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MEN. ROOTS AND CONSEQUENCES OF MASCULINITY NORMS

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Men. Roots and Consequences of Masculinity Norms

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Abstract

Recent research has uncovered the historical roots of gender norms about women and the persistent effect of such norms on economic development. We find similar long-term effects of masculinity norms: beliefs about the proper conduct of men. We exploit a natural historical experiment in which convict transportation in the 18th and 19th century created a variegated spatial pattern of sex ratios across Australia. We show that in areas that were heavily male-biased in the past (though not the present) more Australians recently voted against same-sex marriage, an institution at odds with traditional masculinity norms. Survey data show that this voting pattern is mostly driven by men. Further evidence indicates that these historically male-biased areas also remain characterized by more violence, excessive alcohol consumption, and occupational gender segregation. We interpret these behaviors as manifestations of masculinity norms that emerged due to intense local male-male competition and that persisted over time.

JEL Classification Codes: I31, J12, J16, N37, Z13
Keywords: Masculinity, sex ratio, natural experiment, cultural persistence, same-sex marriage

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1 Introduction

What makes a real man? Certain traditional stereotypes suggest that men ought to be assertive, to the point of being aggressive, and should suppress their emotions ('to man up'). Several current debates illustrate how such entrenched masculinity norms can profoundly impact social, economic, and political outcomes. All these debates focus on so-called 'toxic' masculinity norms that are either harmful to men themselves (for instance due to violence, alcohol abuse, or homophobia) or to others (for instance due to misogyny).

A first debate concerns the fact that in many countries men consistently display worse health outcomes than women and die significantly younger (GBD, 2010; Baker et al., 2014). Recent evidence indicates that masculinity norms – especially a penchant for risk taking and excessive alcohol consumption – are an important cultural driver of this gender health gap (World Health Organization , WHO; Schanzenbach, Nunn and Bauer, 2016).[1] A second debate relates to masculinity norms and occupational gender segregation. Technological progress and globalization have disproportionately affected male employment (Autor, Dorn and Hanson, 2018). Many newly unemployed men refuse to fill jobs that do not match their self-perceived gender identity (Akerlof and Kranton, 2000; Katz, 2014). Instead, they remain unemployed or leave the labor force (Autor, Dorn and Hanson, 2018). Third, masculinity norms have become integral to debates about the rise of populism. Progressive cultural change and the socio-economic enfranchisement of women, as well as of sexual and ethnic minorities, have eroded the position of white heterosexual men in Western society (Inglehart and Norris, 2016). Men who adhere to conservative masculinity norms can respond to these societal shifts by supporting populist politicians, who exploit sentiments of aggrieved entitlement (Kimmel, 2013), or by voting against out-groups during referendums.[2]

The extent to which 'manly' behavior is expected of men differs across societies, cultures, and over time (Traister (2000)). This raises the question: Where do norms about masculinity come from? And what purpose do they serve? In this paper, we suggest that masculinity norms can originate in specific historical circumstances that affect the relative return of the behavior and identity associated with 'toxic masculinity'. These norms can then persist over time, even when the circumstances that gave rise to them change. We focus on a primary driver of male-male competition: the number of males relative to the number of females. We study how variation in this sex ratio has given rise to systematic differences in the manifestation of toxic masculine behavior, such as violence and risk taking, and the manifestation of a traditional masculine identity, such as opposing the rights of sexual minorities and shunning certain 'female' occupations. We thereby provide the first empirical evidence that masculinity norms manifest themselves in the labor market through occupational gender segregation, which we measure by the share of men employed in stereotypically female occupations.

[1] Relatedly, Case and Deaton (2015) point to a reduced life expectancy among middle-aged white Americans between 1999 and 2013 due to drug abuse, alcohol poisoning, chronic liver disease, cirrhosis, and suicide.

[2] Several recent papers show how import competition and competitive pressures in the labor market have contributed to the rise of populism in Western countries (Dippel, Gold and Heblich, 2015; Algan et al., 2017; Dustmann et al., 2017; Colantone and Stanig, 2018). Often, economic conditions feed back into the 'masculinity crisis', such as when disappearing manufacturing jobs erode the value of (young) men in the marriage market, contributing to their worsening health (Autor, Dorn and Hanson, 2018) and to political radicalization (Autor et al., 2017).

While the sex ratio is recognized by evolutionary biologists as a fundamental driver of male-male competition, this ratio itself is often influenced by environmental conditions which may also affect behavior.[3] Among humans, variation in the sex ratio can reflect sex-selective abortion or the neglect of girls (Hesketh and Xing (2006)), a different cultural and economic value placed upon women (Qian (2008); Carranza (2014); Xue (2016)), or sex-selective migration (Angrist (2002)). All of these can have direct effects on outcomes of interest.

To avoid such confounding factors, we exploit a natural experiment – the convict colonization of Australia – which imposed a variegated spatial pattern in sex ratios. This in turn led to local variation in male-to-male competition in an otherwise homogeneous environmental, cultural and institutional setting. Between 1787 and 1868, Britain transported 133,000 convict men but only 25,000 convict women to Australia. Voluntary migration, which was very limited until the discovery of gold in the 1850s, was heavily male-biased as well. Convicts were not confined to prisons but allocated across different areas, in a highly centralized manner.

We argue that the resulting quasi-exogenous pattern of local male-to-male competition shaped masculinity norms, which persist in today's Australia. We test this idea by combining data on historical sex ratios, using data from 91 historical counties from Australian colonial censuses compiled by Grosjean and Khattar (2018, henceforth GK), with various proxies for present-day masculinity norms. Our main proxy of the political manifestation of masculine identity is opposition against same-sex marriage, which we measure using postal-area voting records from the 2017 nation-wide referendum on same-sex marriage. We also analyze detailed information on the social and economic manifestations of masculinity norms such as violent behavior, crime, excessive drinking, and occupational choice.

Our results paint a consistent picture of how skewed sex ratios instilled masculinity norms that have persisted to this day and still deeply influence the political, social, and economic landscape. By way of preview, we find that in areas that were more male-biased in the past (though not the present), fewer Australians support same-sex marriage today. A one standard deviation increase in the historical sex ratio is associated with a 3 percentage point decrease in the probability of voting "yes" in the 2017 referendum. Accounting for historical factors explains 8.8 percent of the variation in the "yes" vote that is unexplained by a wide range of socio-demographic and economic factors, including religious background, unemployment, urbanization, and the present-day sex ratio. Moreover, additional data from a nationally representative household survey, the Household, Income and Labor Dynamics in Australia survey (HILDA), indicate that these results are primarily driven by men. We also find that areas that were heavily male-biased in the past remain characterized by more violent behavior and excessive alcohol consumption today. For example, a one standard deviation increase in historical sex ratio is associated with a 15 percent increase in incidents of assault, and a 10 percent increase in incidents of sexual assaults. Finally, we find that historical circumstances explain 31 percent of the variation in *male* employment in stereotypically *male* occupations, and 7 percent of the variation in *male* employment in stereotypically *female* occupations, which are left unexplained by a wide range of present-day characteristics, including the overall share of employment in those occupations at a very granular (postcode) level.

[3] See Bachtrog et al. (2014) for a review.

To gain a deeper understanding of our results, we consider several alternative explanations. These include differences in legislation across Australia today, initial differences across areas with high or low sex ratios, self-selection of migrants to different areas, or the persistence of criminal and violent behavior, temperament, or even genes[4] of initial convicts themselves. Different states in Australia vary in their criminal legislation and in legislation that affects sexual minorities, and they differed in whether they harbored convicts historically. Our results include state fixed effects throughout to account for the influence of such time-invariant state characteristics. In addition, we check that historical sex ratios were not systematically different as a function of environmental, cultural, or economic characteristics. Even then, our results are robust to controlling for initial circumstances, such as geographic characteristics and economic specialization, which may have influenced prevailing sex ratios and may still influence outcomes of interest. We also control for a wide range of present-day postal-area characteristics – including the share of different religious groups and the present-day sex ratio.

Nevertheless, variation in historical sex ratios could reflect unobservable characteristics that varied within states. Male and female migrants to Australia could have sorted across geographic areas based on unobservable taste characteristics that are related to our outcomes of interest. For example, fewer female migrants may have chosen to settle where men were more violent or more opposed to sexual minorities. To tackle this issue, we instrument the population sex ratio by the ratio among convicts only. The rationale for this instrumentation strategy is two-fold. First, the instrument is highly relevant since most of the white Australian population initially consisted of convicts and, in the historical period we consider, convicts represented a large part of the population. Second, convicts were not free to move: a centralized assignment scheme determined their location as a function of labor needs, which we proxy by initial economic specialization. This circumvents the possibility that our results are driven by self-selection across different areas of Australia. An immediate concern, however, is that convicts were different from the rest of the population in ways that are correlated with our outcomes of interest; in particular that convicts were more prone to violence, crime, risk taking, and, perhaps, homophobia; and that the persistence of this convict 'stain' is what we observe today.[5] Historical evidence argues against such a mechanism. As we describe in the historical background section, convicts transported to Australia were not "hardened and professional criminals" ((Nicholas, 1988, p. 3)) but rather "ordinary working-class men and women" ((Nicholas, 1988, p. 7)). The majority was transported for a first offense, usually a minor property offense, such as petty theft (Oxley (1996)). Nevertheless, we control for the number of convicts throughout our IV specifications.

Our results allow us to contribute to several strands of the literature. First and foremost, we provide a new perspective on the causes and consequences of gender norms. Recent work has explored the historical origins – differences in technology (Alesina, Giuliano and Nunn (2013); Xue (2016)), soil structure (Carranza (2014)), political institutions (Lippmann, Georgieff and Senik (2016)) or, as in this study, historical sex ratios (GK) – of gender norms about women.

[4] Tiihonen et al. (2015) identify a gene and a genotype associated with extremely violent behaviour – although not crime in general – in a Finnish population.

[5] The fear of the so-called 'convict stain' began with the anti-transportationist movement in the mid-1850s (Holdridge (2015)).

Related work assesses the implications of the resulting female identity for household formation and female work choices (Bertrand, Kamenica and Pan (2015)). In contrast, this paper deals with the origin and manifestation of persistent norms about men.[6] Moreover, the mechanism though which historical circumstances affect gender norms, according to most of the existing literature, consists of their effects on male-female bargaining. We focus instead on a different, and novel, mechanism: within-sex competition.

We also uncover new dimensions of normative gender identity, in particular crime and violence. Our results thereby contribute to a broader literature on the economic role of norms and identity (Akerlof and Kranton (2000)) and stereotypes (Bordalo et al. (2016)) as well as to the literature on crime and violent behavior. Several studies highlight the role of perceived threats to one's honor or reputation (Nisbett and Cohen (1996); Grosjean (2014)), or masculinity (Wilson and Daly (1985)) as central drivers of violent behavior. We suggest that concerns with one's status or masculinity are heightened in more competitive environments. We focus here on competition in the marriage market, but we believe that our reasoning extends more broadly to other dimensions of competition.[7] Last, but not least, we provide some empirical evidence on a hotly debated topic in recent years: the role of masculine identity in occupational choice. This has been hypothesized as an important factor contributing to stubborn male unemployment despite service sector jobs being more plentiful though in large part stereotypically female (Katz (2014)).[8]

Second, we add to the literature on the consequences of skewed sex ratios. Increased male competition for scarce female partners has been shown to correlate with violent crime in general (Hesketh and Xing (2006); Edlund et al. (2013); Cameron, Meng and Zhang (2017)) and molestation and rape in particular (Ullman and Fidell (1989)). Although most papers find a positive association between male-biased sex ratios and crime and violence, others document a negative relationship (Schacht, Tharp and Smith (2016)). A possible reason for such ambiguous results is that the variation in sex ratios exploited in these papers results from sex-selective abortion or sex-skewed mortality, themselves endogenous cultural outcomes (Qian (2008); Almond and Mazumder (2011); Carranza (2014); Xue (2016)), or from incarceration of the (mostly) male population (Schacht, Tharp and Smith (2016)), an endogenous confound. In contrast, we rely on a unique natural experiment that generated quasi-random variation in the sex ratio. Our results confirm the existence of a positive relationship between sex ratios and crime. More broadly, we suggest a novel mechanism, the role of masculinity norms, which underlies this relationship.

Third, we contribute to the emerging literature on the determinants of support for the enfranchisement of minorities, such as same-sex relationship recognition. Most studies have so far concentrated on the individual correlates of attitudes towards sexual minorities, highlight-

[6] As such, our findings are consistent with a large literature that highlights how cultural norms originate in critical junctures in history (Nunn and Wantchekon (2011); Grosfeld, Rodnyansky and Zhuravskaya (2013)), how founder populations leave particularly resilient and persistent identities (Grosjean (2014); Bazzi, Fiszbein and Gebresilasse (2018)) and how cultural evolution is characterized by strong hysteresis (Bisin and Verdier (2001); Doepke and Zilibotti (2008); Fernández (2013))

[7] Recent work shows how competition in the labor market feeds back into marriage market competition by affecting the eligibility of males in the marriage market (Autor, Dorn and Hanson (2018)).

[8] See https://www.nytimes.com/2017/01/04/upshot/why-men-dont-want-the-jobs-done-mostly-by-women.html

ing the role of one's gender, with more negative attitudes among men (Kite (1984)); education and rural residence (Stephan and McMullin (1982); Lottes and Kuriloff (1994); Herek and Capitanio (1996)); and age and religion (Inglehart (1990); Edwards (2007)).[9] Our contribution is to uncover historical roots of cultural attitudes towards homosexuality. In that respect, the Australian postal referendum provides us with unbiased and high-quality data on citizens' revealed preferences for enfranchising sexual minorities. Given that real legislation was at stake, and turnout was high (at 79.5 percent), these data arguably better reflect people's true convictions than the surveys that have so far been used to elicit attitudes towards same-sex marriage and sexual minorities more generally.

Lastly, we also contribute to a longstanding debate among historians and commentators about the legacy of the 'convict stain' in Australia, and especially the long-run effects of convictism on crime.[10] Our analysis highlights that such a legacy, which is indeed sometimes negative, is more a reflection of the radical distortion in sex ratios that convict transportation imposed than of convictism itself.

We proceed as follows. Section 2 describes the conceptual background after which Section 3 provides some historical detail about colonial Australia. Section 4 describes the various data. Sections 5 and 6 then discuss our empirical approach and results. Section 7 considers other mechanisms and Section 8 concludes.

2 Conceptual background

This section provides a conceptual discussion of the link between sex ratios and reproductive competition (Section 2.1.), the impact of sex ratios on attitudes towards homosexuality (Section 2.2.) and the mechanisms though which sex ratios can have persistent impacts (Section 2.3).

2.1 Sex ratios, reproductive competition, and violence

The sex ratio, i.e. the number of males relative to females, is a central concept in evolutionary biology. The idea that sex differences in behavior originate in the conditions of reproductive competition, among which the sex ratio plays a central role, was the cornerstone of Darwin's *The Descent of Man* (1871). Skewed sex ratios will intensify male-male competition for scarce females, with direct (e.g. eliminating or repressing rivals with violence) or indirect (e.g. accumulating resources to woo females) behavioral consequences.[11] Such competition can in turn foster stricter masculinity norms that manifest themselves in more risk-taking behavior,

[9] At an aggregate level, countries with English common law, a communist past, or high (contemporary) sex ratios are less accepting of homosexuality (Asal, Sommer and Harwood (2013); Andersen and Fetner (2008); Chang (2015)). These studies do not address the potential endogeneity of such broad cross-country differences.

[10] See https://theconversation.com/stain-or-badge-of-honour-convict-heritage-inspires-mixed-feelings-41097 for a recent summary.

[11] While females also compete among themselves for mating opportunities, it is well accepted since Darwin that males compete more intensely and overtly. The reason is that the price of reproduction is much lower for males because their sex cells are widely available compared to those of females and because their investment in offspring (though gestation, lactation, and provisioning) is more limited. Although human males are often involved in provisioning and parenting, their effort is on average both lower and more variable than that of their female partners in most, if not all, cultures.

violence and crime, and control over the reproductive opportunities of dominated males and females (Emlen and Oring (1977); Buss (2016)).[12]

Unlike the focus of evolutionary biology on intrasexual competition, economics has largely neglected how male-male competition, and for that matter female-female competition, affects gender roles and related outcomes. Instead, economists have analyzed the impact of sex ratios on bargaining between men and women (intersexual competition). That research shows how male-biased sex ratios increase female bargaining power and hence shift resources and family structures in a way that benefits females. Women are then less likely to participate in the labor force and instead enjoy more leisure (Grossbard-Shechtman (1984); Chiappori, Fortin and Lacroix (2002)). Men, in contrast, work and save more to become attractive partners (Wei and Zhang (2011)). Men also adopt behaviors that are consistent with female preferences for conservative mating strategies (Guttentag and Secord (1983); Pedersen (1991)).[13] Male-biased sex ratios correlate with more monogamy, more committed relationships and higher marriage rates (Grosjean and Khattar (2018); Schacht and Kramer (2016)), greater marital stability and satisfaction (Otterbein (1965); Grosjean and Brooks (2017)), and more paternal involvement (Schmitt (2005)).

The behavioral impact of a male-biased sex ratio on male-male competition (such as risk taking and violence) may be opposite to that on male-female competition and bargaining (such as an increased focus on long-term relationships).[14] In terms of our analysis, the influence of male-biased sex ratios through *male-female* bargaining, as studied in GK, may introduce a downward bias in most of our estimates of the lasting effects of *male-male* competition.

2.2 Sex ratios and attitudes towards homosexuality

It is useful to clarify how male-biased sex ratios can generate persistent biases against sexual minorities. The sociobiological and evolutionary biology literature suggests three mechanisms. First, as discussed in Section 2.1., a shortage of women increases mating competition among males. This competition rewards stereotypical masculine behavior and can encourage homophobia as men affirm their masculinity or assert their status through enforcing traditional male gender roles (Parrott and Zeichner (2008)). Attitudes towards homosexuality are, indeed, a good test of the manifestation of masculinity norms. Gay men are not only viewed as violators of – or even a threat to – traditional masculinity, but also as weak and unreliable coalition members by other men (Winegard et al. (2016)). A quintessential insult to one's manhood, one that can quickly and easily result in violent confrontation, is, after all, to be called 'gay'.

Second, men tend to be more hostile to homosexuality than women (Kite (1984); Britton (1990); Winegard et al. (2016)). In regions with high sex ratios (that is, an abundance of men) hostility against homosexuals is thus more likely to become the dominant social norm. This

[12] Experimental studies of lizards, birds, and primates find that male-biased sex ratios increase male aggression towards males as well as females (Sapolsky (1990, 1991)).

[13] Parental investment theory advances that from an evolutionary perspective the potential reproductive benefits from promiscuity and multiple mating are higher for men than for women (Symons (1979); Buss (2016)).

[14] Masculine behavior that provides an edge in inter-male competitive interactions is not necessarily valued by females. Indeed, experimental evidence indicates that women trade off the advantages of masculine behaviour (higher status of a strong man) with the risk of being exposed to male aggression themselves (Li et al. (2014)).

effect can be particularly strong in settings, such as the Victorian era, in which men hold significantly more power than women in determining social norms and laws.

Third, reproductive competition makes men willing to forego promiscuous behavior to accommodate female preferences for conservative mating strategies. In such societies, people tend to marry and procreate at a younger age (Cahn and Carbone (2010)). Yet, conservative mating strategies also sexually restrict people early on and hence make relationships vulnerable to sexual promiscuity and the associated risks of abandonment and cuckoldry. If homosexuality is perceived to be associated with promiscuity, it may represent a threat to the conservative norms that characterize societies with high sex ratios (Pinsof and Haselton (2016)).

It is important to bear in mind that although these last two channels may explain the relationship between sex ratios and attitudes towards homosexuality, only the first one can explain the relationship between sex ratios and violence. In particular, many studies have highlighted the existence of a *negative* relationship between conservative mating strategies and violence, both at the individual and group level. Married men are less likely to commit crimes (Sampson, Laub and Wimer (2006)), and groups with smaller shares of unmarried men display lower levels of crime, including rape, murder and assault (Henrich, Boyd and Richerson (2012)).

Another potential manifestation of male identity, for which we test in this paper, consists of occupational choice. The role of identity in determining job choice has been discussed since Akerlof and Kranton (2000). More recently, the role of *masculine* identity in preventing men from taking up occupations that are perceived as stereotypically female has attracted attention as a driver of so-called retrospective wait unemployment (Katz (2014)) and of occupational sorting between stereotypically male and female jobs (i.e., occupational gender segregation).

To sum up, we expect that historical male-biased sex ratios led to heightened norms of masculinity as expressed in (a) more violence and other risky behavior, (b) more negative attitudes towards the enfranchisement of sexual minorities, and (c) occupational gender segregation. How can one explain that these effects persist in the long run?

2.3 Persistence mechanisms

In line with earlier work on cultural norms, we explore two persistence channels. First, short-run outcomes of male-male competition (such as heightened norms of masculinity and a penchant for risk taking) can imprint on cultural norms and persist in the long-run through cultural transmission within families (Bisin and Verdier (2001)). For instance, in line with other studies of the persistence of gender roles since the Paleolithic Revolution until today (Alesina, Giuliano and Nunn (2013)), GK and Grosjean and Brooks (2017) document long-term effects of male-biased sex ratios in Australia on female labor force participation, leisure, and relationship satisfaction.

Second, cultural traits may also continue to provide direct benefits that further add to their persistence (Grosjean (2014)). In our setting, masculinity norms may remain beneficial on the marriage market. Displaying stereotypical masculine behavior may still give an edge in within-sex competitive environments, for example by discouraging potential rivals. It could also be that attitudes consistent with more masculine norms, which emerged in response to historical circumstances, have now become standard societal norms, held by men but also by

women. In that case, adhering to such norms can have direct benefits on the marriage market because of marriage homogamy. Since people prefer to marry others with similar views (Becker, Landes and Michael (1977); Lehrer and Chiswick (1993)), holding dominant views increases the probability of finding a match. We provide evidence consistent with this interpretation.

3 Historical background

Between 1787 and 1868, 132,308 male and 24,960 female convicts were transported from Britain to Australia. The 1836 and 1842 censuses in New South Wales (NSW) and Tasmania showed that the average convict sex ratio stood at more than 28 men for every woman (Table 1). Convicts were quite representative of the Victorian working class at the time (Nicholas (1988); Oxley (1996)). The majority (two thirds) of transported convicts were first offenders of minor property crime, such as petty theft (Nicholas (1988)), rather than hardened criminals guilty of violent crime (these tended to be readily executed in England).[15]

Once in Australia, convicts were not confined to prisons but were assigned to work, first under government supervision and later, as the number of free settlers and emancipists (ex-convicts) grew, under the direction of private employers. Convicts were generally freed after seven years. When we examine population sex ratios, we include convicts, emancipists, free migrants as well as people born in the colony, of all ages. Although the adult sex ratio (ASR) would be a better proxy of the intensity of mating competition, which is at the core of our mechanism, the historical Census does not provide a consistent breakdown of population by sex and age, making it impossible to compute the ASR.[16] However, given the absence of imbalance at birth documented by demographers of historical Australia (Opeskin and Kippen (2012)), local population sex ratios provide unbiased, if noisy, proxies of local ASRs.[17]

Convicts and ex-convicts represented the majority of the population in Australia well into the mid-19th century. Male convicts made up 80 percent of the adult population of NSW in 1833. Later immigrants were also predominantly male, who migrated in response to male-biased economic opportunities available in agriculture and, after the discovery of gold in the 1850s, mining. Because of the predominance of male convicts and of male migrants, male-biased population sex ratios endured in Australia for more than a century, although less severely after the end of convict transportation (Figure 1).

[15] In total, five convicts were ever transported to Australia for 'culpable homicide' and 141 for 'murder'. This is close to the number of convicts deported for 'stealing a handkerchief' (113) and much less than the numbers deported for 'stealing a watch' (189), 'pickpocketing' (191), or 'steeling a sheep' (732). These statistics are obtained from convict records and are available at convictrecords.com.au/crimes (accessed 16 March 2018). These data were digitized from the British convict transportation registers, which contain information on the characteristics of each convict in each shipment but not on where such convicts were assigned once in Australia.

[16] Many individual Census records were destroyed in a fire in 1882.

[17] None of our historical data include Indigenous Australians (Aboriginal and Torres Strait Islanders), who were not counted until the 1960s. Only very rough historical estimates are available for this population.

4 Data

We combine various datasets on historical and modern-day Australia. More specifically, we match the first historical Census in each state to (i) data on the 2017 referendum on same-sex marriage; (ii) modern-day nationally representative surveys that allow us to explore individual heterogeneity and to document excessive alcohol consumption; (iii) modern-day postcode-level data on violence and crime; and (iv) present-day Census data on occupations.

4.1 Historical data

Our measure of the historical sex ratio in present-day regressions comes from the first reliable census in each state available from the Historical Census and Colonial Data Archive. We focus on the first Census in each state to measure population before the onset of mass migration and to rely on measures of population in which the quasi-exogenous component stemming from convict transportation represents a larger share of the population. We use the 1836 NSW Census[18] (which also included the Australian Capital Territory at the time), the 1842 Tasmanian Census, the 1844 South Australian Census, the 1848 Western Australian Census, the 1854 Victorian Census, and the 1861 Queensland Census.[19] The Censuses in the penal colonies of NSW and Tasmania also include information on the number and gender of convicts.

Although the total population of Australia at the time was only about 255,000 people, more than 60 percent of the current population of Australia now lives in areas covered by the historical data. Our unit of observation in the census is a county.[20] There are a total of 91 counties, 34 of which harbored convicts. The average county had 4,480 individuals, and most counties (about 85 percent) had between 300 and 10,000 people. Although the average sex ratio was about 3 men for every woman, it was much higher among convicts, at nearly 30 men for every woman. The historical censuses also contain data on economic occupation.

Table 1 compares how well covariates are balanced between counties with historical sex ratios above or below the median (2.24). Agriculture was the largest employment sector in Australia at the time, accounting for 22 percent of the labor force. Domestic services followed at 13 percent, and then manufacturing and mining with a combined total of 10 percent. The shares of people employed in agriculture and domestic services are, respectively, slightly higher and lower in areas that were above the median sex ratio, but the share of people employed in mining and manufacturing are not statistically different from one another (see Panel A of Table 1). We will control throughout in the historical shares of employment in different sectors. Areas with high or low historical sex ratios are broadly similar in terms of land characteristics and mineral endowments. However, we find that high historical sex ratios as associated with a greater likelihood of religious affiliation, particularly the Christian faiths. Interestingly, this pattern may have emerged post-colonization: census data from 1836 (18 counties in NSW) reveal that religion (primarily Protestant or Catholic) was orthogonal to the historical sex ratio.

[18] This is the second oldest Census for NSW. The 1833 Census is very aggregated and therefore lacks sufficient geographic granularity for our purpose.

[19] The dates of the Censuses vary because states were independent colonies until 1901.

[20] "Counties" is used here to refer to historical administrative divisions within the different colonies of Australia, variously called "counties", "police districts", "towns", or "districts."

Figure 2 maps the sex ratio in the whole population and in the subset of the convict population in areas of Australia that were already settled at the time of the study. The concentration of sexes does not have a definite pattern: high and low sex ratios were found in the hinterland as well as along the coast.

4.2 Present-day data

To explore the long-run effects of male-biased sex ratios, we use several data sources. First, we obtain the results of the 2017 referendum on same-sex marriage at the electoral district level (150 districts). The Australian Marriage Law Postal Survey was conducted by the Australian Bureau of Statistics (ABS) as a postal vote between 12 September and 7 November 2017. Unlike compulsory electoral voting, responding to the survey was voluntary. A survey form, instructions, and a reply-paid envelope were mailed to everyone on the electoral roll, asking the question *"Should the law be changed to allow same-sex couples to marry?"*.[21] The results showed that 61.6 percent had voted in favor of marriage equality while 38.4 percent voted against it. Turnout was high, at 79.5 percent. While the postal survey was non-binding, the Liberal–National Coalition government had pledged to support a Parliamentary bill to legalize same-sex marriage in case of a *"Yes"* outcome. A few weeks after the vote, a large majority of MPs in Australia's House of Representatives voted in favor of legalizing same-sex marriage.

The district-level postal vote data provide us with a clean manifestation of masculinity norms, as negative attitudes towards sexual minorities are often seen as at the heart of such norms. The vote data are also unique in that they provide us with an 'undiluted' measure of people's support for a salient normative cause (electoral voting would conflagrate these issues with many other ones, including economic considerations). Moreover, anonymous voting is not susceptible to response bias that plagues surveys.

Second, we use a nationally representative survey, HILDA, which identifies respondents through their residential postcode. Of particular interest is the question on attitudes towards enfranchisement of sexual minorities: *"Homosexual couples should have the same rights as heterosexual couples do"*. Answers range from 1 (strongly disagree) to 7 (strongly agree), and we categorized individuals as broadly supportive of same-sex rights if they answered 4 (neutral) or above. Individual-level variation in responses to this question is useful to test finer mechanisms underlying the aggregate relationship between historical sex ratios and voting in the referendum. We retain a HILDA question on individual alcohol consumption as a proxy of excessive risk-taking, one of the markers of toxic masculinity. We define excessive drinking as consuming more than four standard units of alcohol on a daily basis.

Third, to further refine our understanding of the mechanism underlying the relationship between historical sex ratios and voting outcomes, we obtain crime statistics at the postcode level in most states from the police or statistical agencies.[22] As described in the online Appendix, crime reporting exhibits variability across states. Certain categories of crime, such as

[21] The ABS ensured that Australians without access to postal services could vote nevertheless.

[22] We obtained data for Queensland, New South Wales, South Australia, Tasmania, and Victoria. These are the states for which most of the historical Census data is available. We are in the process of obtaining crime data for other states, such as Australian Capital Territory and Western Australia, for which some historical Census data is available.

assault, homicide, and robberies and burglaries are reported in a homogenous manner across states, while others, such as domestic violence, are not. This explains why the number of observations varies for different categories of crime. The dates for which the data is available to researchers also vary, but we obtained consistent crime estimates between 2006 and 2016, except for South Australia (2012-2016). We match these data to the 2006, 2011, and 2016 census and extrapolate population between Census years to compute crime rates per capita.

Lastly, we use data from the 2016 Census on the share of men and women in different occupations at the 4-digit occupation code level. To be left with a manageable number of occupations, we retain all occupations with employment shares higher than 0.7 percent.[23] We then categorize the remaining occupations as 'male' (85 percent of employment or more is male), 'female' (15 percent of employment or less is male) or 'neutral' (the remaining category). Examples of most masculine occupations are 'Carpenters and Joiners', 'Metal Fitters and Machinists', and 'Motor Mechanics' (all 99 percent male). Examples of most feminine occupations are 'Child carers' (4.9 percent male), 'Receptionists' (5.2 percent male), or 'Education Aides' (9.6 percent male). Examples of neutral occupations are 'Real estate sale agents' (50.0 percent male) and 'Retail managers' (50.5 percent male).

To match present-day data to historical data, we rely on the correspondence between 2011 postcodes and historical boundaries established by GK. To deal with postcode boundary changes between 2011 and 2016, we match smaller geographic units (SA2) from the 2016 Census to 2011 postcodes. We then match 2016 electoral districts to the 2016 Census at the SA2 level and to the historical data. After matching HILDA data to historical data, we are left with a sample of between 30,000 and 50,000 individual observations, depending on the questions used, in more than 1,500 postcodes.

We retain additional characteristics at the SA2 level from the Census such as present-day sex ratio, population, and urbanization, as well as religious composition, unemployment, education, age, and percentage Australian born. We also collect data on mineral and land type from Geoscience Australia. Panels B-E of Table 1 provide descriptive statistics. The balance of covariates across areas below or above the median historical sex ratio is presented in the last two columns. We observe no statistically significant differences of meaningful size across high versus low historical sex ratio areas in terms of present-day age, gender, ancestry composition, income, or education. Areas that historically had more men than women tend to be still somewhat more male-biased. We therefore retain the present-day sex ratio as a covariate.

5 Empirical strategy

We examine the long-term effects of male-biased sex ratios on present-day outcomes by estimating the following equations:

$$y_{pcs} = \alpha_1 + \beta_1 SexRatio_{cs} + X^G_{pcs}\Gamma_1 + X^H_{cs}\Pi_1 + T^C_{pcs}\Lambda_1 + \delta_s + \varepsilon_{pcs} \tag{5.1}$$

[23] This leaves us with 23.6 percent of total employment.

$$y_{ipcs} = \alpha_1 + \beta_2^M Male_i \times SexRatio_{cs} + \beta_2^F Female_i \times SexRatio_{cs} + \gamma Male_i + X_{pcs}^G \Gamma_2 + X_{cs}^H \Pi_2 + X_{ipcs}^C \Theta_2 + \delta_s + \varepsilon_{ipcs} \tag{5.2}$$

Where y_{pcs} are the measures of electoral outcomes and violent behaviour in area p (postcode), part of historical county c in state s. y_{ipcs} is the survey-based measure of attitudes or excessive drinking for individual i in postal area p, part of historical county c in state s. $SexRatio_{cs}$ is the historical sex ratio: the number of males to females in historical county c, as per the first census in each state or colony s. δ_s is a vector of state dummies. δ_t is a vector of HILDA wave dummies where applicable. Since historical data at the level of the 91 historical counties is less granular than present-day data at the postal area or individual level, all standard errors are clustered at the county level.

X_{pcs}^G and X_{cs}^H are vectors of time-invariant geographic and historic characteristics that may have correlated with the historical sex ratio and might still influence present-day outcomes. Economic opportunities in 19th century Australia, that consisted primarily of agriculture and mining, influenced where convicts were assigned and where free settlers and ex-convicts located. This could bias our estimates if they are also related to our outcomes of interest. If, for example, economic specialization persisted over time, these initial conditions could directly influence present-day economic conditions as well as violence, drinking, or voting outcomes. To flexibly account for geographic differences across counties that may be correlated with agricultural potential, we control for latitude and longitude in all specifications. To control more precisely for mining and agricultural opportunities, we control for nine detailed categories of mineral deposits and land characteristics.[24] We also control for county historical economic specialization by including in X_{cs}^H the historical shares of the population employed in the main categories of employment in 19th century Australia: agriculture, domestic services, mining and manufacturing, government, and learned professions. Total historical population in the county is also included in X_{cs}^H.

T_{pcs}^C and X_{ipcs}^C are vectors of postcode-level and individual-level present-day controls. As discussed in Section 4.2., areas that were more male-biased in the past tend to be marginally more male-biased today and one concern is that we would observe the influence of present-day, not past, sex ratios. Urbanization and population density are important drivers of attitudes towards sexual minorities (Stephan and McMullin (1982)) and crime (Glaeser and Sacerdote (1999)). For these reasons, we include controls for present-day sex ratio, population, and degree of urbanization at the postcode level.

Another concern is the potential influence of religion. There was very little variation across historical counties in religious affiliation, with the main groups being fairly evenly distributed across areas. In the 1836 New South Wales Census, 67 percent of the population was Protestant and 33 percent was Catholic, with a standard deviation of 0.13 for the two distributions across counties, and we observe no statistically significant difference across high and low sex ratio

[24] Deposit types include 'minor coal', 'minor other', 'major coal', 'major copper', 'major gold', 'major mineral sands', 'major oil and gas', 'major others'. The excluded category is 'no deposits or traces only'. Land types include 'plains', 'plateaus', 'sand plains', 'hills and ridges', 'low plateaus and low hills', and 'mountains'. Source: Geoscience Australia.

areas. Today, the shares of religious groups are fairly distributed across high and low historic sex ratios areas (see Table 1), although we see some statistically significant differences, albeit small in magnitude, in the shares of Anglican and agnostics. Because of such present-day differences, and because of the potential large influence of religious groups and organizations on risk-taking and violent behavior and on attitudes towards same-sex marriage, we include the shares of religious groups at the postcode level as additional controls in robustness.

In these robustness specifications, we include additional controls for important drivers of violence, excessive risk taking, and political preferences. These include the unemployment rate, proportion of people with a high school degree, proportion of the population under 30, and proportion of the population with both parents born in Australia. To the extent that these variables are endogenous to the historical sex ratio, they are bad controls and might bias our estimates. Yet, GK find no evidence supporting the hypothesis that historical sex ratios explain investments in education or current industrial specialization (neither historically nor today).

In the models of individual attitudes and drinking behavior using survey data, individual controls are gender, marital status, age, income, education, and whether the respondent was born in Australia. Postal area-level controls include present-day sex ratio today, population, and urbanization, taken from the Census closest in time to the implementation of the survey (either 2011 or 2016).

To identify a causal effect of the historical sex ratio in (1) and (2), we need to assume that the spatial distribution of the relative number of men and women was random, conditional on our proxies for economic opportunities and total population at the time. While economic opportunities were an important dimension of the decision of where to settle, it is possible that the latter was also influenced by unobservable characteristics, such as a taste for risk and violence. These could subsequently have been transmitted to present-day populations and influence outcomes of interest. In a second part of the analysis, we therefore adopt an instrumental variable strategy based on a subpopulation that was not free to choose where to live: convicts. That is, we instrument the overall sex ratio by the sex ratio among the convict population only. This instrument is relevant because convicts constituted a large proportion of the population, so that the sex ratio among convicts is an important component of the overall sex ratio. The raw correlation between total population and convict population is 0.94, and the raw correlation coefficient between the convict and population sex ratios is 0.72. Since convicts were not free to move, using the sex ratio among them as an instrument alleviates the self-selection issue that historically men and women chose their location based on unobservable preferences. That said, as discussed in the historical background section, convict assignment was not purely random but also influenced by labor requirements. We remove this potential endogeneity bias by controlling for historical employment sector shares and for the full set of geographic factors, including the location of minerals and land type.

Causal identification requires that: (i) conditional on our proxies for labor needs, allocation of convicts was random, and (ii) the convict sex ratio only influenced present-day outcomes through its effect on the historical population sex ratio (exclusion restriction). We have just defended (i). A potential source of violation of (ii) resides in the possibility that the presence of convicts itself had a direct effect on crime and electoral outcomes today, independently of the

effect on sex ratios – a genuine concern since we are talking, after all, about convicts. Furthermore, it is possible that more hardened, risk-loving and violent convicts were systematically sent to more male-biased areas. This would be a form of endogenous selection generating a correlation between the convict sex ratio, average preferences for risk and violence stemming from convictism itself, which may have persisted until today.

Historical evidence reduces this concern. First, as we describe in Section 3, convicts that were deported to Australia were not hardened criminals guilty of violent crime. Instead, they were mostly first-time offenders of petty property crime (Nicholas (1988); Oxley (1996)). Second, the placement of convicts was decided in a highly centralized way, making it unlikely that the spatial distribution was determined by unobservable taste for risk. As described by Governor Bligh of New South Wales in 1812: "They (the convicts) were arranged in our book (...) in order to enable *me* to distribute them according" ((Nicholas, 1988, p. 15, emphasis added)). Third, it is likely that the endogeneity bias, if it existed, would go the other way and lead our estimates to be underestimated. Indeed, as shown by Parliamentary debates on transportation to Australia, authorities became concerned about unrest and the potential negative consequences of male-biased sex ratios. This would have provided incentives to send relatively fewer males, especially potentially violent ones, to areas where sex ratios were already heavily male-biased. However, such concerns by the authorities only emerged later than the historical period we consider, mostly after the 1850s, and thus should not affect our results.[25] Nevertheless, we control throughout in our IV specifications for the overall number of convicts. This absorbs the legacy of convictism as separate from the legacy of the sex ratio. To address the possibility that the relationship between overall number of convicts and sex ratio among convicts was not mean preserving, i.e., that only the more hardened, risk-loving and violent *male* convicts were systematically sent to more male-biased areas, we perform the analysis with the total number of *male* convicts, rather than overall convict population.[26]

As only New South Wales and Tasmania were penal colonies, convicts were only present in about a third of the historical counties. To adjust for the small number of clusters, we compute standard errors using the wild cluster bootstrap method based on 1,000 replications, as recommended by Cameron, Gelbach and Miller (2008); Cameron and Miller (2015).

6 Empirical results: Historical sex ratios and present-day outcomes

This section investigates the long-term consequences of male-biased sex ratios on the outcome of the 2017 same-sex marriage referendum; violence and crime; excessive drinking; and occupational gender segregation. We discuss OLS and IV results together throughout.

[25] The sex ratio among convicts is measured from the 1836 NSW Census and the 1842 TAS Census. The first parliamentary committee headed by Sir William Molesworth started discussions on ending transportation to NSW in 1837. It took several years of debate until the Colonial Government decided to cease transportation to NSW in 1852. Transportation continued to TAS, then Van Diemen's land, until 1853.

[26] We do not show those results as they are nearly identical. This is not surprising given that the correlation coefficient between total convict number and total convict men is 0.999.

6.1 Voting in the referendum on same-sex marriage

OLS and IV results

Table 2 presents the estimation results of 5.1 using the share of votes in favor of same-sex marriage as the dependent variable in Panel A and the share of abstention in Panel B. The share of abstention can be interpreted as the expression of (a weaker form of) opposition to same-sex marriage as well. Several Members of Parliament who were opposed to same-sex marriage, expressed their intention to abstain and some constituents may have followed suit in this silent opposition.[27] We express votes or abstention as percentages of total voting population. That is, although "Yes" won 62 percent of all expressed suffrage, it only represented 49 percent of the total voting population, given the 21 percent abstention rate.

For each dependent variable, we present six specifications: three OLS (Columns 1-4) and three IV (Columns 5-7). The first specification (Columns 1 and 5) controls for the full set of geographic and historic controls described in Section 5. We then add controls for present-day sex ratio, population, and urbanization in Columns 2 and 6. In the last specification (Columns 3 and 7), as a robustness exercise, we also control for the extended set of present-day covariates: religious composition, unemployment rate, share with high-school degree, age composition, and share Australian ancestry. Column 4 presents the OLS results for the subset of counties used in the IV estimates with the same controls as in Columns 2 and 6. Our preferred specification throughout is the second one (Columns 2 and 6), with the full set of historic and geographic controls as well as the present-day sex ratio, population, and urbanization.

Table 2 shows that both the share of votes in favor of marriage equality and the participation rate are substantially lower in areas where sex ratios were more male-biased in the past. These results are statistically significant, consistent, and large in magnitude in all specifications. In our preferred specification, the coefficient associated with the historic sex ratio is statistically significant in the OLS and IV regressions of the share of "Yes" vote at the 1 and 5 percent level, and at close to the 10 percent level when we adjust the IV results for the small number of clusters using the wild cluster bootstrap method (Cameron, Gelbach and Miller (2008); Cameron and Miller (2015)). For the share of abstention, the coefficient associated with the historic sex ratio is statistically significant at the 1 percent level and at the 5 percent level when we adjust for the small number of clusters in the IV. The first stage of the IV is string, with a F-stat of 34 (See Columns 1 and 2 of Table 8).

In terms of magnitude, the IV results indicate that a one standard deviation increase in the historical sex ratio (3.0, a value also equivalent to going from the 25th to the 75th percentile of the historical sex ratio distribution) is associated with a 1.8-2.4 percentage point (pp) (Column 1-2) to 3.0-3.6 pp (Columns 4-6) decrease in support for same-sex marriage. This represents 4 to 7 percent of the mean. Such a one standard deviation higher sex ratio is also associated with an increase in abstention by 1.5pp (Column 5). This equals 8 percent of the mean. Overall, accounting for historical factors explains 8.8 percent of the variation in the "yes" vote that is unexplained by a wide range of socio-demographic and economic factors, including religious

[27] The members of the Liberals/Nationals coalition who were the most prominent opponents to same-sex marriage abstained during the vote for the final bill that legalized same-sex marriage (http://www.abc.net.au/news/2017-12-08/same-sex-marriage-who-didnt-vote/9240584).

background, unemployment, urbanization, as well as the present-day sex ratio.[28]

ATE versus LATE

The IV estimates are somewhat larger than the OLS ones. We expect this to be the case for three reasons. First, our suggested mechanism is that the sex ratio shapes attitudes through its effect on mating competition. Evolutionary biologists generally focus on the sex ratio among adults of reproductive age (ASR). However, the historical censuses do not systematically break down the population by age, so that we cannot compute the ASR in the total population. However, convicts were of marriageable age, so that the sex ratio among convicts, used in the IV regressions, is effectively an ASR. The population sex ratio used in OLS is, by contrast, a noisier measure of the treatment of interest, and we expect such OLS estimates to be biased downwards due to such an attenuation bias.

Second, mating competition was much stronger among convicts than in the full population because the convict population was more male-biased. Moreover, female convicts could (and did) marry free men while it was very rare for convict men to marry free women. In other words, mating competition was much more intense in the convict subpopulation. We therefore expect the local average treatment effect (LATE) among convicts to be larger than the average treatment effect (ATE) in the whole population.

Third, the estimation populations differ. Convicts were only present in a subset of areas that were settled in the 19th century and these areas are more urbanized today.[29] Since the IV estimates rely on this more urbanized subpopulation, and because both "Yes" votes and vote participation are higher in these areas (the coefficient associated with 'urban' in Column 2 in Panel B of Table 1 is -2.14 (s.e. 0.43)), these sample differences also explain part of the difference in coefficient estimates. As a matter of fact, as displayed in Columns 3-4, the OLS estimate is twice as high in the IV estimation sample than in the OLS estimation sample, and on par with the IV estimate.[30]

Mechanisms

We discussed in Section 2.2. three potential mechanisms underlying the relationship between sex ratios and attitudes towards sexual minorities: (i) heightened masculinity norms, (ii) negative male views becoming wider social norms, and (iii) conservative mating strategies and social conservatism. (ii) and (iii) imply a change in norms that should affect all individuals, *irrespective of gender*, today. Instead, (i) is more specific to men. Although voting results are not available at the individual level, we can explore heterogeneous effects by gender with the HILDA survey, which includes a question on attitudes towards same-sex couples. Our focus is not on gender differences per se, but rather on whether the long-run influence of male-biased

[28]This figure is computed as the percentage difference in R^2 s between the regression in Column 3 with ($R^2 = 0.69$) and one without historical characteristics ($R^2 = 0.65$).

[29]85 percent of areas where convicts were present historically are classified as urban today, compared with 62 percent of places with any colonial population presence and 57 percent of places with population but no convicts. All these differences are significant at the 1 percent level.

[30]The coefficient associated with the historic population sex ratio in the IV estimation sample is -0.009 in our preferred specification (column 4). This is on par with the IV point estimate of -0.012 (Column 6).

sex ratios is differentiated by gender, i.e., in coefficients β_2^M and β_2^F from estimating 5.2. Our hypothesized mechanism relies on the effect of sex ratios on mating competition. Men – not women – feel competitive pressure when sex ratios are male-biased, and it is therefore men who should develop behaviors and norms that are instrumental to male-male competition. In other words, we expect β_2^M to be positive and statistically different from 0, but not necessarily β_2^F.

The results in Table 3 show that the coefficient associated with the historical sex ratio is statistically significant for men in most specifications, although it hovers around the 15 percent significance level when we adjust for the small number of clusters in the IV.[31] By contrast, the coefficient for women is not significant in our IV specifications. The coefficient for men is also systematically larger in magnitude (generally twice as large in the OLS, and more than 20 percent in our preferred IV specification), although not statistically significantly so.

The fact that the results are larger and more robust for men compared to women provides evidence that voting and attitudes towards same-sex marriage may be one of the political manifestations of masculinity norms. In the next sub-sections, we provide more direct evidence on violence, excessive drinking, and occupational gender segregation to show that norms of masculinity are heightened in areas that were more male-biased in the past.

6.2 Violence and crime

We investigate the long-term consequences of male-biased sex ratios on crime and violence in Tables 4 and 5. The unit of observation is a postcode. The dependent variables are the natural logarithm of the mean number of offenses per 100,000 inhabitants between 2006 and 2016 for the categories: all assaults, assaults of a non-domestic nature, domestic violence, sexual offenses, property crime, and homicide. The number of observations differs across the different types of offenses, because, as explained in Section 4.2. and described in more detail in the Appendix, crime reporting is not uniform across states. For this reason, and because all assaults also include assaults against the police, the sum of domestic and non-domestic assaults does not equal all assaults.

For each dependent variable, we again report six specifications, identical to the ones described in Section 6.1.: four OLS and three IV specifications. The estimates in Table 4 show that today, the rate of assaults is higher in areas that were more male-biased in the past. The coefficient associated with the historic sex ration is statistically significant at the 1 percent level in our preferred OLS and IV specifications, including when we adjust the IV for the small number of clusters. When we consider non-domestic and domestic assaults separately, the OLS estimates are more imprecisely estimated. However, in our preferred IV specifications, the coefficient associated with the historic sex ratio is positive and statistically significant at the 1 percent level, and around the 10 percent level when we adjust for the small number of clusters[32], in the specifications that look at rates of non-domestic and of domestic assaults sep-

[31] One limitation of the HILDA dataset consists in the limited number of observations in some clusters. This also explains why the F-stat in the first stage of the IV (See Columns 3 and 4 of Table 8) is much lower than in specifications relying on the full Census.

[32] There are fewer clusters in the regressions in which domestic and non-domestic assaults are considered separately because only few states provide this breakdown.

arately. The first stage of the IV is strong for all crime and violence regressions, with a F-stat of 34 (see Table 8).

In our preferred IV specification, a one standard deviation increase in the historical sex ratio is associated with a 59 percent increase in the rate of total assault and more than a 75 percent increase in the rates of non-domestic and of domestic assaults. According to a more detailed breakdown of assaults by gender that we were able to obtain for New South Wales, 83 percent of assaults of a non-domestic nature are committed by men, and 72 percent of victims are male. This variable thus broadly proxies for male-on-male violence. For domestic violence, 87 percent of perpetrators are male, and 71 percent of victims are female. This variable thus broadly proxies for male-on-female violence. We also consider the rate of sexual assaults in the last Panel of Table 4. Although the OLS estimates are imprecisely estimated, our preferred IV specification reveals that a one standard deviation increase in the historical sex ratio among convicts is associated with a 30 percent increase in the rate of sexual assaults, but the relationship is not robust.

We find no evidence of elevated homicide in Table 5, indicating that assaults do not translate into homicide. Indeed, homicide rates are very low in Australia and the country ranks 179 out of 219 countries according to the United Nations Office on Drugs and Crime (UNODC). Up to 65 percent of our included postcodes have zero homicides over the 10 years period we consider.

We also find no evidence of elevated property crime in Table 5. Although the coefficient borders statistical significance in some specifications, it is not robust and small in magnitude. This contrasts with Cameron, Meng and Zhang (2017), who find large effects of cohort sex ratios on property crime. However, a key difference between their study and ours is that they look at contemporaneous effects, while we look at long-term effects. In their case, property crime is motivated by men?s desire to accumulate resources to be more attractive to potential wives. By contrast, we look at long-term cultural effects of sex ratios. Men in our study may not face hardship in finding wives – the sex ratio is balanced today.

In contrast, we argue, the historic sex ratio has forged a culture of violence. Although in principle this culture could push individuals to engage in all forms of crime, crime is also costly, due to the risk of being arrested. Cultural underpinnings of violence will act very differently on premeditated versus non-premeditated crime. Assaults are mostly non-premeditated and often result from quickly escalating confrontations, often over what seems to the initiator of the assault as a grave insult to his masculinity or lack of respect (e.g., Wolfgang (1958); Goffman (1959); Wilson and Daly (1985)). Property crime is much more premeditated, less responsive to impulse, and more reflective of a calculation of costs and benefits (Pinker (2011)). The differentiated long-term effect of sex ratios on assaults versus property crime is, in fact, similar to the situation in the US South, where the Scots-Irish culture of honor still contributes to high rates of homicide and assault, but not other types of crime, such as property crime (Grosjean (2014)). It is also reassuring that we do not find evidence for more widespread crime and lawlessness in areas that were more male-biased in the past, but only evidence of very specific male-on-male violence, one of the costly manifestations of toxic masculinity.

6.3 Excessive drinking

We investigate the long-term effect of historic sex ratio on excessive drinking in Table 6. Excessive drinking is defined as consuming strictly more than 4 standard drinks a day (equivalent to 2.9 standard drinks in the US). This applies to 13 percent of the HILDA sample: 8 percent of women, and 18 percent of men (p-value of difference in means across genders: 0.000). Observations are at the individual level. Since we expect the effect of male-biased sex ratios to exert a particularly strong influence on men, we investigate heterogeneous effects by gender. We also add controls for individual socio-demographic characteristics such as age, gender and Australian born, to the list of controls for historic, geographic, and present-day postcode level characteristics. Our six specifications are identical to the ones used so far.

While the OLS estimates are not precisely estimated, the IV estimates suggest that a one standard deviation higher historic sex ratio is associated with a statistically significant 10 percent increase in the probability of an individual drinking excessively. The relationship is statistically significant, both for men and women, at the 1 to 5 percent level, when we correct for the small number of clusters. However, the magnitude of the effect is similar for men and women.

6.4 Occupational gender segregation

To explore the relationship between historical sex ratios and occupational gender segregation, we regress, separately, the shares of men and women employed in 2016 in feminine, neutral, and masculine occupations, as defined in Section 4.2. The first three columns of Table 7 present the results for men, the last three for women. We present only the results of our preferred specification. In addition to our usual controls, in each case we also control for total employment in the relevant employment category. This control captures variation due to local labor-market circumstances. The coefficient associated with the historical sex ratio thus measures how much this ratio explains of the share of workers of a specific gender-stereotypical occupation, relative to the local share of this occupation in the postcode.

The results paint a clear picture: Historical sex ratios significantly contribute to occupational gender segregation for Australian males today. In the OLS, the coefficient associated with the historical sex ratio is significant for males for all categories of employment. The sign of the coefficient is consistent with our interpretation that historical sex ratios forged a culture of masculinity, which still leads men to find employment in stereotypically male occupations, and to shun employment in stereotypically female occupations (and even in neutral occupations, although only the effect on stereotypically male occupations is robust to the IV strategy). Overall, historical circumstances can explain 31 percent of the remaining variation in male employment in stereotypically male occupations, and 7 percent of the remaining variation in male employment in stereotypically female occupations (i.e., of the variation left unexplained by a wide range of present-day characteristics, including the overall share of employment in those occupations in the postcode). The historical sex ratio is also significantly associated with the share of women employed in same-gender occupations in a postcode but is not statically significant for neutral or opposite gender occupations.

6.5 Robustness

Our results are robust to non-linear effects of the sex ratio, as well as to removing outliers. The results of these robustness tests can be found in the online Appendix.

7 Empirical results: Other potential explanations

We have already examined at length the possibility that the cross-sectional variation in historical sex ratios is endogenously determined in a way that would influence present-day outcomes. We provided evidence in Section 4.1. and in Section 5 that this is unlikely. The relationship between historical sex ratios and present-day political attitudes towards same-sex marriage could also reflect a legacy of sex ratios on social conservatism more broadly. Past work has shown that sex ratios are associated with more conservative gender roles, and that these effects have persisted in the long run in Australia (GK). However, GK are unable to document differentiated effects by gender, while we find that the relationship between historic sex ratios and present-day attitudes towards same-sex marriage is much more robust for men. Moreover, conservative individuals and societies are less, not more, prone to violence and substance abuse (Sampson, Laub and Wimer (2006); Henrich, Boyd and Richerson (2012)). Hence, this explanation cannot account for the results we document on crime, violence, and risk-taking.

In this section, we explore two other alternative explanations for the long-term relationship between male-biased sex ratios and, what we suggest, various manifestations of masculinity norms: opposition to sexual minorities' rights, occupational gender segregation, and violence and excessive drinking. First, we rule out that institutional differences across Australia explain our results. Second, we examine whether our findings could be due to the long-term effects of convictism, rather than the sex ratio. We conclude that the most likely explanation for our results is that a male-biased sex ratio environment selected for norms of masculinity, which then persisted over time and still manifest themselves in a consistent way across political, economic, and societal domains.

7.1 Institutional differences

The different states in Australia were independent colonies until 1901. As such, some were convict colonies: New South Wales (which included the Australia Capital Territories and parts of Queensland at the time), Tasmania, and in later periods Western Australia, whereas others, such as South Australia and Victoria never were. This may have affected the reputation of different areas and rendered them more or less attractive to free migrants in a way that could have affected the sex ratio (for example if families or single women were not willing to migrate to convict colonies). Moreover, different states today vary in their criminal legislation and in legislation that affects sexual minorities, in ways that could be correlated with historical circumstances. For example, South Australia was the first state to decriminalize homosexuality in 1975, and Tasmania the last, in 1997. Nevertheless, our results include state fixed effects throughout, which remove the influence of time-invariant state characteristics or differences

in legislation across states.

7.2 Convictism versus sex ratio

The extent to which present-day violence, crime, and attitudes towards homosexuality are all stained by Australia's convict past has been the object of a long-standing and intense debate. Studies highlighting the potential role of genes as a determinant of violent behavior (Tiihonen et al. (2015)) are particularly anxiogenic for many Australians.[33] Authorities were so concerned about *"blasphemy, rage, mutual hatred, and the unrestrained indulgence of unnatural lust"* among convicts that it became one of the main arguments of transportation abolitionists.[34] This in turn has led some to go so far as stating that: *"prejudice toward LGBTI people [in Australia] can be summed up in one word: convictism"*.[35] Our results control throughout for the number of convicts (and in robustness, the number of convict men specifically) and are therefore immune to the potential legacy of convictism in and of itself. Instead, our results show that it is the dramatic distortion in sex ratios that was imposed by convictism more than convictism itself that consistently explains crime, violence, and 'prejudice'.

We report the coefficients for the number of convicts separately from the historic sex ratio in all regressions. In the referendum about same-sex marriage (Table 3), the coefficient associated with the number of convicts is, indeed, negative and statistically significant.[36] For violence and crime (Tables 4 and 5), the coefficient associated with the number of convicts is generally not significant is, if anything, *negative*. In the OLS, the historic number of convicts is significantly and negatively associated with non-domestic assaults, sexual offenses, property crime, and homicide. However, the relationship is never statistically significant in the IV regressions. For occupational gender segregation, the coefficient associated with the historical number of convicts is neither robust nor consistent across specifications.

8 Discussion and conclusions

We exploit a historical experiment, the colonization of Australia in the 18th and 19th century, to identify the long-lasting impact of male-biased sex ratios on masculinity norms. We show that in areas that were historically more male-biased, fewer Australians support same-sex marriage today. This result is driven by men and those born in Australia. Moreover, we find that areas that were heavily male-biased in the past (though not the present) remain characterized by more violent behavior, excessive alcohol consumption, and a higher likelihood of men selecting more (less) into stereotypically male (female) occupations. Taken together, our results indicate that male-biased sex ratios fostered a culture of masculinity that persists until today.

[33] See https://theconversation.com/stain-or-badge-of-honour-convict-heritage-inspires-mixed-feelings-41097

[34] *There could have been no better breeding ground for the ferocious bigotry with which Australians of all classes, long after the abandonment of Norfolk Island and the System itself, perceived the homosexual. And this in turn seemed like an act of cleansing – for homosexuality was one of the mute, stark, subliminal elements in the 'convict stain' whose removal (...) so preoccupied Australian nationalists"* (Hughes, 2003, p. 272)

[35] https://www.theguardian.com/commentisfree/2017/sep/30/australias-homophobia-is-deeply-rooted-in-its-colonial-past

[36] Bear in mind that in the OLS, the coefficient on number of convicts is identified only in states where convicts were present. In other states, the variable only includes zeros.

Indeed, the consequences of uneven sex ratios persist long after contemporary sex ratios have returned to their natural rate. This persistence can reflect both vertical transmission across generations and the fact that certain cultural norms can also provide direct benefits and/or status that make their persistence more likely. While our experimental setting is unique, and allows for rigorous identification, we believe our findings have wider applicability. Indeed, our results can inform the debate about the long-term socio-economic consequences and risks of skewed sex ratios as currently observed in many developing countries such as China, India, and parts of the Middle East. In these settings, sex-selective abortion and mortality, polygamy, the cultural relegation and seclusion of women, as well as migration have created societies with highly skewed sex ratios. Our results suggest that the traditional masculinity norms that develop as a result, may not only be detrimental to (future generations of) men themselves, but can also have important repercussions for other groups in society, in particular women who may suffer from assaults and rape, and gays and lesbians who may suffer from discrimination.[37]

Moreover, our results also help inform discussions about norm setting in heavily male-biased settings *within* societies with otherwise balanced sex ratios, such as the army, policy force, gender-segregated schools, prisons, executive management boards of large companies, or some academic departments. This is important because our results show that the cultural biases that result from uneven sex ratios can be both strong and persistent. Our findings are thus in line with recent research revealing that decision makers that spent their formative years in all-male high schools or neighborhoods with greater gender inequality, display more gender-biased behavior during their subsequent professional career (Duchin, Simutin and Sosyura (2018)).[38]

[37] A recent literature demonstrates that legally allowing sexual minorities to marry, one of the main outcome variables in this paper, can have positive impacts on a wide range of outcomes including health (Sherbourne and Hays (1990); Dee (2008)), access to health insurance (Gonzales (2015)), financial access (Miller and Park (2018)), and reduced suicide rates (Raifman et al. (2017)).

[38] Dahl, Kotsadam and Rooth (2018) show that in environments with highly skewed sex ratios, such as the military, gender stereotypes can be altered by integrating members of the opposite sex.

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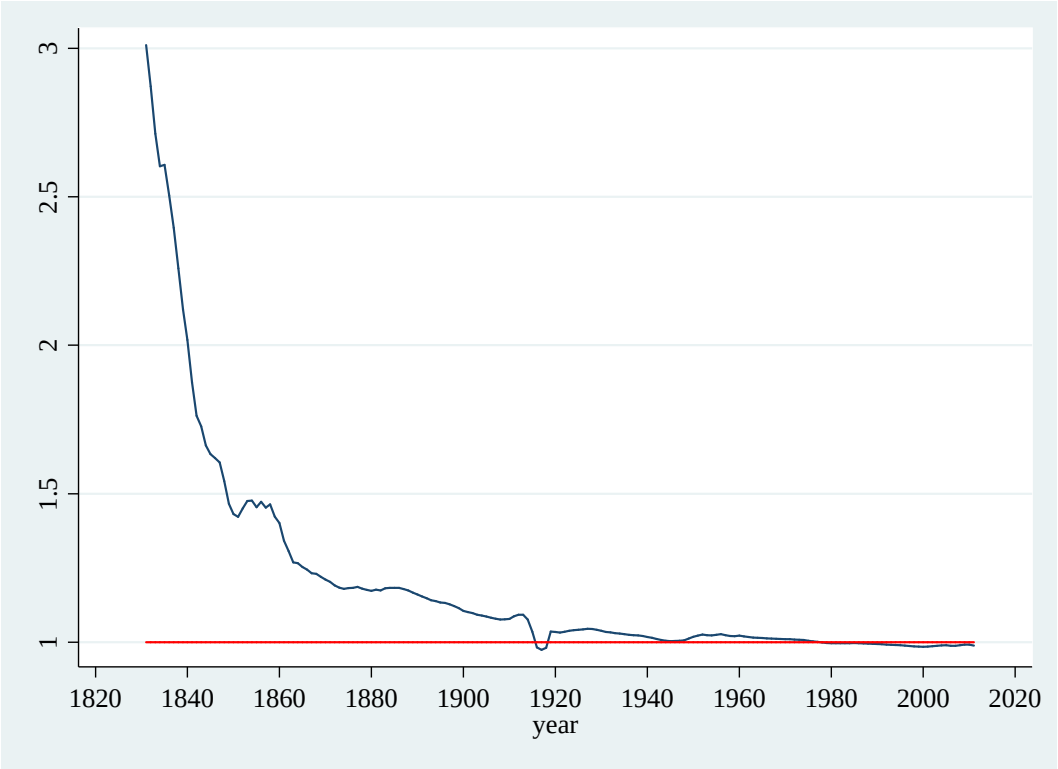
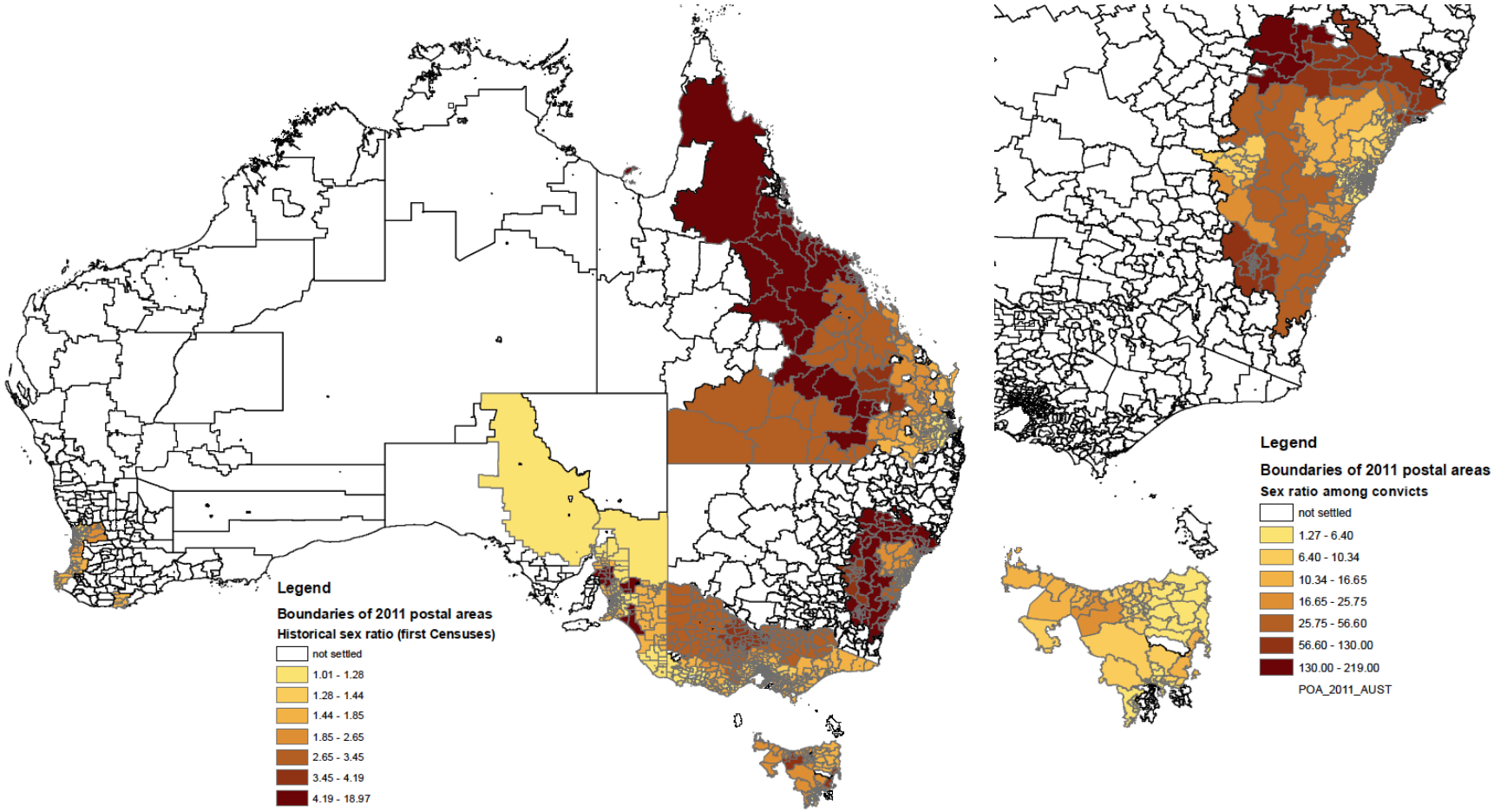
FIGURES

Figure 1: Sex Ratio in Australia: Number of Men to every Woman, 1830-2011



Source: Australian Bureau of Statistics

Figure 2: Sex Ratios in Mid-19th Century Australia: Whole Population (Left Panel) and Among Convicts (Right Panel)



Notes: The maps only show the parts of Australia for which census data is available for the period of study. Left panel: Australian Capital Territory, New South Wales, Queensland, South Australia, Tasmania, Victoria, and Western Australia. Right panel: Australian Capital Territory, New South Wales, and Tasmania.
Source: Australian Historical Census

Table 1 – Sample characteristics and balance

	(1) Mean	(2) SD	(3) Above minus below median historical SR	(4) p-val	(5) Obs
Panel A: Historical data & Geographic features					
Historical sex ratio	3.09	3.0	3.38	0.00***	91
Convict sex ratio	28.39	42.4	16.98	0.02**	34
Historical population (1000s)	4.48	12.0	−4.62	0.12	91
% of county pop. employed in agriculture	0.22	0.1	0.06	0.07*	88
% of county pop. employed in domestic service	0.13	0.1	−0.06	0.04**	88
% of county pop. employed in manufactoring/mining	0.10	0.2	−0.02	0.75	88
Minerals: None	0.11	0.3	−0.08	0.32	91
Minerals: Coal	0.21	0.4	−0.12	0.21	91
Minerals: Gold	0.49	0.5	0.06	0.62	91
Landforms: Plains, plateaus	0.35	0.5	−0.06	0.63	91
Landforms: Mountains	0.55	0.5	0.05	0.70	91
Panel B: 2016 Census data (postcode level)					
Contemporary sex ratio	1.07	0.7	0.04	0.00***	1891
Contemporary population (1000s)	8.76	12.5	−1.30	0.27	1898
Urban	0.65	0.5	−0.10	0.24	1898
Unemployment rate	0.06	0.0	0.00	0.38	1891
% under 30 years old	0.35	0.1	−0.01	0.23	1895
Buddhist	0.01	0.0	−0.00	0.01**	1895
Anglican	0.16	0.1	0.03	0.02**	1895
Catholic	0.20	0.1	0.01	0.40	1895
Other Christian	0.17	0.1	0.01	0.26	1895
Muslim	0.01	0.0	−0.00	0.07*	1895
No Religion	0.31	0.1	−0.04	0.00***	1895
Panel C: 2017 Same-sex marriage referendum (electoral division matched to postcode level)					
% voted 'Yes' (of total registered)	0.47	0.1	−0.03	0.00***	1890
% abstention from referendum	0.21	0.0	0.02	0.00***	1890
Panel D: HILDA data on attitudes and norms (individual level)					
Identifies as heterosexual	0.92	0.3	0.00	0.89	13174
Age	43.69	18.4	0.52	0.69	49017
Male	0.47	0.5	0.04	0.04**	49017
Australia-born	0.76	0.4	0.03	0.47	49004
Beyong year 12 education	0.34	0.5	−0.06	0.17	48987
Income (log)	8.06	4.1	−0.07	0.82	43444
Supports same-sex marriage	0.63	0.5	−0.07	0.11	32245
Drinks excessively (>4 std. drinks/day)	0.13	0.3	0.01	0.70	44196
Panel E: Crime data (postcode level)					
Assault - log(Incidents/100K)	6.48	1.4	0.62	0.01***	1712
Non-domestic assault - log(Incidents/100K)	6.44	1.1	0.14	0.37	1616
Domestic violence - log(Incidents/100K)	6.36	0.7	0.25	0.02**	394
Sexual offenses - log(Incidents/100K)	2.99	2.9	−0.08	0.80	1451
Property crime - log(Incidents/100K)	6.77	2.3	−0.03	0.88	1712
Homicide - log(Incidents/100K)	0.62	1.0	0.07	0.48	1712

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Notes: Column (3) contains the coefficient on a dummy for above median historical Sex Ratio of 2.24, controlling for state fixed effects. Column (4) provides the p-value from the test of whether coefficient in column (3) is equal to zero, where standard errors are clustered at the historical county level.

Table 2 – Male-biased historical sex ratios and support for same-sex marriage in the Australian referendum

	OLS				IV		
	(1) Geo+Hist	(2) +Present SR	(3) +Extended	(4) IV sample	(5) Geo+Hist	(6) +Present SR	(7) +Extended
Panel A: Percent voted 'yes'							
Historical SR	-0.008^{***}	-0.006^{***}	-0.004^{***}	-0.009^{***}	-0.012^{*}	-0.012^{**}	-0.010^{***}
	(0.002)	(0.002)	(0.001)	(0.002)	(0.007)	(0.006)	(0.002)
Number of convicts (1000s)	-0.012^{***}	-0.016^{***}	-0.011^{***}	-0.010^{+}	-0.016^{+}	-0.010	0.022^{***}
	(0.002)	(0.002)	(0.002)	(0.007)	(0.010)	(0.007)	(0.008)
Observations	1890	1881	1880	508	509	508	508
R^2	0.35	0.50	0.69	0.43	0.29	0.42	0.79
Mean of dependent var	0.49			0.48			
Number of clusters	91	91	91	34	34	34	34
Panel B: Percent abstained							
Historical SR	0.003^{***}	0.002^{***}	0.002^{**}	0.003^{***}	0.005^{***}	0.005^{***}	0.004^{**}
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Number of convicts (1000s)	0.001^{**}	0.002^{**}	0.001^{*}	0.004	0.006	0.004	-0.003
	(0.001)	(0.001)	(0.001)	(0.004)	(0.005)	(0.004)	(0.003)
Observations	1890	1881	1880	508	509	508	508
R^2	0.43	0.48	0.64	0.43	0.38	0.43	0.72
Mean of dependent var	0.20			0.20			
Number of clusters	91	91	91	34	34	34	34
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Minerals and land type	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Present-day SR and population	No	Yes	Yes	Yes	No	Yes	Yes
Present-day postal area controls	No	No	Yes	No	No	No	Yes
Wild-t bootstrapped p-value							
Percent voted yes						0.106	
Percent abstained						0.046	

$+\ p < 0.15$, $*\ p < 0.1$, $**\ p < 0.05$, $***\ p < 0.01$.

Standard errors clustered at the historical county level. 'Geographic controls' are a postal area's centroid's latitude and longitude. 'Minerals and land type' is the presence and type of mineral deposit (minor coal; minor other; major coal; major copper; major gold; major mineral sands; major others) and land formation (plains and plateaus; hills and ridges; low plateaus and low hills; mountains), which are provided by Geoscience Australia. 'Historic controls' are: the historical county population, convict population, as well as the proportion of residents working historically in agriculture, domestic service, manufacturing, mining, government services and learned professions. 'Present-day SR and population' in are the number of men to women in a postal area, total population of postal area, and whether a postal area is urban. 'Present-day postal area controls' include education (share completed year 12), unemployment rate, religion shares, proportion under 30, and proportion with both parents born in Australia.

Table 3 – Individual-level support for same-sex marriage (HILDA)

	OLS				IV		
	(1) Geo+Hist	(2) +Present SR	(3) +Extended	(4) IV sample	(5) Geo+Hist	(6) +Present SR	(7) +Extended
Historical SR - Males	-0.018^{***}	-0.015^{***}	-0.012^{***}	-0.026^{***}	-0.024	-0.039^{**}	-0.031^{*}
	(0.003)	(0.003)	(0.003)	(0.008)	(0.025)	(0.020)	(0.017)
Historical SR - Females	-0.010^{***}	-0.007^{*}	-0.004	-0.016^{*}	-0.018	-0.032^{+}	-0.025
	(0.004)	(0.004)	(0.003)	(0.009)	(0.026)	(0.021)	(0.019)
Number of convicts (1000s)	-0.006^{**}	-0.013^{***}	-0.008^{***}	-0.073^{***}	-0.055^{**}	-0.073^{***}	-0.025
	(0.002)	(0.003)	(0.002)	(0.023)	(0.025)	(0.026)	(0.029)
Observations	32234	32234	32234	10892	10892	10892	10892
R^2	0.09	0.10	0.11	0.11	0.10	0.10	0.12
Mean of dependent var	0.63			0.64			
Number of clusters	81	81	81	31	31	31	31
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Minerals and land type	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Present-day SR and population	No	Yes	Yes	Yes	No	Yes	Yes
Present-day postal area controls	No	No	Yes	No	No	No	Yes
Wild-t bootstrapped p-value							
Males						0.174	
Females						0.300	

$+\ p < 0.15$, $*\ p < 0.1$, $**\ p < 0.05$, $***\ p < 0.01$.

Notes: Source: HILDA, waves 2005, 2008, and 2011. Individual-level controls include age, gender, and if born in Australia, as well as year fixed effects. Standard errors clustered at the historical county level. 'Geographic controls' are a postal area's centroid's latitude and longitude. 'Minerals and land type' is the presence and type of mineral deposit (minor coal; minor other; major coal; major copper; major gold; major mineral sands; major others) and land formation (plains and plateaus; hills and ridges; low plateaus and low hills; mountains), which are provided by Geoscience Australia. 'Historic controls' are: the historical county population, convict population, as well as the proportion of residents working historically in agriculture, domestic service, manufacturing, mining, government services and learned professions. 'Present-day SR and population' in are the number of men to women in a postal area, total population of postal area, and whether a postal area is urban. 'Present-day postal area controls' include education (share completed year 12), unemployment rate, religion shares, proportion under 30, and proportion with both parents born in Australia.

Table 4 – Violence and crime

	OLS				IV		
	(1) Geo+Hist	(2) +Present SR	(3) +Extended	(4) IV sample	(5) Geo+Hist	(6) +Present SR	(7) +Extended
	Assault - log(Incidents/100K)						
Historical SR	0.038**	0.049***	0.043**	0.142***	0.090+	0.196***	0.152**
	(0.017)	(0.017)	(0.017)	(0.050)	(0.058)	(0.068)	(0.070)
Number of convicts (1000s)	−0.074***	−0.089***	−0.038*	0.198	0.115	0.197	0.025
	(0.017)	(0.018)	(0.021)	(0.279)	(0.229)	(0.273)	(0.219)
Observations	1712	1709	1707	489	490	489	489
Mean rate per 100,000	1391			845			
Number of clusters	85	85	85	34	34	34	34
Wild-t bootstrapped p-value						0.016	
	Non-domestic assault - log(Incidents/100K)						
Historical SR	0.037**	0.042***	0.037**	0.068	0.136**	0.257***	0.064
	(0.014)	(0.014)	(0.014)	(0.050)	(0.060)	(0.080)	(0.045)
Number of convicts (1000s)	−0.067***	−0.092***	−0.044**	0.281	0.303	−0.045	0.347**
	(0.016)	(0.018)	(0.022)	(0.271)	(0.246)	(0.306)	(0.171)
Observations	1616	1613	1611	393	394	393	393
Mean rate per 100,000	1315			614			
Number of clusters	69	69	69	18	18	18	18
Wild-t bootstrapped p-value						0.092	
	Domestic violence - log(Incidents/100K)						
Historical SR	0.026	0.042	0.049+	0.042	0.170**	0.254***	0.077*
	(0.042)	(0.041)	(0.029)	(0.041)	(0.069)	(0.088)	(0.047)
Number of convicts (1000s)	0.219	0.116	0.103	0.116	0.047	−0.248	0.058
	(0.227)	(0.253)	(0.167)	(0.253)	(0.213)	(0.289)	(0.154)
Observations	394	393	393	393	394	393	393
Mean rate per 100,000	561			350			
Number of clusters	18	18	18	18	18	18	18
Wild-t bootstrapped p-value						0.102	
	Sexual offenses - log(Incidents/100K)						
Historical SR	−0.046	−0.032	−0.008	0.073*	0.026	0.100*	0.049
	(0.040)	(0.044)	(0.048)	(0.040)	(0.044)	(0.052)	(0.050)
Number of convicts (1000s)	−0.103***	−0.121***	−0.093***	−0.149	−0.212	−0.149	−0.297+
	(0.018)	(0.021)	(0.025)	(0.192)	(0.279)	(0.181)	(0.198)
Observations	1451	1448	1447	489	490	489	489
Mean rate per 100,000	242			139			
Number of clusters	69	69	69	34	34	34	34
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Minerals and land type	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Present-day SR and population	No	Yes	Yes	Yes	No	Yes	Yes
Present-day postal area controls	No	No	Yes	No	No	No	Yes

+ $p < 0.15$, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Notes: Standard errors clustered at the historical county level. 'Geographic controls' are a postal area's centroid's latitude and longitude. 'Minerals and land type' is the presence and type of mineral deposit (minor coal; minor other; major coal; major copper; major gold; major mineral sands; major others) and land formation (plains and plateaus; hills and ridges; low plateaus and low hills; mountains), which are provided by Geoscience Australia. 'Historic controls' are: the historical county population, convict population, as well as the proportion of residents working historically in agriculture, domestic service, manufacturing, mining, government services and learned professions. 'Present-day SR and population' in are the number of men to women in a postal area, total population of postal area, and whether a postal area is urban. 'Present-day postal area controls' include education (share completed year 12), unemployment rate, religion shares, proportion under 30, and proportion with both parents born in Australia.

Table 5 – Violence and crime

	OLS				IV		
	(1) Geo+Hist	(2) +Present SR	(3) +Extended	(4) IV sample	(5) Geo+Hist	(6) +Present SR	(7) +Extended
	Property crime - log(Incidents/100K)						
Historical SR	−0.021	−0.003	0.015	0.036	0.026	0.065^{+}	0.027
	(0.029)	(0.023)	(0.016)	(0.031)	(0.037)	(0.041)	(0.026)
Number of convicts (1000s)	−0.091***	−0.115***	−0.107***	−0.003	−0.026	−0.004	−0.020
	(0.023)	(0.025)	(0.027)	(0.113)	(0.146)	(0.103)	(0.110)
Observations	1712	1709	1707	489	490	489	489
Mean rate per 100,000	4115			3813			
Number of clusters	85	85	85	34	34	34	34
	Homicide - log(Incidents/100K)						
Historical SR	0.022	0.029	0.041**	−0.002	−0.049	−0.051	−0.058
	(0.027)	(0.024)	(0.018)	(0.045)	(0.055)	(0.059)	(0.061)
Number of convicts (1000s)	−0.040**	−0.056***	−0.043**	0.214	0.231	0.214	0.169
	(0.019)	(0.019)	(0.020)	(0.182)	(0.187)	(0.189)	(0.185)
Observations	1712	1709	1707	489	490	489	489
Mean rate per 100,000	2			2			
Number of clusters	85	85	85	34	34	34	34
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Minerals and land type	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Present-day SR and population	No	Yes	Yes	Yes	No	Yes	Yes
Present-day postal area controls	No	No	Yes	No	No	No	Yes

$^{+}$ $p < 0.15$, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Notes: Standard errors clustered at the historical county level. 'Geographic controls' are a postal area's centroid's latitude and longitude. 'Minerals and land type' is the presence and type of mineral deposit (minor coal; minor other; major coal; major copper; major gold; major mineral sands; major others) and land formation (plains and plateaus; hills and ridges; low plateaus and low hills; mountains), which are provided by Geoscience Australia. 'Historic controls' are: the historical county population, convict population, as well as the proportion of residents working historically in agriculture, domestic service, manufacturing, mining, government services and learned professions. 'Present-day SR and population' in are the number of men to women in a postal area, total population of postal area, and whether a postal area is urban. 'Present-day postal area controls' include education (share completed year 12), unemployment rate, religion shares, proportion under 30, and proportion with both parents born in Australia.

Table 6 – Excessive drinking (HILDA)

	OLS				IV		
	(1) Geo+Hist	(2) +Present SR	(3) +Extended	(4) IV sample	(5) Geo+Hist	(6) +Present SR	(7) +Extended
Historical SR - Males	0.001	0.001	0.001	0.003	0.033***	0.036**	0.029**
	(0.002)	(0.002)	(0.001)	(0.004)	(0.013)	(0.016)	(0.014)
Historical SR - Females	−0.000	−0.001	−0.001	0.000	0.028**	0.031**	0.024*
	(0.002)	(0.002)	(0.002)	(0.003)	(0.012)	(0.015)	(0.013)
Number of convicts (1000s)	−0.004***	−0.005***	−0.002+	0.020*	0.018+	0.021*	0.018+
	(0.001)	(0.001)	(0.001)	(0.010)	(0.012)	(0.012)	(0.012)
Observations	44183	44183	44183	14962	14962	14962	14962
R^2	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Mean of dependent var	0.13			0.12			
Number of clusters	81	81	81	31	31	31	31
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Minerals and land type	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Present-day SR and population	No	Yes	Yes	Yes	No	Yes	Yes
Present-day postal area controls	No	No	Yes	No	No	No	Yes
Wild-t bootstrapped p-value							
Males						0.004	
Females						0.006	

+ $p < 0.15$, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Notes: Source: HILDA, waves 2001, 2005, 2008, and 2011. Individual-level controls include age, gender, and if born in Australia, as well as year fixed effects. Standard errors clustered at the historical county level. 'Geographic controls' are a postal area's centroid's latitude and longitude. 'Minerals and land type' is the presence and type of mineral deposit (minor coal; minor other; major coal; major copper; major gold; major mineral sands; major others) and land formation (plains and plateaus; hills and ridges; low plateaus and low hills; mountains), which are provided by Geoscience Australia. 'Historic controls' are: the historical county population, convict population, as well as the proportion of residents working historically in agriculture, domestic service, manufacturing, mining, government services and learned professions. 'Present-day SR and population' in are the number of men to women in a postal area, total population of postal area, and whether a postal area is urban. 'Present-day postal area controls' include education (share completed year 12), unemployment rate, religion shares, proportion under 30, and proportion with both parents born in Australia.

Table 7 – Present-day employment in stereotypically male or female occupations

	Share of men employed in			Share of women employed in		
	(1) Feminine occupation	(2) Neutral occupation	(3) Masculine occupation	(4) Feminine occupation	(5) Neutral occupation	(6) Masculine occupation
Panel A: OLS						
Historical SR	−0.226***	−1.165***	0.344*	0.657***	0.832+	−0.023
	(0.072)	(0.267)	(0.204)	(0.213)	(0.518)	(0.023)
Number of convicts (1000s)	−0.452***	−0.184	−0.090	0.406***	−0.015	−0.038
	(0.085)	(0.301)	(0.127)	(0.135)	(0.314)	(0.031)
Observations	1889	1889	1889	1889	1889	1889
R^2	0.39	0.31	0.05	0.10	0.17	0.16
Mean of dependent var	6.83	40.57	95.88	91.11	56.15	1.36
Number of clusters	91	91	91	91	91	91
Panel B: IV						
Historical SR	−0.250	−0.001	0.623**	0.819*	0.339	−0.011
	(0.408)	(0.833)	(0.272)	(0.456)	(0.786)	(0.088)
Number of convicts (1000s)	−1.810*	−0.210	0.572	1.049	1.107	−0.161
	(1.016)	(2.883)	(0.861)	(1.248)	(2.742)	(0.192)
Observations	509	509	509	509	509	509
R^2	0.36	0.41	0.05	0.12	0.36	0.24
Mean of dependent var	8.84	45.48	97.31	90.57	53.54	1.51
Number of clusters	34	34	34	34	34	34

+ $p < 0.15$, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Standard errors clustered at the historical county level. Estimated based on the prefered specification with the following controls: 'Geographic controls' are a postal area's centroid's latitude and longitude. 'Minerals and land type' is the presence and type of mineral deposit (minor coal; minor other; major coal; major copper; major gold; major mineral sands; major others) and land formation (plains and plateaus; hills and ridges; low plateaus and low hills; mountains), which are provided by Geoscience Australia. 'Historic controls' are: the historical county population, convict population, as well as the proportion of residents working historically in agriculture, domestic service, manufacturing, mining, government services and learned professions. 'Present-day SR and population' in are the number of men to women in a postal area, total population of postal area, and whether a postal area is urban.Data are from the 2011 Australian Census.

Table 8 – First stage

	Dependent var: Historical sex ratio					
	Referendum		HILDA		Crime	
	(1)	(2)	(3)	(4)	(5)	(6)
Convict sex ratio	0.036***	0.036***	0.024***	0.025***	0.036***	0.036***
	(0.006)	(0.006)	(0.008)	(0.008)	(0.006)	(0.006)
Number of convicts (1000s)	0.556	0.609+	0.329	0.316	0.559	0.610+
	(0.438)	(0.405)	(0.420)	(0.423)	(0.440)	(0.406)
Observations	512	512	16717	16717	489	489
Number of clusters	34	34	31	31	34	34
R^2	0.83	0.85	0.86	0.87	0.81	0.83
F-statistic (1st stage)	36	40	10	9	36	40
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes
Minerals and land type	Yes	Yes	Yes	Yes	Yes	Yes
Present-day SR and population	Yes	Yes	Yes	Yes	Yes	Yes
Present-day postal area controls	No	Yes	No	Yes	No	Yes

+ $p < 0.15$, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Notes: Source: HILDA, waves 2001, 2005, 2008, and 2011. Individual-level controls include age, gender, and if born in Australia, as well as year fixed effects. Standard errors clustered at the historical county level. 'Geographic controls' are a postal area's centroid's latitude and longitude. 'Minerals and land type' is the presence and type of mineral deposit (minor coal; minor other; major coal; major copper; major gold; major mineral sands; major others) and land formation (plains and plateaus; hills and ridges; low plateaus and low hills; mountains), which are provided by Geoscience Australia. 'Historic controls' are: the historical county population, convict population, as well as the proportion of residents working historically in agriculture, domestic service, manufacturing, mining, government services and learned professions. 'Present-day SR and population' in are the number of men to women in a postal area, total population of postal area, and whether a postal area is urban. 'Present-day postal area controls' include education (share completed year 12), unemployment rate, religion shares, proportion under 30, and proportion with both parents born in Australia.

For Online Publication Only

APPENDIX

Men. Roots and Consequences of Masculinity Norms

Victoria Baranov, Ralph De Haas and Pauline Grosjean

Contents:

1. Variables description

We describe below the data sources and variable definitions for the variables used in the current paper.

1.1. Historical variables

For a full list of maps and description of historical data sources used in the construction of the historical variables, we refer the reader to Grosjean and Khattar (2018) online Appendix, section 3.

The historical data used in the current paper consists of the earliest reliable Census collected in each state. The first Censuses administered are used to calculate the gender ratio for all colonies, except NSW where the second Census is used for the following reason. The first Census at the county level in NSW was in 1833. However, adequate information on county boundaries is not available for NSW until 1834 when Surveyor General Major Thomas Mitchell was commissioned to map NSW into 19 formal counties. As a result, for NSW we use the second Census, which occurred in 1834. Here are the years of each Census used in the paper for each state: NSW (includes ACT): 1834, TAS: 1842, SA: 1844, WA: 1848, VIC: 1854, QLD: 1861. Historical Census data is taken from the Historical Census and Colonial Data Archive (HCCDA).[1] [2] For all historical variables, the unit of observation is the county or police district (as applicable). Data on economic occupations is from the Census in which it is first available (see Table A13 in Online Appendix of Grosjean and Khattar (2018)).

Variable	Description
Historical Sex Ratio	Number of men to the number of women
Convict Sex Ratio	Number of convict men to the number of convict women
Prop. agriculture	Proportion of population employed in agriculture
Prop. domestic services	Proportion of population employed in domestic services
Prop. mining and manufacturing	Proportion of population employed in mining and manufacturing
Prop. government and learned professions	Proportion of population employed in government and learned professions, including teaching

1.2. Referendum on same-sex marriage

The Australian Marriage Law Postal Survey was conducted by the Australian Bureau of Statistics (ABS) as a postal vote between 12 September and 7 November 2017. Turnout was 79.5%. Results of the referendum were released at the Federal Electoral

[1] For the 1881 Tasmanian census, the HCCDA was supplemented by the actual Census report due to errors.

[2] Only the Census reports are available consistently across the relevant period, as some of the individual records were destroyed in a fire in 1882.

Division level (150 Federal Electoral Divisions) by the ABS on 15 November 2017 at 11.30AM (abs.gov.au/ausstats/abs@.nsf/mf/1800.0), and accessed by the researchers on 15 November 2017 at 7PM.

Variable	**Description**
% voted 'Yes'	Percentage of total eligible registered voters who voted yes to the question posed in the Marriage Law Postal Survey: "*Should the law be changed to allow same-sex couples to marry?*"
% abstention	Percentage of total eligible registered voters who did not send back their reply in the Marriage Law Postal Survey

3. Census

We use postcode-level controls from the 2016 Australian Census.

Variable	**Description**
Contemporary sex ratio	Number of men to the number of women
Contemporary population	Total population
Urban	Dummy variable equal to one if a postal area is classified as urban by the Australian Bureau of Statistics
Unemployment rate	Percentage of people not working more than one hour in the reference week; actively looking for work in previous four weeks; and being available to start work in the reference week.
Religious shares	% of the population self-declaring as: - Buddhist - Anglican - Catholic - Other Christian - Islam - No religion
% under 30 years old	Percentage of the population under 30 years of age
% completed high school	Percentage of people who completed year 12 education (graduated from high school)
% parents born in Australia	Percentage of the population with both parents born in Australia

4. HILDA

HILDA is a nationally representative survey available since 2001. For our paper, variables taken from the HILDA survey are observed in 2005, 2008 and 2011. HILDA provides a vast array of information on households and individuals who are representative of the Australian population. Adult members of households are interviewed annually and are asked to complete a questionnaire but the set of variables change every year.

For all HILDA variables, the unit of observation is an individual living in a postcode.

Variable	Description
Supports same-sex marriage	A dummy variable taking value 1 if the respondents'' response to the following question: "*How much do you agree with the statement: 'Homosexual couples should have the same rights as heterosexual couples do'* is strictly above 3. Response categories range from 1 (strongly disagree) to 7 (strongly agree).
Drinks excessively	Dummy variable taking value 1 if the respondent answers that he/she drinks strictly more than 4 standard drinks to a question probing about the number of standard drinks usually consumed per day. There are 7 categories of possible answers: 1) 13 or more standard drinks, 2) 11 to 12 standard drinks, 3) 9 to 10 standard drinks, 4) 7 to 8 standard drinks, 5) 5 to 6 standard drinks, 6) 3 to 4 standard drinks, 7) 1 to 2 standard drinks. Drinks excessively takes value of 0 if the respondent does not drink, or answers 7 or 6 to this question. If the respondent answers 1) to 5) to this question, Drinks excessively takes value of 1.

5. Crime data

Each state in Australia constitutes a separate criminal jurisdiction. As a consequence, crime classification and reporting varies across states. We obtain crime data at the postcode level from each state. The process to obtain such data varies across states. For our states of interest:
- NSW, SA, VIC: crime data is available through dedicated statistical agencies (the NSW Bureau of Crime Statistics and Research, the SA Office of Crime Statistics and Research, and the Crime Statistics Agency of VIC) and publicly available. For NSW, we were also able to obtain further data on offenders and victims of assault and homicide (excluding driving causing death) by gender, age postcode of residence of offenders and postcode where the offense took place. Publicly available crime data from QLD was obtained from the QLD Police Service. Data was obtained from the TAS department of police after filing of a special request.
- WA and ACT: additional procedures and filing of a Freedom of Information act are necessary. We are in the process of obtaining data for those states.

Crime classification and reporting periods vary across states, as described in the following table. For some states, we do not list exhaustively all the crime categories, and group other reported offences as "Other offences". Many states (see Table Crime1 below) do not provide information on domestic violence because of confidentiality issues.

Table Crime1: Crime data available in Australia

State	Type of crime reported	Reporting years
NSW	- Homicide - Assaults (broken down by assault against police, domestic violence, non domestic violence) - Sexual offenses - Robbery - Theft - Drug offenses - Disorderly conduct (with several subcategories) - Other offences	1995 - 2016
TAS	- Homicide - Assaults - Sexual assault - Offences against property	1999 - 2016
VIC	- Homicide - Assaults - Sexual offenses - Robbery	2005 - 2016
SA	- Homicide - Assaults - Disorderly conduct - Robbery - Theft - Other offences	2012 - 2016
QLD	- Homicide - Assaults - Sexual offenses - Robbery - Disorderly conduct - Other offences	1998 - 2016

We only retain data between 2006 and 2016. We merge the crime data with early counts of population from the 2006, 2011, 2016 population Census, with interpolation in between Census years in order to compute rates of assaults per 100,000 people. Below is a description of the variables used in the paper and information related to the available data:

Table Crime2: Crime variables used in the paper:

Variable	Description
Assault	Natural logarithm of the mean of the number of all assaults per 100,000 people between 2006 and 2016 (+1)
Non-domestic assault	Natural logarithm of the mean of the number of all non-domestic assaults per 100,000 people between 2006 and 2016 (+1)
Domestic assault	Natural logarithm of the mean of the number of all domestic assaults per 100,000 people between 2006 and 2016 (+1)
Sexual offenses	Natural logarithm of the mean of the number of all domestic assaults per 100,000 people between 2006 and 2016 (+1)

Property crime	Natural logarithm of the mean of the number of all robbery and theft/offences against property per 100,000 people between 2006 and 2016 (+1)
Homicide	

6. Minerals and land formation

Data on minerals and land formation is taken from Geoscience Australia (https://ecat.ga.gov.au/geonetwork/srv/eng/catalog.search;jsessionid=AA779B91F9E5623DAD7B242B094803CD#/search?resultType=details&from=1&to=20&sortBy=changeDate). We downloaded topology and mineral deposits maps and aggregated this information at the postcode level.

Variable	**Description**
Landform	Main classification of the postcode in different categories: - Plains, plateaus, sand plains - Hills and ridges - Low plateaus and low hills - Mountains
Minerals	Main classification of the postcode in different categories: - Minor coal - Minor others - Major coal - Major copper - Major gold - Major mineral sands - Major oil and gas - Major other - No minerals or traces

2. Additional tables

Table A1 to A6 replicate the results tables in the main paper with the log of the historical sex ratio instead of the historical sex ratio in order to investigate the robustness of the results to non-linear effects of the historical sex ratio.

Table A1: Male-biased historical sex ratios and support for same-sex marriage in the Australian referendum – historical sex ratio in logs

	OLS				IV		
	(1) Geo+Hist	(2) +Present SR	(3) +Extended	(4) IV sample	(5) Geo+Hist	(6) +Present SR	(7) +Extended
Panel A: Percent voted 'yes'							
Historical SR (log)	−0.045***	−0.030***	−0.018***	−0.044***	−0.046+	−0.048**	−0.042***
	(0.009)	(0.006)	(0.006)	(0.012)	(0.028)	(0.023)	(0.011)
Number of convicts (1000s)	−0.013***	−0.016***	−0.011***	−0.011	−0.010	−0.010	0.027***
	(0.002)	(0.002)	(0.002)	(0.008)	(0.011)	(0.008)	(0.009)
Observations	1890	1884	1880	508	509	508	508
R^2	0.35	0.49	0.69	0.39	0.29	0.39	0.78
Mean of dependent var	0.49			0.48	0.48		
Number of clusters	91	91	91	34	34	34	34
Panel B: Percent abstained							
Historical SR (log)	0.013***	0.010***	0.008**	0.015**	0.009	0.008	0.007
	(0.004)	(0.003)	(0.003)	(0.006)	(0.008)	(0.008)	(0.008)
Number of convicts (1000s)	0.002**	0.002**	0.001*	0.004	0.005	0.005	−0.003
	(0.001)	(0.001)	(0.001)	(0.006)	(0.006)	(0.006)	(0.004)
Observations	1890	1884	1880	508	509	508	508
R^2	0.43	0.47	0.64	0.39	0.38	0.39	0.71
Mean of dependent var	0.20			0.20			
Number of clusters	91	91	91	34	34	34	34
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Minerals and land type	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Present-day SR and population	No	Yes	Yes	Yes	No	Yes	Yes
Present-day postal area controls	No	No	Yes	No	No	No	Yes
Wild-t bootstrapped p-value Percent voted yes						0.12	
Wild-t bootstrapped p-value Percent abstained						0.04	

$+ p < 0.15$, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Standard errors clustered at the historical county level. 'Geographic controls' are a postal area's centroid's latitude and longitude. 'Minerals and land type' is the presence and type of mineral deposit (minor coal; minor other; major coal; major copper; major gold; major mineral sands; major others) and land formation (plains and plateaus; hills and ridges; low plateaus and low hills; mountains), which are provided by Geoscience Australia. 'Historic controls' are: the historical county population, convict population, as well as the proportion of residents working historically in agriculture, domestic service, manufacturing, mining, government services and learned professions. 'Present-day SR and population' in are the number of men to women in a postal area, total population of postal area, and whether a postal area is urban. 'Present-day postal area controls' include education (share completed year 12), unemployment rate, religion shares, proportion under 30, and proportion with both parents born in Australia.

Table A2: Individual-level support for same-sex marriage (HILDA) – historical sex ratio in logs

	OLS				IV		
	(1) Geo+Hist	(2) +Present SR	(3) +Extended	(4) IV sample	(5) Geo+Hist	(6) +Present SR	(7) +Extended
Historical SR - Males	−0.081***	−0.059***	−0.040***	−0.113**	−0.070	−0.114*	−0.116**
	(0.016)	(0.016)	(0.014)	(0.043)	(0.074)	(0.063)	(0.046)
Historical SR - Females	−0.054***	−0.031*	−0.012	−0.073+	−0.041	−0.083	−0.090*
	(0.016)	(0.016)	(0.015)	(0.045)	(0.079)	(0.067)	(0.047)
Number of convicts (1000s)	−0.007***	−0.014***	−0.008***	−0.060**	−0.048*	−0.059**	−0.010
	(0.002)	(0.003)	(0.003)	(0.026)	(0.028)	(0.028)	(0.029)
Observations	32234	32234	32234	10892	10892	10892	10892
R^2	0.09	0.10	0.11	0.11	0.10	0.11	0.12
Mean of dependent var	0.63			0.64			
Number of clusters	81	81	81	31	31	31	31
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Minerals and land type	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Present-day SR and population	No	Yes	Yes	Yes	No	Yes	Yes
Present-day postal area controls	No	No	Yes	No	No	No	Yes

$+ p < 0.15$, $* p < 0.1$, $** p < 0.05$, $*** p < 0.01$.

Notes: Source: HILDA, waves 2005, 2008, and 2011. Individual-level controls include age, gender, and if born in Australia, as well as year fixed effects. Standard errors clustered at the historical county level. 'Geographic controls' are a postal area's centroid's latitude and longitude. 'Minerals and land type' is the presence and type of mineral deposit (minor coal; minor other; major coal; major copper; major gold; major mineral sands; major others) and land formation (plains and plateaus; hills and ridges; low plateaus and low hills; mountains), which are provided by Geoscience Australia. 'Historic controls' are: the historical county population, convict population, as well as the proportion of residents working historically in agriculture, domestic service, manufacturing, mining, government services and learned professions. 'Present-day SR and population' in are the number of men to women in a postal area, total population of postal area, and whether a postal area is urban. 'Present-day postal area controls' include education (share completed year 12), unemployment rate, religion shares, proportion under 30, and proportion with both parents born in Australia.

Table A3: Violence and crime – historical sex ratio in logs

	OLS				IV		
	(1) Geo+Hist	(2) +Present SR	(3) +Extended	(4) IV sample	(5) Geo+Hist	(6) +Present SR	(7) +Extended
	Assault - log(Incidents/100K)						
Historical SR (log)	0.096	0.178^{+}	0.160	0.715**	0.055	0.538	0.635*
	(0.125)	(0.117)	(0.113)	(0.278)	(0.320)	(0.391)	(0.369)
Number of convicts (1000s)	−0.076***	−0.089***	−0.037*	0.098	0.117	0.124	−0.059
	(0.018)	(0.019)	(0.021)	(0.287)	(0.252)	(0.286)	(0.239)
Observations	1712	1709	1707	489	490	489	489
Mean rate per 100,000	1391			845			
Number of clusters	85	85	85	34	34	34	34
	Non-domestic assault - log(Incidents/100K)						
Historical SR (log)	0.123	0.167^{+}	0.155^{+}	0.315	0.437*	0.789**	0.451**
	(0.108)	(0.103)	(0.105)	(0.241)	(0.252)	(0.323)	(0.196)
Number of convicts (1000s)	−0.067***	−0.090***	−0.042**	0.218	0.260	−0.052	0.207
	(0.017)	(0.018)	(0.021)	(0.286)	(0.240)	(0.279)	(0.187)
Observations	1616	1613	1611	393	394	393	393
Mean rate per 100,000	1315			614			
Number of clusters	69	69	69	18	18	18	18
	Domestic violence - log(Incidents/100K)						
Historical SR (log)	0.103	0.185	0.239^{+}	0.185	0.400^{+}	0.595**	0.391*
	(0.211)	(0.208)	(0.153)	(0.208)	(0.259)	(0.258)	(0.208)
Number of convicts (1000s)	0.201	0.084	0.053	0.084	0.062	−0.150	−0.029
	(0.241)	(0.266)	(0.189)	(0.266)	(0.214)	(0.233)	(0.187)
Observations	394	393	393	393	394	393	393
Mean rate per 100,000	561			350			
Number of clusters	18	18	18	18	18	18	18
	Sexual offenses - log(Incidents/100K)						
Historical SR (log)	−0.258	−0.198	−0.157	0.372*	−0.039	0.301	0.282
	(0.190)	(0.204)	(0.219)	(0.209)	(0.245)	(0.285)	(0.235)
Number of convicts (1000s)	−0.109***	−0.127***	−0.100***	−0.201	−0.203	−0.191	−0.337*
	(0.020)	(0.023)	(0.027)	(0.195)	(0.270)	(0.187)	(0.191)
Observations	1451	1448	1447	489	490	489	489
Mean rate per 100,000	242			139			
Number of clusters	69	69	69	34	34	34	34
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Minerals and land type	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Present-day SR and population	No	Yes	Yes	Yes	No	Yes	Yes
Present-day postal area controls	No	No	Yes	No	No	No	Yes

$+\ p < 0.15$, $^{*}\ p < 0.1$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$.

Notes: Standard errors clustered at the historical county level. 'Geographic controls' are a postal area's centroid's latitude and longitude. 'Minerals and land type' is the presence and type of mineral deposit (minor coal; minor other; major coal; major copper; major gold; major mineral sands; major others) and land formation (plains and plateaus; hills and ridges; low plateaus and low hills; mountains), which are provided by Geoscience Australia. 'Historic controls' are: the historical county population, convict population, as well as the proportion of residents working historically in agriculture, domestic service, manufacturing, mining, government services and learned professions. 'Present-day SR and population' in are the number of men to women in a postal area, total population of postal area, and whether a postal area is urban. 'Present-day postal area controls' include education (share completed year 12), unemployment rate, religion shares, proportion under 30, and proportion with both parents born in Australia.

Table A4: Violence and crime ct'd - – historical sex ratio in logs

	OLS				IV		
	(1) Geo+Hist	(2) +Present SR	(3) +Extended	(4) IV sample	(5) Geo+Hist	(6) +Present SR	(7) +Extended
	Property crime - log(Incidents/100K)						
Historical SR (log)	−0.323**	−0.211+	−0.084	0.207	0.005	0.188	0.129
	(0.160)	(0.136)	(0.098)	(0.182)	(0.207)	(0.262)	(0.161)
Number of convicts (1000s)	−0.106***	−0.127***	−0.114***	−0.032	−0.023	−0.029	−0.038
	(0.025)	(0.027)	(0.028)	(0.115)	(0.151)	(0.119)	(0.112)
Observations	1712	1709	1707	489	490	489	489
Mean rate per 100,000	4115			3813			
Number of clusters	85	85	85	34	34	34	34
	Homicide - log(Incidents/100K)						
Historical SR (log)	−0.032	0.016	0.103	−0.025	−0.280	−0.283	−0.210
	(0.131)	(0.123)	(0.101)	(0.238)	(0.277)	(0.291)	(0.274)
Number of convicts (1000s)	−0.046**	−0.061***	−0.045**	0.217	0.270	0.254	0.196
	(0.020)	(0.020)	(0.021)	(0.182)	(0.198)	(0.198)	(0.186)
Observations	1712	1709	1707	489	490	489	489
Mean rate per 100,000	2			2			
Number of clusters	85	85	85	34	34	34	34
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Minerals and land type	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Present-day SR and population	No	Yes	Yes	Yes	No	Yes	Yes
Present-day postal area controls	No	No	Yes	No	No	No	Yes

+ $p < 0.15$, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Notes: Standard errors clustered at the historical county level. 'Geographic controls' are a postal area's centroid's latitude and longitude. 'Minerals and land type' is the presence and type of mineral deposit (minor coal; minor other; major coal; major copper; major gold; major mineral sands; major others) and land formation (plains and plateaus; hills and ridges; low plateaus and low hills; mountains), which are provided by Geoscience Australia. 'Historic controls' are: the historical county population, convict population, as well as the proportion of residents working historically in agriculture, domestic service, manufacturing, mining, government services and learned professions. 'Present-day SR and population' in are the number of men to women in a postal area, total population of postal area, and whether a postal area is urban. 'Present-day postal area controls' include education (share completed year 12), unemployment rate, religion shares, proportion under 30, and proportion with both parents born in Australia.

Table A5: Excessive drinking – historical sex ratio in logs

	OLS				IV		
	(1) Geo+Hist	(2) +Present SR	(3) +Extended	(4) IV sample	(5) Geo+Hist	(6) +Present SR	(7) +Extended
Historical SR - Males	0.010	0.009	0.007	0.019	0.065	0.064+	0.073**
	(0.009)	(0.009)	(0.009)	(0.020)	(0.046)	(0.044)	(0.037)
Historical SR - Females	0.001	0.001	−0.001	0.005	0.047	0.047	0.056+
	(0.009)	(0.009)	(0.008)	(0.019)	(0.044)	(0.042)	(0.035)
Number of convicts (1000s)	−0.004**	−0.005***	−0.002	0.019*	0.013	0.013	0.009
	(0.002)	(0.002)	(0.001)	(0.010)	(0.012)	(0.012)	(0.012)
Observations	44183	44183	44183	14962	14962	14962	14962
R^2	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Mean of dependent var	0.13			0.12			
Number of clusters	81	81	81	31	31	31	31
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Minerals and land type	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Present-day SR and population	No	Yes	Yes	Yes	No	Yes	Yes
Present-day postal area controls	No	No	Yes	No	No	No	Yes

+ $p < 0.15$, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Notes: Source: HILDA, waves 2001, 2005, 2008, and 2011. Individual-level controls include age, gender, and if born in Australia, as well as year fixed effects. Standard errors clustered at the historical county level. 'Geographic controls' are a postal area's centroid's latitude and longitude. 'Minerals and land type' is the presence and type of mineral deposit (minor coal; minor other; major coal; major copper; major gold; major mineral sands; major others) and land formation (plains and plateaus; hills and ridges; low plateaus and low hills; mountains), which are provided by Geoscience Australia. 'Historic controls' are: the historical county population, convict population, as well as the proportion of residents working historically in agriculture, domestic service, manufacturing, mining, government services and learned professions. 'Present-day SR and population' in are the number of men to women in a postal area, total population of postal area, and whether a postal area is urban. 'Present-day postal area controls' include education (share completed year 12), unemployment rate, religion shares, proportion under 30, and proportion with both parents born in Australia.

Table A6: First stage – historical sex ratio in logs

	Dependent var: Historical sex ratio					
	Referendum		HILDA		Crime	
	(1)	(2)	(3)	(4)	(5)	(6)
Convict sex ratio (log)	0.381***	0.376***	0.365***	0.360***	0.381***	0.376***
	(0.056)	(0.054)	(0.068)	(0.066)	(0.056)	(0.054)
Number of convicts (1000s)	0.074	0.079	0.027	0.023	0.074	0.079
	(0.126)	(0.117)	(0.111)	(0.107)	(0.126)	(0.117)
Observations	512	512	16717	16717	489	489
Number of clusters	34	34	31	31	34	34
R^2	0.94	0.94	0.96	0.96	0.92	0.93
F-statistic (1st stage)	47	49	28	29	47	48
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes
Minerals and land type	Yes	Yes	Yes	Yes	Yes	Yes
Present-day SR and population	Yes	Yes	Yes	Yes	Yes	Yes
Present-day postal area controls	No	Yes	No	Yes	No	Yes

$+ p < 0.15$, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Notes: Source: HILDA, waves 2001, 2005, 2008, and 2011. Individual-level controls include age, gender, and if born in Australia, as well as year fixed effects. Standard errors clustered at the historical county level. 'Geographic controls' are a postal area's centroid's latitude and longitude. 'Minerals and land type' is the presence and type of mineral deposit (minor coal; minor other; major coal; major copper; major gold; major mineral sands; major others) and land formation (plains and plateaus; hills and ridges; low plateaus and low hills; mountains), which are provided by Geoscience Australia. 'Historic controls' are: the historical county population, convict population, as well as the proportion of residents working historically in agriculture, domestic service, manufacturing, mining, government services and learned professions. 'Present-day SR and population' in are the number of men to women in a postal area, total population of postal area, and whether a postal area is urban. 'Present-day postal area controls' include education (share completed year 12), unemployment rate, religion shares, proportion under 30, and proportion with both parents born in Australia.

Table A7 to A12 replicate the results tables in the main paper when outliers in terms of the historical sex ratio are removed. We removed any county in which the local historical sex ratio was above 11 (781 postcodes included in 4 historical counties deleted), and counties in which the local sex ratio among convicts was above 200 (5 additional postcodes in an additional historical county deleted).

Table A7: Male-biased historical sex ratios and support for same-sex marriage in the Australian referendum – without outliers

	OLS				IV		
	(1) Geo+Hist	(2) +Present SR	(3) +Extended	(4) IV sample	(5) Geo+Hist	(6) +Present SR	(7) +Extended
Panel A: Percent voted 'yes'							
Historical SR	−0.016***	−0.010***	−0.007***	−0.010***	−0.019+	−0.017+	−0.008***
	(0.004)	(0.003)	(0.002)	(0.003)	(0.013)	(0.011)	(0.003)
Number of convicts (1000s)	−0.013***	−0.017***	−0.011***	−0.016*	−0.010	−0.013	0.020***
	(0.002)	(0.002)	(0.002)	(0.009)	(0.012)	(0.010)	(0.007)
Observations	1878	1872	1868	503	504	503	503
R^2	0.35	0.48	0.69	0.38	0.28	0.38	0.78
Mean of dependent var	0.49			0.48	0.48		
Number of clusters	88	88	88	33	33	33	33
Panel B: Percent abstained							
Historical SR	0.004**	0.002+	0.002	0.002*	0.002	0.002	−0.000
	(0.002)	(0.002)	(0.001)	(0.001)	(0.003)	(0.003)	(0.001)
Number of convicts (1000s)	0.002**	0.002**	0.001**	0.008	0.009+	0.008+	0.001
	(0.001)	(0.001)	(0.001)	(0.006)	(0.006)	(0.005)	(0.004)
Observations	1878	1872	1868	503	504	503	503
R^2	0.42	0.46	0.64	0.36	0.35	0.36	0.71
Mean of dependent var	0.20			0.20			
Number of clusters	88	88	88	33	33	33	33
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Minerals and land type	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Present-day SR and population	No	Yes	Yes	Yes	No	Yes	Yes
Present-day postal area controls	No	No	Yes	No	No	No	Yes
Wild-t bootstrapped p-value Percent voted yes						0.12	
Wild-t bootstrapped p-value Percent abstained						0.04	

+ $p < 0.15$, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
Standard errors clustered at the historical county level. 'Geographic controls' are a postal area's centroid's latitude and longitude. 'Minerals and land type' is the presence and type of mineral deposit (minor coal; minor other; major coal; major copper; major gold; major mineral sands; major others) and land formation (plains and plateaus; hills and ridges; low plateaus and low hills; mountains), which are provided by Geoscience Australia. 'Historic controls' are: the historical county population, convict population, as well as the proportion of residents working historically in agriculture, domestic service, manufacturing, mining, government services and learned professions. 'Present-day SR and population' in are the number of men to women in a postal area, total population of postal area, and whether a postal area is urban. 'Present-day postal area controls' include education (share completed year 12), unemployment rate, religion shares, proportion under 30, and proportion with both parents born in Australia.

Table A8: Individual-level support for same-sex marriage (HILDA) – without outliers

	OLS				IV		
	(1) Geo+Hist	(2) +Present SR	(3) +Extended	(4) IV sample	(5) Geo+Hist	(6) +Present SR	(7) +Extended
Historical SR - Males	−0.027***	−0.022***	−0.017***	−0.029***	−0.045**	−0.048***	−0.040***
	(0.005)	(0.005)	(0.005)	(0.007)	(0.021)	(0.018)	(0.013)
Historical SR - Females	−0.019***	−0.014**	−0.009	−0.019**	−0.039*	−0.041**	−0.035**
	(0.006)	(0.006)	(0.007)	(0.007)	(0.023)	(0.020)	(0.015)
Number of convicts (1000s)	−0.007***	−0.014***	−0.008***	−0.068**	−0.043	−0.065**	−0.018
	(0.002)	(0.003)	(0.002)	(0.025)	(0.031)	(0.031)	(0.032)
Observations	32079	32079	32079	10843	10843	10843	10843
R^2	0.09	0.10	0.11	0.11	0.10	0.10	0.12
Mean of dependent var	0.63			0.64			
Number of clusters	79	79	79	30	30	30	30
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Minerals and land type	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Present-day SR and population	No	Yes	Yes	Yes	No	Yes	Yes
Present-day postal area controls	No	No	Yes	No	No	No	Yes

+ $p < 0.15$, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
Notes: Source: HILDA, waves 2005, 2008, and 2011. Individual-level controls include age, gender, and if born in Australia, as well as year fixed effects. Standard errors clustered at the historical county level. 'Geographic controls' are a postal area's centroid's latitude and longitude. 'Minerals and land type' is the presence and type of mineral deposit (minor coal; minor other; major coal; major copper; major gold; major mineral sands; major others) and land formation (plains and plateaus; hills and ridges; low plateaus and low hills; mountains), which are provided by Geoscience Australia. 'Historic controls' are: the historical county population, convict population, as well as the proportion of residents working historically in agriculture, domestic service, manufacturing, mining, government services and learned professions. 'Present-day SR and population' in are the number of men to women in a postal area, total population of postal area, and whether a postal area is urban. 'Present-day postal area controls' include education (share completed year 12), unemployment rate, religion shares, proportion under 30, and proportion with both parents born in Australia.

Table A9: Violence and crime – without outliers

	OLS				IV		
	(1) Geo+Hist	(2) +Present SR	(3) +Extended	(4) IV sample	(5) Geo+Hist	(6) +Present SR	(7) +Extended
	Assault - log(Incidents/100K)						
Historical SR	0.024	0.057	0.064	0.114**	0.062	0.151^{+}	0.128
	(0.043)	(0.041)	(0.046)	(0.052)	(0.095)	(0.102)	(0.113)
Number of convicts (1000s)	−0.074***	−0.086***	−0.033^{+}	0.254	0.143	0.240	0.058
	(0.019)	(0.020)	(0.022)	(0.297)	(0.256)	(0.296)	(0.244)
Observations	1700	1697	1695	484	485	484	484
Mean rate per 100,000	1395			841			
Number of clusters	82	82	82	33	33	33	33
	Non-domestic assault - log(Incidents/100K)						
Historical SR	0.023	0.038	0.040	0.049	0.090*	0.192***	0.101**
	(0.039)	(0.037)	(0.044)	(0.045)	(0.052)	(0.068)	(0.051)
Number of convicts (1000s)	−0.068***	−0.091***	−0.043*	0.423	0.429*	0.128	0.278^{+}
	(0.018)	(0.020)	(0.023)	(0.286)	(0.227)	(0.260)	(0.189)
Observations	1604	1601	1599	388	389	388	388
Mean rate per 100,000	1321			613			
Number of clusters	66	66	66	17	17	17	17
	Domestic violence - log(Incidents/100K)						
Historical SR	−0.002	0.021	0.043^{+}	0.021	0.094	0.161**	0.072*
	(0.024)	(0.022)	(0.025)	(0.022)	(0.069)	(0.074)	(0.044)
Number of convicts (1000s)	0.402^{+}	0.288	0.146	0.288	0.245	−0.001	0.090
	(0.264)	(0.287)	(0.173)	(0.287)	(0.242)	(0.264)	(0.167)
Observations	389	388	388	388	389	388	388
Mean rate per 100,000	560			347			
Number of clusters	17	17	17	17	17	17	17
	Sexual offenses - log(Incidents/100K)						
Historical SR	−0.070*	−0.053	−0.031	0.055^{+}	0.003	0.062	0.043
	(0.040)	(0.044)	(0.050)	(0.037)	(0.063)	(0.062)	(0.069)
Number of convicts (1000s)	−0.105***	−0.122***	−0.095***	−0.115	−0.193	−0.118	−0.289
	(0.018)	(0.021)	(0.026)	(0.199)	(0.283)	(0.187)	(0.203)
Observations	1446	1443	1442	484	485	484	484
Mean rate per 100,000	242			137			
Number of clusters	68	68	68	33	33	33	33
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Minerals and land type	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Present-day SR and population	No	Yes	Yes	Yes	No	Yes	Yes
Present-day postal area controls	No	No	Yes	No	No	No	Yes

$^{+}$ $p < 0.15$, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Notes: Standard errors clustered at the historical county level. 'Geographic controls' are a postal area's centroid's latitude and longitude. 'Minerals and land type' is the presence and type of mineral deposit (minor coal; minor other; major coal; major copper; major gold; major mineral sands; major others) and land formation (plains and plateaus; hills and ridges; low plateaus and low hills; mountains), which are provided by Geoscience Australia. 'Historic controls' are: the historical county population, convict population, as well as the proportion of residents working historically in agriculture, domestic service, manufacturing, mining, government services and learned professions. 'Present-day SR and population' in are the number of men to women in a postal area, total population of postal area, and whether a postal area is urban. 'Present-day postal area controls' include education (share completed year 12), unemployment rate, religion shares, proportion under 30, and proportion with both parents born in Australia.

Table A10: Violence and crime ct'd – without outliers

	OLS				IV		
	(1) Geo+Hist	(2) +Present SR	(3) +Extended	(4) IV sample	(5) Geo+Hist	(6) +Present SR	(7) +Extended
	Property crime - log(Incidents/100K)						
Historical SR	−0.128***	−0.082*	−0.027	0.023	0.004	0.048	0.031
	(0.048)	(0.043)	(0.037)	(0.033)	(0.064)	(0.068)	(0.050)
Number of convicts (1000s)	−0.107***	−0.126***	−0.111***	0.022	−0.006	0.012	−0.019
	(0.026)	(0.027)	(0.027)	(0.120)	(0.159)	(0.113)	(0.114)
Observations	1700	1697	1695	484	485	484	484
Mean rate per 100,000	4130			3817			
Number of clusters	82	82	82	33	33	33	33
	Homicide - log(Incidents/100K)						
Historical SR	−0.069*	−0.053	−0.011	−0.002	−0.098	−0.089	−0.091
	(0.038)	(0.038)	(0.037)	(0.060)	(0.100)	(0.097)	(0.120)
Number of convicts (1000s)	−0.056***	−0.071***	−0.049**	0.218	0.279	0.252	0.204
	(0.021)	(0.021)	(0.022)	(0.193)	(0.210)	(0.209)	(0.209)
Observations	1700	1697	1695	484	485	484	484
Mean rate per 100,000	2			2			
Number of clusters	82	82	82	33	33	33	33
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Minerals and land type	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Present-day SR and population	No	Yes	Yes	Yes	No	Yes	Yes
Present-day postal area controls	No	No	Yes	No	No	No	Yes

$+ p < 0.15$, $* p < 0.1$, $** p < 0.05$, $*** p < 0.01$.

Notes: Standard errors clustered at the historical county level. 'Geographic controls' are a postal area's centroid's latitude and longitude. 'Minerals and land type' is the presence and type of mineral deposit (minor coal; minor other; major coal; major copper; major gold; major mineral sands; major others) and land formation (plains and plateaus; hills and ridges; low plateaus and low hills; mountains), which are provided by Geoscience Australia. 'Historic controls' are: the historical county population, convict population, as well as the proportion of residents working historically in agriculture, domestic service, manufacturing, mining, government services and learned professions. 'Present-day SR and population' in are the number of men to women in a postal area, total population of postal area, and whether a postal area is urban. 'Present-day postal area controls' include education (share completed year 12), unemployment rate, religion shares, proportion under 30, and proportion with both parents born in Australia.

Table A11: Excessive drinking – without outliers

	OLS				IV		
	(1) Geo+Hist	(2) +Present SR	(3) +Extended	(4) IV sample	(5) Geo+Hist	(6) +Present SR	(7) +Extended
Historical SR - Males	0.001	0.000	0.000	0.003	0.027+	0.029+	0.030*
	(0.004)	(0.004)	(0.004)	(0.004)	(0.018)	(0.019)	(0.016)
Historical SR - Females	−0.002	−0.002	−0.003	0.000	0.021	0.023	0.024*
	(0.004)	(0.004)	(0.004)	(0.003)	(0.016)	(0.017)	(0.014)
Number of convicts (1000s)	−0.004***	−0.006***	−0.002+	0.027**	0.021+	0.026*	0.018
	(0.002)	(0.002)	(0.001)	(0.013)	(0.013)	(0.014)	(0.014)
Observations	43955	43955	43955	14880	14880	14880	14880
R^2	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Mean of dependent var	0.13			0.12			
Number of clusters	79	79	79	30	30	30	30
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Minerals and land type	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Present-day SR and population	No	Yes	Yes	Yes	No	Yes	Yes
Present-day postal area controls	No	No	Yes	No	No	No	Yes

$+ p < 0.15$, $* p < 0.1$, $** p < 0.05$, $*** p < 0.01$.

Notes: Source: HILDA, waves 2001, 2005, 2008, and 2011. Individual-level controls include age, gender, and if born in Australia, as well as year fixed effects. Standard errors clustered at the historical county level. 'Geographic controls' are a postal area's centroid's latitude and longitude. 'Minerals and land type' is the presence and type of mineral deposit (minor coal; minor other; major coal; major copper; major gold; major mineral sands; major others) and land formation (plains and plateaus; hills and ridges; low plateaus and low hills; mountains), which are provided by Geoscience Australia. 'Historic controls' are: the historical county population, convict population, as well as the proportion of residents working historically in agriculture, domestic service, manufacturing, mining, government services and learned professions. 'Present-day SR and population' in are the number of men to women in a postal area, total population of postal area, and whether a postal area is urban. 'Present-day postal area controls' include education (share completed year 12), unemployment rate, religion shares, proportion under 30, and proportion with both parents born in Australia.

Table A12: First stage – without outliers

	Dependent var: Historical sex ratio					
	Referendum		HILDA		Crime	
	(1)	(2)	(3)	(4)	(5)	(6)
Convict sex ratio	0.037**	0.036***	0.034**	0.033**	0.037**	0.036***
	(0.014)	(0.012)	(0.016)	(0.016)	(0.014)	(0.012)
Number of convicts (1000s)	0.554	0.607^{+}	0.200	0.203	0.555	0.609^{+}
	(0.445)	(0.408)	(0.418)	(0.417)	(0.445)	(0.409)
Observations	507	507	16626	16626	484	484
Number of clusters	33	33	30	30	33	33
R^2	0.79	0.81	0.85	0.86	0.75	0.78
F-statistic (1st stage)	7	9	4	5	7	9
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Geographic controls	Yes	Yes	Yes	Yes	Yes	Yes
Historical controls	Yes	Yes	Yes	Yes	Yes	Yes
Minerals and land type	Yes	Yes	Yes	Yes	Yes	Yes
Present-day SR and population	Yes	Yes	Yes	Yes	Yes	Yes
Present-day postal area controls	No	Yes	No	Yes	No	Yes

$+ p < 0.15$, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Notes: Source: HILDA, waves 2001, 2005, 2008, and 2011. Individual-level controls include age, gender, and if born in Australia, as well as year fixed effects. Standard errors clustered at the historical county level. 'Geographic controls' are a postal area's centroid's latitude and longitude. 'Minerals and land type' is the presence and type of mineral deposit (minor coal; minor other; major coal; major copper; major gold; major mineral sands; major others) and land formation (plains and plateaus; hills and ridges; low plateaus and low hills; mountains), which are provided by Geoscience Australia. 'Historic controls' are: the historical county population, convict population, as well as the proportion of residents working historically in agriculture, domestic service, manufacturing, mining, government services and learned professions. 'Present-day SR and population' in are the number of men to women in a postal area, total population of postal area, and whether a postal area is urban. 'Present-day postal area controls' include education (share completed year 12), unemployment rate, religion shares, proportion under 30, and proportion with both parents born in Australia.