forward with some confidence to a job, it marks the point at which the pleasures and privileges of adulthood become much more fully accessible. Those who do not do well at school often suffer the frustration of being denied this access. If they drop out of school, or fail to complete it and fail to obtain a job, their frustration coincides with a sharp diminution in the level of supervision and control characteristic of the school and work environment. Those who leave school around the age of sixteen experience this loss of control at precisely the age when they are most prone to involvement in crime.

Polk and White (1999) have recently highlighted the possibility that school variables may play an important role in shaping the relationship between unemployment and crime in Australia. They point out that one of the most notable developments in Australia over the last two decades has been the collapse of the full-time labour market for 16-19 year olds. Whereas 25 years ago two-thirds of this age group were in full-time employment, by the 1990s this figure had fallen to well under 20 per cent. In the years between 1983 and 1992 this change was accompanied by an increase in school retention rates. Since 1992, however, school retention rates have been in slow decline. Those leaving school now face very limited full-time employment prospects and must make do with insecure, part-time poorly paid employment. These changes have coincided with a steep increase in several major categories of property crime (Australian Bureau of Statistics, 2001a and 2001b).

Surprisingly, no aggregate-level studies have reported on the relationship between school retention rates and crime. The only research on this topic has focused on the individual-level effects of poor school performance or 'dropping out' of high school. It shows that those who do poorly at school, particularly males, are more likely to offend during their school years (Braithwaite, 1979; Schafer and Polk, 1967; West, 1984; Baker, 1997).

It seems likely, however, that the effect of early school leaving depends, at least to some degree, upon the state of the labour market. Other things being equal, we would expect lower rates of school retention to produce higher rates of offending. However those dropping out of school early may be far less likely to become involved in crime where they either obtain or hold out a reasonable expectation of finding satisfactory employment. If this is true, the effect of lower school retention rates on aggregate crime rates will depend upon the ease and speed with which those not completing secondary school are able to find satisfactory employment.

EMPIRICAL ANALYSIS: MODEL SPECIFICATION AND DATA

The conceptual framework discussed above provides the basis for our statistical analysis and econometric modelling. The simplest model reflecting our discussion is:

Crime =

a * (Unemployment duration) +

b * (High school education success) +

c * (Other labour market measures) +

d * (Other economic controls) +

random error

where a, b, c, and d are parameter vectors. Our theoretical framework predicts that $a > 0$ and $b < 0$. The nature and meaning of the variables used to represent the above are now described.[6]

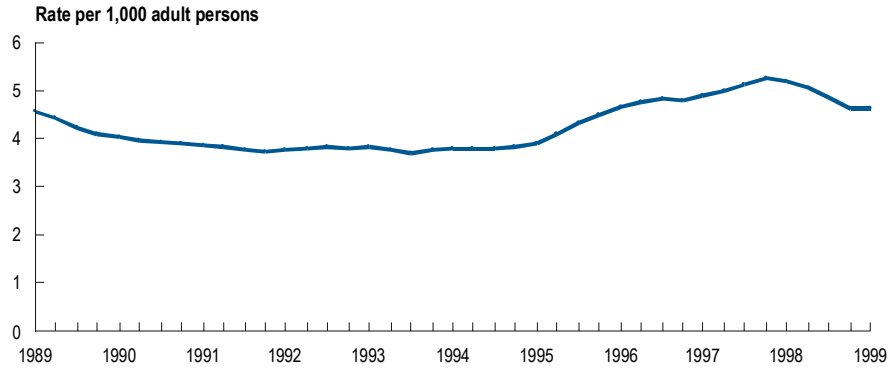
DEPENDENT VARIABLE: BREAK, ENTER AND STEAL

Our analysis relates to one homogenous type of property crime — breaking, entering and stealing (BES) from a dwelling. We exclude commercial burglaries because the dynamic underpinning them may differ from domestic burglaries (Chamlin and Cochran, 1998). Break, enter and steal from a dwelling is also the single largest category of crime recorded by the NSW Police Service, with about 80,000 occurrences annually. The data were obtained from 'COPS', the NSW Police Service database containing information on offences reported to the police. However, the total number of crimes reported is unlikely to be an accurate indication of the propensity of criminal activity, since it takes no account of demographic changes. That is, the crime rate per head of the adult population is the more correct measure and is shown in Figure 1.

INDEPENDENT VARIABLES: THE DURATION OF UNEMPLOYMENT

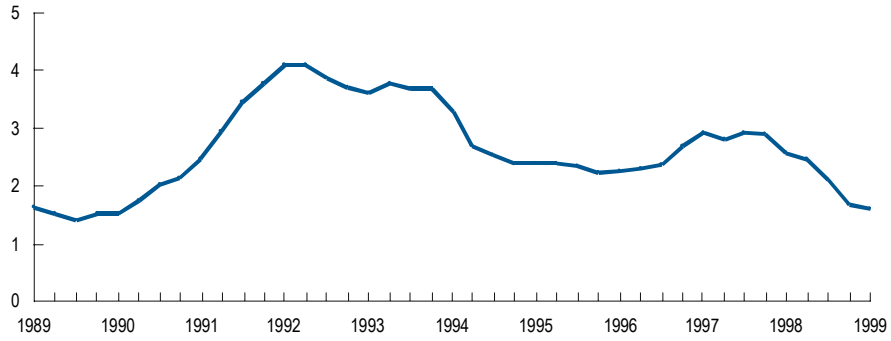
All people in the civilian population aged 15 years and over are classified into one of three categories: employed; unemployed; or not in the labour force. A person is defined as 'employed' if he/she worked for one hour or more for pay or in a family business in the reference period (the week prior to the survey). To be classified as 'unemployed' in the reference period a person must be: not employed (according to the previous definition of employment); actively looking for work; and, be available for work (see Australian Bureau of Statistics, 2001a).

Figure 1: The rate of BES (per 1,000 adult persons): 1989.IV - 1999.IV



Note: *The BES measure in this figure has been smoothed with a four-period moving average. The period covered in the graph refers to the transformed series.*

Figure 2: Ratio of NSW young male LTU to young male population: 1989.IV - 1999.IV (deseasonalised)



Note: *The LTU ratio in this figure has been smoothed with a four-period moving average. The period covered in the graph refers to the transformed series.*

The 'duration of unemployment' is also provided by the Australian Bureau of Statistics, and is measured as the length of time between the reference period and the date an unemployed person first began continuously looking for paid work. Long-term unemployment (LTU) defines individuals who have been unemployed for 12 months or more. One of the independent variables is its incidence for young people (aged 15-24 years), that is, the proportion of all young people who have been unemployed for 12 months or more. We use separate measures for males and females, and Figure 2 shows the ratio for young males in LTU (corrected for seasonal influences) to the total population of young males.[7]

INDEPENDENT VARIABLES: HIGH SCHOOL OUTCOMES

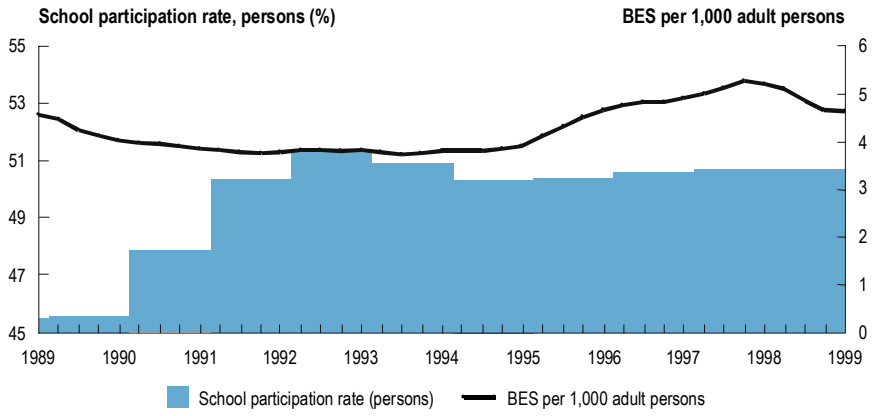
We are interested in representing two dimensions of education: the percentage of young people graduating from senior high school; and the proportion of those enrolled in senior high school but who do not graduate. The first is relatively straightforward and is known in Australia as the 'Year 12 retention rate'. The Year 12 retention rate is shown in Figure 3 and is measured as the proportion of senior high school students in a given age cohort who graduate, and might thus be taken to be an indication of the success of the education system. For comparative purposes the figure also includes the rate of BES per head of the adult population for the same period.

Representing the extent of high school non-completion turned out to be quite a challenge for our exercise, because such a variable is not directly available. However, given that the regression analysis includes the Year 12 retention rate we are able to proxy non-completion in an indirect way, using the so-called age participation rate. This is now explained.

The age participation rate is the number of full-time school students of a particular age and sex expressed as a proportion of the population of the same age and sex. That is, it reflects full-time

enrolments. Thus, the combination of Year 12 retention and the participation rate in a regression equation suggests that the latter variable holding all else constant can be interpreted as measuring the proportion of young people who begin, but do not complete, high school. Figure 4 shows the time profile of the BES rate in comparison with the school participation rate.

Figure 4: The rate of BES (per 1,000 adult persons, deseasonalised) and the NSW school participation rate (15-19 year olds): 1989.IV -1999.IV



Note:
1. *BES is measured on the right-hand axis and the school participation rate is measured on the left-hand axis.*
2. *The BES measure in this figure has been smoothed with a four-period moving average. The period covered in the graph refers to the transformed series.*

OTHER INDEPENDENT VARIABLES

In common with other studies investigating the links between crime and unemployment, we include a number of measures of the state of the labour market. These should be interpreted as measures of both labour supply and labour demand, and thus reflect relative job opportunities. They are as follows:

(i) the labour force participation rate (LFPR): the number of employed and unemployed as a proportion of the relevant population group (e.g. males aged 15-24);

(ii) the employment-population ratio (EP): the number employed as a proportion of the relevant population group; and

(iii) the vacancy rate: the stock of unfilled jobs as a proportion of total employment.

Two additional controls included in the estimations represent scale (or opportunity) effects: the annual growth rate of NSW gross product per capita, and per capita retail sales in department stores (in 1990 prices). Their inclusion in the model is designed to capture the effects of economic growth (and hence higher incomes) on, respectively, household spending and the availability of goods which can be stolen from dwellings. Even so, given the relatively short time-span of our data (less than one business cycle) it would be surprising if these controls were to play an important empirical role.

Finally, we explore the role of heroin addiction on property crime This is potentially a major issue given that a significant proportion of property crime in NSW is committed in order to finance the purchase of narcotics (Makkai, 2002). Unfortunately there are no reliable data on the number of addicts. Trends in the number of persons on methadone, however, are generally thought to mirror trends in the number of heroin addicts (Law, Lynskey, Ross and Hall, 2001). We can thus proxy the effect of narcotic addiction on crime through the use of the methadone program user numbers.

EMPIRICAL ANALYSIS: ESTIMATION AND DIAGNOSTIC RESULTS

MODEL ESTIMATION

Before discussing the results of our estimation of models of property crime, it is worth pointing out that preliminary testing of stationarity and cointegration properties of variables revealed similarity of time-series characteristics of the relevant variables and, thus, appropriateness of estimation of classical regression models.

Table 1 presents empirical tests of the theoretical model, with several variations of the model being reported. First, we show the results of estimations employing the traditional approach used in the crime/unemployment literature. That is, property crime activity is modelled to be a function only of the aggregate (i.e. not disaggregated by duration of unemployment or age group) unemployment rate and broad controls; measures of LTU and educational outcomes are excluded.

Also presented are the results of the model motivated by our theoretical discussion (Model A). Finally, Model B augments the specification of Model A with a proxy for drug dependence (the ratio of the number in the methadone program to the population aged 15-24). Diagnostic tests for all the estimated models are given in Table 2.

We also estimate a number of additional models each based on different functional forms and variables representing arrest probabilities and conviction rates. The most important specification differences relate to the possibility that there are interactions between long-term unemployment and the educational success variables. In none of these exercises were the additional variables or the alternative specifications significant, nor did any of the other coefficients change with these models. We report the specifications of these additional models in Appendix D.

Table 1: Estimated models of property crime, NSW, 1989.I - 1999.IV

	Traditional model		*Model A*		*Model B*	
Variable	***coefficient***	***t-ratio***	***coefficient***	***t-ratio***	***coefficient***	***t-ratio***
LTU/population, males, 15-24			0.247	2.48**	0.224	2.52**
LTU/population, females, 15-24			-0.028	-0.24	0.118	1.02
UER: all males	0.908	0.30				
UER: all females	-4.694	-1.58				
UER: males, 15-24			-0.266	-0.43	0.140	0.24
UER: females, 15-24			0.501	0.63	0.659	0.93
LFPR: all males	-1.678	-0.45				
LFPR: all females	8.175	1.56				
LFPR: males, 15-24			0.240	0.33	-0.215	-0.32
LFPR: females, 15-24			-0.632	-0.61	-0.853	-0.93
Emp/population, all males	1.444	0.35				
Emp/population, all females	-8.862	-1.56				
Emp/population, males, 15-24			-0.267	-0.31	0.328	0.41
Emp/population, females, 15-24			0.799	0.67	1.014	0.96
Vacancy rate	-0.795	-2.01**	0.194	0.51	-0.266	-0.71
School participation rate			0.971	5.68***	0.595	2.96***
School retention rate to Year 12			-0.399	-6.98***	-0.302	-4.94***
Gross product, NSW, $'000 p.c.	0.241	0.85	-0.022	-0.13	-0.472	-2.21**
Retail sales, dpt. stores, $'000 p.c.	7.061	0.57	-25.198	-2.54**	-6.475	-0.59
No. methadone users / pop. 15-24					0.227	2.86***
Quarter 1	0.047	0.13	0.134	0.55	-0.151	-0.64
Quarter 2	-0.365	-1.43	0.282	1.10	0.384	1.67*
Quarter 3	0.161	0.75	0.258	1.17	0.149	0.75
Constant	56.30	1.48	-21.43	-1.95*	-19.77	-2.03**

Note:

1. The dependent variable in all models is the rate of break, enter and steal (per 1000 adults).

2. The asterisks indicate the significance of coefficients: three stars denote significance at 1% level, two denote significance at 5% level, one indicates significance at 10% level.

The important findings from our empirical analyses are as follows. First, the traditional model performs poorly and is not a satisfactory estimation in econometric terms. Specifically, while the equation explains more than half of the variation in the dependent variable, the explanatory power as indicated by the R-bar square is still low for time series. Further, virtually no regressors are individually significant. More importantly, the regression suffers from a number of econometric problems. One is the presence of serial correlation (as indicated by the low Durbin-Watson statistic and as demonstrated by the auto-correlation function (ACF)). This indicates that the model is not properly specified and is consequently unable to track adequately the behaviour of the dependent variable. Furthermore, the model does poorly in explaining variations in (i.e. behaviour of) the time-series of our dependent variable.[8]

The combination of the overall fit of the regression (a significant F-test) and the insignificance of the individual regressors also suggest that the estimated model simply reflects common trends of the variables (see also the discussion of cointegration between the BES variable and the labour market variables in Appendix B). Most notably, the traditionally estimated specification also shows no relationship between aggregate unemployment rates and property crime. It is the type of result most often found in the literature and consequently is not a surprise.

The other two models, A and B, are much more interesting, because the estimations are more valid representations of the potential impact on property crime of unemployment duration and high school success. They differ only in that B includes the heroin addiction proxy. Both models appear statistically adequate with both

regressions explaining a significant proportion of variation in the BES rate (around 78 per cent for Model A and 83 per cent for Model B). Their standard errors are less than half of the standard deviation of the dependent variable and the diagnostic tests indicate satisfactory fits without any evidence of model misspecification.[9]

A more detailed look at the estimation results reveals the following for Model A: a positive and significant relationship between the level of long-term unemployment among young (15-24 years) males and property crime; a positive and significant relationship between crime and school participation rates; and a negative and significant relationship between crime and the school retention rate variable. The second and third results, in combination, imply that property crime is diminished as higher proportions of young people enrol in senior high school, but only if this is associated with successful completion.

These results are preserved in Model B. Estimation of Model B also indicates strongly that our proxy for the extent of heroin addiction appears to confirm the anecdotal evidence that a large proportion of property crime is undertaken to finance drug purchases by addicts.

Of interest is the performance of the business cycle proxies (retail sales and state GDP per head variables). In Model A retail sales has an unexpectedly negative and significant relationship with property crime, but this turns out to be illusory: once there is control for methadone use (Model B) there is no significant role for retail sales. On the other hand in Model B, and as expected, the proxy for income is strongly and negatively related to crime.

In summary, the results from both Models A and B indicate that our theoretical specification of the link between crime and both human capital (schooling success) and male employment disadvantage (unemployment duration) is strongly supported. The size of these relationships, and the implications for policy, are now discussed.

Table 2: Summary of diagnostics of the estimated models of property crime

Diagnostic	*Traditional model*	*Model A*	*Model B*
R-bar square	0.554	0.781	0.827
Regression F-test	5.46	10.55	13.06
SEE	0.353	0.248	0.220
St.Dev (regressand)	0.529	0.529	0.529
Jarque-Bera test	0.923	1.761	1.333
Durbin-Watson	1.041	1.823	1.697
LM(1)	3.740	0.811	1.269
ACF: lag 1	3.02	0.58	1.00
ACF: lag 2	1.09	-1.54	-2.76
ACF: lag 3	-0.69	-0.53	-1.20
ACF: lag 4	-0.71	0.96	0.46
RESET (2)	0.001	0.617	2.971

Note:

1. *R-bar square is the adjusted regression coefficient of determination.*
2. *Regression F-test is the test that all coefficients are zero. The marginal significance value in all cases is less than 1%.*
3. *SEE is the standard error of the regression, while Std. Dev (regressand) is the standard deviation of the dependent variable.*
4. *Jarque-Bera test is the test for normality of regression residuals. The critical value is 5.99.*
5. *Durbin-Watson is a test for first-order serial correlation.*
6. *ACF is the residual autocorrelation function. The entries in the table are the t-ratios of the first four coefficients. The critical value at 1% level is 2.69.*
7. *LM(1) is the Lagrange Multiplier test for serial correlation of order one. The critical value at 1% level is 2.57.*
8. *RESET (2) is a test for regression misspecification. The critical value at 1% level is 4.46.*

POLICY SIMULATIONS

Since most variables included in our models are entered in the regressions as ratios, the interpretation of the estimated coefficients is not straightforward.[10] In order to aid understanding and as a substitution for a detailed discussion of coefficient sizes we now present a number of simulations based on a range of targeted labour market programs and education policy scenarios. Given that the emerging message from our modelling is the importance of the interaction and interdependence between the states of education, employment and unemployment, the scenarios are designed to evaluate the impact on property crime of *simultaneous* changes of both the origin state (that is, LTU) and the destination state (education or not in education).

The starting point of our four policy scenarios is the reduction of long-term unemployment among young males. For our purposes, it is assumed that this can be achieved in one of two ways. First, the long-term unemployed could be provided with jobs, for example through the use of wage subsidies or direct public sector job creation. Second, the targeted group could be encouraged – or required – to take up senior high school. Within this category there could be several outcomes, and we consider three possibilities: all those enrolling in senior high school are educationally successful and graduate; half of the group graduate and the other half drop out and become part of the short-term unemployed; and, none of the group graduates, with all members becoming part of the short-term unemployed.

Technically the empirical consequences of these scenarios are achieved in the following ways. In all cases the reduction of young male LTU has a direct negative effect on criminal activity, and this is the only impact from the first scenario. However, in the education policy cases, there will also be impacts from changes in school participation rates and school retention rates. For example, in the example of a fully successful education

Table 3: Outline of simulation scenarios

Policy number	*Policy type*	*Description*	*Initial transition*	*Final state*	*Policy outcome*
i	Targeted labour market program (LMP)	Permanent job creation for young LTU males	LTU to employment	Employment	Success
ii	Successful secondary education program	Enrolment into Year 11 with 100% graduation	LTU to education	Education	Success
iii	Half-successful education program	Enrolment into Year 11 with 50% graduation	LTU to education	Half in education, half in short-term unemployment	Partial success
iv	Completely unsuccessful secondary education program	Enrolment into Year 11 with zero graduation	LTU to education	None in education, all in short-term unemployment	Failure

program, the absolute increase in the number participating is the same as the absolute increase in retention; for the case of half-successful education policy, the absolute increase in retention is half the number of the increase in participation.

Table 3 summarises the main features of these policy scenarios including the final activity outcome for the individuals involved (column headed 'final state').[11] The last column (headed 'policy outcome') simply indicates whether the primary objective of the policy is being achieved based on the postulated final state of individuals. To evaluate the impact of these alternative policies we can ask: (a) what would be the result at a margin, say, of a reduction in LTU by 1000 individuals (about 8 per cent of the average number of 15-24 years old males in long-term unemployed); and (b) what would be the result if all long term unemployment among 15-24 years old males is eliminated (which amounts to 7,000 individuals at the end of our sample period). While we focus in the paper on the latter case, for completeness Appendix E includes the simulation outcomes for the first case.

RESULTS AND INTERPRETATION

The results of our simulations of eliminating LTU among young males are presented in Table 4.[12] The tabulations also present the contributions from our three variables of interest: the initial effect from the change in the LTU itself, the effect from the change in school participation rate and the effect from the change in the school retention rate.

The results indicate a substantial cost of youth long-term unemployment. Using the (preferred) Model B results, we can see that a job creation program in NSW

Table 4: Simulated effects on property crime (BES) of complete elimination of male long-term unemployment amongst males aged 15-24

	Contribution from			*Total effect*	
Policy	*Long-term unemployment*	*Retention rate*	*School participation rate*	*Number of BES*	*% of annual BES*
			Model A		
i	-5,947	0	0	-5,947	8.92
ii	-5,947	-12,249	6,035	-12,162	18.23
iii	-5,947	-6,125	6,035	-6,037	9.05
iv	-5,947	0	6,035	88	-0.13
			Model B		
i	-5,386	0	0	-5,386	8.08
ii	-5,386	-9,267	3,698	-10,954	16.42
iii	-5,386	-4,633	3,698	-6,321	9.48
iv	-5,386	0	3,698	-1,688	2.53

which places in employment all long-term unemployed males aged 15-24 would reduce property crime by just over 8 per cent. However, if this cohort of young people returned and completed senior high school, the reduction in crime from successful education would be twice as large, at 16 per cent (or around 11,000 less cases of break, enter and steal). These outcomes are illustrated in Figure 5.

To put these percentages in perspective we have translated them into the predicted number of remaining break, enter and steal occurrences, which we have plotted alongside the actual number of property crime during the last year of our simulations (see Figure 6).

Our calculations also indicate that even some successful education for the simulated cohort is better than none at all. In particular, if long-term unemployed males aged 15-24 are encouraged to continue with schooling, but half of them drop out before finishing senior high school, the gain in terms of lower crime is still larger than in the job generation case only (1.4 percentage point difference on an annual basis, or just under 1000 incidents of property crime as calculated from Table 4).

Figure 5: Percentage reduction in property crime in NSW due to alternative policy scenarios when all male youth LTU is eliminated

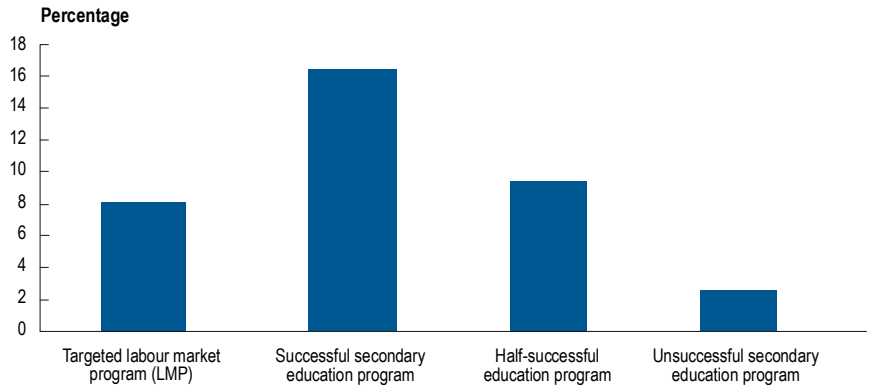
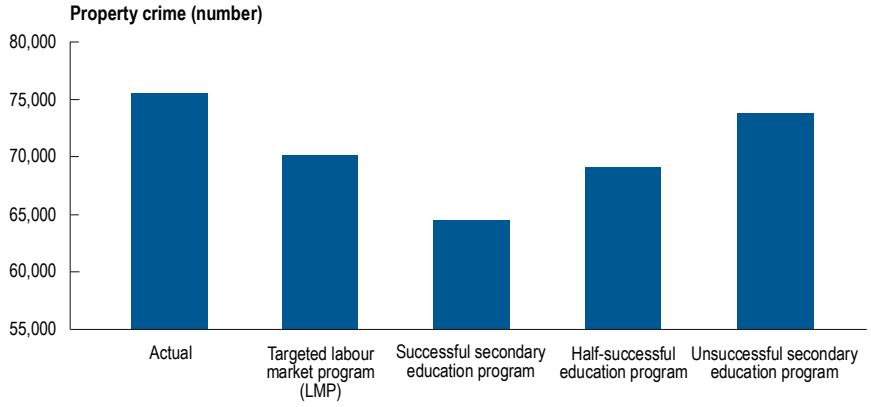


Figure 6: Property crime in NSW: Actual number and simulated numbers with alternative policy scenarios when all male youth LTU is eliminated



CONCLUSIONS

This paper has proposed a new theoretical argument behind the link between unemployment and crime. Our modelling is based on the consequences for an individual of continuing unemployment and the relative returns to property crime conditional on one's education. In particular, we argue that the longer the person is unemployed the higher the relative attractiveness of crime. Further, we suggest that higher levels of education diminish the relative attractiveness of criminal activity through their effect on the returns to employment.

Our results support those of Chamlin and Cochran (2000) and Greenberg (2001) in suggesting that much of the inconsistency in studies of unemployment and crime seems to stem from poor conceptualisation of the way in which unemployment influences crime. On the other hand, our models which incorporate the sex and age specific unemployment duration data results in an adequate empirical specification and supports the theoretical expectations.

This does not mean there is no room for improvement in aggregate-level modelling of the unemployment-crime relationship. If unemployment duration increases involvement in property crime because of its corrosive effect on an individual's expectations of future employment, we would expect other variables having similarly corrosive effects (e.g. drug dependence, criminal conviction, racial discrimination, broken family background) to increase involvement in crime. The individual-level effect of these variables is, of course, much easier to measure than their aggregate-level effect. The fundamental challenge in developing an adequate theoretical account of the aggregate-level relationship between unemployment and property crime lies in identifying and measuring key determinants of the balance between the expected returns from legitimate activity and the expected returns from crime.

Finally, while there may be many theoretical and empirical issues left to resolve in relation to unemployment and

crime, it is important not to lose sight of the policy implications of our findings. Simulations based on our models indicate that long term unemployment amongst young males has a substantial effect on property crime: elimination of long term unemployment amongst males aged 15-24 by direct job creation would result in close to a 7 per cent reduction in property crime in NSW per annum. Better still, if these individuals continued in formal education to the end of senior high school (increasing school retention by an extra 7,000 individuals) the reduction in break, enter and steal over the course of a year would amount to almost 15 per cent. The results highlight the potential societal benefits in terms of crime reduction that might follow from the institution of policies that are effective in the reduction of long-term unemployment and promote young people's educational success.

NOTES

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6 See also Appendix A for descriptive statistics of all the variables.

7 It is important to point out that developed countries around the world use the same definition of unemployment developed by the International Labour Organisation (1982). However, the nature of implementation of the labour force surveys as well as differences in the national policies in relation to the income support for the unemployed result in variations in the data available for different countries, meaning that strict comparisons are not viable. For example, due to the limited length of income support, the US unemployment statistics are unlikely to provide as comprehensive a picture of long-term unemployment than is the case for Australia.

8 This conclusion is based on the value of the regression standard error which indicates that the model only marginally improves on the standard deviation of the rate of BES.

9 While a number of the labour force variables are not individually significant, as discussed earlier, econometric theory suggests keeping these variables in the estimated model.

10 Appendix C provides a list of elasticities estimated at the means.

11 While the models presented in Table 1 include a range of labour market variables, our simulations are based only on the three key variables: long term unemployment, school participation and school retention. Given that none of the male labour market variables are significant, the extension of simulations to incorporate these variables would not have changed either the direction or the relativities of impacts of various policies although their numeric values would, of course, be slightly different. All results available from the authors.

12 See Appendix E for the results of simulated reduction of LTU by 1000.

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APPENDIX A: DESCRIPTIVE STATISTICS OF VARIABLES

Table A.1: Descriptive statistics of variables

Variable	*Mean*	*Standard deviation*	*Minimum*	*Maximum*
BES number	16,674	2,680	13,428	22,275
BES number / pop. 26 and over	4.28	0.53	3.58	5.40
LTU/population, males, 15-24	2.58	0.91	1.30	4.85
LTU/population, females, 15-24	1.69	0.62	0.67	3.17
UER: all males	8.45	1.89	5.68	12.38
UER: all females	7.82	1.27	5.84	10.82
UER: males, 15-24	15.52	3.06	8.16	20.71
UER: females, 15-24	13.34	2.22	9.23	17.43
LFPR: all males	73.13	1.11	71.24	75.79
LFPR: all females	51.75	1.20	49.10	53.78
LFPR: males, 15-24	72.19	2.34	68.32	77.26
LFPR: females, 15-24	66.65	2.64	62.02	73.18
Emp/population, all males	66.96	1.84	63.50	70.99
Emp/population, all females	47.71	1.39	45.02	50.29
Emp/population, males, 15-24	61.00	3.15	55.14	67.17
Emp/population, females, 15-24	57.75	2.54	52.93	63.41
Vacancy rate	0.92	0.30	0.34	1.47
School participation rate	49.49	2.06	45.50	51.40
School retention rate to Year 12	65.54	5.31	54.40	70.60
Gross product, NSW, $'000 p.c.	9.31	0.72	8.16	11.15
Retail sales, dept. stores, $'000 p.c.	0.18	0.01	0.16	0.21
No. methadone users / pop. 15-24	9.58	3.29	4.39	14.31

APPENDIX B: ANALYSIS OF TIME SERIES BEHAVIOR OF VARIABLES

Recent developments in econometrics have emphasised the role of time series properties of variables in correct inferences. In particular, non-stationarity of time-series may invalidate inferences due to the problem of spurious regression while different stationarity properties of regressors may indicate a lack of long-term relationship between variables of interest. We have subjected variables used in our analysis to a test for unit roots (i.e. non-stationarity). We should note, however, that due to the relatively short historical period of time (11 years), these results should be treated with caution.

The results, given in Table B.1, indicate that the regressand (BES rate) is integrated of order one. For the regressors we can reject the hypothesis of non-stationarity only for all males unemployment rate, and age-specific female unemployment rate – both only at 10% significance level. Given that stationary variables can be used in regressions involving non-stationary regressand and regressors, these results suggest that our models can include these unemployment rates as regressors.

We have also carried out preliminary tests of long-term relationship (cointegration) between the BES variable and the unemployment rate variable under two conditions. In the first case, we tested for cointegration between BES and only the gender-specific (but not age-specific) unemployment rates. This corresponds to the usual framework of analysis of the link between unemployment and crime.

In the second case we replaced the all-person unemployment rates with gender-specific and age-specific equivalents. We also included the variables measuring the duration of unemployment and school retention rate. The results indicate that in the first case we can reject the null of cointegration (DF test = -7.7 with the critical value of -11.2), while in the second case we cannot reject such a hypothesis (DF test = -14.2 with the critical value of -11.2). Such results, while only indicative of the long-term links between our variables of interest, do provide however some empirical support to our theoretical arguments regarding the need to include a measure of unemployment duration and education success in models linking unemployment and crime.

Table B.1: Tests of unit-root stationarity of variables

Variable	*DF test*
BES number / pop. 26 and over	-2.45
LTU/population, males, 15-24	-2.14
LTU/population, females, 15-24	-1.69
UER: all males	-3.41
UER: all females	-2.81
UER: males, 15-24	-2.00
UER: females, 15-24	-3.78
LFPR: all males	-2.24
LFPR: all females	-2.57
LFPR: males, 15-24	-2.26
LFPR: females, 15-24	-2.05
Emp/population, all males	-3.09
Emp/population, all females	-1.90
Emp/population, males, 15-24	-2.15
Emp/population, females, 15-24	-1.95
Vacancy rate	-2.19
School participation rate	-2.65
School retention to year 12 rate	-2.59
Gross product, NSW, $'000 p.c.	-1.35
Retail sales, dept. stores, $'000 p.c.	-2.70
Methadone program users rate	-0.82

Note:

1. The column headed DF test reports the t-ratio of the Dickey-Fuller test for unit root.

2. The critical value at 5% is approximately -3.4, while the critical value at 10% is -3.1.

APPENDIX C: DERIVED ELASTICITIES OF MODEL VARIABLES

Table C.1: Derived elasticities of model variables

Variable	*Traditional model*	*Model A*	*Model B*
LTU/population, males, 15-24		0.15	0.13
LTU/population, females, 15-24		-0.01	0.05
UER: all males	1.79		
UER: all females	-8.58		
UER: males, 15-24		-0.97	0.51
UER: females, 15-24		1.56	2.05
LFPR: all males	-28.66		
LFPR: all females	98.82		
LFPR: males, 15-24		4.05	-3.62
LFPR: females, 15-24		-9.84	-13.28
Emp/population, all males	22.59		
Emp/population, all females	-98.75		
Emp/population, males, 15-24		-3.81	4.67
Emp/population, females, 15-24		10.78	13.68
Vacancy rate	-0.17	0.04	-0.06
School participation rate		11.23	6.88
School retention rate to Year 12		-6.12	-4.63
Gross product, NSW, $'000 p.c.	0.52	-0.05	-1.03
Retail sales, dept. stores, $'000 p.c.	0.30	-1.06	-0.27
No. methadone users / pop. 15-24			0.51

Note: *Elasticities are calculated at means.*

APPENDIX D: ALTERNATIVE SPECIFICATIONS OF MODEL B

While our preferred specification (Model B) appears statistically adequate, it is useful to test it against alternative specifications. Two such extensions involve the introduction of non-linearities in the model and the inclusion of deterrent effect variables.

The most important non-linearity relates to the possible interaction between long-term unemployment and schooling. Given that our regressors dealing with these two variables are both continuous their direct product (i.e. an interaction term) not only has no easy interpretation but also is dependent on the units chosen for each variable. To alleviate such problems we have created an index variable equal to one when the long-term unemployment is rising over two quarters and interacted this qualitative indictor with the schooling variables. The results of estimating such an extended model appear in Table D.1 (with Table D.2 providing basic diagnostics). The results indicate that this extension of our preferred model is not supported by the data – only two of the additional variables are marginally significant and, as a group, all four are not significant.

With respect to the deterrent variables, simple tests for a time trend in the series 'number of court appearances for break,

Table D.1: Estimates of alternative specifications of the preferred model of property crime

	Model B with interactive terms		*Model B with deterrent variables (court data)*	
Variable	***coefficient***	***t-ratio***	***coefficient***	***t-ratio***
LTU/population, males, 15-24	0.254	3.11***	0.232	2.47**
LTU/population, females, 15-24	0.124	1.13	0.112	0.93
UER: males, 15-24	0.917	1.50	0.885	1.53
UER: females, 15-24	0.080	0.12	0.446	0.67
LFPR: males, 15-24	-1.102	-1.55	-1.084	-1.60
LFPR: females, 15-24	-0.066	-0.07	-0.575	-0.66
Emp/population, males, 15-24	1.457	1.69*	1.350	1.66*
Emp/population, females, 15-24	0.118	0.11	0.713	0.71
Vacancy rate	-0.373	-0.99	0.109	0.26
School participation rate	0.837	3.89***	0.906	2.88***
School retention rate to Year 12	-0.358	-5.67***	-0.433	-4.00***
Gross product, NSW, $'000 p.c.	-0.636	-3.05***	-0.652	-2.51**
Retail sales, dept. stores, $'000 p.c.	-6.297	-0.59	-4.308	-0.41
No. methadone users / pop. 15-24	0.230	2.96***	0.212	2.30***
Retention rate * male LTU	0.077	1.40		
Retention rate * female LTU	0.098	1.80*		
School participation rate * male LTU	-0.056	-1.36		
School participation rate * female LTU	-0.073	-1.82*		
No. charged with BES / total pop.			5.673	0.96
No. convicted for BES / total pop.			-16.859	-1.55
Quarter 1	-0.252	-1.13	-0.401	-1.71*
Quarter 2	0.588	2.61***	0.264	1.17
Quarter 3	0.190	1.03	-0.051	-0.25
Constant	-36.54	-3.47***	-34.94	-2.79***

Note:

1. *The dependent variable in all models is the rate of break, enter and steal (per 1000 adults).*
2. *The asterisks indicate the significance of coefficients: three stars denote significance at 1% level, two denote significance at 5% level, one indicates significance at 10% level.*

APPENDIX D: ALTERNATIVE SPECIFICATIONS OF MODEL B, *continued*

enter and steal' and 'proportion of people charged sent to prison' reveal no statistical evidence of a time trend at the 5% level of significance (t-ratios on the coefficient of a time trend being 1.31 and 0.53, respectively). Therefore, it can be expected that their inclusion in our model explaining BES will not change our fundamental results. The estimated model testing this proposition is provided in Table D.1, and indicates that the additional variables are not contributing to the explanatory power of our preferred model.

It is important to note, however, that in both cases the additions of the new variables does not in any significant way affect either the significance or the size of the coefficients of importance, i.e. the long term unemployment, the schooling variables and the methadone users.

Table D.2: Summary of diagnostics of the alternative estimates of the preferred model of property crime

Diagnostic	*Model B with interaction terms*	*Model B with deterrent variables (court data)*
R-bar square	0.857	0.868
Regression F-test	13.28	14.54
SEE	0.200	0.195
St.Dev (regressand)	0.529	0.529
Jarque-Bera test	0.269	0.419
Durbin-Watson	1.813	1.411
LM(1)	0.950	2.200
ACF: lag 1	0.61	1.69
ACF: lag 2	-2.25	-1.66
ACF: lag 3	-0.29	-1.47
ACF: lag 4	-0.14	-0.36
RESET (2)	1.383	1.964
F-test on interaction terms	2.389	
F-test on deterrent variables		1.223

Note:
1. For description of diagnostic tests see Table 2 in the text.
2. Critical values for the F-test on the interaction variables are 4.31 (at 1% level) and 2.82 (at 5% level).
3. Critical values for the F-test on the deterrent variables are 5.85 (at 1% level) and 3.49 (at 5% level).

APPENDIX E: DECREASE BY 1,000 IN THE NUMBER OF MALE LONG-TERM UNEMPLOYED AGED 15-24

Table E.1: Simulated effects on property crime (BES) of a decrease by 1,000 in the number of male long-term unemployed aged 15-24

	Contribution from			*Total effect*	
Policy	*Long-term unemployment*	*Retention rate*	*School participation rate*	*Number of BES*	*% of annual BES*
			Model A		
i	-847	0	0	-847	1.27
ii	-847	-1773	862	-1758	2.64
iii	-847	-886	862	-871	1.31
iv	-847	0	862	15	-0.02
			Model B		
i	-767	0	0	-767	1.15
ii	-767	-1341	528	-1580	2.37
iii	-767	-671	528	-909	1.36
iv	-767	0	528	-239	0.36

Note: *Policies are as described in Table 3 in the text.*

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