DETERMINANTS OF RECIDIVISM IN PAROLED QUEENSLAND PRISONERS: A COMPARATIVE ANALYSIS OF CUSTODIAL AND SOCIOECONOMIC CHARACTERISTICS

ANDREW WORTHINGTON

HELEN HIGGS

GLYN EDWARDS[*]
Queensland University of Technology

A multinomial ordered probit model is used to predict post-release performance in a sample of Queensland prisoners released between January 1992 and December 1994. Post-release performance is defined in terms of the seriousness of parole breaches and/or reoffences over the length of the parole period or until April 1996. The paper examines the statistical significance of a number of custodial and socioeconomic variables on the likelihood of a parole breach or re-offence. Factors analysed include family composition, age, occupation, ethnicity, the number of events in custody, the number of prison violations and the length of sentence of the most recent custodial episode. All other things being equal, the marginal effects of readmission with respect to the set of explanatory variables varies markedly according to whether readmission is through a parole breach or through actual recidivist behaviour.

I. INTRODUCTION

In Australia, as in most developed countries, prison populations are rapidly expanding. For instance, in Queensland [Australia's third most populous state and, based '... on present trends, soon to have the highest imprisonment rate of any State in Australia' (Criminal Justice Commission, 1998, p. 1)] the number of court appearances resulting in imprisonment (including fully or partly suspended sentences) rose from 46 to 50 per cent between 1992/93 and 1996/97 (57 to 64 per cent for personal offences and 38 to 41 per cent for property offences). This increase in the imprisonment rate has resulted in a dramatic increase in the number of sentenced offenders actually admitted to prison with admissions growing by 98 per cent over this period and a further 17 per cent in the twelve months to 31 March 1998.

By March 1998 the Queensland prison system was at approximately 132 per cent of capacity.

These figures are interesting in that imprisonment rates have generally not been matched by trends in the rate of offences across many categories of recorded crime in Queensland. For example, the overall rate of recorded 'offences against the person' (including serious assaults, robbery offences, murder, and reported and attempted rapes) has been basically stable since 1993/94, and the rate of recorded 'offences against property' (break and enter, stealing, and motor vehicle offences) has increased only slightly (CJC, 1998, p. 2). The remaining broad category of recorded crime, namely 'other offences' has continued to increase, though it is argued that '... this may reflect greater law enforcement activity by police, rather than an increase in offending'. Within this category, the rate of recorded 'drug offences' rose by 5.4 per cent (largely possession of drugs and/or items for use in consuming drugs, with cannabis typically being the drug seized by police), with the rate of 'good order offences' (resisting/hindering police, disorderly conduct, and language offences) remaining stable.

At the same time, the Queensland imprisonment rate (excluding partly or fully suspended sentences) has also risen despite a number of procedures aimed at reducing the prison population. For example, the number of suspended sentences imposed has either remained stable or slightly decreased, with 1996/97 figures suggesting that an additional 200 to 250 people are sent to prison by higher courts through a declining trend in the use of this option. Likewise, community custody facilities (including home detention) are still being under-utilised and parole has been increasingly denied beyond eligibility dates for community release (CJC, 1998, p. 13). Furthermore, from this relatively smaller set of paroled prisoners the number of offenders admitted to prison after revocation of 'intervention-type orders' (including home detention, parole, and probation) has continued to grow and has added to the burgeoning prison population. For example, and as noted earlier, appearances for 'other offences' have primarily accounted for the growth in the imprisonment rate, and of this a major component has been 'enforcement of order' appearances (including breaches of home detention, leave of absence, probation or recognisance, and parole).

Australia's increasing imprisonment rate, the growth of 'enforcement of order' appearances and the declining use of community release touches on two important aspects of the economics of prisons literature [see, for example, Buchanan and Hartley (1992), DiIulio (1996) and Avio (1998)]. The first aspect is that serving time in prison, as well as participating in various prison and post-release programs, may have either positive or negative effects upon the activities of released prisoners (Avio, 1998, p. 154). The obvious focus is the rate of criminal recidivism (a variously defined measure relating to the criminal activity of released inmates). Avio (1998, p. 154) argues that 'nailing down the specifics of the relationships is clearly an important factor in evaluating overall social policies towards crime as well as in evaluating specific programs for incarcerated and paroled offenders'.

This objective is particularly important in that prison overcrowding has been recognised by Queensland's Criminal Justice Commission (1998, p. 14) as a likely contributor to 'an increase in the number of reported assaults by prisoners on other prisoners'. Other matters include an increase in the number of deaths in prison custody, and the fact that prisoners are generally spending longer periods of time in secure custody. Economic models of recidivist behaviour to examine these social issues are now relatively commonplace, and the empirical analyses of this economic approach to prisons proceeds apace [see, for instance, Schmidt and Witte (1989), Kim (1993), Lattimore *et al*. (1995) and Benda and Tollett (1999)]. There

is an obvious need to quantify the impact of these custodial and traditional socio-economic characteristics on criminal recidivism in Australia.

Unfortunately, 'there have been few attempts to empirically test the economic model [of crime] using Australian data' (Smyth, 1997). However, those studies that do exist throw at least some light on the broad issue of criminal deterrence, and the much narrower concern of criminal recidivism, within an Australian context. Withers (1984), for example, used pooled time-series, cross-sectional state-level data to measure the deterrence and incapacitation effect of imprisonment. Withers (1984) concluded that the committal and imprisonment rate were the most reliable determinants of variation in crime, and that pecuniary and attitudinal variables (including unemployment and education) were either statistically insignificant or highly sensitive to the specification of included variables.

Bodman and Maultby (1997) likewise estimated an aggregate 'supply-of-offences' equation where the crime rate was related to a number of explanatory variables (including economic, demographic and socio-economic factors) representing the costs and benefits of criminal behaviour. While Bodman and Maultby (1997, p. 896) concluded that the results offered significant support for the economic theory of crime, they also observed:

> It is clear that the data which are currently available to perform a rigorous economic analysis of crime are clearly inadequate. Disaggregated data over an extended time period would facilitate a more robust and satisfactory statistical analysis of the economic and social determinants of crime, including the relationships between changes in the income distribution and crime and the time series dynamics underlying the relationship between unemployment and crime.

Smyth (1995) also tested the economic model of crime using aggregate data, though unlike the state-level data of Withers (1984) and Bodman and Maultby (1997), this was based on statistical divisions for New South Wales and subdivisions for Sydney. The results suggested '. . . contra to Withers, that neither deterrence nor pecuniary and attitudinal variables are, on their own, good indicators of variations in the crime rate' (Smyth, 1997, p. 87). Finally, Torre and Hazari (1999) examined court delays from an economic, rather than a legal, perspective. They found that the behaviour of the defendant regarding the choice of plea (and regarding the prosecutor's offer) depended on the expected cost function as derived from the expected value framework.

The second aspect concerning the economics of crime literature is that the difficulty of prisoners in obtaining release through stricter early release guidelines, and the dramatic increase in the rate at which such community correction orders are revoked, suggests an opening for the economic analysis of the parole function in Australian prisons. In general, parole is argued to reduce 'social costs by prompting prison inmates to behave and by decreasing the number of person-days of incarceration supplied. On the other hand, a system utilising parole and/or probation reduces the costs of crime to potential offenders and reduces the incapacitation effect' (Avio, 1998, p. 145). An efficient punishment system would attempt to balance these costs and benefits and an emerging literature exists on the rate at which released offenders return to crime while on parole [see, for example, Miceli (1994) and Garoupa (1997)].

However, in contrast to the analysis of recidivism in the strictest sense (where released prisoners are readmitted on the basis of a return to criminal activity) hypotheses linking the custodial and socio-economic characteristics of parolees to readmittance through often relatively minor breaches of parole conditions are relatively underdeveloped. There is an obvious need to investigate economic models of recidivism within the context of a judicial

system (such as Australia) that relies heavily on parole, and to simultaneously address the impact of parole orders on the likelihood of a return to criminal activity. The only study known to examine the economic aspects of the parole decision in the Australian context was undertaken by Lewis (1983) using NSW offender-level data. Lewis (1983) used simulations to estimate the optimal amount of time specified in the parole decision such that the total societal costs of property crime were minimised.

Accordingly, the purpose of the present paper is to investigate the role of both custodial and socio-economic characteristics in determining the rate of recidivism in paroled Australian prisoners. The paper itself is divided into four main parts. The first section outlines the models for the analysis of recidivism and readmittance to custody through parole violations for Queensland prisoners. The second section discusses the custodial and socio-economic characteristics thought to explain recidivist behaviour. The results of the analysis are examined in the third section. The paper ends with some brief concluding remarks.

II. DATA AND MODEL ESTIMATION

The economic theory of crime is based upon the assumption that most criminals are rational agents and that the amount of crime (and the return criminals can expect to receive) is determined by the balance between the expected marginal costs and benefits of criminal activity. The decision whether to undertake criminal activity is thus made taking into account the costs and benefits of alternative forms of action. From the individual's perspective, the costs of criminal activity increase with increases in the probability of capture and through increases in penalties (the deterrence effect). However, the modern economic theory of crime also focuses on the impact of a broad range of economic, demographic and socio-economic factors that further modify the costs and benefits of criminal (and non-criminal) activity (largely pecuniary and attitudinal effects).

Within this general framework, it is thought that released prisoners are subject to four additional factors that influence the level of future criminal activity (recidivism), both relative to other prisoners and the overall population. First, the probability of capture and conviction (through existing criminal records) and the expected size of the penalty for future criminal activity are likely to be higher for released prisoners than for the population at large. This would serve to increase the deterrent effect for released prisoners. Second, economic theory suggests that remissions and other forms of early release (such as parole), reduce the deterrent effect of punishment by making prison sentences more tolerable (Buchanan and Hartley, 1992).

Third, there '... is the possible effect of prison in "educating" the criminal into more effective methods of committing crime and introducing him to other criminals who might help him in future criminal activity after release' (Buchanan and Hartley, 1992, p. 30). Prisons as 'schools' for future criminal activity would tend to reduce the probability of capture and increase the returns to criminal activity. Finally, there is possibility that imprisonment may have assisted in the reform process and those prisoners who have gained early release through good behaviour are less likely to engage in future criminal activity relative to those that served their full sentence (Lewis, 1983). Unfortunately, there is no established theoretical model of recidivism that incorporates these effects. Accordingly, the following analysis relies upon explanatory factors that have been specified by similar overseas research.

The data used in this study is extracted from the Queensland Corrective Services

Commission (QCSC) records of six hundred and twenty inmates paroled between January 1992 and December 1994. The use of individual-level data is thought to be an advance over previous work in this area using aggregated data. More particularly, quite apart from the standard problems of aggregation and the fact that the economic model of crime is only theoretically sound at the individual level, the primary focus of studies of this type is invariably on predictions for individual behaviour. The data is composed of three sets of information. The first set consists of parolee socio-economic characteristics (at time of incarceration). Characteristics recorded include ethnic background, age, number of children on admission of custody, educational level, and employment and marital status. The second set of information relates to parolee 'custodial' characteristics. Information collected includes the number of previous custodial episodes, years spent in custody and prisoner occupation (if any) during the current episode, the number of separate prisons and prison violations during the current episode, the security level of the prison of release, and the parole period served.

The final set of information relates to the post-release 'performance' of paroled prisoners. The observation period in which performance is assessed is either the length of the parole period or the length of time from release until April 1996. Post-release performance (PRP) itself is defined in terms of the seriousness of parole breaches and/or re-offences, if any, during the observation period. Parolees are categorised as either (number of cases and per centage of sample in brackets): (i) inmates who have neither breached parole nor re-offended during the observation period ($PRP = 0$) (360/58.06); (ii) inmates who have violated or breached their conditions of parole and been re-admitted to custody ($PRP = 1$) (183/29.52); and (iii) inmates who have committed another criminal offence while on parole and been re-admitted to custody ($PRP = 2$) (77/12.42).

Categorising post-release performance on this basis is thought to recognise the differing behaviour of paroled prisoners. Three courses of action are possible. First, there is the large group of prisoners who have neither breached parole nor re-offended during the observation period. Important qualifications are that undetected parole breaches or criminal activity may have occurred during, or future parole breaches or criminal activity could occur after, the observation period. Second, paroled prisoners may have committed a serious breach of parole conditions thereby entailing a return to custody and the requirement to serve the remainder of their sentence. Parole conditions can include the requirement '... to report periodically to a parole officer, to gain permission to travel interstate and to refrain from the use of alcohol and drugs' (Lewis, 1983, p. 261). It is thought that categorising paroled prisoners as 'parole violators' may highlight some of the specific factors that contribute to prisoners not meeting their parole conditions. These are posited to differ substantially from those associated with recidivism and to be leading indicator of a return to criminal activity. Finally, there is the category of paroled prisoners who have committed additional criminal activity since release. This category of paroled prisoners is regraded as recidivist in the truest sense.

The analytical technique employed in the present study is to specify post-release perform-ance as the dependent variable (y) in a regression with parolee socio-economic and custodial characteristics as explanatory variables (x). Caulkins et al. (1996) and Benda and Tollett (1999) also used various groupings of demographic, criminal and psychological character-istics to predict the dichotomous outcomes of criminal recidivism. The nature of the dependent variable (post-release performance) indicates discrete dependent variable techni-ques are appropriate. However, although the outcomes of the dependent variable are discrete for each of the parolees, multinomial logit or probit models would fail to account for the

ordinal nature of the dependent variable; that is, the severity of readmission to custody, if at all. Ordinary regression would err in the opposite direction such that the differences between, say, '$PRP = 0$' and '$PRP = 1$' (no readmission and parole violation), would be treated in the same manner as that between, say, '$PRP = 1$' and '$PRP = 2$' (parole violation and criminal recidivism), whereas in fact they are only a ranking. Accordingly, the following multinomial ordered probit model with simple heteroskedasticity is specified

$$y_i^* = \beta_*' x_i + \varepsilon_i,$$

$$\varepsilon_i \sim N[0, \, w_i],$$

$$y_i = 0 \text{ if } y_i^* \leqslant \mu_0, \tag{1}$$

$$= 1 \text{ if } \mu_0 < y_i^* \leqslant \mu_1,$$

$$= 2 \text{ if } \mu_1 < y_i^* \leqslant \mu_2,$$

$$\dots$$

$$= J \text{ if } y_i^* \leqslant \mu_{J-1}.$$

where ε_i is distributed normally with a mean of zero and $\text{Var}(\varepsilon_i)$ equals $w_i^{\,2}$. This model comprises a form of censoring. The μs are unknown parameters to be estimated with β. The coefficients imputed by the multinomial ordered probit provide inferences about the effects of the explanatory variables on the probability of the three possible outcomes for post release performance.

III.   Specification of Explanatory Variables

The first set of explanatory variables used to predict parolee post-release performance relates to individual socio-economic characteristics. Selected descriptive statistics (for quantitative variables only) are detailed in Table I. The first variable specified is a qualitative variable indicating whether the parolee is from an Aboriginal and Torres Strait Islander background (*ABTS*) (148 cases or 23.87 per cent of the sample). There is generally strong evidence to suggest that minority status is an important ingredient of post-release failure vis-à-vis readmittance to custody (Walker 1989; Mukherjee 1999; Benda and Tollett 1999). For example, Edwards (1998) used a table of risk indices to suggest that Aborigines had a 78 per cent greater likelihood of re-offending than parolees of other ethnic backgrounds. Similarly, Sickles' *et al.* (1979) and Schmidt and Witte's (1989) studies of criminal recidivism in North Carolina found that non-whites were more likely to re-offend following release. However, Bodman and Maultby (1997, p. 895) concluded that the variable '... representing the per centage of the population that is Aboriginal or Torres-Strait Islander, is not significant in explaining the variation in all four categories of property crime' and Withers (1984, p. 181) found that '... the Aboriginal population share produces a negative and statistically signifi-cant sign [when specified as a regressor for per capita crime rates]'. Nevertheless, since both these studies were based on aggregated data, a positive sign is hypothesised when post-release performance is regressed against ethnic background.

The second socio-economic variable specified is each parolee's age at time of most recent incarceration (*AGE*). It is generally acknowledged that inmates in higher age brackets are

less likely to re-offend or breach parole. For instance, Schmidt and Witte (1989) included age as an explanatory variable in their study. From their estimated equations, age was found to be the most significant variable. The *ex ante* sign on *AGE* is negative.

The next two variables relate to additional socio-economic dimensions: namely, the number of years in education (*EDU*) and a qualitative variable indicating employment status at time of incarceration (*EMP*) (206 cases or 33.23 per cent of the sample). The *a priori* hypothesis in both instances is that better-educated inmates and/or those who possess current labour skills have greater employment opportunities and are less likely to re-offend. This would imply a lower likelihood of post-release failure and negative *ex ante* coefficients are hypothesised. The inclusion of these variables is a logical extension of Becker's (1968) costs and benefits of criminal behaviour to recidivist outcomes. More recent studies in this area include Piehl and DiIulio (1995) and Caulkins *et al.* (1996).

The final two socio-economic variables specified in the analysis relate to each parolees' family-based characteristics. These are the number of children on admission to custody (*CHL*) and the parolee's marital status (*MRT*) (including *de facto*) (Sickles *et al.*, 1979). To start with, it is generally posited that those inmates who are in existing marital relationships and/or have children tend to exhibit a lower rate of recidivism than parolees who are single and without children. Both variables are therefore usually included as proxy measures of domestic stability and responsibility. The sign on both coefficients is thought to be positive. An alternative is that the need to provide financial support for families may place additional pressure on parolees, though this 'provider-role' may be less important where welfare payments are available and the gap between this and employment income is negligible. No particular *a priori* sign is hypothesised when post-release performance is regressed against the number of children.

The second set of explanatory variables used to identify post-release performance relates to each parolee's actual custodial characteristics. The first five characteristic variables have positive relationships with post-release performance. These are: (i) the number of previous episodes in custody (*PRV*); (ii) the length of sentence of the most recent custodial episode (*SNT*); (iii) the number of prisons in which this custodial episode was served (*NOP*); (iv) the total number of prison violations during the current sentence (*VIO*); and (v) whether the prison of release was 'open' or 'secure' (medium or high security) (*SEC*) (442 cases or 71.29 per cent of inmates were in medium-level security or higher). The basic hypothesis for *PRV, SNT, NOP, VIO* and *SEC* is that inmates with more previous and more severe convictions, a greater propensity to commit violations whilst in custody, and an unstable reform environment as indicated by frequent relocation, are a high risk group in terms of

Table I   Selected continuous variable descriptive statistics

	Mean	Standard deviation	First quartile	Second quartile	Third quartile	Fourth quatile
AGE	29.7047	9.4556	22.3005	27.4150	35.0550	70.6430
CHL	0.8129	1.4006	0.0000	0.0000	1.0000	13.0000
EDU	10.5428	7.0948	9.0000	10.0000	10.0000	12.0000
PRV	1.2968	1.5344	0.0000	1.0000	2.0000	10.0000
SNT	1.5622	2.7204	0.5198	0.9690	1.7763	40.9650
NOP	2.7371	1.5557	1.0000	3.0000	4.0000	8.0000
VIO	3.7839	5.5797	0.0000	2.0000	5.0000	54.0000
PAR	1.7013	1.9320	0.6175	1.0450	2.0125	20.0000

parole violation and/or recidivism. Doren (1998), for example, found that the number of previous convictions was the most useful factor in determining the 'true' recidivist base rate for sex offences, and Dembo *et al*. (1995) linked patterns of previous arrest and custody with potential vocational, leisure and family problems with similar findings. Caulkins *et al*. (1996) also established that the number of previous convictions in a number of categories, along with a prisoner's custody classification, was instrumental in predicting recidivism. Some additional explanation may be found in the preparation for release by lower security institutions and the fact that inmates in open custody have shown themselves to be more suited to re-integration, having gained a lower security level.

Conversely, Brennan and Mednick (1994) in a study of recidivism in a Danish birth cohort found that rates of future arrest were negatively related to the severity, frequency and variety of sanctions, though discontinuation of punishment generally resulted in recovery in criminal arrests. Lastly, Lewis (1986) argued that the general deterrent effect of longer sentences might be difficult to quantify, especially given the confounding of the hypothesised deterrent and incapacitation effects. One final qualification is that it is unlikely that higher risk inmates (those with longer sentences and/or security classifications) would be granted parole. This would suggest that parolees usually possess a lower risk profile (in terms of recidivism) than the overall prison population. Regardless, and in common with the large majority of previous studies, positive coefficients are hypothesised when reoccurrence of criminal activity is regressed against measures of previous criminal activity and severity.

The final two custodial characteristics indicate whether an inmate was employed in service and/or revenue-producing work while in custody (*OCC*) (228 inmates or 36.77 per cent of the sample recorded a prison occupation) and the parole sentence (in years) given by the court (*PAR*). In the first instance, a number of studies have indicated that prison work is an important contributor to criminal reform (Leiber and Mawhorr, 1995). And in the second, Caulkins *et al*. (1996) and Edwards (1998), amongst others, have found that the likelihood of criminal recidivism falls as the parole period increases. One consideration is that offenders must regularly report to a community corrections officer and may be required to attend specific programs or undergo drug testing during the parole period. The *ex ante* sign on both *OCC* and *PAR* is thought to be negative.

IV. Empirical Results

The estimated coefficients and standard errors of the parameters detailed above are presented in Table II. Care must be taken in interpreting estimated coefficients in this model. While a positive (negative) coefficient would indicate a shift in probability to the right-most (left-most) cell, the impact on the middle cell is ambiguous and depends on the particular density functions. Nevertheless, some comment can be made on the levels of significance of the probability density shifts, and the limitations discussed earlier can be countered by the calculation of marginal effects (Greene, 1997). Also included in Table II are statistics for joint hypothesis and likelihood ratio tests, and the results of a prediction success table for the dependent variable. Four separate models are estimated. The estimated coefficients and standard errors employing the entire vector of socio-economic and custodial characteristics are shown in Table I columns 1 and 2. The results of estimations using first, the set of socio-economic variables and then the set of custodial characteristics alone, are detailed in columns 3 and 4 and 5 and 6.

The estimated models are highly significant, with likelihood ratio tests of the hypothesis

that all of the slope coefficients are zero rejected at the .01 level using the chi-square statistic. The percentage of observations predicted correctly on the basis of the given vector of socio-economic variables varies from over 60 per cent for the overall specification (including both custodial and socio-economic characteristics), to just under 58 per cent for the socioeconomic characteristics alone. The results also appear sensible in terms of both the precision of the estimates and the signs on the coefficients. In the full specification, the estimated coefficients for Aboriginal and Torres Strait Islander background (*ABTS*), marital status (*MRT*), the number of children (*CHL*), and the number of prisons (*NOP*) and prison violations (*VIO*) during the most recent custodial episode are significant and conform with *a priori* expectations. These results are consistent with the estimated coefficients in the second regression where only the set of socio-economic characteristics are included, though the coefficient on *AGE* is significantly negative. This would suggest that older parolees have a lesser likelihood of readmittance to prison through either parole violations or further criminal activity. The sign on educational level (*EDU*) is consistent with *a priori* expectations, though insignificant, and previous employment status (*EMP*) is neither significant nor consistent with the hypothesis of current labour market skills reducing the likelihood of recidivism.

Finally, the model is re-estimated with only the set of custodial characteristics. The estimated coefficients and standard errors of this regression are detailed in columns 5 and 6 of Table II. In addition to the levels of significance found in the original specification, the number of previous episode in custody (*PRV*) is significant and positive indicating that a history of incarceration is associated with an increased likelihood of recidivist behaviour. Schmidt and Witte (1984) likewise found that the likelihood of reconviction is found to vary significantly with the number of previous convictions. However, the coefficients on the length of sentence (*SNT*), the security level of the prison of release (*SEC*), whether the prisoner had an occupation (*OCC*) during the most recent period of custody, and the length of the parole period (*PAR*) are not significant. Log-likelihood tests are employed to reject the null hypotheses that the model of criminal recidivism could be estimated on the basis of the nested 'no custodial effect' and 'no socio-economic effect' models, and we may conclude that recidivism and parole violation are a function of both custodial and socio-economic characteristics.

In order to further refine the overall specification, Wald and LR tests were used to test combinations of coefficients for joint significance and on this basis the variables for *EMP*, *SNT* and *SEC* were excluded from the final specification [$W = 0.87 \sim \chi^2_{(3)}$]. Each of the remaining variables were tested in a similar manner, though they failed to be excluded from the final specification [$W = 26.02 \sim \chi^2_{(5)}$]. The refined model is presented in columns 7 and 8 of Table II. The likelihood ratio for the refined model is compared with the critical χ^2 value at the 5 per cent level of significance and 10 degrees of freedom of 18.3070. At the 5 per cent level of significance, the explanatory variables as a group can be used to investigate the post-release performance of inmates from Queensland prisons.

The most important determinants of post-release performance in terms of significance are the number of violations in prison during the current sentence (*VIO*), the number of prisons during the current episode (*NOP*), ethnic background (*ABTS*), marital status (*MRT*) and the number of children (*CHL*). The results indicate that there is a higher probability that inmates with greater number of violations and prisons during their current sentence or of Aboriginal ethnic background or with large families will re-offend, while married inmates will have a lower probability of re-offending. This result is consistent with the model of Sickles (1979) where the explanatory variables an individual with a serious problem with alcohol, martial

Table II Multinomial ordered probit model maximum-likelihood estimates

	Full Specification		No custodial effect		No socio-economic effect		Final specificaton	
	Coefficient	Std. error	Coefficient	Std. error	Coefficient	Std. error	Coefficient	Std. error
CONS	**−0.6048	0.2811	**0.4693	0.2189	***−0.7979	0.1387	**−0.5245	0.2614
ABTS	***0.5089	0.1249	***0.2885	0.1092			***0.4927	0.1231
AGE	−0.0073	0.0064	***−0.0195	0.0059			−0.0082	0.0062
EDU	−0.0157	0.0122	−0.0151	0.0113			−0.0151	0.0122
EMP	0.0590	0.1110	0.0067	0.1033			**−0.2328	0.1193
MRT	**−0.2398	0.1210	**−0.2311	0.1145				
CHL	*0.0655	0.0390	*0.0644	0.0365			*0.0621	0.0386
PRV	0.0341	0.0327			**0.0630	0.0312	0.0373	0.0323
SNT	−0.0110	0.0183			−0.0160	0.0173		
NOP	***0.1613	0.0365			***0.1220	0.0334	***0.1523	0.02359
VIO	***0.0548	0.0060			***0.0566	0.0057	***0.0553	0.0058
SEC	0.0464	0.0813			0.0452	0.0799		
OCC	−0.0919	0.0739			−0.0752	0.0714	−0.0881	0.0727
PAR	−0.0192	0.0225			−0.0156	0.0212	−0.0194	0.0223
$\mu(1)$	***1.0834	0.0695	***0.9845	0.0647	***1.0456	0.0664	***1.0788	0.0689
LnL	−522.18		−564.06		−537.34		−542.24	
Ln$L(0)$	−579.62		−579.61		−579.62		−579.62	
LR	***114.87		***31.10		***84.55		***110.75	
S	60.65		57.74		60.00		60.81	

Asterisks denote significance at the *−.10, **−.05, and ***−.01 level; ln$L$ – log-likelihood, ln$L(0)$ – restricted slopes log-likelihood, LR – likelihood ratio statistic; values for $\mu(n)$ indicate significance of cut-off parameter; significance of LR calculated using $\chi^2(p)$ where p = number of explanatory variables; S is the percentage of 'right' predictions.

status, minority status and age were most significant in explaining criminal recidivism. Schmidt (1989) and Caulkin (1996) also included variables relating to alcohol or drug-related problems in their analyses, and these explanatory variables were found to be highly significant. A limitation of this model for the prediction of post-release performance of Queensland inmates is the lack of data on these socio-economic factors.

To facilitate further comparability, marginal effects are calculated. These indicate the marginal effect of each outcome on the probability of post release performance (ranked from 0 to 2, with 2 being the worst offence). These are presented in Table III. In order to provide the marginal effects for the continuous variables, the standard normal density function is used. Note that the marginal effects sum to zero; this follows from the requirement that the probabilities add to one. However, this approach is not appropriate for evaluating the marginal effects of dummy variables. In this case, a dummy variable is analysed by comparing the probabilities that result when the variable takes it's two different values with those that occur with the other variables held at their sample means (Greene, 1997).

Using these marginal effects, it appears that ethnic background (*ABTS*), the number of children (*CHL*), the number of prisons during current episode (*NOP*) and the number of violations in prison during the current sentence (*VIO*) have the greatest positive impact on the offence of violating or breaching conditions of parole and re-admitted to custody (*PRP* = 1) with a negative impact on the post-release performance of neither breaching parole nor re-offending during the observation period (*PRP* = 0). The negative impact of marital status is concentrated in the offence of violating or breaching conditions of parole and re-admitted to custody (*PRP* = 1) with a positive impact on inmates who have neither breached parole nor re-offended during the observation period (*PRP* = 0). Likewise, *AGE*, *EDU*, prison occupation during sentence (*OCC*) and the length of time served on the parole period (*PAR*) have the greatest negative impact on the offence of violating or breaching conditions of parole and re-admittance to custody (*PRP* = 1) with positive impacts on the outcome of neither breaching parole nor re-offending during the observation period (*PRP* = 0). The number of previous episodes in custody (*PRV*) has a positive impact on the offence of violating or breaching conditions of parole and re-admitted to custody (*PRP* = 1) with a negative impact on inmates who have neither breached parole nor re-offended during the observation period (*PRP* = 0).

A number of points can be made. First, it would appear that primary influences on recidivism through criminal activity and/or parole violations include marital status and the

Table III   Marginal effects for the mulitnomial ordered probit model

	Outcomes		
	PRP = 0	*PRP = 1*	*PRP = 2*
ABTS	−0.1914	0.1081	0.0834
AGE	0.0032	−0.0018	−0.0014
CHL	−0.0241	0.0136	0.0105
EDU	0.0059	−0.0033	−0.0026
MRT	0.0905	−0.0511	−0.0394
PRV	−0.0145	0.0082	0.0063
NOP	−0.0592	0.0334	0.0258
VIO	−0.0215	0.0121	0.0094
OCC	0.0342	−0.0193	−0.0149
PAR	0.0075	−0.0043	−0.0033

Table IV   Observed and predicted values for the multinomial ordered
probit model

Actual	Predicted			
	0	1	2	Total
0	337	19	4	360
1	135	35	13	183
2	51	21	5	77
Total	523	75	22	620

number of children, the number of prisons resided in and the number of violations
committed during the most recent period of custody, and aboriginal background. Of these
variables, the most significant marginal effects on a return to criminal activity occur where
the parolee is from an Aboriginal and Torres Strait Islander background, the number of
prisons held in the most recent episode of custody, and the number of violations committed
during this custody. Second, the influence of the custodial and socio-economic characteristics
of paroled prisoners varies across readmittance to custody through parole violations and
readmittance through a return to criminal activity. In fact, the marginal effect of all the
custodial and socio-economic variables are higher for readmittance to prison through parole
violation, than through further criminal activity.

Finally, the ability of the model to accurately predict outcomes in paroled prisoners also
varies across the measures of post-release performance. Table IV contains the predicted and
observed results. For example, of the 360 paroled prisoners who neither re-offended nor
breached parole, the final model specification predicted 337 cases (93.6%) correctly, and
identified 19 parolees (5.3%) as parole violators, and 4 (1.1%) as recidivists (at least during
the observation period). Alternatively, when used to predict the post-release outcome of
parole violation, 35 (19.1%) instances were correctly identified, 13 (7.1%) predicted as re-
offenders and more than 135 (73.8%) as neither re-offenders nor parole violators. Lastly, the
model correctly predicted only 5 (6.5%) parolees as re-offenders, with 21 (27.3%) as parole
violators and 51 (66.2%) as parolees who neither breached parole nor re-offended in the
observation period. These findings would suggest that the model of criminal recidivism
employed might be more useful in identifying non-offenders and parole violators than the
perpetrators of future criminal acts.

V.   CONCLUDING REMARKS

The present study uses a multinomial ordered probit model to investigate the custodial
and socio-economic determinants of criminal recidivism and parole violations in 620
Queensland prisoners. The current paper extends empirical work in this area in at least two
ways. First, and as far as the authors are aware, it represents the first attempt to apply
qualitative statistical models of recidivism in Australia. The evidence provided suggests that
recidivism is a function (at least in the context of models of this type) of Aboriginal and
Torres Strait Islander background, marital and family status, and the number of prisons held
in and the number of violations committed in the most recent episode of custody.

Second, the study analyses in detail the varying influences of custodial and socio-
economic characteristics. The results indicate that custodial characteristics, whilst in

themselves useful indicators of post-release performance, may be supplemented by socio-economic factors. Further, the influence of these factors varies across the different measures of post-release performance, whether defined in terms of parole violations the more serious outcome of a return to criminal activity. Unfortunately, from a policy perspective the results do more to identify likely reoffenders, than to present possible ways to reduce the criminal activity of paroled prisoners (prison industry programs, longer parole periods, less frequent relocation of prisoners, etc.).

Of course, the study does suffer a number of limitations, all of which suggest directions for future research. To start with, and following Avio (1998: 156), 'one can conclude that there is value in using sophisticated models in predicting recidivism for random samples of released offenders, but that the models are not yet sufficiently refined for application to individuals'. Put differently, while the results of the study are suggestive of policy changes, they are not sufficiently developed to provide an empirically feasible guide to parole boards, let alone Avio's (1998) 'selective incapacitation' (where predictions of future behaviour of individual convicted offenders are used to set sentences and parole periods). This is particularly relevant in that Miceli's (1994) 'efficient punishment system' typically requires a period of punishment followed by supervised release, and this socially optimal punishment system is often demonstrated to vary across individuals. While some promising advances have been made in the use of neural network models to predict criminal recidivism in this regard, these have not yet been shown to exhibit any advantage over well-known statistical methods (Caulkins *et al.*, 1996).

A second limitation is that the data used contains no information concerning post-release controls and other contemporaneous regressors. These could include information on whether the individual worked during the observation period, the length of time to attain employment after release, and earnings from this employment. Equally, it is likely that the explanatory variables for recidivist outcomes are likely to vary across time; that is, in terms of post-release 'survival time' (the length of time from release to recidivism). Schmidt and Witte (1989), for example, used a hazard model to link the time since prisoner release and differences in exposure to the risk of recidivism. It is argued that 'not only is this variable of interest in itself, but ignoring information on length of time to recidivism (however defined) is statistically inefficient' (Avio, 1998, p. 155). Unfortunately, the data does not include information on the time between release and readmittance to custody (through either parole violation or re-offending).

A third limitation is that studies of recidivism need to incorporate more fully the economic model of crime. For example, given that post-release performance in the present study is defined very broadly, much more needs to be done in examining the seriousness and type of criminal activity, the degree of certainty and severity of punishment for these crimes, and the legitimate and illegitimate opportunities available to paroled prisoners. This would more closely adhere to Becker's (1968, p. 176) seminal argument that 'a person commits an offence if the expected utility to him exceeds the utility he could get by using his time and other resources at other activities'. Regrettably, detailed information of this type was not available.

Finally, there is the persistent problem of simultaneity in studies of criminal recidivism. That is, there is reason to believe that an individual's decision to engage in criminal activity can affect at least some of the more frequently specified explanatory variables. For example, Sickles *et al.* (1979) provide an early simultaneous analysis of parolee's wages rates and the time sentenced (as a proxy for the severity of the offence). It is also likely that exogeneity is likely to be questioned for other variables such as marital status, the number of children,

employment and education. However, this problem may not be as severe as initially thought, at least in part. For example, Sickles *et al*. (1979, p. 171) found that 'the relationship between the criminal activity level and legitimate opportunities may be recursive (legitimate opportunity affects the level of criminal activity, but not the reverse), rather than simultaneous'. Nonetheless, the problem of accurately measuring the set of explanatory variables and then specifying these variables in an appropriate model presents an ongoing challenge.

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