



Gender Crime Convergence over Twenty Years

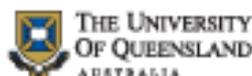
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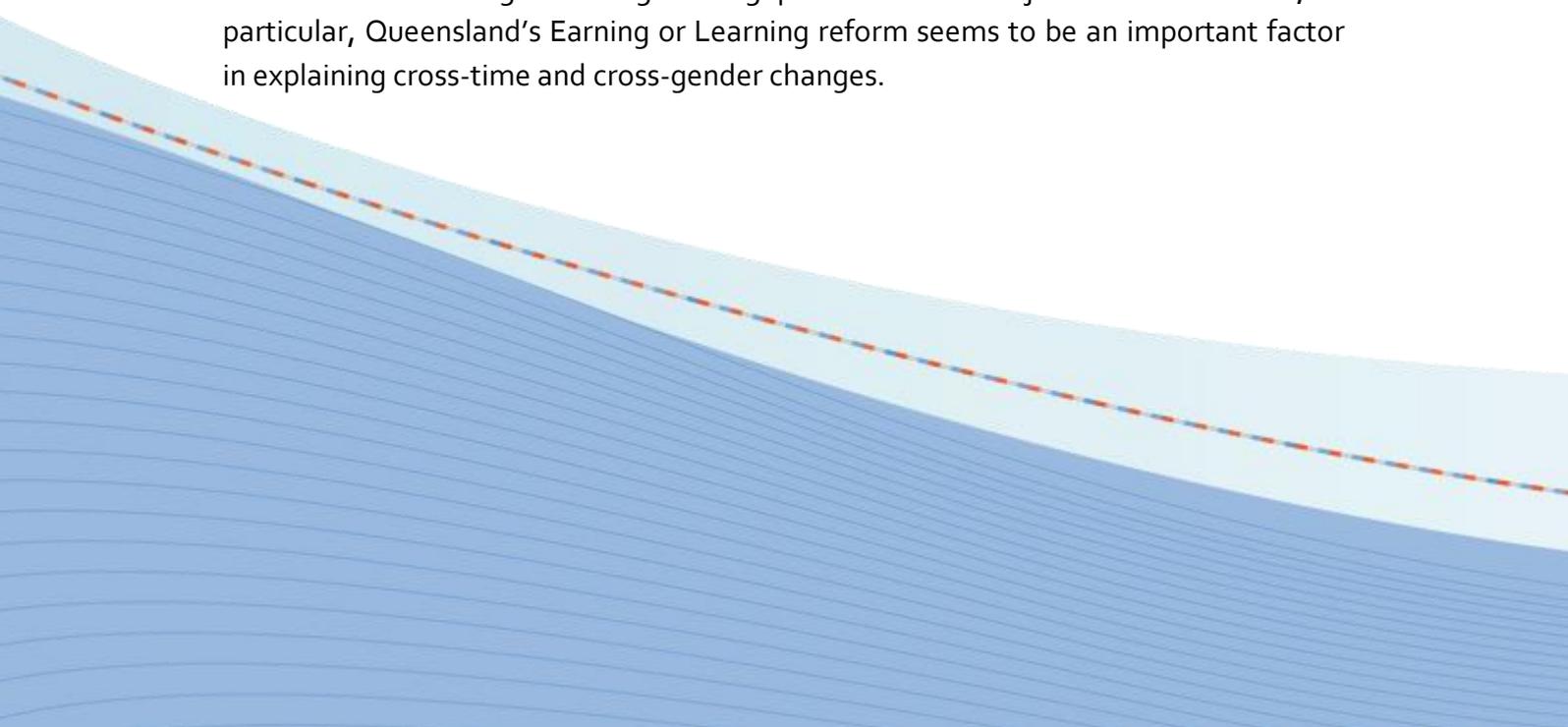


NON-TECHNICAL SUMMARY

In her American Economic Association Presidential address, Goldin (2014) highlights the convergence in female/male economic and social outcomes as one of the most significant advances of the twentieth century. She points to gender convergence in human capital skills; women are overtaking men in terms of the proportion with a college degree, and there are declining gender differences in labour force participation and accumulated labour market experience. This study looks at an interesting and almost entirely neglected research question: “Do women look more like men in terms of crime participation?”

This research explicitly focussed on trends in the gender gap in crime and on whether or not there is evidence of convergence. Our analysis uses very rich administrative data on the population of young people in Queensland, Australia. The evidence illustrates a significant narrowing of the gender-offending gap over a twenty-year period from 1995 onwards. This crime convergence occurs for property and violent crime, and for almost all sub-categories. We also employ a spatial panel data set by gender and police force district across four census years (2001, 2006, 2011 and 2016) to further explore crime trends by gender. This enables us to look at several factors that may be connected to gender crime convergence, and to present an illustrative decomposition of the gender gap in crime by these factors. Finally, we consider an education policy reform enacted in Queensland, the Earning or Learning reform that appears to have altered the speed of gender crime convergence in the mid to late 2000s.

The study revealed a strong convergence in offending rates by gender amongst young people in Queensland, Australia. Dependent on crime type, and on the age of individuals, we show there has been a significant narrowing of the gender-offending gap over the last two decades. The reduction in the gender gap is larger for juveniles and, in particular, for property crime. Amongst violent crimes, there is evidence of substantial narrowing of the gender gap in assaults for juveniles. Education, in particular, Queensland’s Earning or Learning reform seems to be an important factor in explaining cross-time and cross-gender changes.



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Abstract

Men have typically been responsible for the majority of criminal activity and dominate prison populations around the globe. The twentieth century witnessed significant male-female convergence in a myriad of positive dimensions including human capital acquisition, labour force participation and wages. This has prompted the question, to what extent are women 'looking more like men'? In this paper we examine whether similar forces are at play in the context of criminality. We study the pattern of gender convergence in crime using rich administrative data on the population of young people in Queensland, Australia. We present evidence of significant narrowing of the gender gap in criminal activity over the course of the last twenty years. Crime convergence occurs for broad aggregates of both property and violent crime, as well as for almost all sub-component categories. Convergence occurs largely because crime has fallen significantly for men, combined with much less of a downward trend for women. Results are supported by aggregate analysis of rates of offending in police force districts matched to census data by gender between 2001 and 2016.

Keywords: crime; gender; education; Australia

1. Introduction

In her American Economic Association Presidential address, Goldin (2014) highlights the convergence in female/male economic and social outcomes as one of the most significant advances of the twentieth century. She points to gender convergence in human capital skills; women overtaking men in terms of the proportion with a college degree, and declining gender differences in labour force participation and accumulated labour market experience. Observed female progress in terms of human capital acquisition in turn led to greater gender equality in wages. As Goldin suggests, women are looking ‘more like men’. However, one feature untouched by her address is the possibility of gender convergence in one particularly important economic and social outcome, criminality. It is an interesting, yet almost entirely neglected research question to ask “Do women look more like men in terms of crime participation?”

Unlike other areas of economic research, where the importance of gender is prominent and has been studied in great detail¹, a lot of the empirical literature in the economics of crime focusses solely on males.² This, of course, is because traditionally crime is very much in the male domain. Indeed, it is very clear if one looks at patterns of criminality that the male share is, and always has been, high. Table 1 shows information on the rate of imprisonment and female prisoner shares. The latter is less than 10 percent and appears independent of a country’s aggregate level of incarceration.³ There are two underlying reasons; females commit less crime than males, and the types of crime females commit tend to be of the less serious variety.⁴ The data analysed in this paper suggests that

¹ Goldin (2014) outlines a series of marked changes in the lives and labour market experiences of women. Dramatic rises in labour force participation, massive increases in education and labour market experience- all leading to significant male-female wage convergence. Goldin points out that the overall male-female wage gap in the US declined due to significant convergence in levels of human capital. She hypothesises that one of the key explanations underlying the remaining residual wage gap is non-linear pay schemes rewarding long hours and work continuity. See the Handbook of Labor Economics Chapter by Altonji and Blank (1999) for more details on the prolific research area covering gender and the labour market.

² There are a lot more research papers by criminologists and sociologists on gender and crime, a core research area for a long time. We refer to some of this work in more detail below.

³ The US is characterised by high levels of imprisonment, Sweden with a low incarceration rate and Australia is in the middle. Data for many more countries show the same pattern – see data on the World Prison Brief website, <http://www.prisonstudies.org/>.

⁴ Examples such as minor property crimes (e.g. shoplifting) or drug use record female/male gaps that are much smaller than for gender gaps in major crimes like robbery and murder. Of course, prostitution is the one crime dominated by females.

overall the female share of violent or property crimes is just over 20 percent, but with much lower shares for murder and other serious assaults.

Patterns of female/male criminality have clearly changed over time.⁵ In the United States, for example, over the course of the 20th century less than 20 females per 100,000 population were incarcerated. From 2000 onwards, the rate rose, reaching in excess of 120 per 100,000 population. A similar pattern of an increasing share of women is also seen in the lower imprisonment countries shown in Table 1, i.e. Australia and Sweden.⁶

So, is gender crime convergence associated with female advances in economic and social status, i.e. is it another element of Goldin's (2014) 'looking like men' hypothesis, or are there significant differences in context? Whilst largely untouched by economists, these issues have frequently featured in the criminology and sociology of crime literatures (see Schwartz and Steffensmeier, 2015). Arguments abound as to whether or not the same proximate causes are relevant for male and female crime, and whether a gender specific or gender-neutral approach holds the most promise (see, for example, Steffensmeier and Allen, 1996; or Daigle et al., 2007). Approaches vary though they frequently share a focus on gender differences in socialisation and roles. Exposure to violence, peer group delinquency and victimisation are also seen to play a critical role (see Nofziger and Kurtz, 2005; and Moffitt and Caspi, 2011). Hoskin (2017), on the other hand, studies biological differences between males and females, and in particular the role of testosterone in generating gender differences in risk taking and levels of empathy.

In light of Goldin's (2014) analysis of gender convergence, it is interesting that the gender equality hypothesis gained traction quite some time ago in the sociology of crime literature, and has been hotly debated since. In this paradigm, a by-product of female progress in economic and social status is a higher female share of crime. One potential mechanism of power-control underlying this

⁵ See Schwartz et al (2009) and Lauritsen et al (2009) for a robust discussion of whether or not female-male violent crime rates have converged within the US.

⁶ The World Prison Brief reports female shares of prisoners for these countries as: Australia – 2000, 6.4 percent and 2016, 8.0 percent; Sweden - 2000, 5.1 percent and 2016, 5.8 percent. The female share also rises in the US between 2000 and 2014, going from 8.2 to 9.7 percent.

link is associated with the traditional family and dominant male head of household (Hagan, 1989; Grasmick et al., 1996). In this environment, girls experience greater social control, with a reduced role for delinquent peers and extra-family social bonds. The idea is that greater freedom provides increased opportunity to commit crime and lower social control. Thus, greater equality may lead to more female crime.

An interesting counterpoint emerges from the conventional economic approach to modelling crime. Goldin (2014) paints a picture of substantial female progress, with females looking ‘more like men’, achieving greater equality and yet the gender equality hypothesis suggests that this in turn leads to increased crime, just like men. This fits some of the stylised facts, but maybe not the orthodox economic intuition. Indeed, the standard Becker (1968) model argues that economic incentives and opportunities are key to crime participation.⁷ One would expect that as females experience improved labour market opportunities, acquire superior human capital skills and gain more equitable labour market wages, the attractions of a life of crime would decline.

Given this, it is surprising that there are only a small number of research papers in the economics of crime literature that directly consider gender.⁸ Some of the work on crime and education considers female crime, but this is usually in passing or included as a supplement to the main focus on men.⁹ The two papers that place more emphasis on gender in the crime-education area are Costa (2017) and Cano-Urbina and Lochner (2016). These papers look specifically at education and female crime, with a focus on unpacking the causal impact. Gavrilova and Campaniello (2015) study gender differences in crime by examining the role of differential economic incentives as a possible driver of male-female crime patterns. With a sole focus upon property crime they conclude that the size of the swag, or returns to criminal activity are significantly lower for women, and their probability of arrest

⁷ See Draca and Machin (2014) for an up to date review of crime and economic incentives.

⁸ Their share of research papers is undoubtedly much lower than the female share of crime itself.

⁹ For example, among the papers that look at the causal effect of education of crime working through school leaving age reforms, the seminal paper by Lochner and Moretti (2004) looks at males only, Machin et al. (2011) do look at females, but only in an Appendix Table, and Bell et al. (2016) study only males. An exception which looks at males and females on an equal footing is Hjalmarsson et al. (2015).

significantly higher. In a stylised Becker (1968) environment these forces would both lead to lower crime vis-a-vis men. None of this work shares our focus on gender convergence in crime over time.¹⁰

In this paper we explicitly focus on trends in the gender gap in crime and on whether or not there is evidence of convergence. Our analysis first uses very rich administrative data on the whole population of young people in Queensland, Australia. The evidence illustrates a significant narrowing of the gender offending gap over a twenty-year time period from 1995 onwards. This crime convergence occurs for property and violent crime, and for almost all sub-component categories. We also compile a spatial panel data set by gender and police force district across four Census years (2001, 2006, 2011 and 2016) to further explore crime trends by gender. This enables us to look at several factors that may be connected to gender crime convergence, and to present an illustrative decomposition of the gender gap in crime by these factors. Finally, we consider an education policy reform enacted in Queensland, the Earning or Learning reform that appears to have altered the speed of gender crime convergence in the mid to late 2000s.

The rest of the paper is structured as follows. In section 2 we describe the data and draw some stylised facts about crime and gender. In section 3, we offer our empirical analysis of gender convergence in criminality based upon statistical modelling of the administrative data. In section 4, we present some initial evidence on factors that may be related to gender crime convergence based upon spatial panel data. Section 5 concludes.

2. Data and Some Facts on Crime and Gender

Data

The empirical analysis is split into two components, an individual and aggregate district based panel analysis. It begins with a description of the rich individual level data, and defers discussion of the

¹⁰ In a literature review in their paper (which is heavily weighted towards criminology and sociology studies, rather than work by economists) Gavrilova and Campaniello (2015) identify three empirical studies (by Bartel, 1979; Gavrilova, 2013; and by Corman et al., 2014), which they note represent the only empirical work in economics that they could identify on crime and gender.

aggregate data until section 4. The individual level analysis is based on administrative data from the Queensland Police Service (QPS) for the entire population of 15 to 24-year olds in Queensland, Australia. The data track the criminal population of Queensland over the period 1995 to 2013. They refer to criminal offences, and so the focus is on whether an individual in a given year is an alleged offender. The data includes age by single year and gender for the entire Queensland population, permitting study of the changing proportion of offenders through time by age and gender. An offender is a person who has allegedly committed a crime and has been processed for that offence by arrest, caution or warrant of apprehension. The analysis first focusses on two broad aggregate crime classifications; violent and property offences. Then these are broken down into their constituent parts: i) violent crime – murder, attempted murder, manslaughter, sex offences, assault, robbery; and ii) property crime – theft and handling, burglary, property damage.

Facts on Crime and Gender

The upper panel of Table 2 provides information on offending rates by gender i.e. whether a given individual committed either a violent or property offence, or both, for the full sample period. The numbers pertain to the entire resident population of 15 to 24-year olds in Queensland between 1995 and 2013. The average rate of offending for the composite violent/property crime is 2.66 per 100 people, with rates per 100 of 1.23 for females and 4.04 for males. Thus, the average gender offending gap is 2.81, or equivalently the female to male gap is -69.55 percent of the male baseline. The final column shows that the female share of violent-property crime is 22.73 percent. The figures clearly document a sizable gender gap in offending behaviour.

There are important gender differences in the types of crimes committed by men and women. This is made clear from looking at the broad criminal aggregates with the female offending rate much lower for violent crime than for property crime. This translates to the female offending rate being 74.05 percent lower than the male rate for violent crime, as compared to 69.51 percent lower for property crime. In terms of female share the percentages are 20.16 versus 22.84 percent respectively.

This, of course, masks more substantial gender differences for sub-components of the composite violent and property crime categories. The lower two panels of Table 2, show the disaggregated breakdown, for violent crime in panel B and property crime in panel C. They demonstrate in more detail that women participate much less in more serious crime categories. Indeed, for violent crime the gender gaps in offending rates are very high for the murder-manslaughter, sex crime and robbery categories and for property crime in the burglary and property damage groupings. All of these gender gaps are (in absolute terms) in excess of 84 percent. In the violent crime group, the assaults category has a smaller gap, which is still sizable, at -70.99 percent. Finally, in terms of gaps in offending rates, the narrowest gap is still large at -62.46 percent gap for theft. As the final column of the Table shows, these patterns can also be described in terms of female crime shares, which range from a low of 5 percent for sex crimes, up to 27 percent for theft.

3. Gender Convergence in Crime?

Changes in the Gender Gap

The focus now moves to the main research question of interest, namely to study changes in the gender gap over time. It is very clear that the gender criminality gap has narrowed through time. Figure 1 shows the temporal evolution of the offending rates of 15-24 year old males and females separately between 1995 and 2013. At least two things are evident from the Figure. As documented earlier, the offending rate for young males is considerably higher than that of females. But this gap has altered over time, as male offending rates have fallen, but female rates have not. This accords well with evidence reported by Estrada et al. (2016) for Sweden from the 1980s onwards demonstrating a big decline over time in male theft convictions to be a key factor in the falling gender crime gap.¹¹

¹¹ Interestingly, Estrada et al. (2016) motivate their study with long run data that shows the gender crime gap in Sweden started to decline from round about 1950. We were not able to assemble comparable long run crime data defined on a consistent basis for Queensland, nor for the whole of Australia to do the same. The only data we could measure from the 1950s to the present day was imprisonment data, where male and female imprisonment rates both rise, but female rates rise much faster from very low initial levels. In Queensland in 1955 female and male imprisonment rates were respectively 1.7 and 85.7 per 100,000 population; in 1975 they were 2.0 and 140.1; in 1995 they were 6.3 and 166.4; and by 2015 they had respectively reached 32.2 and 300.6

Similarly Costa's (2017) analysis of US crime trends from 1980 to 2015 by gender shows falling male arrest rates, and relatively stable female arrest rates.

The gender convergence underlying the two different time series profiles in Figure 1 is what we wish to better understand. Therefore, the analysis derives separate year by year estimates of the gender gap in the offending rates of young people in Queensland between 1995 and 2013. All the estimates are from linear probability models, with each cross-section specification controlling for a full set of age dummy variables.¹² Table 3 shows estimates for the start and end year, whilst each individual year estimate is plotted in Figure 2.¹³

The upper panel of Table 3 shows results for the violent and property crime composite, and the lower two panels for violent and property offences separately. Consider first the composite results - there is a very clear narrowing of the gender-offending gap through time. In 1995, the first year of our analysis, the gender gap was -3.057; by 2013, the final year of the study, the gap decreased to -2.148. Thus, we observe a strong narrowing of the gender gap in offending of 0.909, or a reduction of 29.7 percent relative to the 1995 gap.

The year-by-year estimates of gender crime differences shown in Figure 2 reveal an uneven narrowing over time, the gap is relatively constant from 1995 to 2003 with an (approximately) linear upward trend for the following decade. This amounts to strong evidence of gender crime convergence, especially in the period from the mid-2000s onwards.¹⁴

The lower panel of Table 3 presents estimates separately for violent and property crime. There is evidence of clear convergence by gender for both crime categories. Interestingly, the narrowing turns out to be larger for property (32.1 percent) than for violent offences (18.6 percent), over the 1995 to 2013 time period. The variation in these broad categories suggests it may be useful to

(Sources: Queensland Government, 1998, for 1955, 1975 and 1995 numbers and ABS, 2015, for the 2015 numbers).

¹² Estimated probit marginal effects were essentially identical to the reported linear probability estimates. Results are available from the authors upon request.

¹³ The full set of year-by-year estimates are in Appendix Table A1.

¹⁴ One point of note, to which we return later, is that the single biggest year of narrowing in the Figure is the jump that occurs between 2006 and 2007.

study convergence patterns within these groups, so next we move to consider patterns at a more disaggregated level.

More Detailed Crime Categories

Table 4 shows results on gender convergence for the various sub-components of violent and property composites. Violent crime is divided into murder attempted murder and manslaughter (the three categories being aggregated because of their very low incidence), sex offences, assault and robbery. Property crime is subdivided into theft, burglary and property damage. The Table shows the estimated gender offending rate gaps for the start and end years of 1995 and 2013 respectively, the absolute change and the percent narrowing over the period.

In terms of investigating the gender convergence hypothesis, the pattern of results is striking. Other than sex offences, the female-male gap converges for all crime sub-components. Interestingly, in the violent crime category, we observe quite sizable narrowing of the gap for some of the traditionally male crimes e.g. murder/attempted murder/manslaughter and assault. Convergence for robbery also occurs, as the change is numerically positive, but at 7.7 percent is far more modest in size and statistically indistinguishable from no change.

The pattern for property crime is more even. Strong gender convergence is seen for all three sub-components - theft, burglary and property damage - ranging between 24 and 37 percent depending on crime type. Thus, for the types of crime that the standard Becker (1968) model emphasises should be sensitive to economic incentives, namely property crimes, we see females increasing their crime share, despite an improvement in their economic opportunities through time.¹⁵

Differences for Juveniles and Adults

In the period under study, in Queensland the age cut-off for juveniles and adults in the criminal justice system was 17. Table 5 shows results separately for the juvenile (ages 15 and 16) and adult (age 17 to 24) groups. The Panel is structured as for Table 4, showing estimates for start and end

¹⁵ For evidence from Australia, see Kidd and Shannon (2002) on the evolution over time of the gender gaps in wages and Booth and Kee (2011) on women overtaking men in terms of university education.

year, the change between them and the percent narrowing. The left-hand side of the Table shows results for individuals aged less than 17 and the right-hand side for those aged 17 and over. Results are shown for both broad offence categories, in the upper panel, and for the more detailed sub-components, in the lower panel of the Table.

Consider first the broad categories; the results reported in the Table reveal that gender convergence occurred more rapidly for the juvenile group. Convergence is seen for all three crime groupings, at 47.7 percent for the violent or property composite category, 31.8 percent for violent and 49.3 percent for property offences. The rate of convergence is remarkable, reaching close to a halving of the gender gap between 1995 and 2013 for the property offence category. For adults, gender crime convergence is also evident, but occurring at a slower pace and, in terms of magnitudes, by roughly half that of the juvenile group.

The year on year trends are also informative. Figure 3 shows these for the composite violent or property offences for the juvenile and adult age groups separately. Two issues are self-evident. First, the existence of a larger narrowing of the gender-offending gap for the younger group. Second, there appears to be more narrowing in the second half of the time period.

Returning to Table 5, the more detailed offence breakdown in the lower panel of the Table mostly replicates the faster rate of convergence for juveniles. This is true for almost all crimes, except for the most serious crime category – the murder/manslaughter group – where gender convergence is greater for adults than juveniles (but, of course, involves a relatively small number of offences).

4. Factors Connected to Gender Crime Convergence

The administrative data studied to date provides great detail on the nature of offences but, like many data sources on crime, is very limited in terms of information on characteristics of individual offenders (other than containing the information on age and gender that we have already used). In this

section we move to a more aggregated analysis that permits consideration of additional variables matched to data on offending at the spatial district level over time.

Police District Level Analysis

The data utilised for the analysis in this section of the paper is publicly available from the Queensland Police Service on offender counts by police force district by gender and over time. We match these data at the spatial level to Census data from the Australian Bureau of Statistics (ABS, 2011).¹⁶ The data covers four Census years (2001, 2006, 2011 and 2016) matched to thirteen (aggregated) police force districts with offences broken down by gender. Thus the sample size is 104 (= 4 x 13 x 2).

The equation to be estimated has dependent variable crime rate C for gender group i in police force district d in year t:

$$C_{idt} = \alpha_d + \beta \text{Female}_i + \sum_{j=1}^J \gamma_j X_{jidt} + \alpha_t + v_{idt} \quad (1)$$

This specification includes a dummy variable for gender as well as a set of crime determinants X suggested by prior research: the share of the population enrolled in education, the share of Australian born individuals, average age of the population and the unemployment rate. The X variables vary by gender, police district and time. Equation (1) also includes a set of district fixed effects (α_d), year fixed effects (α_t), and v is an error term. The major focus is on the estimated coefficient on the gender dummy as well as the pattern of Census year coefficients which reveal the trend in crime.

Table 6 reports the results of estimating several variants of equation (1). The Table shows three specifications each for the composite violent and property offending rate, as well as separately by violent and property offending rates. The first specification includes only the Female dummy variable and the district and year fixed effects. The estimated coefficient on the Female dummy is

¹⁶ The QPS reported offender data is available at: <https://www.police.qld.gov.au/online/data/>. The Census data is extracted from the ABS website: <http://stat.data.abs.gov.au/>.

strongly negative in all cases, and of very similar magnitude to that estimated in the analysis of administrative data in the previous section of the paper.

The second specification interacts Female with the year dummies to show separate gender estimates for 2001, 2006, 2011 and 2016. A clear pattern of convergence appears for all crime types, with the period 2006 to 2011 showing rapid change, with the gap continuing to close (albeit at a slower rate) right up to 2016.

The third specification adds the X variables, both to see if their inclusion alters the pattern and to examine whether they are significant empirical factors associated with crime in their own right. There is a clear negative connection between education and crime in the panel data models that emerges for all three crime types.¹⁷ The native population measure (i.e. born in Australia) attracts a positive coefficient, which interestingly is significant only for violent crime.¹⁸ The average age and unemployment rate do not appear to have a significant association with crime.

Decomposition

We compute a standard Blinder-Oaxaca decomposition of the aggregate female-male crime rate using the above data.¹⁹ This decomposes the overall gender gap into two components. The first measures gender differences in the means of the independent variables (the endowment effect, or “Differences in Means” component) and so captures the influence of female-male differences in human capital characteristics and demographics. The second measures gender differences in the estimated coefficients (the coefficient effect, or “Differences in Coefficients” component). Formally, the decomposition involves estimates equation (1) separately by gender then decomposing the average offending gap between females and males in this way.

¹⁷ This, of course, is an empirical association with lower crime and not a causal effect, like that identified in various pieces of crime and education research (see, for example, Lochner and Moretti, 2004; Machin et al., 2011; Hjalmarsson et al., 2014; Bell et al., 2016).

¹⁸ This implies a negative connection between the immigrant share and crime. This finding is in line with most of the crime and immigration literature which typically fails to find evidence of an average link between immigration and crime (for examples of papers studying directly the connections between crime and immigration see Bell et al., 2013; Bianchi et al., 2012; and Mastrobuoni and Pinotti, 2015).

¹⁹ There is a very long established literature on these types of decomposition, with detail of the nuances and practicalities. For examples of up to date discussions see Fortin et al (2011).

Table 7 shows the decomposition results for the composite violent and property crime measure, as well as violent and property crime separately.²⁰ There is a consistent pattern across crime type, as the percentage of the gap attributable to differences in characteristics and coefficients are virtually identical. Thus approximately 60 percent of the female-male gap is attributable to differences in means between the genders, and the other 40 percent to differences in coefficients. Thus both components are important, with there being a slightly bigger contribution from differences in female-male characteristics.

It is possible to further break down these components to consider particular independent variables of interest. Of specific interest for gender crime convergence are the female/male differences in coefficients on the year fixed effects in the gender-specific estimates of equation (1). For the composite crime category, relative to the base year of 2001, the component for the year dummies is actually positive and sizable at 0.688. This generates magnitudes of gender crime convergence of the same order as we reported earlier in the paper.²¹ Under a counterfactual scenario where gender crime trends do not differ over time (i.e. when the year dummies component is zero), ceteris paribus, the gender gap would be larger (in absolute terms) at -3.603 (the actual change in the gender gap of -2.915 less 0.688), or 24 percent larger. Carrying out an equivalent counterfactual exercise for violent and property crime separately produced percent changes for violent and property crime of respectively 7 and 30 percent. This reiterates the finding from section 3 that gender crime convergence has been faster for property than for violent crime.

Crime Convergence in the 2006 to 2011 Sub-Period

One noticeable feature of the gender crime gap observed above is the accelerated pace of convergence between the 2006 and 2011 Census years. Also recall in the earlier analysis there was evidence of bigger reductions in the gender crime gap amongst younger people. The two results together are suggestive of a role for an impact of the Earning or Learning education reform enacted in

²⁰ The gender specific regression estimates of equation (1) are shown in Appendix Table A2.

²¹ The coefficients are reported in Table A2 of the Appendix, where the gender difference of 0.688 is calculated as the female/male differences in the coefficients on the 2006, 2011 and 2016 year dummies divided by 4 (the reference group dummy set to 0 is for 2001).

Queensland in 2006 to accounting for the more rapid convergence that took place in this time window.

The Earning or Learning reform of 2006 required that individuals aged 16 and 17 who previously could have left compulsory education at age 15 had to participate in some form of education, training or work. The reform's impact on crime has been studied in depth by Beaton et al. (2016), but it is interesting in the context of the current paper to explore whether the reform played a role in accelerated gender convergence seen in the mid to late 2000s. This would require the reform to have a greater impact on male vis a vis female offending, and thus speed up convergence. This is explored in Table 8 where Beaton et al.'s data and methodological approach (which focusses in on a narrow time window for relevant birth cohorts) is used to show separate estimates of the reform impact by gender for 15 to 21 year olds.²²

In the specification reported in Panel A of the Table, the impact of the education reform on the violent and property crime composite is negative and significant for both genders. However, in terms of rates, the male effect (-0.389) is more than double the corresponding female result (-0.140), showing the reform have been significantly more effective in reducing offending for males. Hence the reform substantially narrowed the female-male offender gap

The rest of the Table shows results that distinguish between violent and property crime, reported in Panels B and C respectively. There are important differences between the genders. The reform had less of an impact on violent than property crime, and there is no violent crime reducing impact for females. Property crime, on the other hand, is significantly reduced by the reform for both genders, although once again the male effect is more marked than that of the female.

These results are supportive of the notion that the reform played a role in the convergence of female-male crime over time. Clearly the reform significantly reduced male crime by more, and although property crimes were significantly reduced for females there was a smaller impact on female

²² The structure of the Beaton et al (2016) sample is matched to education data which begins only in 2002 and so older ages (from 21 up to 24) cannot be analysed as they are not present pre-reform.

criminal activity. Thus, the bigger crime reducing effect of education for males reinforced and acted to speed up the observed gender convergence in crime amongst young people in Queensland.

5. Conclusions

Study of rich administrative data on crime by gender reveals a strong convergence in offending rates by gender amongst young people in Queensland, Australia. Dependent on crime type, and on the age of individuals, we show there has been a significant narrowing of the gender offending gap over the last two decades. The reduction in the gender gap is larger for juveniles and, in particular, for property crime. Amongst violent crimes, there is evidence of substantial narrowing of the gender gap in assaults for juveniles.

The significant closing of the gender gap in crime is further confirmed by an aggregate analysis at district level over time, where not only is crime convergence observed, but also linked to different trends in the socio-economic characteristics of men and women. Education, in particular, seems to be an important factor in explaining cross-time and cross-gender changes. This emerges both in terms of longer run shifts, as well as rapid gender crime convergence over the period 2006 to 2011 time period. This coincides with the introduction of Queensland's Earning or Learning reform which reduced offending by more for male youth (because of their lower education levels before the reform was enacted) vis a vis females.

It should be noted that the Becker's (1968) economic model of crime predicts, *ceteris paribus*, that improved economic opportunities should reduce crime. This raises a possible conundrum since gender crime convergence occurred over a time with well-documented female progress in economic and social status. One possibility, raised by Gavrilova and Campaniello (2015) in their interesting study of US gender crime differences, is that rather than changing incentives it is the other side of the Becker model which focusses on criminal earnings opportunities – the return to crime - that matters here. They postulate that returns to crime may explain the level of crime by gender (although not its temporal evolution) and that females tend to sort into less lucrative crime groupings

than men. This notion has some credence in our context, where we see a faster narrowing of the offending gap for the least serious crimes we study, with the gender gap in theft in particular narrowing the fastest. However, the fact that we see gender gaps narrowing for almost all crime categories suggests that moves towards greater gender equality have played a role in the relative rise in female crime.

There are several key areas to pursue in future work by economists studying gender patterns of criminality. One is to better understand the factors driving crime convergence. To the extent that we can with the available data, we have made a start at looking at the roles of gender, education, labour force status and demographics as factors associated with gender crime convergence, but more work is evidently needed. A second area of research, which has been studied in the criminology area, is the extent to which males and females may be treated differently at different stages of the criminal justice system.²³ Finally, economic theory is well behind other social science disciplines in developing candidate explanations for gender engagement in crime, and whether men and women are effectively perfect substitutes as potential criminals or whether behavioral and cultural differences mean they are not. Development of work in this area would be useful in developing empirical predictions that can help generate a better understanding of the factors driving the kinds of gender crime gaps, and their movement over time, that we have reported in this paper.

²³ See, for example, the discussion in Kempf-Leonard (2012) with particular reference to female juveniles.

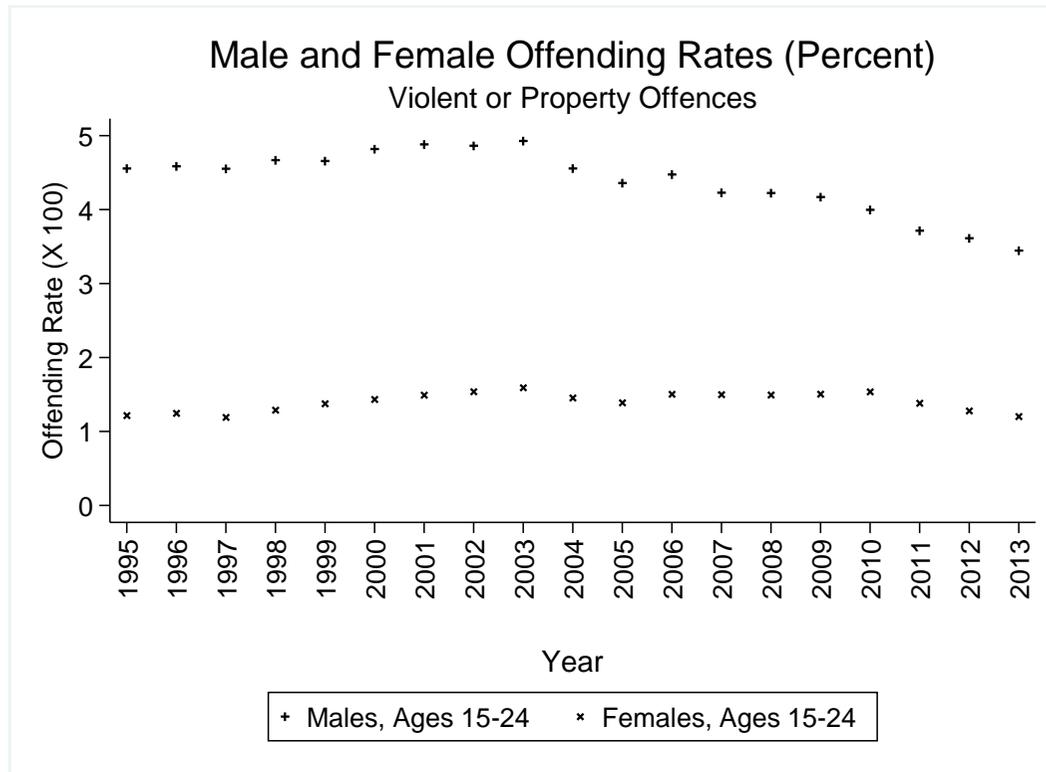
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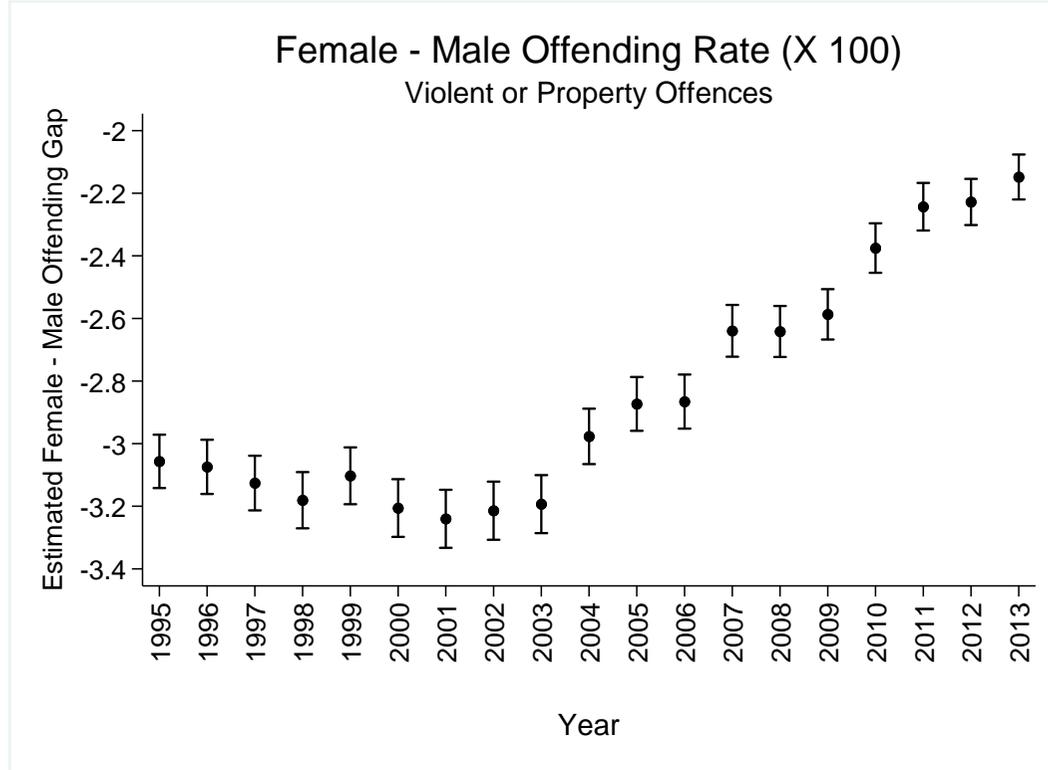
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Figure 1: Female and Male Offending Rates, Ages 15 to 24, 1995 to 2013



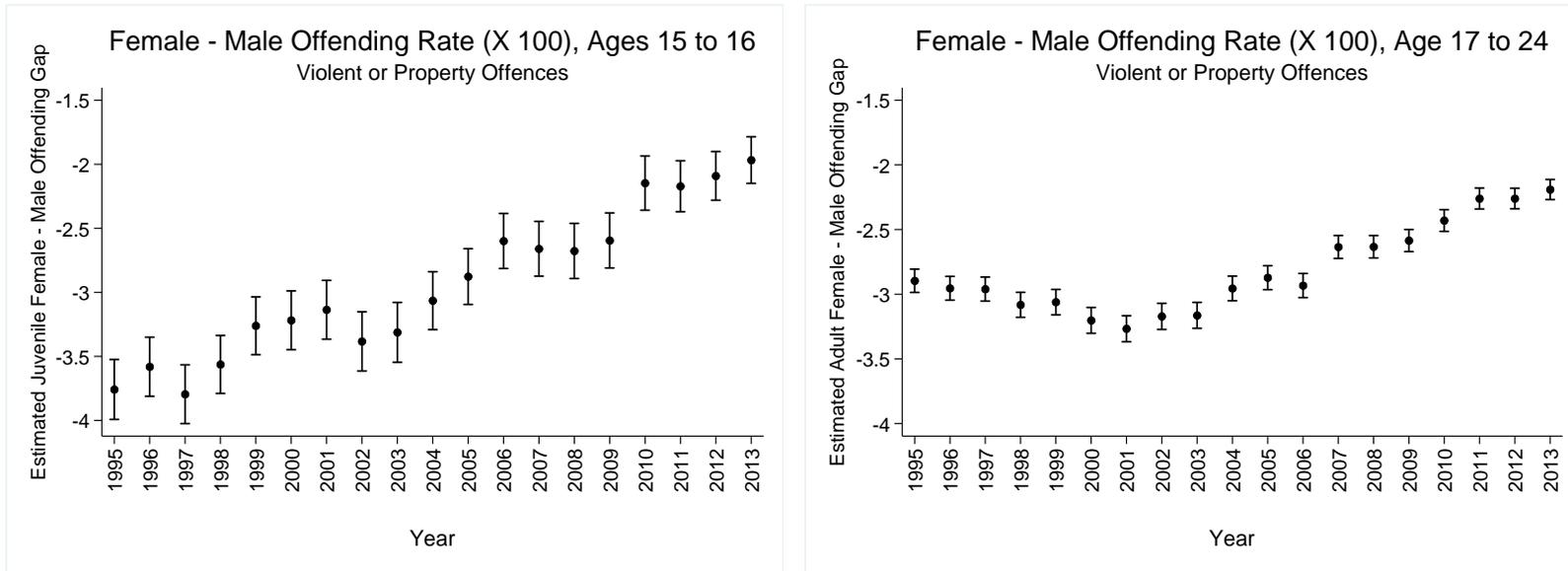
Notes: Calculated from QPS administrative data.

Figure 2: Female/Male Offending Gaps, Ages 15 to 24, 1995 to 2013



Notes: Based on regression coefficients (and standard errors) from Table 3 and Table A1. 95% confidence interval reported.

Figure 3: Juvenile and Adult Female/Male Offending Gaps, 1995 to 2013



Notes: Based on regression coefficients (and standard errors) for 1995 and 2013 from Table 4 and additional estimates calculated for all years in between. 95% confidence interval reported.

Table 1: Imprisonment Rates and Female Shares in Three Selected Countries

| | Australia | Sweden | United States |
|--|-----------|--------|---------------|
| Imprisonment rate (per 100,000 population) | 162 | 53 | 693 |
| Female share (percent) | 8.0 | 5.8 | 9.7 |

Notes: From World Prison Brief, <http://www.prisonstudies.org/>. The years the numbers correspond to for each country are: Australia – 2016; Sweden – 2016; United States – 2014.

Table 2: Male and Female Offending Rates in Queensland, Ages 15 to 24, 1995 to 2013

| | Offending Rates (X 100) | | | Gender Gap | | Gender Share (X 100) |
|--|-------------------------|---------|-------|-------------------|---------------------------|----------------------|
| | All | Females | Males | Female - Male Gap | Female - Male Percent Gap | Female Share |
| A. Broad Offence Types | | | | | | |
| Violent or Property | 2.66 | 1.23 | 4.04 | -2.81 | -69.55 | 22.73 |
| Violent | 0.83 | 0.34 | 1.31 | -0.97 | -74.05 | 20.16 |
| Property | 2.16 | 1.00 | 3.28 | -2.28 | -69.51 | 22.84 |
| B. Violent Offences | | | | | | |
| Murder or Attempted Murder or Manslaughter | 0.01 | 0.00 | 0.02 | -0.02 | -85.36 | 12.77 |
| Sex | 0.08 | 0.01 | 0.15 | -0.14 | -94.73 | 5.13 |
| Assault | 0.68 | 0.31 | 1.04 | -0.73 | -70.99 | 22.49 |
| Robbery | 0.10 | 0.03 | 0.17 | -0.14 | -84.30 | 13.57 |
| C. Property Offences | | | | | | |
| Theft | 1.51 | 0.84 | 2.16 | -1.32 | -62.46 | 27.29 |
| Burglary | 0.61 | 0.14 | 1.06 | -0.92 | -86.95 | 11.54 |
| Property Damage | 0.77 | 0.20 | 1.31 | -0.91 | -85.53 | 12.64 |

Notes: Calculated from the resident population of 15 to 24 year olds in Queensland between 1995 and 2013.

Table 3: Gender Offending Gaps in 1995 and 2013

| | Female - Male Offending Gaps (X 100) | | | |
|-------------------------------|--------------------------------------|----------------|---------------------------------|-------------------|
| | 1995 | 2013 | Change Between 1995 and 2013 | Percent Narrowing |
| A. Violent or Property | | | | |
| Female | -3.057 (0.044) | -2.148 (0.037) | 0.909 (0.056) | 29.72 |
| Age Effects | Yes | Yes | | |
| Sample Size | 503916 | 640270 | | |
| B. Violent | | | | |
| Female | -0.983 (0.024) | -0.800 (0.022) | 0.183 (0.033) | 18.60 |
| Age Effects | Yes | Yes | | |
| Sample Size | 503916 | 640270 | | |
| C. Property | | | | |
| Female | -2.485 (0.040) | -1.687 (0.032) | 0.798 (0.051) | 32.11 |
| Age Effects | Yes | Yes | | |
| Sample Size | 503916 | 640270 | | |

Notes: Age effects refers to a full set of age dummies. Standard errors in parentheses.

Table 4: Gender Offending Gaps, 1995 to 2013, Detailed Offence Types

| Detailed Offence Type | 1995 Gender Gap | 2013 Gender Gap | Change Between 1995 and 2013 | Percent Narrowing |
|---|-----------------|-----------------|------------------------------|-------------------|
| A. Violent | | | | |
| Murder or Attempted Murder or Manslaughter (Gap X 1000) | -0.170 (0.032) | -0.079 (0.020) | 0.091 (0.036) | 53.59 |
| Sex (Gap X 1000) | -0.916 (0.061) | -1.623 (0.081) | -0.708 (0.106) | Widens |
| Assault | -0.829 (0.022) | -0.552 (0.019) | 0.278 (0.030) | 33.48 |
| Robbery | -0.128 (0.008) | -0.119 (0.008) | 0.009 (0.011) | 7.70 |
| B. Property | | | | |
| Theft | -1.561 (0.034) | -0.984 (0.027) | 0.577 (0.043) | 36.96 |
| Burglary | -0.908 (0.021) | -0.646 (0.017) | 0.265 (0.027) | 28.90 |
| Property Damage | -1.075 (0.023) | -0.813 (0.019) | 0.261 (0.031) | 24.29 |
| Sample Size | 503916 | 640270 | | |

Notes: As for Table 3.

Table 5: Juvenile and Adult Gender Offending Gaps, 1995 to 2013

| | Juvenile Gender Offending Gaps | | | | Adult Gender Offending Gaps | | | |
|---|--------------------------------|-----------------|------------------------------|-------------------|-----------------------------|-----------------|------------------------------|-------------------|
| | 1995 Gender Gap | 2013 Gender Gap | Change Between 1995 and 2013 | Percent Narrowing | 1995 Gender Gap | 2013 Gender Gap | Change Between 1995 and 2013 | Percent Narrowing |
| A. Broad Offence Types | | | | | | | | |
| Violent or Property | -3.758 (0.119) | -1.967 (0.093) | 1.791 (0.148) | 47.65 | -2.896 (0.046) | -2.190 (0.040) | 0.706 (0.060) | 24.37 |
| Violent | -0.778 (0.056) | -0.531 (0.054) | 0.247 (0.079) | 31.77 | -1.031 (0.027) | -0.864 (0.024) | 0.167 (0.035) | 16.19 |
| Property | -3.396 (0.113) | -1.721 (0.084) | 1.674 (0.138) | 49.31 | -2.277 (0.041) | -1.679 (0.034) | 0.597 (0.054) | 26.24 |
| B. Detailed Offence Types | | | | | | | | |
| Murder or Attempted Murder or Manslaughter (Gap X 1000) | 0.000 (0.043) | 0.017 (0.029) | -0.015 (0.050) | Widens | -0.210 (0.038) | -0.102 (0.023) | 0.108 (0.043) | 51.58 |
| Sex (Gap X 1000) | -1.118 (0.159) | -2.609 (0.275) | -1.490 (0.342) | Widens | -0.869 (0.066) | -1.393 (0.077) | -0.524 (0.104) | Widens |
| Assault | -0.628 (0.052) | -0.211 (0.044) | 0.417 (0.068) | 66.39 | -0.876 (0.025) | -0.631 (0.022) | 0.244 (0.033) | 27.89 |
| Robbery | -0.130 (0.022) | -0.082 (0.021) | 0.048 (0.030) | 36.93 | -0.128 (0.009) | -0.127 (0.008) | 0.001 (0.012) | 0.75 |
| Theft | -2.347 (0.100) | -1.070 (0.073) | 1.277 (0.121) | 54.42 | -1.381 (0.034) | -0.964 (0.028) | 0.417 (0.045) | 30.20 |
| Burglary | -1.501 (0.064) | -0.964 (0.050) | 0.537 (0.081) | 35.80 | -0.772 (0.021) | -0.571 (0.017) | 0.201 (0.027) | 26.03 |
| Property Damage | -1.332 (0.063) | -0.943 (0.053) | 0.390 (0.082) | 29.25 | -1.015 (0.025) | -0.783 (0.020) | 0.232 (0.032) | 22.87 |
| Sample Size | 93891 | 121332 | | | 410025 | 518938 | | |

Notes: As for Table 3.

Table 6: Police District Level Crime Regressions

| Offending Rate (X 100), 13 Police Districts By Gender, Census Years 2001, 2006, 2011, 2016 | | | | | | | | | | |
|--|----------------------|----------------|----------------|-------|----------------|----------------|-------|----------------|----------------|-----|
| | Violent and Property | | | | Violent | | | | Property | |
| Female | -2.901 (0.140) | | | | -1.021 (0.050) | | | | -1.880 (0.108) | |
| Female X 2001 | | -3.585 (0.282) | -3.828 (0.309) | | -1.198 (0.105) | -1.286 (0.117) | | -2.387 (0.193) | -2.542 (0.212) | |
| Female X 2006 | | -3.441 (0.266) | -3.663 (0.300) | | -1.158 (0.099) | -1.237 (0.113) | | -2.282 (0.182) | -2.426 (0.206) | |
| Female X 2011 | | -2.433 (0.252) | -2.624 (0.282) | | -0.938 (0.090) | -0.916 (0.106) | | -1.587 (0.172) | -1.707 (0.193) | |
| Female X 2016 | | -2.384 (0.242) | -2.394 (0.293) | | -0.846 (0.094) | -0.916 (0.111) | | -1.446 (0.165) | -1.478 (0.201) | |
| Share In Education (X 100) | | | -0.235 (0.079) | | | -0.078 (0.030) | | | -0.157 (0.054) | |
| Share Australian (X 100) | | | 0.127 (0.080) | | | 0.068 (0.030) | | | 0.060 (0.055) | |
| Average Age | | | 0.171 (0.128) | | | 0.033 (0.048) | | | 0.137 (0.087) | |
| Unemployment Rate (X 100) | | | -0.026 (0.053) | | | -0.016 (0.020) | | | -0.009 (0.036) | |
| District Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Male Mean of Dependent Variable | 3.963 | 3.963 | 3.963 | 1.385 | 1.385 | 1.385 | 2.578 | 2.578 | 2.578 | |
| Sample Size | 104 | 104 | 104 | 104 | 104 | 104 | 104 | 104 | 104 | |

Notes: Standard errors in parentheses. The right hand side variables are all gender-specific. Regressions weighted by population.

Table 7: Blinder-Oaxaca Decompositions

| | Violent and Property | Violent | Property |
|--|----------------------|----------------|----------------|
| Male Mean Offending Rate | 3.963 | 1.385 | 2.578 |
| Female Mean Offending Rate | 1.047 | 0.357 | 0.691 |
| Female – Male Difference | -2.915 | -1.028 | -1.887 |
| Differences in Means (Percent) | -1.759 (60) | -0.627 (61) | -1.140 (60) |
| Differences in Coefficients (Percent) | -1.156 (40) | -0.401 (39) | -0.747 (40) |

Notes: The separate female and male regressions from which these are calculated are reported in Appendix Table A2. For female (f) and male (m) crime regressions with independent variables Z of the form $C^f = \theta^f Z^f + u^f$ and $C^m = \theta^m Z^m + u^m$ the decomposition is $\Delta C = \bar{C}^f - \bar{C}^m = (\bar{Z}^f - \bar{Z}^m)\hat{\theta}^f + (\hat{\theta}^f - \hat{\theta}^m)\bar{Z}^m$, where a bar denotes a mean and a hat a coefficient estimate. The first term $(\bar{Z}^f - \bar{Z}^m)\hat{\theta}^f$ is termed the Differences in Means component and the second term the Differences in Coefficients component in the Table.

Table 8: Gender Differences in Offending and Queensland's Earning or Learning Reform

| Birth Cohorts 1987 to 1992, Ages 15-21, Years 2002 to 2013 | | | |
|--|----------------|----------------|------------------------------|
| | Females | Males | Female - Male Differences |
| | Crime X 100 | Crime X 100 | Crime X 100 |
| | Reduced Form | Reduced Form | Reduced Form |
| A. Violent or Property Offences | | | |
| Earning or Learning Reform | -0.140 (0.065) | -0.389 (0.120) | 0.249 (0.118) |
| B. Violent Offences | | | |
| Earning or Learning Reform | -0.027 (0.031) | -0.122 (0.060) | 0.095 (0.068) |
| C. Property Offences | | | |
| Earning or Learning Reform | -0.102 (0.058) | -0.323 (0.107) | 0.222 (0.102) |
| Age Dummies | Yes | Yes | |
| Year Dummies | Yes | Yes | |
| Number of Individuals | 147079 | 151709 | |
| Sample Size | 1029143 | 1061494 | |

Notes: Samples as used in Beaton et al. (2016). Standard errors clustered by individual in parentheses.

Appendix

Table A1: Gender Offending Gaps Over Time, 1995 to 2013

| | | Female - Male Offending Gaps (X 100) | | | | | | | | | | | | | | | | | | |
|--|-----|--------------------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|---------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| | | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
| A. Violent or Property | | | | | | | | | | | | | | | | | | | | |
| Female | | -3.057 (0.044) | -3.074 (0.044) | -3.126 (0.045) | -3.181 (0.046) | -3.103 (0.046) | -3.206 (0.047) | -3.240 (0.047) | -3.214 (0.047) | -3.193 (0.047) | -2.977 (0.045) | -2.873 (0.044) | -2.866 (0.044) | -2.640 (0.042) | -2.642 (0.042) | -2.587 (0.041) | -2.375 (0.040) | -2.243 (0.039) | -2.228 (0.038) | -2.148 (0.037) |
| Age Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Sample Size | | 503916 | 501965 | 496222 | 492839 | 491896 | 494054 | 500770 | 511181 | 523324 | 536466 | 550616 | 564584 | 580304 | 596239 | 613332 | 620641 | 624631 | 632878 | 640270 |
| Change Between 1995 and 2013 = 0.909 (0.056) | | | | | | | | | | | | Percent Narrowing = 29.72 | | | | | | | | |
| B. Violent | | | | | | | | | | | | | | | | | | | | |
| Female | | -0.983 (0.024) | -0.965 (0.024) | -0.973 (0.025) | -0.967 (0.027) | -0.961 (0.025) | -1.009 (0.025) | -1.022 (0.026) | -1.018 (0.026) | -1.045 (0.026) | -1.045 (0.025) | -1.024 (0.025) | -1.072 (0.026) | -0.975 (0.024) | -0.959 (0.024) | -0.987 (0.023) | -0.881 (0.023) | -0.876 (0.023) | -0.831 (0.022) | -0.800 (0.022) |
| Age Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Sample Size | | 503916 | 501965 | 496222 | 492839 | 491896 | 494054 | 500770 | 511181 | 523324 | 536466 | 550616 | 564584 | 580304 | 596239 | 613332 | 620641 | 624631 | 632878 | 640270 |
| Change Between 1995 and 2013 = 0.183 (0.033) | | | | | | | | | | | | Percent Narrowing = 18.60 | | | | | | | | |
| C. Property | | | | | | | | | | | | | | | | | | | | |
| Female | | -2.485 (0.040) | -2.552 (0.040) | -2.604 (0.041) | -2.676 (0.042) | -2.597 (0.042) | -2.649 (0.043) | -2.704 (0.043) | -2.659 (0.043) | -2.644 (0.043) | -2.385 (0.041) | -2.279 (0.040) | -2.273 (0.039) | -2.057 (0.038) | -2.063 (0.037) | -1.995 (0.037) | -1.882 (0.036) | -1.754 (0.035) | -1.767 (0.034) | -1.687 (0.032) |
| Age Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Sample Size | | 503916 | 501965 | 496222 | 492839 | 491896 | 494054 | 500770 | 511181 | 523324 | 536466 | 550616 | 564584 | 580304 | 596239 | 613332 | 620641 | 624631 | 632878 | 640270 |
| Change Between 1995 and 2013 = 0.798 (0.051) | | | | | | | | | | | | Percent Narrowing = 32.11 | | | | | | | | |

Notes: Age effects refers to a full set of age dummies. Standard errors clustered by individual in parentheses.

Table A2: Gender Specific Police District Level Crime Regressions

| | Offending Rate (X 100), 13 Police Districts By Gender, Census Years 2001, 2006, 2011, 2016 | | | | | |
|----------------------------|--|----------------|----------------|----------------|----------------|----------------|
| | Violent and Property | | Violent | | Property | |
| | Females | Males | Females | Males | Females | Males |
| Share In Education (X 100) | -0.031 (0.023) | -0.141 (0.077) | -0.022 (0.011) | -0.018 (0.037) | -0.009 (0.018) | -0.123 (0.061) |
| Share Australian (X 100) | 0.009 (0.023) | 0.051 (0.072) | 0.020 (0.011) | 0.037 (0.035) | -0.011 (0.018) | 0.013 (0.057) |
| Average Age | 0.022 (0.036) | 0.143 (0.130) | -0.021 (0.017) | -0.027 (0.062) | 0.042 (0.028) | 0.173 (0.102) |
| Unemployment Rate (X 100) | 0.027 (0.015) | -0.045 (0.045) | 0.001 (0.007) | -0.022 (0.022) | 0.026 (0.011) | -0.023 (0.036) |
| Year = 2006 | 0.212 (0.139) | 0.025 (0.493) | 0.227 (0.067) | 0.165 (0.236) | -0.015 (0.108) | -0.140 (0.389) |
| Year = 2011 | 0.024 (0.169) | -1.245 (0.544) | 0.192 (0.081) | -0.106 (0.262) | -0.168 (0.131) | -1.139 (0.429) |
| Year = 2016 | 0.078 (0.265) | -1.218 (0.727) | 0.276 (0.127) | 0.124 (0.349) | -0.197 (0.206) | -1.342 (0.574) |
| District Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Mean of Dependent Variable | 1.047 | 3.963 | 0.357 | 1.385 | 0.691 | 2.578 |
| Sample Size | 52 | 52 | 52 | 52 | 52 | 52 |

Notes: Standard errors in parentheses. The right hand side variables are all gender-specific. Regressions weighted by population.