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# **Sex Ratio and Global Sodomy Law Reform in the Post-WWII Era**

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## **Abstract**

This paper studies the role of population sex ratio, i.e. ratio of men to women, in the global wave of sodomy law reform in the post-WWII era. Using a global survey, this paper first finds that men are more homophobic than women and such pattern has persisted across countries and time. With a newly constructed panel data of 183 countries, this paper then finds that high sex ratio causally makes sodomy law less likely to be repealed. The result is robust to numerous checks, including using temperature as an instrumental variable for sex ratio.

Keywords: Sex Ratio, Sodomy Law, Gay Rights, Homophobia

JEL Codes: J16, J18, K14

## 1. Introduction

Alan Turing is widely considered as the founding father of computer science and hailed as a war hero who saved not only the United Kingdom but also millions of lives in the Second World War. Ironically, the war hero was prosecuted in 1952 for violating the then-in-effect British sodomy law, forced to undergo chemical castration as an alternative to prison and then died in 1954.<sup>1</sup> Almost six decades after his death, Queen Elizabeth II finally granted Mr. Turing a posthumous pardon. One would wonder what more could Mr. Turing have contributed to human beings regardless their sexual orientation, had the British sodomy law been repealed earlier?

Historically, sodomy law spread through the world in the 19<sup>th</sup> century largely as a legacy of British colonialism (Human Rights Watch 2008; Sanders 2009). Nevertheless, the post-WWII era has witnessed a global wave of sodomy law reform (Frank and Mceneaney 1999; Frank, Camp and Boutcher 2010). A total of 65 countries decriminalized sodomy during 1945-2016 (Carroll and Mendos, 2017). The 1990s, in particular, was the decade that has seen the most cases of decriminalization (Asal et al. 2012).

Today, despite the global wave of sodomy law reform, nearly two fifths of countries in the world still penalize same-sex sexual conduct by imprisonment or even capital punishment (Carroll and Mendos, 2017). To find out why, scholars have studied the cross-country variation in the legality of sodomy and related legislative changes from the perspective of colonialism, religion, legislative process, economic conditions etc. (Asal et al. 2012; Sommer et al. 2013; Han and O'Mahoney 2014). This small thriving literature,

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<sup>1</sup> The word, *sodomy*, originates from a biblical city *Sodom*, which was destroyed by God for the sins of its inhabitants (the Book of Genesis). The sexual acts meant by the term *sodomy* generally refer to not only sexual intercourse between individuals of the same sex but also oral sex, anal sex and bestiality. Other common legal terms include “sex against nature,” “gross indecency,” “buggery,” “unnatural intercourse,” etc. Most laws do not make a distinction between consensual and non-consensual acts. Throughout this paper, the term “sodomy law” is used to refer to these laws. Sodomy and homosexual conduct are used interchangeably.

however, overlooks the lurking global trend in gender imbalance over this period and its effect in couple with the gender difference in homophobia.

As illustrated in Figure 1, the median country sex ratio (the solid line), i.e. ratio of men to women, exhibits a U-shape curve during 1970-2015. In particular, the ratio was declining steadily and accordingly more countries were becoming feminine countries (the bar), i.e. countries with more women than men, until late 1990s when the trend was reversed. Looking back in history, the major source of variation in sex ratio across populations has been the excess in men's mortality relative to women's.<sup>2</sup> Demographers have documented that the worldwide gender gap in mortality had been widening since the late 19<sup>th</sup> century until the late 1990s when the gap started to narrow and eventually reversed (Waldron 1993; Trovato and Lalu 1996; Pampel 2002; Beltran-Sanchez et al. 2015).<sup>3</sup>

The trend in gender imbalance has a profound implication on sodomy law reform across the globe. Psychological studies, although mostly in western societies, have established that men generally hold more negative attitudes toward homosexuality than women (Herek 1988; Herek and Capitanio 1999; Whitely and Kite 1995; Kite and Whitely 1996; Lim 2002).<sup>4</sup> Provided the gender difference in homophobia, a society with a high sex ratio would arguably be more homophobic than its counterpart with a low sex ratio. Hence, one reasonable conjecture is that sodomy law would be more likely to be repealed in a feminine country that has a low sex ratio than in a masculine country with a high sex ratio.

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<sup>2</sup> Other explanations include differences in the sex ratio at birth and differences in gains and losses through migration. Yet, these explanations cannot really account for the substantial variation in country sex ratios (Coale 1991).

<sup>3</sup> Factors that have been linked to the changes in sex mortality differentials include male vulnerability to cardiovascular conditions, motor accidents, cancers, smoking, drinking, competition stress, declining maternity-related death etc. (Madigan 1957; Preston 1976; Waldron 1976, 1993; Pampel 2002; Beltran-Sanchez et al. 2015). These factors could further interact with each other. It is, nonetheless, difficult to single out a factor that explains most of the sex mortality differentials in the post-WWII era.

<sup>4</sup> Various theories have been proposed to explain the gender difference in homophobic bias (Herek 1986; Winegard et al. 2016). Yet, the inquiry on the origin of the gender difference in homophobia is beyond the scope of this paper.

The declining trend in median country sex ratio thus would lead to more sodomy law reform around the world.

The correlation between sex ratio and decriminalization of sodomy is evident in Figure 2, which plots the country sex ratios for those countries that have decriminalized sodomy in the year of decriminalization. Most of the decriminalizations occurred to the feminine countries with sex ratios below 100. It also shows that the 1990s was the decade that has seen the most decriminalisations in parallel with lowest median country sex ratio in Figure 1. Certainly, such correlation between country sex ratio and sodomy law reform can be confounded by many other factors. This paper thus attempts to identify the causal effect of sex ratio on sodomy law reform by adopting the following steps in its empirical investigation.

The first step is to gauge the gender difference in homophobia at the individual level using a global survey. Most of the previous psychological studies are restricted to western societies and may not apply to non-western countries. Moreover, many of these studies rely on small samples drawn from college students, which may not necessarily represent the general population. In contrast, empirical results in this paper are derived from a global sample of more than 300,000 individuals of age 15 and older in 100 countries and territories over three decades. The analysis shows that throughout the world, men find homosexuality less justifiable by 12% than do women. Men are also less likely than women to accept homosexuals to be their neighbors by five percentage points.

These findings suggest that population sex ratio can serve as a proxy of social homophobia. For comparison, this paper also uses another social homophobia measure collected by the Gallup World Poll, which is a more direct measure but unfortunately only available for two years for a smaller number of countries. The comparison result shows the two measures are qualitatively consistent in predicting sodomy law reform.

The second step is the main analysis that employs a newly constructed panel data of 183 countries during 1970-2015 to estimate the country sex ratio effect with controls for country fixed effect, global time trend, time-varying country political regime and real GDP per capita. The results show that homosexual conduct indeed is more likely to be illegal in countries with higher sex ratios and vice versa. Moreover, the association is stronger among democratic countries, where presumably institutional reforms and legislative changes are more likely to be influenced by individual citizens than in authoritarian countries.

The major concern of the previous country fixed effect estimation is that there may still exist unobserved differential cultural or institutional changes across countries over time that could be correlated with both sex ratio and sodomy law reform. To mitigate this concern, this paper conducts two robustness checks.

The first robustness check focuses on two specific countries, the United States and Australia, which went through sodomy law repeals state by state respectively. It is assumed that states within a country share the same culture and political institution even if they could change over time. Two state-level panel data sets are constructed to facilitate separate fixed-effect estimations at state level that, in addition to state and time fixed effects, allow us to further control for more time-varying state characteristics such as religion, race, education, income etc. The estimation results from these two countries consistently show that states with higher sex ratios are less likely to repeal their sodomy law and vice versa.

The second robustness check adopts an instrumental variable fixed effect (IV-FE) estimation using the same country panel data in the main analysis. In particular, we use temperature to instrument for sex ratio on the ground that men are more susceptible to temperature-related mortality than women (Catalano et al. 2008; Catalano et al. 2012; Basu and Samet 2002). On the other hand, it is assumed that temperature is orthogonal to unobserved differential cultural or institutional changes after controlling for country fixed

effect, global time trend, time-varying country political regime and real GDP per capita. The IV-FE estimation results show consistent but substantially larger sex ratio effect on the legality of homosexual conduct. Most importantly, both robustness checks confirm that sex ratio impedes the advancement of sodomy law reform.

The findings from this paper add to our understanding of the interplay between the advancement of gay rights and the demographic structure in a society. The root of the sex ratio effect is the gender difference in homophobia that has persisted across societies and time. From a policy perspective, it is an intriguing question to ask how we can uproot homophobia.

The rest of this paper is organized as follows. The second section briefly reviews the history of sodomy law and prior literature. The third section builds a conceptual framework for our analysis. The fourth section estimates the gender difference in homophobia using a global survey. The fifth section presents the country fixed-effect estimation of the sex ratio effect on sodomy law. The sixth section provides robustness checks of the sex ratio effect. The last section concludes.

## **2. Historical Background and Prior Literature**

The provenance of the respective criminal laws in the Judeo-Christian world can be traced back to the Bible (Human Rights Watch 2008; Sanders 2009; Kirby 2011). The most influential biblical condemnations appear in the Book of Leviticus 18:22 and 20:13 where the passages respectively state “*thou shalt not lie with mankind as with womankind; it is abomination,*” and “*if a man also lie with mankind, as he lieth with a woman, both of them have committed an abomination: they shall surely be put to death; their blood shall be upon them.*” In addition, the story about the destruction of Sodom and Gomorrah, which is mentioned in the Book of Genesis as well as the Quran and Hadith, has been interpreted as a punishment of homosexuality (Crompton 2003).

In the 16<sup>th</sup> century, the ecclesiastical prohibition based on the Bible was then turned into secular law when the Protestant Reformation ended church courts in much of Europe and Russia. For example, the Buggery Law promulgated in 1534 under the reign of the British King Henry VIII prohibited “*the detestable and abominable Vice of Buggery committed with mankind or beast.*” The Buggery Law was later rewritten as *unnatural intercourse* in the Section 377 in the *Indian Penal Code* of 1860, which was then spread through the entire British Empire via colonization in the late 19<sup>th</sup> century. In contrast, the *Napoleonic Penal Code* of 1810 in France did not make distinctions between homosexual and heterosexual acts. Such innovation was adopted in the Netherlands, Belgium, Spain, Portugal and Italy. As a result, the British Empire was the only Western colonial power that exported anti-homosexual law to its colonies. As of today, more than half of the countries that still have sodomy laws are former British colonies (Human Rights Watch 2008).

Some other independent states that were not colonized could not avoid the influence of the Western laws, either. For example, Japan made anal intercourse a criminal offence in the Meiji legal code in 1873 but then dropped it in 1881 at the suggestion of a French adviser. Siam, today’s Thailand, was also heavily influenced by the Indian Penal Code. Readers who are interested in learning more about the history of dissemination of sodomy laws in other civilizations are referred to Sanders (2009).

Before WWII, decriminalization of homosexuality took place episodically in Europe and Russia. As noted earlier, the French Revolution led to the first decriminalization of homosexuality in Europe by introducing the Penal Code of 1810 that was silent on consensual sex in private. The reform was then spread to the Netherlands, Belgium, Spain and Italy. In Russia, the Union of Soviet Socialist Republics abolished the prohibition in 1922. However, it later imposed a ban on sodomy again in 1933. Germany had the first gay-



led reform movement in the world in the late 19<sup>th</sup> and early 20<sup>th</sup> century that only ended in failure before Adolf Hitler came into power.

Reform started to gain momentum after WWII. The Charter of the United Nations in 1945 and the Universal Declaration of Human Rights in 1948 set goals for national legal systems to protect individual persons and their rights. In the United States, the American Law Institute published its Model Penal Code in 1955 that treated consensual homosexual acts as matters of private morality that should only concern spiritual authorities. The Model Penal Code led to the decriminalization in Illinois in 1961, which was the first in North America. On the other side of the Atlantic Ocean, the Wolfenden Committee in the United Kingdom produced a report in 1957 recommending that consensual homosexual acts in private should no longer be a criminal offense. The Wolfenden report eventually led to decriminalization in England and Wales in 1967 and gave impetus to other common law jurisdictions, including Canada in 1969. As a result, the post-WWII period has witnessed an explosion of decriminalization. Between 1945 and 2016, a total of 65 countries repealed their respective laws that proscribed sexual conducts in private between consenting adults of the same sex (Carroll and Mendos, 2017).

The related economics literature on sexual minorities has focused on the earnings of and discrimination faced by gays and lesbians in the labor market (Plug and Berkhout 2004; Ahmed and Hammarstedt 2010; Patacchini, Ragusa and Zenou 2015; Baert 2017). Discussions about gay rights, nevertheless, have mostly been the arena for political scientists and sociologists. For instance, Frank et al. (2009, 2010) argued that after WWII a worldwide support for criminal laws has shifted from protecting collective entities to protecting individuals, leading to decriminalization of sodomy and other sex laws around the world. Sommer et al. (2013) focused on the differential effect of legal system, religion and globalization on the repeal of sodomy laws across countries. In her study of the American

state-level repeal of sodomy laws, Kane (2003, 2007) stressed the importance of social movement and its timing. Haider-Markel and Meier (1996) studied more broadly homosexuality-related public policies in the fifty states in the U.S. from the perspective of morality politics and interest group politics.

### **3. Conceptual Framework**

In criminal justice, there are two major perspectives on criminal lawmaking (Chambliss and Seidman 1971). The first perspective is the so-called *consensus model*, which asserts that most members in a society agree on what constitutes criminal offenses and thus a criminal law is simply a codification of the agreed-upon social values. The second one is the *conflict model*, which argues that a criminal law is the prize for antagonistic struggle among vested interest groups and only reflects the values of those who eventually grab the power. Both models hinge on the attitudes of individual members in the society toward certain human behavior. The distinction is that the law making in the consensus model requires that most members share similar attitude, while in the conflict model, it is the attitude of the few in power that matters.

Sodomy law reform, as any other legal reform, often interacts with political institutions. In democratic countries where legislators are elected by voters, individuals could influence sodomy law reform through elections or adding pressure on legislators. On the contrary, penal codes in autocratic countries are often used by authority as a means to control the society; hence individuals are less likely to exert direct influence as much as their counterparts in democratic countries. In some extreme scenarios, citizens in autocratic countries have to resort to armed conflicts.

Other than elections, individuals can also participate in social movements or join Non-governmental Organizations (NGOs) to exert influence over legal reform. Whatever the mechanism is, individual attitude toward homosexuality decides the direction that they would

like to sway the reform. The outcome will be eventually decided by the dominant force in the society one way or another.

Given men are more homophobic than women, above theoretical discussion suggests that sodomy law reform pivots on the gender composition in terms of sex ratio in a society. More specifically, sodomy law is less likely to be repealed in a society where men outnumber women than a society where women outnumber men. In addition, the impact of sex ratio may interact with the political system in the society as previously discussed.

#### **4. Gender Difference in Homophobia**

Since the overarching hypothesis of this paper roots in the gender difference in homophobia, this section provides empirical evidence to show that gender difference in attitudes toward homosexuality is strikingly robust across countries and time.

##### *4.1 Data and Descriptive Analysis*

The empirical analysis builds on data combining six waves of the World Values Survey (WVS) during 1981-2014 that have surveyed more than 300,000 individuals in 100 countries and territories over three decades.<sup>5</sup> In addition to basic demographic and economic information, two key measures of individual attitudes toward homosexuality and homosexual people are employed.

The first measure is derived from a question that asked participants whether they think homosexuality can be justified on a 10-point scale, ranging from “never justifiable” (1 point) to “always justifiable” (10 points). The second measure is based on a question asking participants if they would *not* like to have homosexual people as their neighbors. A dummy variable is constructed accordingly to indicate if one rejects homosexual people as neighbors. The justifiability variable is available in all six waves for a total of 246,575 individuals from

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<sup>5</sup> The number of countries varies across waves. However, the numbers add up to a total of 100 countries across six waves.

97 countries and territories. The homosexual neighbor variable is available in the second to sixth wave for a total of 254,510 individuals from 95 countries and territories.

It is worth noting the difference between these two measures before proceeding to the empirical analysis. The justifiability measure is a general assessment of an individual's attitude toward homosexuality. In contrast, the second variable of rejecting homosexual neighbors may give a nudge to respondents to take into account the physical proximity to the homosexual people.

Figure 3 summarizes the averages of the two measures by gender and age. In Panel A, men (bars capped by M) across all age groups always indicate a lower degree of justifiability of homosexuality than women (bars capped by F) do. On average, men's justifiability is lower than women's by 0.3 points, which is about 10% of the average. Meanwhile, it is also noticeable that older people tend to express lower degrees of justifiability than younger people do. As for the homosexual neighbor variable, Panel B shows that in every age group, men have a higher fraction of individuals who reject homosexual neighbors than women do. Nonetheless, the fraction does not seem to decrease with age. The youth are just as likely to reject homosexual neighbors as the elderly.

Figure 4 breaks down the two measures by gender and religion.<sup>6</sup> Panel A shows a significant variation in justifiability across religious groups. Muslims have the lowest justifiability, while individuals with no religion have the highest one. Yet, in terms of gender differences, men still generally indicate lower justifiability than women do except for Islam and Hinduism, which also have the lowest justifiability. The gender difference appears to be the largest among people with no religion, who are also most friendly to the homosexuals. In other words, religion seems to not only lower the justifiability but also reduce the gender differences. As for the choice of neighbors, Panel B shows that men are consistently more

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<sup>6</sup> Definitions of religious groups are documented in data appendix.

likely than women to reject homosexual neighbors regardless of religion. It is interesting to note that while Islam and Hinduism have the lowest justifiability, they do not seem to differ from other religious groups in rejecting homosexual neighbors. People with no religion are just as likely as religious people to reject homosexual neighbors.

Figure 5 divides people by education. Panel A shows that justifiability increases with education. The gender difference also seems to widen with education. While women always express higher justifiability than men do, the gender gap is the largest among the people with tertiary education or above. In Panel B, a consistent pattern is shown in term of rejecting homosexual neighbors. Women are less likely to reject homosexual neighbors than men, while the gender gap is the largest among the most highly educated.

#### 4.2 Regression Analysis

The following model is estimated to quantify the gender difference in attitudes.

$$y_{ic}^w = \beta_1 Male_{ic}^w + B_2 Edu_{ic}^w + B_3 Relig_{ic}^w + B_4 Male_{ic}^w \times Edu_{ic}^w + B_5 Male_{ic}^w \times Relig_{ic}^w + B_6 X_{ic}^w + \lambda_c + \theta^w + \varepsilon_{ic}^w, \quad (1)$$

where  $y_{ic}^w$  is the attitude measure for individual  $i$  in country  $c$  in wave  $w$ ; *Male* equals to one if one is male and zero if female; *Edu* is a vector of education group dummy variables with primary or lower education as the reference group; *Relig* is a vector of religion dummy variables with no religion as the reference group; *X* is a vector of individual characteristics including age, marital status, employment and income;  $\lambda$  is country fixed effect;  $\theta$  is wave fixed effect;  $\varepsilon$  is an error term. Sampling weights provided by WVS are used in regressions. Robust standard errors clustered at countries are used for statistical inferences. Summary statistics of the pooled data is provided in Table A1.

Regression results are reported in Table 1. The dependent variable in columns (1)-(3) is the 10-point score of justifiability variable, while the dependent variable in columns (4)-(6) is the dummy variable indicating if one rejects homosexual neighbors.

As shown in column (1), the gender difference is about -0.369 points, or about 12% of average justifiability (3.15). Column (2) shows that the gender difference gets larger when people become more educated as the interaction terms with education dummies are both negative. In contrast, column (3) indicates that religion decreases the gender difference. In column (4), the estimate shows that men are more likely to reject homosexual neighbors than women by 5.1 percentage points. Similar to the results of justifiability, columns (5) and (6) suggest that education enlarges the gender gap, while religion generally shrinks it.

Overall, the regression results based on international data show strikingly robust gender difference in attitudes toward homosexuality beyond country borders. Building on this finding, this paper argues that a country with high sex ratio is more homophobic than its counterpart with a low sex ratio. As a consequence, sodomy law is less likely to be repealed in high sex ratio countries than in low sex ratio countries. This following section empirically tests this hypothesis.

## **5. Sex Ratio Effect on Sodomy Law**

Since sodomy law is less likely to be repealed in high sex ratio countries than in low sex ratio countries, we should observe that positive correlation between the illegality of homosexual conduct and sex ratio. We test this hypothesis with a newly constructed country level panel data.

### *5.1 Panel Data Construction*

We first build on the work by Asal et al. (2012) that documents the legal status of homosexual conduct across countries during 1970-2008 and update it with the latest world survey of respective laws by Carroll and Mendos (2017).<sup>7</sup> Table 2 lists the legal status of homosexual conduct in 193 contemporary U.N. member states during 1970-2015. There are

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<sup>7</sup> Whenever an inconsistency occurs between the two documents for a particular country, we adopt the status reported in Carroll and Mendos (2017) since it is more updated.

74 countries where homosexual conduct remains illegal throughout the entire period (column (1)), 60 countries remain legal (column (2)), 58 countries decriminalized homosexual conduct (column (3)) and 2 countries criminalized it. San Marino is the only country that first criminalized sodomy and then decriminalized it; therefore, it is listed in both column (3) and (4). Among the 193 states, 54 of them, indicated by † in Table 2, became independent after 1970 either from occupying states or as a result of the dissolution of previous communist regimes such as the former Soviet Union, Yugoslavia and Czechoslovakia. Three countries, Germany, Yemen and Vietnam, went through unifications during this period.<sup>8</sup>

The population sex ratio data come from the World Population Prospects the 2017 Revision (WPP 2017) produced by Department of Economic and Social Affairs of the United Nations. WPP 2017 estimates population sex ratios for 224 countries or territories during 1950-2015. One advantage of WPP 2017 is that it estimates sex ratios for those newly-independent countries even before they became independent. Unfortunately, WPP 2017 data are only available for 183 of the 193 U.N. member states. The 10 countries that lack sex ratio data, indicated by \* in Table 2, are thus excluded from our longitudinal data.

Political regime characteristics are based on the *polity* score from the Polity IV project, Political Regime Characteristics and Transitions, 1800-2016, Center for Systemic Peace. The value of the *polity* score ranges from 10 (strongly democratic) to -10 (strongly autocratic). A dummy variable, *Democracy*, is constructed accordingly to reflect countries with *polity* score ranging from 6 to 10. Moreover, real GDP per capita is acquired from Penn World Table, Version 9 (PWT 9), which covers 182 countries during 1950-2014. Four dummy variables are constructed to indicate four quartiles of the distribution of real GDP per capita in each year. A dummy variable, *No GDP Data*, is created to indicate those countries

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<sup>8</sup> Before their respective unification, Germany was divided as East and West Germany, Vietnam as North and South Vietnam, Yemen as North and South Yemen. Yet, throughout the period of 1970-2015, the legal status of homosexual conduct remained unchanged before and after the unification in these countries. Therefore, they are treated as three unified countries over this period in our analysis.

and years when real GDP per capita is not available. About 15% of country-year cells in our sample lack GDP data during 1970-2014. Our final panel data set consists of 8,418 observations for 183 countries during 1970-2015. Note the GDP data are only available up to 2014. Among the 183 countries, 51 countries became independent after 1970. Summary statistics of the data are provided in Table A2 in data appendix.

## 5.2 Country Fixed Effect Estimation

To quantify the association between the legality of homosexual conduct and country sex ratio, the following fixed effects model is estimated.

$$\begin{aligned}
 Illegal_{it} = & \beta_0 + \beta_1 Sex Ratio_{it} + \beta_2 Democracy_{it} + \beta_3 Sex Ratio_{it} \\
 & \times Democracy_{it} + \beta_4 GDP_{it} + \beta_5 Indep_{it} + \alpha_i + \delta_t + \varepsilon_{it}, \quad (2)
 \end{aligned}$$

where  $Illegal_{it}$  is a dummy variable equal to one if homosexual conduct is illegal in country  $i$  in year  $t$ ;  $Sex Ratio$  is the number of men per woman in the population;  $Democracy$  is a dummy variable indicating countries with *polity* score ranging from 6 to 10;  $GDP$  is a vector of dummy variables indicating the 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> quartile and the *No GDP Data* dummy, with the 1<sup>st</sup> quartile as the reference group;  $Indep$  is a dummy variable indicating if a country is independent in a certain year;  $\alpha$  is the country fixed effect, which captures time-invariant country-specific components in culture, history, institution and economy;  $\delta$  is the year fixed effect, which represents the global time trend such as the international human rights movement;  $\varepsilon$  is an error term. Robust standard errors clustered at countries are used for statistical inference.

The value of the dependent variable, *Illegal*, takes on either zero or one and can in theory change in either direction. In practice, however, almost all the changes go from one to zero, meaning a country repeals the sodomy law, except for Burundi and San Marino, which criminalized sodomy and thus changed the value from zero to one. San Marino is the only country that experienced two changes during our analysis period of 1970-2015.



The definition of “country” in equation (2) means the 183 contemporary U.N. member states in the sample. As noted, 51 of them were not independent regimes for a certain period during 1970-2015. It is unclear how much legislative autonomy that these countries had before they became fully independent. As a robustness check, equation (2) is re-estimated without the *Indep* dummy variable by excluding the 51 newly independent countries.

Table 3 reports the results using all 183 countries. The estimate on sex ratio without controlling for polity in column (1) is 0.213, suggesting that one additional man per 100 women in a country is associated with a 0.2 percentage-point increase in the probability that homosexual conduct is illegal. The standard deviation in sex ratio is 15 men per 100 women. This would imply one standard deviation increase in sex ratio is associated with an increase of 3 percentage points. Further controlling for *Democracy* in column (2) barely changes the estimate of sex ratio effect. Column (3) further allows *Democracy* to interact with *Sex Ratio*. The interaction term is 1.095, implying that the sex ratio effect is much larger among democratic countries relative to non-democratic countries. This is consistent with our prediction that individual attitudes would have more influence over legislative changes in a democracy than in a non-democratic state.

Table 4 repeats the regressions in Table 3 but excludes the 51 newly-independent countries. Overall, the estimates on sex ratio triple. This suggests that the sex ratio effect in Table 3 may have been diluted because those 51 countries may not have full legislative autonomy before they became independent. In column (3), the interaction between Sex Ratio and Democracy is still positive and becomes larger, although the estimate is less precise for the standard error is large.

### 5.3 Comparison with Alternative Social Homophobia Measure

Although we use population sex ratio as a proxy for social homophobia, one might be concerned about its predictive power of social homophobia. For comparison, we compare the use of sex ratio with an alternative *direct* measure of social homophobia, *the Tolerance of Homosexuals (TOH)*, acquired from the 2017 Social Progress Index. The data were originally conducted by the *Gallup World Poll* in 2014 and 2015, which are the two earliest years available. The value of the measure ranges from 0 to 100 representing the percentage of respondents answer yes to the question “*Is the city or area where you live a good place or not to live for gay or lesbian people?*” There are 139 and 141 countries where both the TOH and sex ratio data are available in 2014 and 2015. We regress the legal status of sodomy at country level on the TOH and sex ratio in each year separately. The dependent variable equals to one if sodomy is illegal in a country and 0 otherwise. In Table 5, the results show that sodomy is more likely to be illegal if the TOH is lower or the sex ratio is higher, suggesting these two different measures have consistent predictive power.

## **6. Robustness Checks**

Although the country fixed effect estimation in Section 5 has controlled for country fixed effect and global time trend, it is not impossible that over these four and half decades countries may have experienced unobserved differential cultural or institutional changes that could be associated with the sodomy law and sex ratio, leading to a bias in the previous estimations. This section attempts to mitigate this concern by conducting two robustness checks. First, we focus on two countries, the U.S. and Australia, both of which went through sodomy law repeals state-by-state. It is reasonable to assume that states within a country would share the same culture and institution even if they could change over time. Hence, case studies of these two countries should be able to mitigate the concern of unobserved differential cultural or institutional changes.

Second, we use temperature to instrument for sex ratio on the ground that men are more susceptible to temperature-related mortality than women. For instance, male fetuses and infants are known to be more fragile in response to environmental stressors, including extreme temperature, than their female counterparts (Catalano et al. 2008; Catalano et al. 2012). For adults, studies have also shown that gender is a key risk factor for vulnerable populations (Basu and Samet 2002). On the other hand, it is assumed that temperature is orthogonal to unobserved differential cultural or institutional changes after controlling for country fixed effect, global time trend, time-varying country political regime and real GDP per capita.

### 6.1 *State Sodomy Law Repeals in the U.S. and Australia*

Until 1961, every state in the U.S. had its own sodomy law that criminalized sexual acts between consenting same-sex members (Kane 2003, 2007). Yet, state sodomy laws were gradually revoked throughout the last half century. Table A3 shows the timeline of the state sodomy law repeals during 1961-2003. Illinois was the first state to rescind its sodomy law in 1961. It then took eight years for the second repeal to occur in Connecticut in 1969. The repeals, however, accelerated in the 1970s. In total, there were 20 states that revoked their sodomy laws in the 1970s. By the end of 2002, 36 states had repealed their sodomy laws via either state legislature or state court decision. In 2003, all remaining state sodomy laws were voided as a result of the US Supreme Court decision on *Lawrence and Gardner v. Texas*, in which case the Supreme Court found the sodomy law in Texas unconstitutional.

In Australia, the British sodomy law was inherited by all Australian states when the federation was achieved in 1901 (Carbery 2014). Similar to the U.S., Australia also went through repeals state by state. South Australia was the first state to revoke its sodomy law in 1975, ensued by the Australian Capital Territory in 1976, Victoria in 1980, the Northern Territory in 1983, New South Wales in 1984, Western Australia in 1989 and Queensland in

1990. In 1991, activist Nick Toonen filed a complaint to United Nations Human Rights Committee (UNHRC) that the Tasmanian Criminal Code criminalizing homosexual acts violates his rights according to the *International Covenant on Civil and Political Rights* (ICCPR), to which Australia was a signatory. In 1994, the UNHRC ruled that the Tasmanian Criminal Code breached the ICCPR. This ruling was the first international tribunal recognition of gay rights and eventually led to the repeal of Tasmania's sodomy law by the state legislature in 1997.

Figure 6 plots the median state sex ratio in the US and Australia over the study period. It is clear that both countries experienced declining in the median state sex ratio except for the case of US in 2000. The declining in sex ratio coincides with the repeals of state sodomy laws in both countries. To identify the sex ratio effect, the following model is estimated for the US and Australia separately.

$$Repeal_{it} = \beta_0 + \beta_1 StateSexRatio_{it} + B_2 X_{it} + \alpha_i + \delta_t + \varepsilon_{it}, \quad (3)$$

where  $Repeal_{it}$  is a dummy variable equal to one if sodomy law had been repealed state  $i$  in year  $t$ .  $StateSexRatio$  is the state sex ratio in terms of number of men per woman.  $X$  is a vector of state characteristics. For the U.S., it includes percentage of Christians, percentage of black people, percentage of adults aged 25+ who have a Bachelor degree or above, median age of population and log of GDP per capita. For Australia, it includes percentage of Christians, percentage of people born in UK and Ireland, percentage of people born in other countries, percentage of people aged 15+ who have a Bachelor degree or above, median age of population and log of average weekly earnings.  $\alpha$  is the state fixed effect.  $\delta$  is the year fixed effect;  $\varepsilon$  is an error term.

Due to limited space, data sources for these countries are described in the data appendix. In particular, summary statistics of the data are provided in Table A4 and A5.

The regression results are reported in Table 6. Panel A is the case of the U.S. and Panel B is the case of Australia. Column (1) controls for only state and year fixed effect, while column (2) further controls for state characteristics. The estimated sex ratio effects in both cases show consistently that states with higher sex ratios are less likely to repeal their sodomy law. Since states within a country share similar culture and institution, this finding suggest the estimated sex ratio effect is likely to be causal.

### *6.2 Instrumental Variable Fixed Effect Estimation*

As discussed earlier, men are more susceptible to temperature-related mortality than women, thus leading to variation in sex ratio. This subsection, therefore, uses annual temperature and its square term to instrument for sex ratio and conducts an instrumental variable fixed effect estimation. The underlying assumption is that after controlling for county fixed effect, year fixed effect and other country characteristics, annual temperature is orthogonal to unobserved cultural changes. The reduced form equation is the same as equation (2). The temperature data are acquired from the World Bank's Climate Change Knowledge Portal (CCKP). All other data are the same as described in Section 5.

Panel A in Table 7 reports the second stage results. As shown, the sex ratio effect again are positive, suggesting homosexual conduct is more likely to be illegal in countries with higher sex ratios. Compared with Table 3, the sex ratio effects are substantially larger. For example, the estimate in column (1) is 5.286, meaning one additional man per 100 women increases the probability of illegality by more than 5 percentage points. The interaction between *Sex Ratio* and *Democracy* is also lager by a multitude.

Panel B, on the other hand, reports the first stage results. It is clearly shown that annual temperature is strongly correlated with sex ratio as the  $F$  statistics based on usual standard errors. The relationship is non-linear, which first decreases then increases. The turning point is about 15°C, which about 70% of observations are above this point. In other

words, in most of the cases, temperature is positively correlated with sex ratio. It is worth pointing out that both usual standard errors (in parentheses) and cluster robust standard errors (in brackets) are reported for readers' discretionary judgement.

## **7. Conclusion**

It is probably fair to say that we as human beings have come a long way in advancing human rights, including gay rights. Yet, it is also fair to say that we are still far away from equality in human rights across countries. This paper studies one aspect of gay rights, in particular, the interplay between sodomy law reform and the demographic structure in a society, which roots in the gender difference in homophobia that has persisted across countries and time. This paper uses a cross-country panel data to find that sodomy law is less likely to be repealed in masculine countries than feminine countries. The sex ratio effect is further found to be robust by the case studies of the U.S. and Australia as well as a study using the instrumental variable approach.

The major finding of this paper can in part explain the global wave of sodomy law reform in the post-WWII era as sex ratio had been declining in more and more countries until the late 1990s. Unfortunately, the declining trend in sex ratio was reversed, likely contributing to the slowdown in sodomy law reform in the remaining countries. There are nearly two fifths of countries in the world that still criminalize homosexuality. The lesson learnt from this paper may help NGOs and human rights activists better craft their strategy in advancing human rights across countries by taking demography into account.

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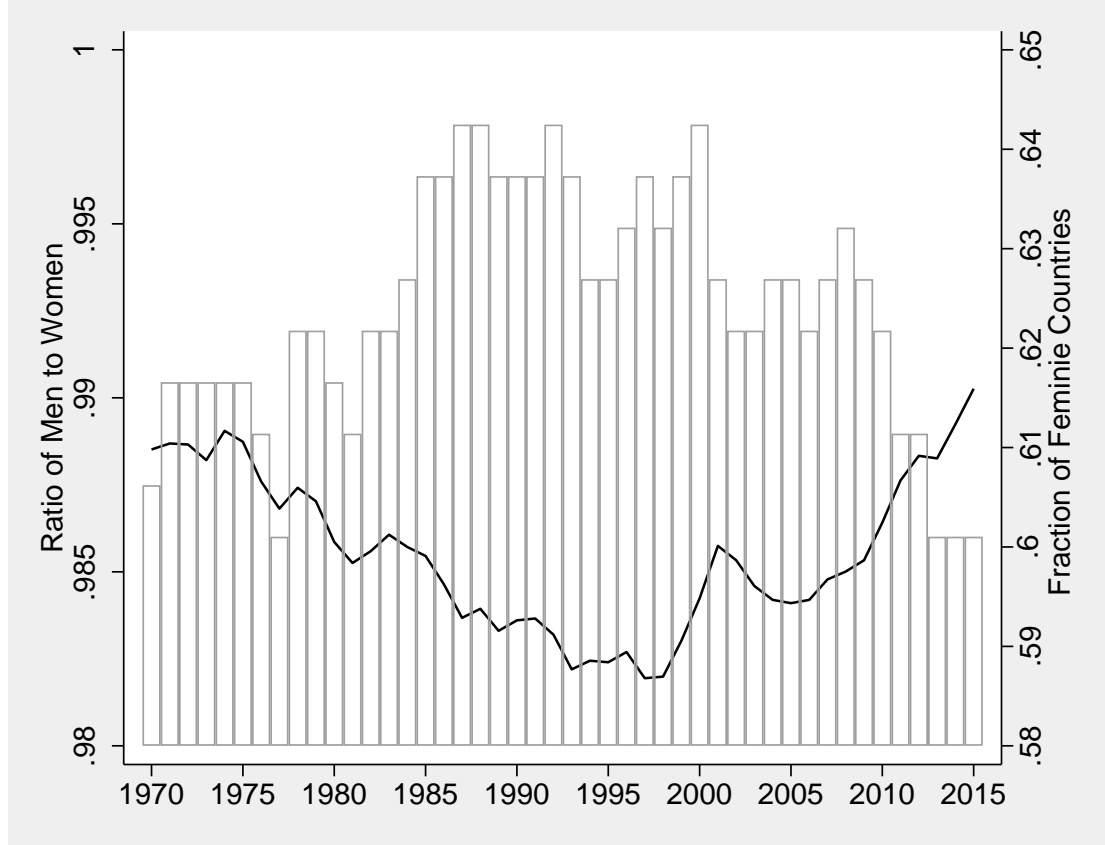
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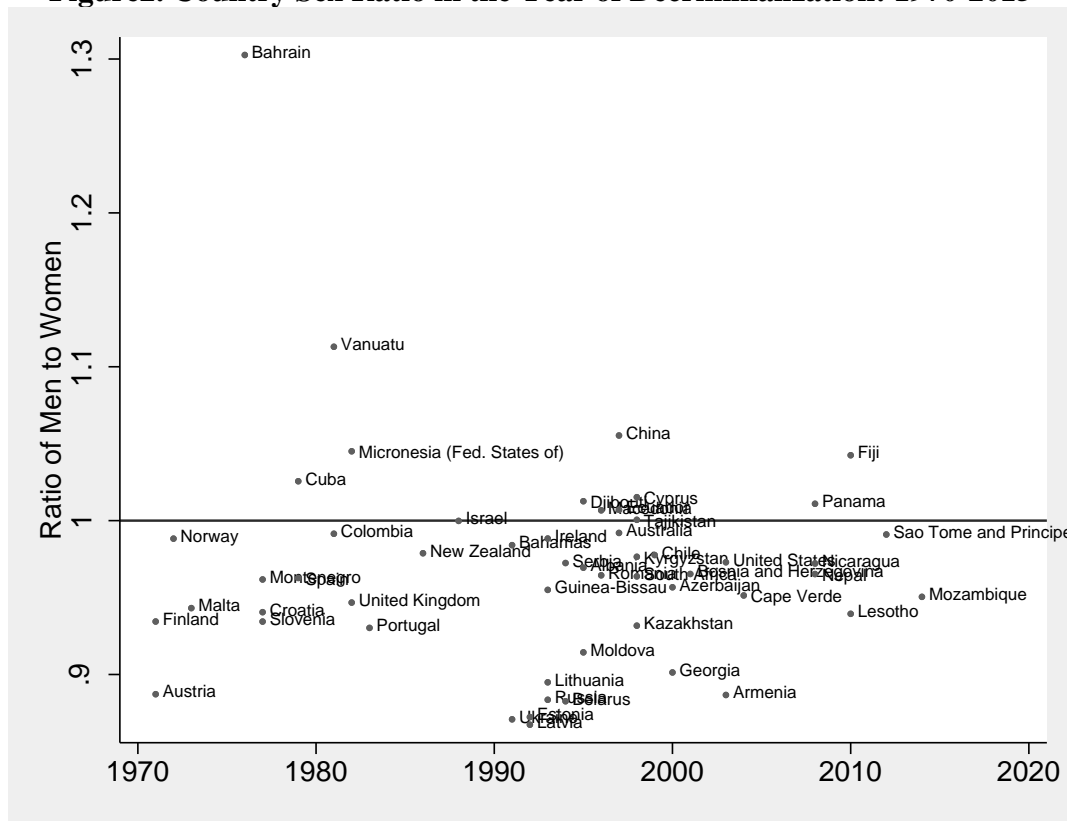
**Figure 1. Median Country Sex Ratio and Fraction of Feminine Countries: 1970-2015**



*Notes:* The solid line indicates the median country sex ratio among 183 countries. The bars indicate the fraction of countries that have more women than men.

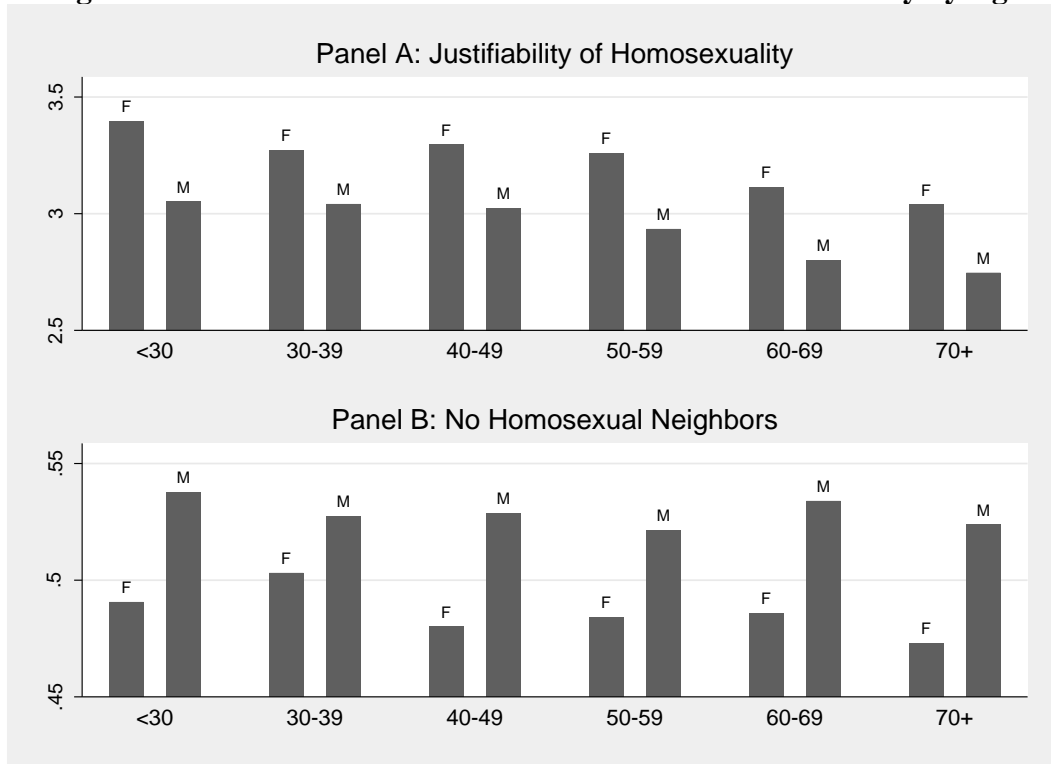
*Source:* World Population Prospects: the 2017 Revision by United Nations, Department of Economic and Social Affairs, Population Division (2017).

**Figure 2. Country Sex Ratio in the Year of Decriminalization: 1970-2015**



*Notes:* 54 countries decriminalized same-sex sexual acts during 1970-2015.  
*Source:* World Population Prospects: the 2017 Revision by United Nations, Department of Economic and Social Affairs, Population Division (2017).

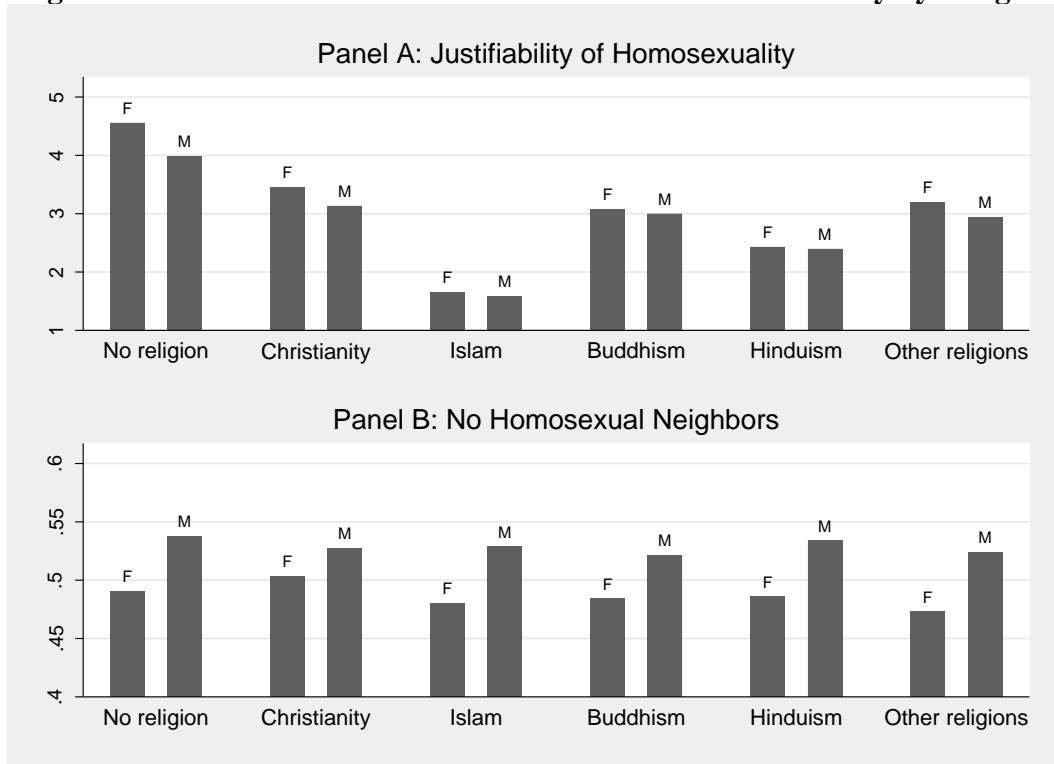
**Figure 3. Gender Difference in Attitudes toward Homosexuality by Age**



*Notes:* Sampling weights adjusting for country-specific demographic structure are used to calculate the means.

*Source:* World Values Survey 1981-2014 Longitudinal Aggregate v.20150418. World Values Association ([www.worldvaluessurvey.org](http://www.worldvaluessurvey.org)). Aggregate File Producer: JDSystems, Madrid SPAIN.

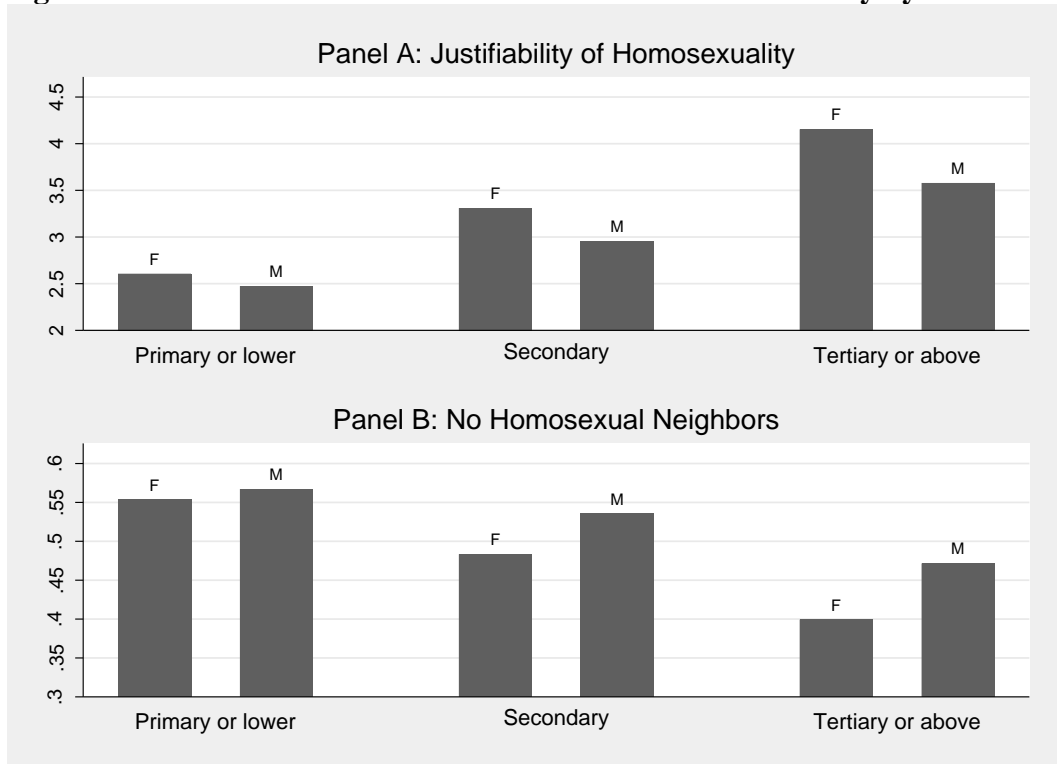
**Figure 4. Gender Difference in Attitudes toward Homosexuality by Religion**



*Notes:* Sampling weights adjusting for country-specific demographic structure are used to calculate the means.

*Source:* World Values Survey 1981-2014 Longitudinal Aggregate v.20150418. World Values Association ([www.worldvaluessurvey.org](http://www.worldvaluessurvey.org)). Aggregate File Producer: JDSystems, Madrid SPAIN.

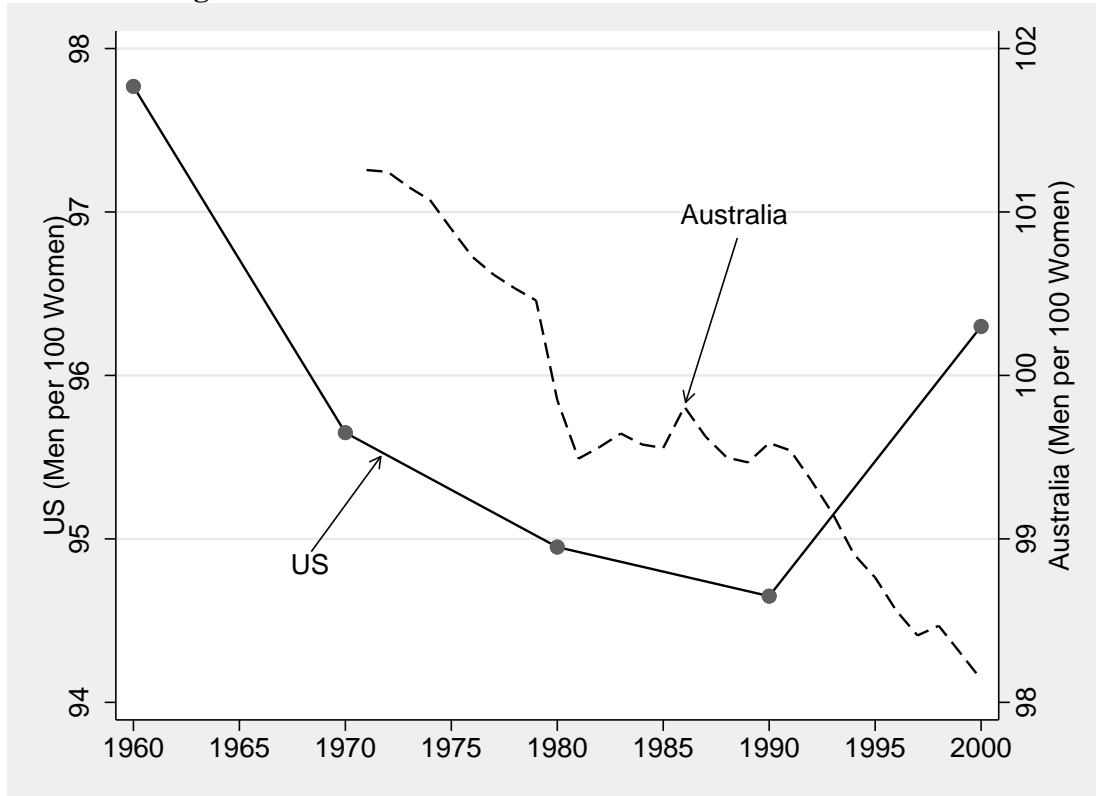
**Figure 5. Gender Difference in Attitudes toward Homosexuality by Education**



*Notes:* Sampling weights adjusting for country-specific demographic structure are used to calculate the means.

*Source:* World Values Survey 1981-2014 Longitudinal Aggregate v.20150418. World Values Association ([www.worldvaluessurvey.org](http://www.worldvaluessurvey.org)). Aggregate File Producer: JDSystems, Madrid SPAIN.

**Figure 6. Median State Sex Ratio in the US and Australia**



*Notes:* The US data are decennial; the Australian data are annual.

*Source:* state sex ratios in the US are from on *US Census of Population and Housing in 1960, 1970, 1980, 1990 and 2000*; Australian state sex ratios are from *Australian Historical Population Statistics 2014* published by the Australian Bureau of Statistics.



**Table 1. Regressions of Individual Attitudes toward Homosexuality and Homosexual People**

	<u>Justifiability of Homosexuality</u>			<u>Reject Homosexual Neighbors</u>		
	(mean=3.15)			(mean=0.51)		
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Male</i>	-0.369*** (0.044)	-0.232*** (0.044)	-0.421*** (0.089)	0.051*** (0.005)	0.033*** (0.007)	0.044*** (0.010)
<i>Male × Secondary</i>		-0.143*** (0.041)	-0.124*** (0.042)		0.020*** (0.007)	0.017** (0.007)
<i>Male × Tertiary</i>		-0.292*** (0.050)	-0.274*** (0.050)		0.037*** (0.009)	0.034*** (0.009)
<i>Male × Christianity</i>			0.137* (0.076)			0.001 (0.010)
<i>Male × Islam</i>			0.381*** (0.087)			-0.033** (0.014)
<i>Male × Buddhism</i>			0.335** (0.128)			-0.029* (0.017)
<i>Male × Hinduism</i>			0.348*** (0.079)			-0.046*** (0.013)
<i>Male × Other religions</i>			0.318*** (0.095)			-0.016 (0.018)
Observations	246,575	246,575	246,575	254,510	254,510	254,510

*Notes:* Dependent variable in column (1)-(3) is a 10-point scale of the justifiability of homosexuality ranging from 1 for never justifiable to 10 for always justifiable. Dependent variable in column (4)-(6) is a dummy variable indicating if one rejects homosexuals as his/her neighbors. The reference education group is primary education or lower. The reference religious group is individuals without any religious belief. All regressions additionally include age, marital status, employment, income, education, religion, and a full set of survey year dummies and country dummies. Sampling weights are used. Robust standard errors clustered at country in parentheses. \*, \*\* and \*\*\* denotes significant at 10%, 5% and 1% respectively.

*Source:* World Values Survey 1981-2014 Longitudinal Aggregate v.20150418. World Values Association ([www.worldvaluessurvey.org](http://www.worldvaluessurvey.org)). Aggregate File Producer: JDSystems, Madrid SPAIN.

**Table 2. Legal Status of Homosexual Conduct in the World 1970-2015**

<b>Illegal throughout</b> (74 countries) (1)	<b>Legal throughout</b> (60 countries) (2)	<b>Illegal to legal</b> (58 countries) (3)	<b>Legal to illegal</b> (2 countries) (4)
Afghanistan	Andorra*	Albania (1995)	Burundi (2009)
Algeria	Argentina	Armenia† (2003)	San Marino* (1975)
Angola†	Belgium	Australia (1997)	
Antigua and Barbuda†	Benin	Austria (1971)	
Bangladesh	Bolivia	Azerbaijan † (2000)	
Barbados	Brazil	Bahamas † (1991)	
Belize†	Bulgaria	Bahrain † (1976)	
Bhutan	Burkina Faso	Belarus † (1994)	
Botswana	Cambodia	Bosnia and Herzegovina †	
Brunei Darussalam†	Canada	(2001)	
Cameroon	Central African Republic	Cape Verde† (2004)	
Comoros	Chad	Chile (1999)	
Dominica†*	Congo	China (1997)	
Eritrea†	Costa Rica	Colombia (1981)	
Ethiopia	Cote d'Ivoire	Croatia† (1977)	
Gambia	Czech Republic†	Cuba (1979)	
Ghana	Democratic Republic of the	Cyprus (1998)	
Grenada†	Congo	Djibouti † (1995)	
Guinea	Denmark	Ecuador (1997)	
Guyana	Dominican Republic	Estonia † (1992)	
India	Egypt	Fiji (2010)	
Iran	El Salvador	Finland (1971)	
Iraq	Equatorial Guinea	Georgia † (2000)	
Jamaica	France	Guinea-Bissau† (1993)	
Kenya	Gabon	Ireland (1993)	
Kiribati†	Germany	Israel (1988)	
Kuwait	Greece	Kazakhstan† (1998)	
Lebanon	Guatemala	Kyrgyzstan † (1998)	
Liberia	Haiti	Latvia† (1992)	
Libya	Honduras	Lesotho (2010)	
Malawi	Hungary	Liechtenstein*	
Malaysia	Iceland	(1989)	
Maldives	Indonesia	Lithuania † (1993)	
Mauritania	Italy	Macedonia† (1996)	
Mauritius	Japan	Malta (1973)	
Morocco	Jordan	Marshall Islands †*	
Myanmar	Korea North	(2005)	
Namibia†	Korea South	Micronesia (Fed. States of) † (1982)	
Nauru*	Laos	Moldova † (1995)	
Nigeria	Luxembourg	Montenegro† (1977)	
Oman	Madagascar	Mozambique†	
Pakistan	Mali	(2014)	
Papua New Guinea†	Mexico	Nepal (2008)	
Qatar†	Monaco*		

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Saint Kitts and Nevis†*	Mongolia	New Zealand (1986)
Saint Lucia†	Netherlands	Nicaragua (2008)
Saint Vincent and the Grenadines†	Niger	Norway (1972)
Samoa	Paraguay	Palau †* (2014)
Saudi Arabia	Peru	Panama (2008)
Senegal	Philippines	Portugal (1983)
Seychelles†	Poland	Romania (1996)
Sierra Leone	Rwanda	Russia† (1993)
Singapore	Slovakia†	San Marino* (2004)
Solomon Islands†	Suriname†	Sao Tome and Principe† (2012)
Somalia	Sweden	Serbia† (1994)
South Sudan†	Switzerland	Slovenia† (1977)
Sri Lanka	Thailand	South Africa (1998)
Sudan	Turkey	Spain (1979)
Swaziland	Uruguay	Tajikistan † (1998)
Syria	Venezuela	Ukraine † (1991)
Tanzania	Vietnam	United Kingdom (1982)
Timor-Leste†		United States (2003)
Togo		Vanuatu† (1981)
Tonga		
Trinidad and Tobago		
Tunisia		
Turkmenistan†		
Tuvalu†*		
Uganda		
United Arab Emirates†		
Uzbekistan†		
Yemen		
Zambia		
Zimbabwe		

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*Notes:* Year in parenthesis indicates the year when the legal status changed. San Marino is the only country that changed the legal status twice over this period and thus listed in both column (3) and (4). † indicates countries gained independence after 1970. \* indicates the countries where the country sex ratio data are not available in the World Population Prospects and thus excluded from our analysis sample.

*Sources:* The legal status around the world is based on Asal, Sommer and Harwood (2012) with updates from Carroll and Mendos (2017). Whenever an inconsistency occurs between the two documents for a particular country, we adopt the status reported in Carroll and Mendos (2017) since it is a more updated version.

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**Table 3. Fixed Effects Estimation of Legal Status of Homosexual Conduct on Country Sex Ratio**

	(1)	(2)	(3)
<i>Sex Ratio</i>	0.213** (0.095)	0.196** (0.095)	0.211** (0.093)
<i>Democracy</i>		-0.039 (0.032)	-1.114** (0.521)
<i>Sex Ratio</i> × <i>Democracy</i>			1.095** (0.522)
Observations	8,235	8,235	8,235
R-squared	0.233	0.273	0.280
Number of Countries	183	183	183
Independence Status	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

*Notes:* The dependent variable is a dummy variable equal to one if homosexual conduct is illegal. Sex ratio is the number of men per woman at country level. The Democracy variable indicates countries with a polity score between 6 and 10. All regressions additionally include a full set of GDP quartile dummies and a dummy indicating if a country was independent in a certain year. Robust standard errors clustered at country level are in parentheses. \*, \*\* and \*\*\* denotes significant at 10%, 5% and 1% respectively.

*Sources:* sex ratio is from World Population Prospects: the 2017 Revision by United Nations, Department of Economic and Social Affairs, Population Division (2017). Political regime is from Polity IV Project, Political Regime Characteristics and Transitions, 1800-2016, Center for Systemic Peace. Real GDP per capita is from Penn World Table, Version 9.

**Table 4. Fixed Effects Estimation of Legal Status of Homosexual Conduct on Country Sex Ratio: Excludes Newly-independent Countries**

	(1)	(2)	(3)
<i>Sex Ratio</i>	0.657** (0.289)	0.638** (0.277)	0.493** (0.242)
<i>Democracy</i>		-0.022 (0.035)	-1.543 (0.959)
<i>Sex Ratio</i> × <i>Democracy</i>			1.538 (0.954)
Observations	5,940	5,940	5,940
R-squared	0.104	0.111	0.119
Number of Countries	132	132	132
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

*Notes:* The dependent variable is a dummy variable equal to one if homosexual conduct is illegal. Sex ratio is the number of men per woman at country level. The Democracy variable indicates countries with a polity score between 6 and 10. All regressions additionally include a full set of GDP quartile dummies and a dummy indicating if a country was independent in a certain year. Robust standard errors clustered at country level are in parentheses. \*, \*\* and \*\*\* denotes significant at 10%, 5% and 1% respectively.

*Sources:* sex ratio is from World Population Prospects: the 2017 Revision by United Nations, Department of Economic and Social Affairs, Population Division (2017). Political regime is from Polity IV Project, Political Regime Characteristics and Transitions, 1800-2016, Center for Systemic Peace. Real GDP per capita is from Penn World Table, Version 9.

**Table 5. Comparison of Social Homophobia Measures**

	(1)	(2)
Panel A: 2014		
<i>Tolerance of Homosexuals</i>	-0.835*** (0.144)	
<i>Sex Ratio</i>		0.031*** (0.009)
R-squared	0.198	0.079
Number of Countries	139	139
Panel B: 2015		
<i>Tolerance of Homosexuals</i>	-0.827*** (0.135)	
<i>Sex Ratio</i>		0.031*** (0.009)
R-squared	0.212	0.084
Number of Countries	141	141

*Notes:* The dependent variable is a dummy variable equal to one if homosexual conduct is illegal. Tolerance of homosexuals measure ranges from 0 (low tolerance) to 100 (high tolerance). Sex ratio is the number of men per woman at country level. \*, \*\* and \*\*\* denotes significant at 10%, 5% and 1% respectively.

*Sources:* sex ratio is from World Population Prospects: the 2017 Revision by United Nations, Department of Economic and Social Affairs, Population Division (2017). Tolerance of homosexuals data are acquired from 2017 *Social Progress Index by the Social Progress Imperative*. The original tolerance of homosexuals data are collected by *the Gallup World Poll*.

**Table 6. Fixed Effect Estimation of State Sodomy Law Repeals in the US & Australia**

	(1)	(2)
	Panel A: US	
<i>State Sex Ratio</i>	-1.998** (0.963)	-2.110** (1.047)
Observations	250	250
R-squared	0.496	0.556
Number of States	50	50
Period	1960-2000	1960-2000
State FE	Yes	Yes
Year FE	Yes	Yes
State Characteristics	No	Yes
	Panel B: Australia	
<i>State Sex Ratio</i>	-2.734* (1.434)	-4.592* (2.249)
Observations	216	216
R-squared	0.578	0.641
Number of States	8	8
Period	1971-1997	1971-1997
State FE	Yes	Yes
Year FE	Yes	Yes
State Characteristics	No	Yes

*Notes:* The panel data in Panel A contain 50 states in the U.S.A. for 5 decennial years, i.e. 1960, 1970, 1980, 1990 and 2000. The panel data in Panel B contain annual data for 8 states in Australia during 1971-1997. Dependent variable in all columns is a dummy variable indicating whether the state sodomy law has been repealed in a given decennial year. State sex ratio is the number of men per woman. All regressions further control for religion, race or birth origin, education, income and median age. Robust standard errors clustered at state in parentheses. \*, \*\* and \*\*\* denotes significant at 10%, 5% and 1% respectively.

*Sources for Panel A:* State GDP per capita data are obtained from *Bureau of Economic Analysis*. Percentage of Christians is obtained from *US Religion Census 1952 to 2010*. Other variables are obtained from the *US Census of Population and Housing in 1960, 1970, 1980, 1990 and 2000*.

*Sources for Panel B:* Annual state sex ratios are obtained from *Australian Historical Population Statistics 2014* published by the Australian Bureau of Statistics. Average weekly earnings are obtained from *Average Weekly Earnings, Australia, May 2015* published by Australian Bureau of Statistics. Other variables are obtained from quinquennial *Census of Population and Housing*.

**Table 7. Instrumental Variable Fixed Effects Estimation of Legal Status of Homosexual Conduct on Country Sex Ratio**

	(1)	(2)	(3)
	Panel A: Second Stage		
<i>Sex Ratio</i>	5.286 (3.077)* [0.654]***	3.940 (2.295)* [0.544]***	1.223 (3.898) [3.281]
<i>Democracy</i>		0.005 (0.037) [0.013]	-43.452 (68.172) [46.455]
<i>Sex Ratio</i> × <i>Democracy</i>			44.247 (69.415) [45.626]
	Panel B: First Stage		
<i>Temperature</i>	-0.0092 (0.0057) [0.0020]***	-0.0104 (0.0056)* [0.0020]***	-0.0104 (0.0056)* [0.0020]***
<i>Temperature</i> <sup>2</sup>	0.0006 (0.0003)** [0.0001]**	0.0006 (0.0003)** [0.0001]***	0.0006 (0.0003)** [0.0001]***
<i>F</i> statistics			
Clustered std. err.	1.88	1.95	1.95
Usual std. err.	57.04	54.70	54.70
Observations	8,235	8,235	8,235
Number of Countries	183	183	183
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

*Notes:* The dependent variable is a dummy variable equal to one if homosexual conduct is illegal. Sex ratio is the number of men per woman at country level. The Democracy variable indicates countries with a polity score between 6 and 10. All regressions additionally include a full set of GDP quartile dummies and a dummy indicating if a country was independent in a certain year. Robust standard errors clustered at country level are in parentheses. Usual standard errors in brackets. \*, \*\* and \*\*\* denotes significant at 10%, 5% and 1% respectively.

*Sources:* sex ratio is from World Population Prospects: the 2017 Revision by United Nations, Department of Economic and Social Affairs, Population Division (2017). Political regime is from Polity IV Project, Political Regime Characteristics and Transitions, 1800-2016, Center for Systemic Peace. Real GDP per capita is from Penn World Table, Version 9. Historical temperature is from World Bank Climate Change Knowledge Portal.



## DATA APPENDIX

### Data Sources for the US and Australia State Panel Data

#### 1. Data for US

To control for unobserved state-fixed characteristics that could still have had influenced state repeats, we conduct state fixed-effect estimation using a decennial panel data set for 1960-2000 that compiles information from various sources. It is decennial because the variables were mostly acquired from the decennial *Census of Population and Housing* 1960-2000, except for the GDP per capita, which was collected from the website of *Bureau of Economic Analysis*.<sup>9</sup> The study period begins in 1960 because Alaska and Hawaii were granted statehood in 1959. It ends in 2000 because all repeats after the Supreme Court ruling on *Lawrence and Gardner v. Texas* in 2003 occurred as a result of the national event.

A decennial panel data set for 1960-2000 is constructed by compiling information from the following sources. State sex ratios, median age, race and education data are acquired from the decennial *Census of Population and Housing* 1960-2000. State religion data are obtained from *U.S. Religion Census 1952 to 2010*. The State GDP per capita data are collected from *Bureau of Economic Analysis*. Summary statistics are provided in Table A4.

#### 2. Data for Australia

The panel data for Australia during 1971-1997 is constructed by using the following sources.<sup>10</sup> Unlike the American case, the data set is annual because the annual state sex ratio data are available from the *Australia Historical Population Statistics* 2014, which was published by the Australian Bureau of Statistics (ABS). Figure 6 shows that the median state sex ratio in Australia had been declining over this period. State average weekly earnings are also published by ABS. Other control variables include percentage of Christians, percentage

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<sup>9</sup> The census data were retrieved from <http://www.census.gov/prod/www/decennial.html#y1970>. The GDP data were retrieved from [http://www.bea.gov/iTable/index\\_regional.cfm](http://www.bea.gov/iTable/index_regional.cfm). The earliest state per capita GDP is 1963. Therefore, I used the 1963 data to proxy for the GDP per capita in 1960.

<sup>10</sup> Note that not every variable in the American panel data set can find its Australian counterpart.

of people aged 15+ who have Bachelor degree or above, percentage of people born in the U.K. and Ireland and other countries, and state median age are obtained from the Australian Census of Population and Housing in 1971, 1976, 1981, 1991 and 1996. Due to the quinquennial nature of the census, all these variables change their values every five years in the annual data for analysis. Summary statistics are provided in Table A5.

**Table A1. Summary Statistics of Pooled World Value Survey**

	Observations (1)	Mean (2)	Std. Dev. (3)	Min (4)	Max (5)
<b>Attitudes</b>					
Justifiability of homosexuality	246,575	3.155	3.007	1	10
Reject homosexual neighbors	254,510	0.511	0.500	0	1
<b>Male</b>	254,510	0.486	0.500	0	1
<b>Age</b>	254,510	40.951	16.095	15	99
<b>Married</b>	254,510	0.570	0.495	0	1
<b>Employed</b>	254,510	0.544	0.498	0	1
<b>Education</b>					
No education	254,510	0.045	0.208	0	1
Primary education	254,510	0.197	0.397	0	1
Secondary education	254,510	0.486	0.500	0	1
Tertiary education	254,510	0.224	0.417	0	1
<b>Income Steps</b>					
Step 1	254,510	0.207	0.405	0	1
Step 2	254,510	0.282	0.450	0	1
Step 3	254,510	0.293	0.455	0	1
Step 4	254,510	0.218	0.413	0	1
<b>Religion</b>					
No religion	254,510	0.184	0.387	0	1
Christianity	254,510	0.505	0.500	0	1
Islam	254,510	0.214	0.410	0	1
Buddhism	254,510	0.027	0.163	0	1
Hinduism	254,510	0.035	0.183	0	1
Other religions	254,510	0.032	0.177	0	1

*Notes:* Justifiability measure is available for 97 countries. Its value ranges from 1 (never justifiable) to 10 (always justifiable). Homosexual neighbors question is available for 95 countries. It is a dummy variable equal to one if one dislikes homosexual neighbors.

*Source:* World Values Survey 1981-2014 Longitudinal Aggregate v.20150418. World Values Association ([www.worldvaluessurvey.org](http://www.worldvaluessurvey.org)). Aggregate File Producer: JDSystems, Madrid SPAIN.

**Table A2. Summary Statistics of Country Panel Data**

		Mean	Std. Dev.	Min	Max	Observations	
		(1)	(2)	(3)	(4)	(5)	
<b>Illegal</b>	(a)	0.531	0.499	0	1	N=8,235	
	(b)		0.440	0	1	n=183	
	(c)		0.237	-0.447	1.509	T=45	
<b>Sex Ratio</b>	(a)	1.004	0.146	0.834	3.180	N=8,235	
	(b)		0.138	0.854	2.208	n=183	
	(c)		0.048	0.520	2.063	T=45	
<b>Political Regime</b>							
	Democracy ( <i>polity</i> : 6 ~ 10)	(a)	0.348	0.476	0	1	N=8,235
		(b)		0.369	0	1	n=183
	(c)		0.302	-0.564	1.329	T=45	
Non-democracy	(a)	0.652	0.476	0	1	N=8,235	
	(b)		0.369	0	1	n=183	
	(c)		0.302	-0.325	1.564	T=45	
<b>Real GDP per capita</b>							
	1 <sup>st</sup> Quartile	(a)	0.220	0.415	0	1	N=8,235
		(b)		0.358	0	1	n=183
(c)			0.210	-0.757	1.198	T=45	
2 <sup>nd</sup> Quartile	(a)	0.213	0.410	0	1	N=8,235	
	(b)		0.304	0	1	n=183	
	(c)		0.276	-0.764	1.191	T=45	
3 <sup>rd</sup> Quartile	(a)	0.206	0.404	0	1	N=8,235	
	(b)		0.316	0	1	n=183	
	(c)		0.253	-0.772	1.184	T=45	
4 <sup>th</sup> Quartile	(a)	0.215	0.411	0	1	N=8,235	
	(b)		0.383	0	1	n=183	
	(c)		0.150	-0.763	1.192	T=45	
No data	(a)	0.146	0.353	0	1	N=8,235	
	(b)		0.304	0	1	n=183	
	(c)		0.180	-0.299	0.723	T=45	

*Notes:* Row (a) provides summary statistics of overall sample. Row (b) and (c) provide *between* and *within* variation. The data on the legal status, sex ratio and political regime cover 1970-2014. The data on real GDP per capita cover 1970-2014. GDP quartiles are defined by country ranking in a given year. Sex ratio is number of men per woman.

*Sources:* sex ratio is from World Population Prospects: the 2017 Revision by United Nations, Department of Economic and Social Affairs, Population Division (2017). Political regime is from Polity IV Project, Political Regime Characteristics and Transitions, 1800-2016, Center for Systemic Peace. Real GDP per capita is from Penn World Table, Version 9.

**Table A3. Timeline of Repeals of State Sodomy Laws in the US**

<i>State</i>	<i>Year</i>
Illinois	1961
Connecticut	1969
Colorado	1971
Oregon	1971
Delaware	1972
Hawaii	1972
Ohio	1972
New Hampshire	1973
North Dakota	1973
California	1975
Maine	1975
New Mexico	1975
Washington	1975
Indiana	1976
Iowa	1976
South Dakota	1976
West Virginia	1976
Nebraska	1977
Vermont	1977
Wyoming	1977
Alaska	1978
New Jersey	1978
New York	1980
Pennsylvania	1980
Wisconsin	1983
Kentucky	1992
Nevada	1993
Tennessee	1996
Montana	1997
Georgia	1998
Rhode Island	1998
Maryland	1999
Arizona	2001
Minnesota	2001
Arkansas	2002
Massachusetts	2002
Texas and all other states	2003

*Notes:* This table is adapted from Table 1 in Kane (2007).

**Table A4. Summary Statistics of American State Panel Data**

		Mean	Std. Dev.	Min	Max	Observations
		(1)	(2)	(3)	(4)	(5)
<b>Legal</b>	(a)	0.332	0.472	0	1	N=250
	(b)		0.290	0	0.800	n=50
	(c)		0.374	-0.468	1.132	T=5
<b>State Sex Ratio</b>	(a)	0.969	0.045	0.905	1.323	N=250
	(b)		0.041	0.922	1.165	n=50
	(c)		0.020	0.873	1.126	T=5
<b>% of Christians</b>	(a)	0.507	0.119	0.264	0.836	N=250
	(b)		0.113	0.313	0.783	n=50
	(c)		0.042	0.347	0.676	T=5
<b>% of Black</b>	(a)	0.092	0.095	0.001	0.420	N=250
	(b)		0.095	0.003	0.372	n=50
	(c)		0.013	0.039	0.151	T=5
<b>% People (age 25+) with Bachelor Degree+</b>	(a)	0.155	0.067	0.048	0.332	N=250
	(b)		0.028	0.099	0.217	n=50
	(c)		0.061	0.040	0.284	T=5
<b>Log of State GDP per capita</b>	(a)	9.254	0.921	7.617	10.900	N=250
	(b)		0.182	8.886	9.879	n=50
	(c)		0.903	7.859	10.612	T=5
<b>State Median Age</b>	(a)	30.757	3.591	22.800	38.900	N=250
	(b)		1.776	24.720	34.640	n=50
	(c)		3.129	25.507	37.677	T=5

Notes: Row (a) provides summary statistics of overall sample. Row (b) and (c) provide between and within variation. *Legal* equals to one if state sodomy law has been repealed. State sex ratio is number of men per woman.

Sources: State GDP per capita data are obtained from *Bureau of Economic Analysis*.

Percentage of Christians is obtained from *US Religion Census 1952 to 2010*. Other variables are obtained from the *US Census of Population and Housing in 1960, 1970, 1980, 1990 and 2000*.

**Table A5. Summary Statistics of Australian State Panel Data**

		Mean	Std. Dev.	Min	Max	Observations
		(1)	(2)	(3)	(4)	(5)
<b>Legal</b>	(a)	0.509	0.501	0	1	N=216
	(b)		0.277	0.037	0.852	n=8
	(c)		0.429	-0.343	1.472	T=27
<b>State Sex Ratio</b>	(a)	1.019	0.056	0.97	1.26	N=216
	(b)		0.055	0.99	1.15	n=8
	(c)		0.020	0.97	1.12	T=27
<b>% of Christians</b>	(a)	0.746	0.073	0.57	0.88	N=216
	(b)		0.056	0.62	0.80	n=8
	(c)		0.051	0.66	0.85	T=27
<b>% People Born in UK &amp; Ireland</b>	(a)	0.082	0.031	0.05	0.15	N=216
	(b)		0.032	0.05	0.14	n=8
	(c)		0.008	0.06	0.10	T=27
<b>% People Born in All Other Countries</b>	(a)	0.133	0.043	0.04	0.22	N=216
	(b)		0.039	0.06	0.18	n=8
	(c)		0.023	0.10	0.20	T=27
<b>% People (age 15+) with Bachelor Degree+</b>	(a)	0.057	0.041	0.01	0.22	N=216
	(b)		0.035	0.04	0.14	n=8
	(c)		0.025	0.01	0.14	T=27
<b>Log of State Average Weekly Earnings</b>	(a)	5.731	0.543	4.49	6.54	N=216
	(b)		0.074	5.66	5.86	n=8
	(c)		0.539	4.41	6.43	T=27
<b>State Median Age</b>	(a)	28.161	2.754	22.85	34.53	N=216
	(b)		1.717	25.07	29.82	n=8
	(c)		2.235	24.90	33.21	T=27

*Notes:* Row (a) provides summary statistics of overall sample. Row (b) and (c) provide *between* and *within* variation. *Legal* equals to one if state sodomy law has been repealed. State sex ratio is number of men per woman.

*Sources:* Annual state sex ratios are obtained from *Australian Historical Population Statistics 2014* published by the Australian Bureau of Statistics. State average weekly earnings are obtained from *Average Weekly Earnings, Australia, May 2015* published by Australian Bureau of Statistics. Other variables are obtained from quinquennial *Census of Population and Housing*.