Larrikin youth: crime and Queensland's earning or learning reform

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Crime and Queensland's Earning or Learning Reform

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Abstract

This paper analyses the impact of the introduction of an Earning or Learning reform on youth crime in Queensland, Australia. The 2006 reform increased learning and reduced earning as school participation rose post-reform, while teen employment fell. Empirical analysis of detailed administrative data reveals that criminal offending fell significantly after enactment of the reform. For males, violent, property and drug crime all declined, while the main effect for females was a significant fall in property crime. The property and drug crime falls are underpinned by a significant incapacitation effect, with some evidence of a persistent crime reduction for young men and women at later ages. Crime reduction is concentrated in significant falls in the likelihood of ever offending by marginal individuals, rather than lower criminality among recalcitrant persistent offenders.

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Larrikin: "A boisterous, often badly behaved young man"[1]

[Noun, Australian, Oxford Dictionary]

1. Introduction

Economic research demonstrates that raising the compulsory minimum school leaving age leads to a decline in criminality. Empirical evidence has accumulated from a variety of settings, including cross-state and over-time comparisons for the US (Lochner and Moretti, 2004; Anderson, 2014; Bell, Costa and Machin, 2016, 2017), England and Wales (Machin, Marie and Vujic, 2011), Sweden (Hjalmarsson, Holmlund and Lindquist, 2015) and elsewhere.[2] In this research, crime reduction occurs as an unintended consequence of policies that raise the minimum school leaving (or dropout) age. It is unintended in that the design and enactment of reforms do not specifically target crime reduction, but nonetheless appear to induce a sizeable decline.

Some of the state based education reforms in the US (see Oreopoulos, 2009, or Domnisoru, 2015) provide exemptions from minimum school leaving age legislation based on proof of employment. Similarly, more recent reforms aimed at tackling school to work transition in other countries broaden the scope of legislation to encourage participation in training or employment. The current paper examines one such reform: the Earning or Learning reform introduced in the state of Queensland, Australia in 2006. The main focus is an analysis of the impact of the reform on criminal behaviour among Queensland youth.

[1] The word is often associated with male youth, but there has been study of the female larrikin (see Bellanta, 2010). This paper studies both male and female criminality among Australian youths.
[2] See the reviews of Lochner (2011) or Rud et al. (2013) for more examples.

Prior to the reform in Queensland, in 2003 only 72.5 percent of 15-19 year olds were in school, well below the national average of 77.3 percent (ABS, 2003). Similarly, the proportion of students completing 12 years of education (i.e. completing high school) in the state was also low and had been static since 1998. Against a backdrop of low education participation rates and poor employment prospects for early school leavers, Queensland enacted legislation entitled the Earning or Learning reform in 2006.

The Earning or Learning reform was designed to increase education, and skill levels more broadly, of Queensland youth. The motive for the reform was to better equip students for a successful transition into employment or further study. The reform stated that:

> ".. a young person of the 21st century no longer lives in a world where they can leave school at 15 with few qualifications and obtain employment, acquiring the necessary skills with on-the-job training. The prospects for school leavers today are less promising if they do not possess high levels of skills and qualifications and the capacity for lifelong learning." (Dixon, 2003, page 5)

Upon turning age 16 or after completing grade 10, the reform mandated a period of compulsory participation. However, rather than simply increase the minimum school leaving age, the reform attempted to address diversity of the youth cohort. Thus additional schooling, enrolment in a vocational education program or taking up employment provided alternative pathways to satisfy the reform. Study of this intervention broadens

prior analysis of the impact of increasing the mandatory minimum school leaving age in the US, UK and in other settings.

The current paper employs individual level administrative data to examine the impact of the Queensland Earning or Learning reform on two key issues: the proclivity of youth to remain in school, and the probability of committing crime. The rich nature of the matched individual level panel data to which we have access, allows the analysis to shed light on the mechanism via which the reform lowers crime and in particular, the role that incapacitation plays (i.e. by keeping children in the classroom for longer).

It is important to note that the individual level crime data is matched only to individuals in school, and not to labour market or vocational education outcomes. The complexity of the legislative reform therefore makes it more difficult to focus on the causal impact of an exogenous increase of education on criminal activity, the focus of much prior crime and education research.[3] This paper therefore begins by presenting survey data based evidence on the impact of the reform on a range of earning and learning outcomes, via pre-/post-reform comparisons of education and employment. This is followed by the principal focus of the paper, an analysis of the reduced form relationship between crime and the Earning or Learning reform.

In common with the non-education focussed dimension of the Queensland reform, there is also a small amount of recent research on the impact of youth intervention programs (other than schooling) on crime reduction. For example, Heller (2014) and Heller et al. (2017) set up a number of randomised control trials (RCTs) in the US to examine a number of Chicago based programs, with a particular emphasis on their scope

[3] From a technical point of view, the exclusion restriction within an instrumental variable (IV) context may be violated by potentially different first stage impacts of the earning or learning reform. Whilst intuitively the reform is likely to be correlated with the level of schooling, it could also generate crime effects via alternative routes, for example by affecting employment or enrolment in vocational education or training.

to affect levels of violent crime. Heller (2014) recites an expression used by Cook and Ludwig (2011) "Nothing stops a bullet like a job". But despite the sentiment, she argues that empirical evidence is not strong in establishing that employment is key to curing delinquency. The RCT examines the impact of a summer job program on violent crime, Heller reports a significant causal crime reduction. Despite the short-term nature of the summer job program (and its associated low cost of implementation) it successfully reduced arrests for violent offences. One of the key conclusions was that the success of the program is not entirely attributable to incapacitation.

To preview the paper's main results, the reform did raise the proportion of youth engaging in earning or learning. Delving a little deeper, this comes about via an increase in the schooling participation rate, with a partially offsetting fall in the youth employment rate. The Earning or Learning reform significantly reduced criminal offending, for both males and females. The effects for males are sizable and highly significant for all three major crime categories, namely violent, property and drug related. For females, results are smaller and the only consistently significant effect is for property crime (although in some specifications a drug crime effect is also evident).

Moreover, part of the reduction in crime is due to an incapacitation effect associated with keeping teenagers in school for longer. This plays a significant role in property and drug crime, but not violent crime. There is also evidence of the reform having a longer run effect, with crime reductions observed at ages after leaving the state school system. Finally, the reform consistently and significantly reduces crime for more marginal potential offenders. It is concentrated in significant falls in the likelihood of ever

offending by marginal individuals, rather than generating lower criminality among recalcitrant persistent offenders.[4]

The remainder of the paper is structured as follows. Section 2 outlines the details of the Earning or Learning reform. Given the reform is broader than just an increase in the minimum school leaving age, we first employ Survey of Education and Work (SEW) micro data to examine the impact of the reform on a spectrum of earning and learning outcomes. We then describe the administrative education data that follows individuals through the Government funded school sector and document statistical regression results showing the impact of the reform on staying on in state school. Section 3 describes the matched administrative data on crime and education, together with presenting baseline estimates of the reduced form crime specification. Section 4 reports the results from studying incapacitation effects, shifts in the crime age profile and changing patterns of offender behaviour. Section 5 offers concluding remarks.

2. The Queensland Earning or Learning Reform and School to Work Transitions

The Queensland Earning or Learning Reform

In Queensland the school system consists of 12 years of education (grades 1 to 12). Prior to the enactment of the Earning or Learning reform of 2006, students were required to attend school until either completing grade 10 or turning 16 whichever occurred first. This was referred to as the compulsory school phase. The Earning or Learning reform introduced a *compulsory participation obligation*. After the compulsory school phase, the reform mandated that young people participate in a range of activities broadly defined as earning or learning for up to an additional two years. Thus, the compulsory participation

[4] This is in line with US findings from Jacob and Lefgren (2003) who also report that school incapacitation predominantly reduces crime of marginal individuals.

phase required youth to either stay on at school until obtaining a high school Senior Certificate[5]; complete a vocational education Certificate III[6]; or participate in paid employment for at least 25 hours per week until turning age 17. The current empirical analysis focusses on the impact of the reform and in particular, treatment is defined as the compulsory participation obligation. This offers an intention-to-treat (ITT) approach to studying potential crime reduction for the birth cohorts of individuals affected by the reform.

Australia is of course one of many jurisdictions to have carried out education reforms.[7] Does Queensland and Australia's reform differ from other interventions? There is a considerable prior empirical literature examining the impact of education reforms across the globe. As far back as 1946, Sweden and the United Kingdom recognised the social benefits of additional years of education. The UK's first reform introduced in April 1947, raised the minimum age of compulsory education from 14 to 15 years (see Oreopoulos, 2006). In the 1972/73 school year, the UK mandated a further increase in minimum school leaving age from 15 to 16 (Machin, Marie and Vujic, 2011). Taken at face value the UK legislation was a simple increase in compulsory schooling age, but delving beneath the surface it also heralded the introduction of the Education (Work Experience) Act. This additional reform enabled Local Education Authorities to organise work experience in lieu of the additional final year of schooling. This led to greater flexibility, and is in keeping with subsequent Australian and Queensland reforms.

In a similar vein, Oreopoulos (2009) outlines differences and changes in the minimum compulsory school leaving age across states and over time in the United States.

[5] A Senior Certificate is awarded after an individual has completed grade 12.
[6] A Certificate III is a level three vocational qualification gained either at a high school or at a vocational training college.
[7] The Earning or Learning reform was a national program implemented across all Australian states between 2006 and 2010 (see ACARA, 2009).

He documents a range of exemptions associated with state legislation. For example, in Arkansas, Connecticut, Illinois, District of Columbia, Maine, Nebraska, New Mexico, New York, Ohio, South Carolina, Utah, Washington and Nevada a student may leave school earlier upon acquiring parental/school principal permission to participate in paid work. In some states, such as Virginia, Kansas and Louisiana a student requires only parental consent to leave the school system early. Similarly, there are important state differences in enforcement and legal guardian penalties associated with students leaving school prior to the compulsory minimum age.

Given the legislative prevalence of exclusions from the compulsory school minimum leaving age, Queensland's Earning or Learning reform is in practical terms different to others.[8] This is actually an important point as most prior analysis of education reforms has focused solely on the impact of the reform on some measure of schooling outcomes. If the legislative reform allows employment or some alternative non-school based activity in lieu of additional years in school, focussing solely on the latter ignores an important part of the behavioural response. This possibility is investigated below.

Data and Empirical Evidence: Impact of the Reform on Earning and Learning

The analysis draws upon two data sources to examine the impact of the reform on earning and learning outcomes of Queensland youth. The first data source is the Survey of Education and Work (SEW) which forms part of the Monthly Population Survey (MPS) carried out by the Australian Bureau of Statistics (ABS). The MPS consists of the Labour Force Survey, plus supplementary surveys. The SEW is a biannual survey from 2001-

[8] Some more recent legislative changes are, in fact, rather like the Queensland reform. For example, the Education and Skills Act 2008 for England and Wales legislated the following provisions: You can leave school on the last Friday in June if you will be 16 by the end of the summer holidays. You must then do one of the following until you are 18: stay in full-time education, for example at a college; start an apprenticeship or traineeship; spend 20 hours or more a week working or volunteering, while in part-time education or training. This was introduced nationally in 2013.

2011 and annual thereafter with a focus on the transition from education to work (see ABS, 2016).

Data from 2003 through 2009 is studied to examine the impact of the 2006 reform on the earning and learning outcomes of individuals aged 15 to 17. Thus a four year window is selected which, because the survey is biennial, covers two cross-sections pre- and post-reform respectively. Table 1 documents various dimensions of earning and learning, presenting means of pre-/post-levels as well as the changes over time for the whole sample and sub-divided by gender.

The first column of Table 1 identifies a significant rise of 2.3 percentage points in Earning or Learning across all individuals. Thus, it would appear at first consideration that the reform has played a significant role. Full-time learning increased by 5.1 percent, with the sub-component in school rising by 7.7 percentage points. The increase in full-time learning is smaller than the increase in schooling alone. This reflects a decrease in enrolments in all non-school education, and vocational education in particular. The other significant contributor to the aggregate change in Earning or Learning is a 2.6 percentage point decline in full-time employment. There is also a significant 1.8 percentage point fall in the unemployment rate (and an associated fall in labour force participation). Overall, the reform significantly increased those staying on at school and decreased employment among youth.

The overall aggregate impact on Earning or Learning differs by gender, with a highly significant 3.2 percentage point increase for women versus an insignificant 1.5 percentage point increase for male youth. This is *a priori* as expected because pre-reform males have a stronger labour market connection and an associated lower schooling participation rate. The reform increased full-time education participation for males and

females by the same (5.1 percentage point) amount. There is a larger increase in the school participation rate for men – of 8.8 versus 6.9 percentage points - from the lower pre-policy level for men (of 68.3 percent), combined with a larger decline in employment (3.5 versus 1.9 percentage points). These are important shifts that are highly relevant for the analysis of criminal behaviour reported later in the paper.

The second data source used to study the in-school aspect of the reform is individual level state-wide administrative data from the Department of Education and Training (DET). These data tracks the entire population of attendees at all Queensland Government funded schools over the period 2002 to 2013. In the current analysis all children enrolled in state schools at age 15 and/or grade 10 both before and after the reform are tracked until they leave the state school system.[9] [10] This is a coherent research strategy to follow since the SEW data described in Table 1 documented a significant increase in school participation following the introduction of the reform. In fact, the dominant impact of the reform was an increase in youth staying on at school.

The state school sector represents around 70 percent of all school children in Queensland, with the remaining 30 percent located in the private school system. The Earning or Learning reform introduced the compulsory participation obligation for those born in birth cohorts 1990 and beyond. The micro data enable analysis of the impact of the Earning or Learning reform on the probability of staying on at school, conditional upon being in school in grade 10. This offers a different margin from, and offers a potentially useful counterpoint to, the SEW results, by longitudinally tracking the same individuals to see if they stay on to grade 11 or 12. Figure 1 provides an initial description of the impact

[9] Grade retention in Queensland means that about 20 percent of grade 10 children are aged 16 in the relevant school year.
[10] We follow these same cohorts up to age 21 and match with Queensland Police Service administrative data in the later crime analysis.

of the reform on the likelihood of students staying on at school beyond grade 10. The vertical line divides the pre and post reform periods. There is a post-reform increase (albeit with some delay as more treated cohorts move through) in the percentage staying on to grade 11 or 12 in the school system. Thus as expected the reform induced an increase in the level of education participation.

Empirical analysis of the micro data produced results, shown in Table 2, which demonstrate that for males and females together the reform significantly increased the probability of staying on to grade 11 or 12 by just over 2 percentage points. In conjunction with Figure 1, which illustrates increases in this percentage separately by gender, this shows that in school education participation increased after the introduction of the Earning or Learning reform. The results in the Table confirm the effect to be larger for men than women, which matches the findings from the SEW data.

3. Crime and the Earning or Learning Reform

Data

The rest of this study uses Queensland administrative data matched at the individual level across state agencies, Department of Education and Training (DET) and the Queensland Police Service (QPS). Thus, we have individual record data for the entire population of attendees at all Queensland Government funded schools, together with matched individual criminal offence data for the period 2002 to 2013.[11] The focus is on males and females aged 15-21. The precise sample structure is shown in Table 3, where the treatment group cells - that is those affected by the Earning or Learning reform - are in bold. Data

[11] For some examples of other research that matches school data to crime records in the US, albeit with a different research focus, see Deming (2011) or Billings, Deming and Rockoff (2014).

collection begins for those in school from 2002 onwards, thus the cohort/age structure is not completely balanced. In the statistical analysis, we begin with the unbalanced sample, but then move to consider balanced samples in a narrow discontinuity window surrounding the reform.

The crime data refers to alleged criminal offences, and so the focus is on whether an individual in a given year is an alleged offender. An alleged offender is a person who has allegedly committed a crime and has been processed for that offence by arrest, caution or warrant of apprehension. These data are matched at the individual level to the Queensland school data. In the latter, we observe individuals until they leave school. Thus, a major advantage relative to that adopted in some of the previous literature is that the matching of education and criminal offence data occurs at the individual level. The same individuals are followed through time in the state education system and to later ages beyond, simultaneously tracking alleged criminal offences.

Descriptive Analysis

Figure 2 shows the cross-cohort evolution of youth crime. The Figure shows offending rates by crime type and gender for 15-17 year olds, with the vertical line distinguishing the pre/post reform period. The three main identified crime types represent violent, property and drug offences.[12] As the Figure makes clear, all three categories of crime are more prevalent for males than females. The main takeaway is that crime appears to decline after the reform was introduced. There are some variations across gender with significant reductions in all three crime types for males, but only for property and drug crimes among females.

[12] Violent offences are: murder, attempted murder, manslaughter, sex offences, assaults and robbery. Property crimes are: theft, burglary and criminal damage. Drug offences are a single group by themselves.

Table 4 shows summary statistics for all crime in the full unbalanced data, for the expanded age sample 15 through 21. The Table also reports results broken down by gender and major crime category for the pre- and post-reform cohorts, together with the change between the two. The Table illustrates similar crime patterns before and after implementation of the Earning or Learning reform for the wider sample *vis-a-vis* school age individuals shown in Figure 2. The one exception is property crime for females, which documents a fall among the 15-17 year olds considered in the Figure, but does not drop post-reform in Table 4. This will be considered in more detail below when treatment is allowed to vary with age. Overall, Figure 2 and Table 4 show the salient descriptive features of the basic trends in the data. These obviously underpin the statistical investigation of crime, to which we now turn.

Crime Reduced Forms

The main statistical analysis involves estimating the parameters of the crime reduced form, observed for individual i from birth cohort c in time period t:

$$C_{ict} = \theta EL_{ic} + \gamma X_{ict} + f(a, t) + \varepsilon_{it} \qquad (1)$$

where C denotes crime, X is a set of control variables (gender and the number of observations per individuals as for some of the analysis data is unbalanced)), f(a, t) is a function of the individual's age (a) and year (t), and ε is an error term. The key parameter of interest is θ, the estimated coefficient on the Earning or Learning reform variable EL, which is defined by birth cohort as previously described. In most specifications – with any exceptions noted below – $f(a, t) = \alpha_{t-c} + \alpha_t$ is modelled by a full set of age (where $a = t - c$) and year dummies α_{t-c} and α_t.

Table 5 reports a number of estimates from different specifications that model the probability of being an offender for any given type of crime. The Table presents results

across 3 different samples. All samples cover individuals aged 15-21 and calendar years 2002 to 2013. Separate results are provided pooled by gender and separately for males and females. The first column provides results for the unbalanced panel birth cohorts 1984 to 1998; the second column is again birth cohorts 1984 to 1998 where each individual is observed in the panel at least six times and the final column is the discontinuity sample which is composed of three birth cohorts pre-reform and three post reform (i.e. birth cohorts 1987 to 1992).

The results in the Table are consistent across specifications and samples, with the Earning or Learning reform always having a significant negative impact on crime. Thus, in these baseline results, the reform significantly decreased the probability of crime. The impact for males is at least three times higher (in terms of reduced offending rates) than for females. It is also higher for males when expressed as a percentage effect of the pre-reform mean.

The results for the final column, the discontinuity sample in the time window close to the reform, are smaller than for the other specifications, but nonetheless show a sizable crime reduction following from the Earning or Learning reform.[13] Relative to the pre-reform mean offence rate of 3.9 percentage points, the discontinuity sample estimate crime reduction for all 15-21 year olds is 10.3 percent. Corresponding percent reductions (relative to their respective pre-reform means) for males and females are 10.8 and 8.9 percent.

Table 6 shows results for the discontinuity sample by type of crime and gender. The results for men suggest that across all crime types the effect of the reform is

[13] Addition of a linear cohort variable (suitably rescaled so that it models a pre-cohort trend) did not substantively alter the pattern of results. For all individuals the estimate became -0.338 with an associated standard error of 0.084, and for males and females the estimates (standard errors) were respectively -0.517 (0.148) and -0.163 (0.080).

consistently negative and significant at the 5 percent level. For females the reform is significant at the 10 percent level for property crime. The gender differences show the reform has a larger effect for men than women. To offer some additional context, estimates broken down into more detailed crime classifications within the violent and property crime groupings are given in Table A1 of the Appendix.

Placebo Analysis

In examining a policy change like the 2006 Earning or Learning reform it is important to consider if the social environment remains the same pre and post the change. The analysis to date has already included age and year fixed effects to mitigate time invariant unobservables that may be correlated with age and year. In addition, we have also considered various placebo analyses to ensure there are not shifts either side of the year (2006) of treatment. For example, setting up a "fake" policy reform in 2004 and then re-estimating the specifications given in Tables 5 and 6 produced statistically insignificant results. These results from the 2004 placebo for the Table 5 crime specifications are reported in Table A2 of the Appendix.[14]

4. Understanding the Crime Impact

In this section, we discuss additional empirical findings in an attempt to try to better understand the mechanisms via which the Earning or Learning reform directly affected crime. We begin by looking at whether incapacitation (i.e. keeping youth off the streets

[14] There was a change in policy that occurred in the period after the Earning or Learning reform where alterations were made to the Queensland Police move-on laws in 2008. This change expanded the options available to a police officer when coming into contact with a potential offender. Under the new laws an offender could be warned, arrested, or, just directed to move-on; i.e. to go home. The former two actions would appear in the police records, but, being told to go home would not. The action a police officer chooses thus has the potential to reduce the number of offenders in the police data and lead to a resultant downward bias in crime analysis results. However, eyeballing the time series plots of offending confirms that it is hard to see any noticeable change in levels of crime occurring at this juncture.

and in the classroom or workplace due to the Earning or Learning reform) reduces crime. Second, we look in more detail at the way in which crime-age profiles shift in response to the reform. Third, we look at whether the reform results in reduced offending levels for more or less marginal potential criminals.

Incapacitation

One clear avenue for possible crime reduction emerges if the reform mandates youth to be in a supervised environment rather than roaming the streets, the so called incapacitation effect. There is a body of evidence to support this which uses plausibly exogenous changes in the length of the school day or exploits random days in which schools do not open, to identify incapacitation effects (Jacob and Lefgren, 2003, and Luallen, 2006).[15] Also, Anderson (2014) examines whether students affected by a dropout reform show different responses by age.

In similar vein to Anderson (2014) and Bell, Costa and Machin (2017), the basic statistical specification outlined earlier is generalised to explore whether the treatment effect of the reform varies by age. For this analysis a full set of interactions between EL and the age dummies α_{t-c} are added to equation (1). Table 7 shows the estimated coefficients on the interactions. The results demonstrate that the reform effects differ by age. Reassuringly there is little effect at age 15, and at subsequent ages the negative effects of the reform begin to appear. For males, the impact of the reform kicks in at age 17 across all categories of violent, property and drug crime. The impact of the reform reaches a peak at age 19 for violent and property crime and age 18 for drug crime. For the male crimes, there is not a significant reform effect at ages 20 and 21, except for drug

[15] Prior to this research focussed on causality, there were earlier (non-causal) estimates of the impact of time spent in school on crime (see, for example, Gottfredson, 1985, Farrington et al., 1986 or Witte and Tauchen, 1994). Hjalmarsson (2008) studied the impact of being arrested and incarcerated before finishing school on the probability of graduating high school, reporting there to be a strong negative association.

crimes. For females the reform does not have a significant role in terms of violent crime apart from at age 19. For property and drug crime the impact of the reform begins and simultaneously reaches a peak at age 17 and 19 respectively. Overall, the pattern suggests a more prominent role for incapacitation in property and drug crime than in violent crime.

Shifts in Crime-Age Profiles

The second, closely related, way in which we study incapacitation builds upon the insight that crime onset often begins in the teenage years and that criminal behaviour peaks in the late teenage years (as in the life course approaches to crime described in, for example, Sampson, and Laub, 1993, 2005). Thus, for many crimes one sees an inverse U-shape in the crime-age profile.[16] If the incapacitation effect reduces criminal activity at these crucial ages, it may in addition generate a persistently lower crime rate as the cohort ages, since some of the cohort members will have avoided going down the wrong path at a crucial age.

The estimates shown in Table 7, when combined with the pre-reform crime age profiles, can be used to focus in on how the crime-age profile changes before and after the Earning or Learning reform (see Bell, Costa and Machin, 2017, for a framework that links changing crime age profiles to changes in dropout age). Figure 3 shows this for the three main types of crime separately by gender. There is evidence of an incapacitation effect for property and drug crime for both genders, with crime reductions for incapacitation ages 16-18. There is also some evidence of longer run persistent crime reductions, though they

[16] Almost two hundred years ago, Quetelet (1831) showed a peak in the late teens for crime in early nineteenth-century France. A mass of subsequent research has confirmed the strong age-crime pattern, with crime peaking in the late teens and declining with age quite rapidly. Hirschi and Gottfredson (1983) proposed that crime-age profiles are broadly invariant over time and across demographic groups. Such a view has been challenged empirically by a number of authors. Examples are Greenberg (1985) who presents evidence that both the peak crime age and the rate of subsequent decline differs across crime types, localities, race and gender. Similarly Hansen (2003) shows that the crime-age profile differs for those who leave school at the compulsory school leaving age and those who remain in education.

generally disappear by age 21 (male drug crime being the exception). The pattern is rather different for violent crime, with no reform effects for 15 and 16 year olds, but a downward shift from age 17 for men and age 18 for women. There are longer run reductions after school dropout age, but these also tend to fade by age 21.

Changes in Offending Behaviour

The final set of issues we study are enabled because of the rich nature of the longitudinal data which follows the same individuals from different birth cohorts over time. Specifically, it is possible to examine whether there are pre- and post- reform changes in the single or multiple offending behaviour of individuals who are observed between ages 15 and 21. This permits a consideration of whether crime reductions are more likely to arise from a change in behaviour of those on the margins of crime participation in their teenage years, or a reduction in criminality among more persistent offenders.

Table 8 reports results examining the impact of the reform on three key measures of criminal activity. The first considers whether or not an individual ever offends between ages 15 and 21. The second and third look only at offenders and ask whether, conditional upon being an offender, individuals offend in more than one year of the seven in which they are observed, and as a measure of prolific offending whether they commit an offence in five or more years. The results reported in the Table distinguishes among the three broad categories of crime and separately by gender.

The clearest result that emerges from Table 8 is that, with the exception of violent crime for females, the dominant impact of the reform is upon the likelihood of ever offending. Strong significant reductions occur for the probability of ever offending for males for violent, property and drug crime, and for females for property and drug crime.

There is much less evidence of effects on multiple offending, either for offending in more than one year or for the prolific offenders committing crime in five of more years. In fact, all of the latter prolific offence effects are insignificantly different from zero. And, at the same time, five of the six multiple (more than once) effects are also insignificant, the one exception being a reduction in multiple offending for drug crimes by males. Overall, it is evident from the longitudinal analysis that the primary impact of the Earning or Learning reform is a reduction in offending by those on the margins of crime, rather than from generating lower criminality among more frequent offenders.

5. Conclusions

The focus of this paper is on whether Queensland's 2006 Earning or Learning reform reduced criminality among the young. The answer is in the affirmative, as offending behaviour is seen to significantly fall after introduction of the reform. This is established from analysis of rich administrative data covering several cohorts of all individuals attending state school between 2002 and 2013. The reform itself significantly increased earning or learning participation. The compositional changes underpinning this feature increased school participation and reduced employment. Crime falls are observed for both males and females, with more sizable effects emerging for violent, property and drug crimes for the former and smaller falls in property (and in some, but not all, specifications in drug crime) for the latter.

Probing the patterns of crime reduction in more detail reveals an incapacitation effect, whereby teenagers are compelled to remain in school longer, and also a longer run effect that persists after the schooling years. Digging deeper reveals that this balance of larger crime reductions for those who are kept in school operates mostly through a

reduction in property or drug crime, rather than violent related offences. Finally, the crime reductions seem to operate through permanent deterrence for those affected by the reform as there is a large drop in the proportion of young men and women who ever offend between ages 15 and 21, but little change in multiple offending that occurs pre- and post-reform. Overall, it seems that, as one might intuitively expect, the Earning or Learning reform brought about desistence in crime from youth on the margins of offending in their teenage years, rather than reductions in criminality among persistent offenders.

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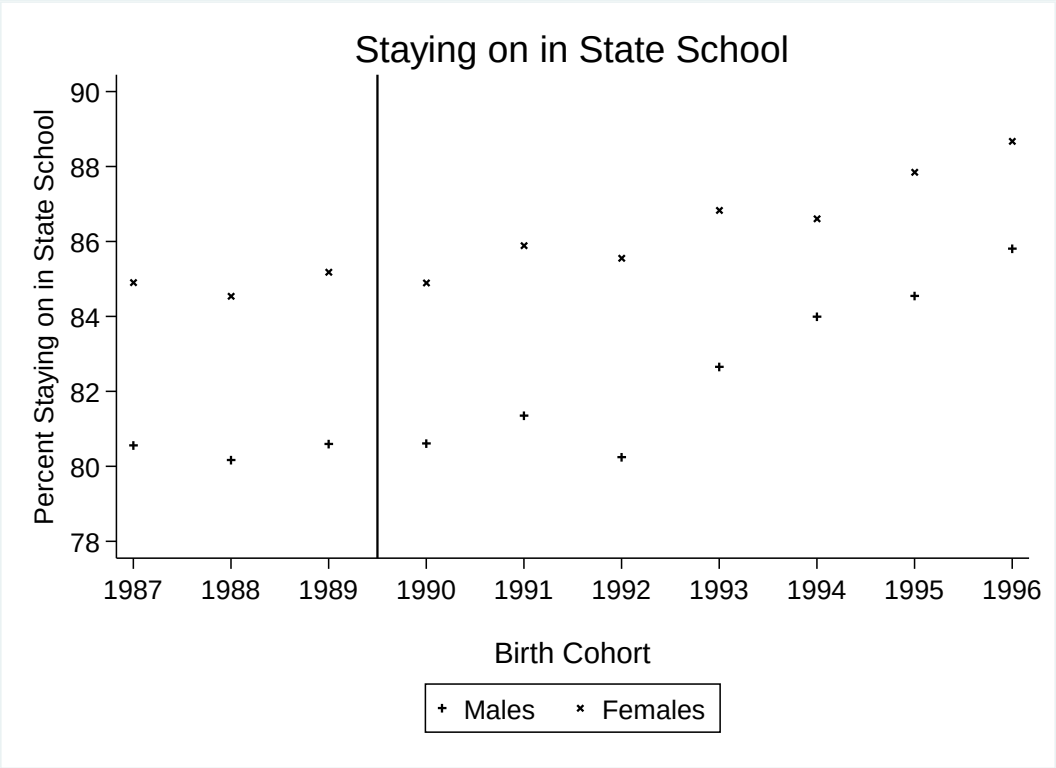
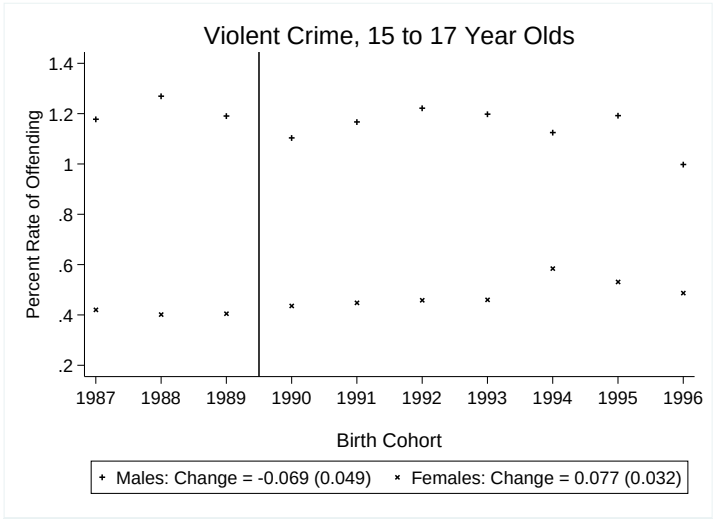
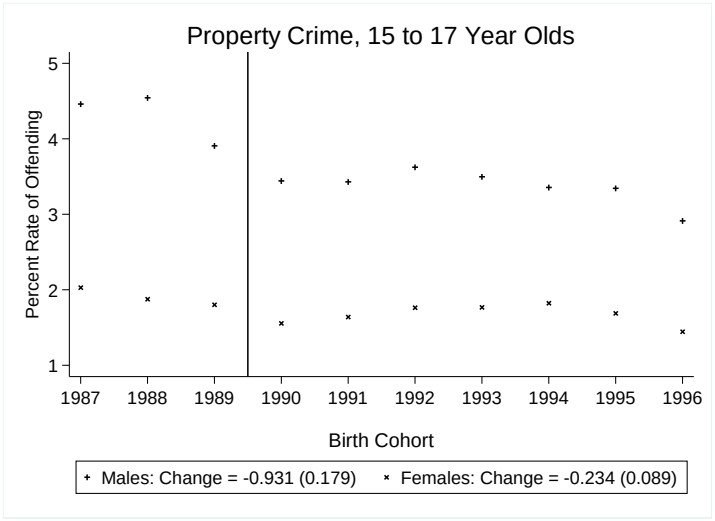
Figure 1: Percent Staying on in State School

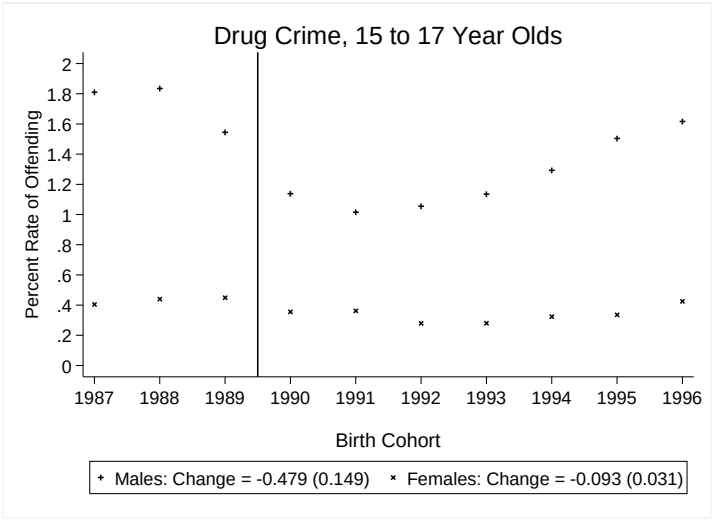


Notes: Based on DET showing percentage of grade 10 individuals in each birth cohort who stay on in school to grade 11 or 12. Pre-reform birth cohorts are to the left of the vertical line, whilst post-reform birth cohorts are to the right.

Figure 2: Youth Crime Incidence Before and After the Earning or Learning Education Reform

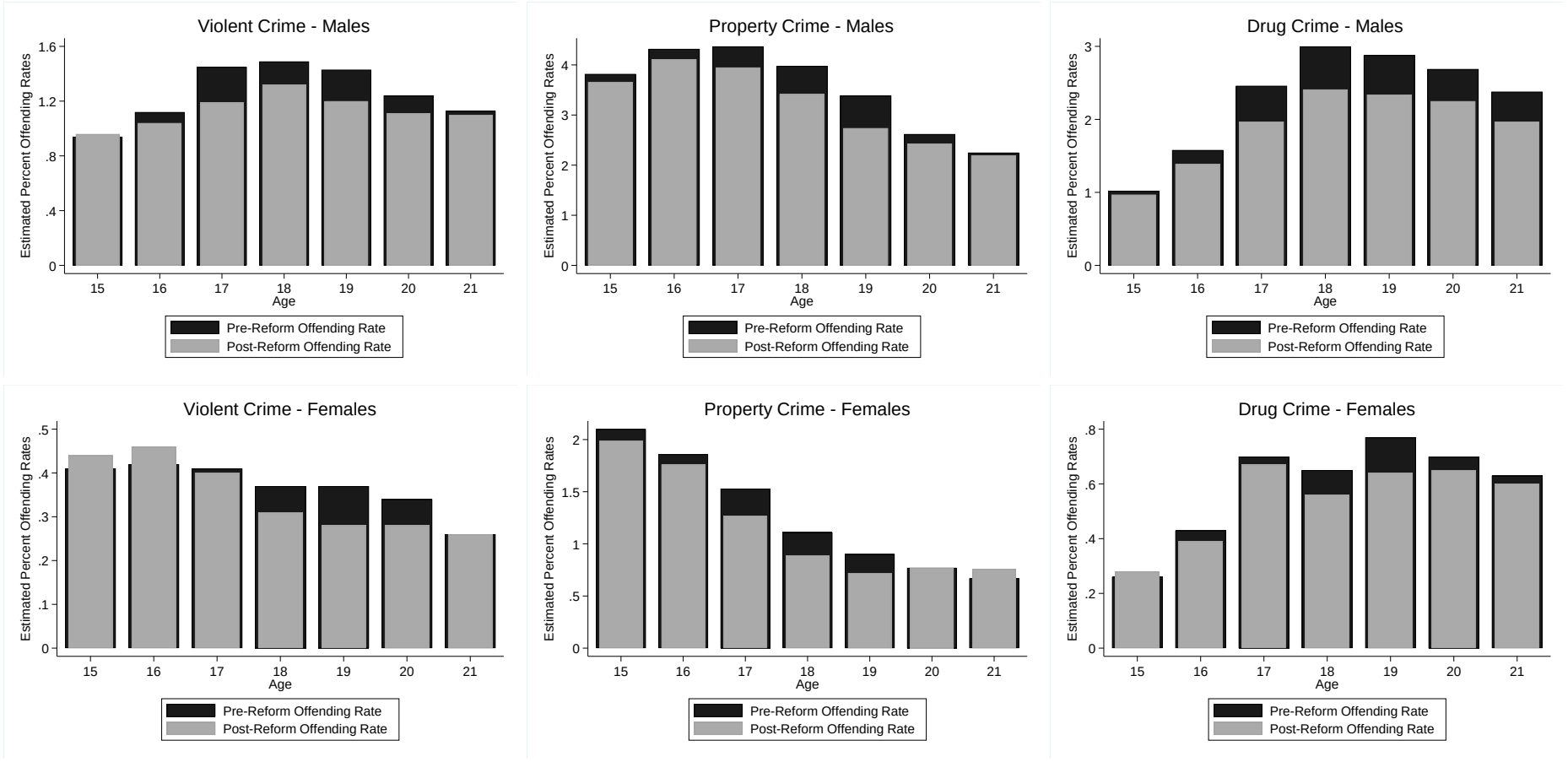






Notes: Matched DET/QPS data showing offending rates of 15 to 17 year olds. Pre-reform birth cohorts are to the left of the vertical line, whilst post-reform birth cohorts are to the right. Standard errors for Changes reported in parentheses.

Figure 3: Youth Crime Age Profiles Before and After the Earning or Learning Education Reform



Notes: Matched DET/QPS data showing pre-reform offending rates by age in black and post-reform offending rates by age calculated from the Table 7 estimates in grey.

Table 1: Pre and Post Reform Earning or Learning Percentages

Survey of Education and Work, 15-17 year olds, 2003 and 2005 to 2007 and 2009

	All			Males			Females		
	Pre-Reform	Post-Reform	Change	Pre-Reform	Post-Reform	Change	Pre-Reform	Post-Reform	Change
Earning or Learning	93.1	95.4	2.3 (1.1)	93.5	95.0	1.5 (1.5)	92.7	95.9	3.2 (1.5)
Full-Time Education	78.0	83.1	5.1 (1.8)	76.0	81.1	5.1 (2.7)	80.0	85.1	5.1 (2.5)
In School	70.1	77.8	7.7 (2.0)	68.3	77.1	8.8 (2.9)	71.8	78.7	6.9 (2.8)
Vocational Education	2.6	1.6	-1.0 (0.7)	2.7	1.1	-1.6 (0.9)	2.6	2.3	-0.3 (0.1)
Employed, Not in Full-Time Education	15.0	12.4	-2.6 (1.6)	17.4	13.9	-3.5 (2.4)	12.7	10.8	-1.9 (2.1)
Unemployed, Not in Full-Time Education	3.9	2.1	-1.8 (0.8)	4.4	3.2	-1.2 (1.3)	3.5	0.9	-2.6 (1.0)
Out of Labour Force, Not in Full-Time Education	3.0	2.5	-0.5 (0.8)	2.2	1.8	-0.4 (0.1)	3.8	3.2	-0.6 (1.2)
Sample size	838	1092	1930	413	562	975	425	530	955

Notes: Standard errors in parentheses.

Table 2: Staying on to Grade 11 or 12 in State School

	[Probability of Staying on to Grade 11 or 12 in State School if in State School in Year 10] X 100		
	All	Men	Women
	(1)	(2)	(3)
Earning or Learning Reform	2.122	2.434	1.791
	(0.124)	(0.182)	(0.068)
Male	3.461	-	-
	(0.119)		
Age 16 in Year 10	-9.694	-9.062	-10.055
	(0.150)	(0.208)	(0.216)
Sample Size	376251	194191	182110

Notes: Standard errors in parentheses.

Table 3: Sample Structure of Age Group by Birth Cohort, Unbalanced Panel

	Age							
Birth Cohort	15	16	17	18	19	20	21	All Ages
1984	-	-	-	7813	7810	7812	7810	31245
1985	-	-	29634	29648	29659	29665	29665	148271
1986	-	34993	34994	35009	35021	35024	35023	210064
1987	39382	39377	39387	39402	39411	39412	39936	275767
1988	42426	42341	42445	42461	42467	42464	42445	297139
1989	45878	45876	45878	45911	45902	45885	45871	321201
1990	54523	**54502**	**54522**	**54521**	**54518**	**54508**	**54480**	381574
1991	**56606**	**56602**	**56627**	**56642**	**56644**	**56640**	**56640**	396401
1992	**59993**	**60020**	**60030**	**60052**	**60060**	**60061**	**60065**	420281
1993	**59723**	**59724**	**59749**	**59774**	**59778**	**59778**	-	358256
1994	**59539**	**59525**	**59542**	**59554**	**59565**	-	-	297725
1995	**59292**	**59306**	**59332**	**59349**	-	-	-	237279
1996	**58095**	**58118**	**58124**	-	-	-	-	174337
1997	**56945**	**56952**	-	-	-	-	-	113897
1998	**55108**	-	-	-	-	-	-	55108
All Birth Cohorts	647510	627416	600264	550136	490835	431249	371395	3718815

Notes: Cohorts and age groups affected by the 2006 Earning or Learning reform are in bold.

Table 4: Pre and Post Reform Offending Rates (Percent)

	Unbalanced, Ages 15-21, Cohorts 1984 to 1998, Years 2002 to 2013								
	All			Males			Females		
	Pre-Reform	Post-Reform	Change	Pre-Reform	Post-Reform	Change	Pre-Reform	Post-Reform	Change
Any Crime	3.834	3.352	-0.482 (0.030)	5.721	4.803	-0.918 (0.052)	1.898	1.849	-0.049 (0.028)
Violent Crime	0.788	0.790	0.002 (0.012)	1.215	1.148	-0.067 (0.021)	0.350	0.420	0.070 (0.011)
Property Crime	2.358	2.152	-0.206 (0.023)	3.452	3.008	-0.444 (0.040)	1.236	1.267	0.031 (0.022)
Drug Crime	1.417	1.107	-0.310 (0.013)	2.245	1.750	-0.495 (0.028)	0.567	0.441	-0.127 (0.014)
Sample size	1338210	2308605	3718815	677748	1210980	1888728	660462	1169625	1830087
Number of Individuals	254876	520287	720619	129261	264575	365982	125615	255712	354637

Notes: Standard errors clustered by individual in parentheses.

Table 5: Offending Reduced Forms

	Pr[Any Crime] X 100		
	Unbalanced, Ages 15-21, Cohorts 1984 to 1998, Years 2002 to 2013	6 or More Observations, Ages 15-21, Cohorts 1984 to 1998, Years 2002 to 2013	Discontinuity +/-3, Ages 15-21, Cohorts 1987 to 1992, Years 2002 to 2013
A. All			
Earning or Learning Reform	-0.610 (0.060)	-0.555 (0.070)	-0.403 (0.082)
Male	3.266 (0.028)	3.442 (0.034)	3.451 (0.39)
Age, Year and Number of Observation Effects	Yes	Yes	Yes
Sample Size	3718815	2658352	2090637
Number of Individuals	720619	393375	298788
Pre-Reform Mean of Dependent Variable	3.834	3.839	3.931
B. Males			
Earning or Learning Reform	-0.991 (0.105)	-0.833 (0.123)	-0.627 (0.142)
Age, Year and Number of Observation Effects	Yes	Yes	Yes
Sample Size	1888728	1350262	1061494
Number of Individuals	365982	199820	151709
Pre-Reform Mean of Dependent Variable	5.721	5.790	5.803
C. Females			
Earning or Learning Reform	-0.219 (0.057)	-0.269 (0.066)	-0.178 (0.077)
Age, Year and Number of Observation Effects	Yes	Yes	Yes
Sample Size	1830087	1308090	1029143
Number of Individuals	354637	193555	147079
Pre-Reform Mean of Dependent Variable	1.898	1.942	1.995

Notes: Standard errors clustered by individual in parentheses.

Table 6: Offending Reduced Forms by Crime Type

	Pr[Crime] X 100		
	Discontinuity +/-3, Ages 15-21, Cohorts 1987 to 1992, Years 2002 to 2013		
	Violent Crime	Property Crime	Drug Crime
A. Males			
Earning or Learning Reform	-0.122 (0.060)	-0.323 (0.107)	-0.398 (0.080)
Age, Year and Number of Observation Effects	Yes	Yes	Yes
Sample Size	1061494	1061494	1061494
Number of Individuals	151709	151709	151709
Pre-Reform Mean of Dependent Variable	1.251	3.553	2.216
B. Females			
Earning or Learning Reform	-0.027 (0.031)	-0.102 (0.058)	-0.051 (0.041)
Age, Year and Number of Observation Effects	Yes	Yes	Yes
Sample Size	1029143	1029143	1029143
Number of Individuals	147079	147079	147079
Pre-Reform Mean of Dependent Variable	0.370	1.324	0.565

Notes: Standard errors clustered by individual in parentheses.

Table 7: Offending Reduced Forms by Crime Type, Age Varying Reform Impacts

Discontinuity +/-3, Ages 15-21, Cohorts 1987 to 1992, Years 2002 to 2013

	Violent Crime	Property Crime	Drug Crime
A. Males			
Earning or Learning Reform X Age=15	0.022 (0.099)	-0.163 (0.180)	-0.051 (0.119)
Earning or Learning Reform X Age=16	-0.079 (0.102)	-0.211 (0.182)	-0.186 (0.127)
Earning or Learning Reform X Age=17	-0.257 (0.095)	-0.424 (0.164)	-0.478 (0.119)
Earning or Learning Reform X Age=18	-0.172 (0.092)	-0.556 (0.153)	-0.585 (0.117)
Earning or Learning Reform X Age=19	-0.225 (0.088)	-0.654 (0.143)	-0.540 (0.118)
Earning or Learning Reform X Age=20	-0.126 (0.089)	-0.185 (0.142)	-0.437 (0.122)
Earning or Learning Reform X Age=21	-0.031 (0.092)	-0.055 (0.143)	-0.409 (0.130)
Age, Year and Number of Observation Effects	Yes	Yes	Yes
Sample Size	1061494	1061494	1061494
Number of Individuals	151709	151709	151709
Pre-Reform Mean of Dependent Variable	1.251	3.553	2.216
B. Females			
Earning or Learning Reform X Age=15	0.026 (0.058)	-0.112 (0.114)	0.020 (0.062)
Earning or Learning Reform X Age=16	0.043 (0.057)	-0.096 (0.111)	-0.035 (0.067)
Earning or Learning Reform X Age=17	-0.014 (0.051)	-0.257 (0.097)	-0.032 (0.063)
Earning or Learning Reform X Age=18	-0.059 (0.048)	-0.220 (0.085)	-0.087 (0.058)
Earning or Learning Reform X Age=19	-0.093 (0.046)	-0.182 (0.078)	-0.129 (0.061)
Earning or Learning Reform X Age=20	-0.058 (0.047)	0.003 (0.078)	-0.052 (0.063)
Earning or Learning Reform X Age=21	0.001 (0.046)	0.090 (0.078)	-0.028 (0.066)
Age, Year and Number of Observation Effects	Yes	Yes	Yes
Sample Size	1029143	1029143	1029143
Number of Individuals	147079	147079	147079
Pre-Reform Mean of Dependent Variable	0.370	1.324	0.565

Notes: Standard errors clustered by individual in parentheses.

Table 8: Change in Individual Offender Behaviour Before and After Reform

Discontinuity +/-3, Ages 15-21, Cohorts 1987 to 1992, Years 2002 to 2013

	Ever Offends X 100			Offends More Than One Year| Ever Offends X 100			Offends Five or More Years| Ever Offends X 100		
	Violent Crime	Property Crime	Drug Crime	Violent Crime	Property Crime	Drug Crime	Violent Crime	Property Crime	Drug Crime
A. Males									
Earning or Learning Reform	-0.546 (0.119)	-2.480 (0.168)	-2.411 (0.146)	-0.218 (0.871)	0.673 (0.652)	-1.994 (0.744)	-0.000 (0.166)	-0.051 (0.284)	0.033 (0.137)
Number of Individuals	151709	151709	151709	9305	20124	14334	9305	20124	14334
Pre-Reform Mean	6.429	14.616	10.764	26.225	36.622	32.393	0.723	4.633	7.150
B. Females									
Earning or Learning Reform	-0.083 (0.070)	-0.778 (0.123)	-0.745 (0.083)	1.779 (1.357)	1.009 (0.813)	0.100 (0.125)	0.076 (0.182)	-0.241 (0.242)	0.106 (0.190)
Number of Individuals	147079	147079	147079	2978	9334	3997	2978	9334	3997
Pre-Reform Mean	2.069	6.777	3.124	17.742	20.834	21.115	0.228	1.676	3.711

Notes: Standard errors in parentheses.

Appendix

Table A1: Offending Reduced Forms by Detailed Crime Type

Pr[Crime] X 100♥

Discontinuity +/-3, Ages 15-21, Cohorts 1987 to 1992, Years 2002 to 2013

	Violent Crime				Property Crime			Drug Crime
	Murder or Attempted Murder or Manslaughter♥	Sex	Assault	Robbery	Theft	Burglary	Criminal Damage	Drug
A. Males								
Earning or Learning Reform	0.048 (0.048)	-0.026 (0.020)	-0.092 (0.052)	-0.028 (0.021)	-0.228 (0.081)	-0.159 (0.058)	-0.057 (0.062)	-0.398 (0.080)
Age, Year and Number of Observation Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample Size	1061494	1061494	1061494	1061494	1061494	1061494	1061494	1061494
Number of Individuals	151709	151709	151709	151709	151709	151709	151709	151709
Mean of Dependent Variable	0.137	0.181	0.955	0.177	2.271	1.151	1.464	2.216
B. Females								
Earning or Learning Reform	-0.022 (0.019)	0.001 (0.005)	-0.027 (0.030)	0.000 (0.001)	-0.082 (0.051)	-0.001 (0.019)	-0.019 (0.023)	-0.051 (0.041)
Age, Year and Number of Observation Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample Size	1029143	1029143	1029143	1029143	1029143	1029143	1029143	1029143
Number of Individuals	147079	147079	147079	147079	147079	147079	147079	147079
Mean of Dependent Variable	0.009	0.010	0.338	0.029	1.118	0.162	0.243	0.565

Notes: Standard errors clustered by individual in parentheses. All coefficients and standard errors multiplied by 100 or by 1000 if denoted by ♥.

Table A2: Offending Reduced Forms for Placebo Two Years (2004) Prior to the Earning or Learning Reform

	Pr[Any Crime] X 100		
	Unbalanced, Ages 15-21, Cohorts 1984 to 1998, Years 2002 to 2013	6 or More Observations, Ages 15-21, Cohorts 1984 to 1998, Years 2002 to 2013	Discontinuity +/-3, Ages 15-21, Cohorts 1987 to 1992, Years 2002 to 2013
A. All			
Earning or Learning Reform	-0.056 (0.075)	0.084 (0.080)	0.097 (0.084)
Male	3.266 (0.028)	3.442 (0.034)	3.451 (0.39)
Age, Year and Number of Observation Effects	Yes	Yes	No
Sample Size	3718815	2658352	2090637
Number of Individuals	720619	393375	298788
Pre-Reform Mean of Dependent Variable	3.840	3.974	4.140
B. Males			
Earning or Learning Reform	-0.130 (0.131)	0.122 (0.140)	0.152 (0.147)
Age, Year and Number of Observation Effects	Yes	Yes	No
Sample Size	1888728	1350262	1061494
Number of Individuals	365982	199820	151709
Pre-Reform Mean of Dependent Variable	5.758	5.922	6.045
C. Females			
Earning or Learning Reform	0.025 (0.070)	0.054 (0.073)	0.052 (0.076)
Age, Year and Number of Observation Effects	Yes	Yes	No
Sample Size	1830087	1308090	1029143
Number of Individuals	354637	193555	147079
Pre-Reform Mean of Dependent Variable	1.875	1.964	2.14

Notes: Standard errors clustered by individual in parentheses.