

# Institutions and Missing women: Evidence from Qing China<sup>1</sup>

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## Abstract

*Does China's missing women problem have historical roots? In this paper, I provide evidence suggesting that sex selection and male-biased sex ratio were deep-rooted phenomena dating back to historical times (circa 1644-1911) in China. To understand potential determinants, I find that sex selection and female deficit were greater in regions with higher clan density proxied by number of genealogies, confirming current hypothesis in historical literature. However, different from a prominent view that argues Confucianism as the cultural root of sex selection in China, the impact of Confucianism, at least some aspects of it, does not hold a robust relationship with premodern sex selection in my estimates.*

## 1 Introduction

The “missing women” problem has generated considerable interest and heated debate among researchers. In the past decades, rising sex ratio has been widely observed in many Asian countries, such as India, Korea and China. China perhaps has the most male-biased birth sex ratios observed among these countries. At the peak of such disparity, more than 120 boys were born for every 100 girls, ranging way above the normal sex ratio range 105.0-107.0 (Banister 2004). In the context of contemporary China, many determinants of high sex ratios in have been explored, such as one child policy (Zeng et al. 1993, Ebenstein 2010, Li et al. 2011), land reform (Almond, Li and Zhang 2017) and modern ultrasound technology (Chen et al. 2013).

Although most studies focus on explanations of sex ratios in recent decades, high sex ratios and extensive sex selection apparently have deep historical roots in China. In the 1920s, American

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economist John Lossing Buck concludes that China's sex ratio "was larger than that for any other country listed" based on his survey of forty thousand households in rural China (Buck, 1984). As early as the Qing dynasty (1644-1911), foreign missionaries and Chinese gazetteers have widely documented the severity of female infanticide and astonishing excess of males across China. Based on extensive historical evidence, it is very likely that besides contemporary policies and technologies, some slow moving historical determinants may lead to the long run persistence of "missing women" problem in China.

Many historical determinants have been postulated by scholars to explain China's missing women problem. One particular reason for female deficits that has been extensively discussed is the Chinese clan (Thornton and Lin, 1994; Yan, 2003; Banister 2004, Das Gupta 2010). According to this literature, the patrilineal, patrilocal and patriarchal nature of Chinese clan leads to strong preference of sons over daughters (Thornton and Lin, 1994). As son preference is closely linked to sex selection (Howarth and Leaman, 2003), the clan may thus contribute to the missing women problem.

Another prominent explanation attributes Confucianism as the cultural root of missing women in China. As early as the early 20<sup>th</sup> century, Christian scholars have charged the tolerance of female infanticide on Confucianism.<sup>2</sup> More recent works, emphasized the inherent gender hierarchical values in Confucianism; for example, "to place emphasis on men and to slight women" (King, 2014). These notions may ultimately rest in the Confucian notion of ancestral worship through the male line: the survival of a family depends only on the production of male heirs (Jimerson, 1990; Li, 2007; King, 2014). In fact, the notion of family line in Confucianism is consistent with patrilineal descent, a key feature of clan. As many dimensions of Confucianism and the clan are entangled (Das Gupta 2010), the strengthening role of Confucianism on clan has been noticed. Greenhalgh (1985, p265) argued that Confucian culture contributes to the development of "the most patriarchal family system that ever existed". Das Gupta (2010) argues that Confucianism incentivized people to develop corporate groups of patrilineages and resulted in a rigidly patrilineal kinship system that led to persistent prejudice against women.

Last but not the least, the dowry system is another frequently mentioned reason for missing women. Anecdotal evidence in many settings suggests that the financial burden of dowry for the bride's family is strongly associated to pro-male bias (Kusum 1993). Chinese historians have also

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2 see The literary Digest, Volume 21, p410. Oct 6, 1900. New York : Funk & Wagnalls.

noticed the link between dowry and sex selection. According to Mao (2007) and Wang (2015), heavy burden of dowry brought many families to total ruin, so parents drown girls once they were born.

To seek better understanding of the missing women issue in historical China and examine hypotheses proposed thus far, this paper attempts to empirically examine the relationship between premodern sex selection and historical institutions in the Qing dynasty (1644-1911). This is done by first constructing datasets measuring historical sex selection and potentially relevant institutions of clan, Confucianism and the dowry system. I collect data of female infanticide in county-level gazetteers and combine them to prefecture-level estimates of prevalence of female infanticide. To estimate Confucian view on women, I use the number of chaste women, the epitome of Confucian gender ideology (Rowe 2012) as my main proxy. To disentangle the effect of Confucianism on education, I control number of Confucian academies in my analysis. For dowry system, I collected descriptive data of dowry custom in local gazetteers and constructed measurements based on payment values.

My analysis then examines variation of sex selection in the form of female infanticide across 227 prefectures in China proper. I find a strong positive effect of clan strength, proxied by the number of genealogies on female infanticide. This result is robust to a rich set of historical covariates, including geography and climate (distance to river and distance to sea, soil quality measurements and rainfall), economic prosperity (agricultural productivity, population density and urbanization), political importance (importance designation of prefecture by government) and other cultural factors (religious Taoism and Buddhism). The result is also robust to an instrumental variable approach by instrumenting clan strength on agricultural suitability of wetland rice. Moreover, this paper explores one potential channel of such effect. Based on results in modern attitude survey, clan culture indicated by genealogy and ancestral temple, corresponds to stronger view of son preference today.

However, the analysis does not support the prominent claim that Confucianism uniformly leads to female deficits. The two indicators of Confucianism, chaste women and Confucian academies, do not display a similarly robust relationship with female infanticide. It is likely that Confucianism, as a cluster of institutions and cultural values, may have heterogenous effect on people's decision of sex selection. Some aspects may correlate with sex selection more than others. I hence suggest some preliminary hypotheses in Section 5.

This paper relates to the literature on the historical origin of gender roles. Carranza (2014) finds that loam soil texture which is suitable for deep land tillage, is associated with larger female deficits compared to clay soil textures in India. Alesina and Nunn (2018) finds historical use of plough corresponds to higher sex ratios today across countries. Rossi and Rouanet (2015) finds ethnic groups that have traditional patrilineal kinship system display stronger son preference and male-biased sex ratios in Africa. So far a large part of this literature focuses on cross-country analysis of historical determinants on results of missing women today. My analysis studies historical sex selection in China specifically, thus shedding light on the embedded nature of the missing women problem, and also the importance of country-specific institutions. My paper arguing the role of institution on missing women, is most closely related to Chakraborty and Kim (2009). Chakraborty and Kim (2009) examines reasons for historical sex ratio imbalance in India, and they find that clusters of institutions including kinship system, religion and caste, largely accounts for systematic differences of sex ratios across regions in early 20<sup>th</sup> century India.

The paper is structured as follows. In the next section, I provide a historical overview of sex selection and potentially relevant institutions in historic China. In Section 3, I present the data on clan, Confucianism and dowry, and discuss my construction of measurements. In Section 4, I present empirical results linking historical data of sex selection and measurements of institutions, and perform robustness checks. Section 5 discusses caveats and implications. In Section 6, I present results that suggest the lasting effect of clan culture on son preference beliefs. Section 7 concludes.

## **2 Historical contexts**

### **2.1. Institutions in Late Imperial China**

#### **2.1.1. The Chinese clan**

The Chinese clan is a patrilineal kin group of related individuals with a common surname tracing ancestry back to a common male ancestor (Keesing 1975). As early as in the Shang dynasty (c.14<sup>th</sup> century BC – c. 1046 BC), the clan already held the social function to bind members, allocate wealth and social standing (Keightley, 1999, p290). By the Qing dynasty, the patrilineal clans has become so prominent that it was regarded as a hallmark of Chinese culture (Greif and

Tabellini, 2017). The Chinese clan shares the characteristics of patrilineality and patrilocality similar to clans in many other societies, but has its uniqueness in its strict hierarchical nature.

The Chinese clan is patrilineal. Patrilineality essentially refers to the inheritance of family line and family property are only traced through male heirs. This system puts the value of sons over daughters, both in terms of property inheritance and ritual importance. First, since daughter could not inherit family land property, parents without sons could only adopt a male heir, who is usually less trustworthy than a biological son. Otherwise, they have to relinquish their rights to select a heir who inherit their property to clan elders (Feng, 2009, p384). Thus, bearing a son is the only way that parents would expect to hold onto the family property and secure their standard of living in old age. Second, only sons could practice family ritual, which is a fundamental clan activity (Feng, 2009) . This was another motivation for parents to bear sons, to ensure continuation of ancestral rituals and survival of ancestral spirits by carrying family name.

The Chinese clan also practices patrilocal marriage. When a woman marries into a clan, she ceases to be a member of her natal family and joins her husband's family and lineage. Such marriage pattern not only cut off her tie with her own parents, but also her social relationship in her lineage. Since daughters will be removed from them both physically and financially eventually, parents cannot expect a daughters' support in their older years and also their future contribution on social network in the lineage. In families with stronger clan ties, the expected returns from daughters are even lower. Thus, for parents, raising a daughter likely accrues less expected economic benefit than a son (Jimmerson, 1990). Hence, in such a system, the key strategy for parents was "to take more from daughters to give more to sons and thus get more for themselves." (Greenhalgh, 1985, p.276). The low perceived value of daughters, not surprisingly, corresponds to prevalent sex selection and male-biased sex ratios observed in Chinese clans by anthropologists<sup>3</sup>.

Different from many clan institution in other societies, the Chinese clan also is characterized as a hierarchical institution based on seniority and gender. According to Feng (2009), the power of the patriarch, usually the senior male member in a family, consists of two parts: the power of father over children, and the power of husband over wife. Such powers include disposing family property, selling wives, and punishing family members. Beyond the extended family, a

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<sup>3</sup> Guo (1987) studies 22 clan genealogies that documents total number of males and females in the clan and finds that sex ratios in these clans range from 104 to 222. Guo(2008) finds high unmarried rate for male members in clans in Hunan province and suggests high sex ratio as the cause.

hierarchical relationship exists between family patriarch (*jiazhang*), lineage patriarch (*zuzhang*) and clan patriarch (*zongzu zhang*) (Feng, p388). Such hierarchy strictly based on seniority and gender, may be a specific reason why the Chinese clan has persistent impact on gender inequality (Das Gupta 2010).

### **2.1.2. Confucianism**

Confucianism has been widely attributed to be the root of female oppression and son preference. Indeed, an aspect of Confucianism that is of “utmost importance” is its gender ideology (Bailey 2012, p16). Confucianism lies a particular emphasis in continuation of family line by male heirs, and associates producing a son with filial piety. A frequently cited Confucian axiom writes, “There are three unfilial things, and having no descendants is the worst” (Rosenlee, 2012). Thus, producing a son is an imperative task for parents to conform to filial piety sanctioned by imperial law, and is also a key channel to improve a woman’s status and bargaining power in the family. Another core doctrine in Confucianism is female chastity. Women should stay at the household realm, which is “women’s sphere proper” (Rosenlee 2012, p141), to protect their chastity and show their loyalty to husbands. Foot binding and determination not to remarry essentially expresses the female virtue of life-long binding with husband. The emphasis of chastity, leading to the seclusion of women in the domestic realm, could potentially strip women’s bargaining power in family and thus weaken perceived values of daughter compared to sons.

### **2.1.3. Dowry system**

Dowry is the transfer of property to the couple or groom at the time of marriage. It is now widely believed that larger marriage payment to the groom’s family, or dowries, is associated son preference (Das Gupta, 1987; Basu, 1999; Kusum 1993). In China, the dowry payment cannot be reverted to the bride’s family after the women became widowed or divorced (Anderson, 2007). The economic cost of dowry could worsen the perceived value of having a daughter. It is thus not surprising that dowries are regarded as a fundamental cause of female infanticide both by historians (Mao (2007), p160) and contemporaries in history. For instance, in 1879, the proclamation by Governor Cheng of Zhejiang Province criticized that heavy burden of dowry led to female infanticide:

*“The main cause of this crime comes from the excessive amount of spent on marriages. I have learned that among the people a man does not marry a girl without making extensive preparations. The costs sometimes rise from one hundred to one thousand taels of silver... The father-in-law and mother-in-law of the new bride measure the hate or love that they will show to her, on the importance or the scantiness of her dowry.”*<sup>4</sup>

## **2.2. Female infanticide in Qing China**

Female infanticide has a long history in China. Before the advent of modern ultrasound technology which made prenatal sex-selective abortion possible, female infanticide was the most prevalent form of postnatal sex selection (Mungello 2008). The legalist philosopher Han Fei documented incidence of female infanticide as early as in the 3<sup>rd</sup> century B.C.<sup>5</sup> By the Qing dynasty, female infanticide had become a serious social problem in China both for its prevalence and severity. The practice of female infanticide as a local custom, was found in twelve provinces (Chang, 2006). Observations in several prefectures found that around thirty to forty percent of female infants were killed<sup>6</sup>. Such a high level of female infanticide not surprisingly leads to an excess of males. For example, in Guangxin prefecture in Jiangxi province, the local gazetteer writes “three or four out of ten baby girls are drown (by their parents), and females are outnumbered by males by thirty to forty percent.” (Refer to the Guangxin Fuzhi, 1873[1]).

## **3 Data and measurements**

In this section, I discuss my data sources for dependent variable of female infanticide, main independent variables of interest (clan, Confucianism and dowry) and other variables. The data for clan and Confucianism are available in 227 prefectures, and data for dowry is available for 105

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4 Proclamation of Daoguang year 5, month 7, day 1 (1879). Yu Zhi, Deyi Lu, juan 1, pt. 2, 16, in Palatré, L’infanticide, 15, app.5

5 In Hanfeizi, Han Fei wrote “[I]f a boy is born, the parents congratulate each other, if a girl is born, they kill her. [Both boys and girls] all come from the same parents, yet boys are celebrated, girls are killed; this is because they [i.e., the parents] consider the benefits (of having a boy) in the long run.” See 294–95, 300 Jensen, Lionel M. (1997) Manufacturing Confucianism: Chinese Traditions and Universal Civilization. Durham and London: Duke University Press.

6 David Abeel, a missionary of the Dutch Reformed Church claimed that on average around 39% female infants were killed by their parents based on his survey in forty villages in Fujian province. (see the Chinese Repository, 12 (October 1843):540-548.)

prefectures out of 318 prefecture-level administration regions in the Qing dynasty in the early 19<sup>th</sup> century.

### 3.1 Female infanticide data

It is a challenging task to obtain precise quantitative measurement of female infanticide even today, because of the concealed character of such practice. Thus, my measurement focuses on whether female infanticide is observed. My data source mainly comes from the *Zhongguo fangzhi ku* (China Gazetteers Database) developed by Beijing Erudition Digital Research Center <sup>7</sup>. It encompasses over 4,000 volumes of gazetteers and 2,729 of them were written in the Qing dynasty, the period of interest. Thus this dataset essentially covers all the prefectures and counties in China proper, the region of interest to this study. To measure female infanticide, I specifically look for “*ni nü*” (to drown girls) and “*bu ju nü*” (not raise girls) the most commonly used text to refer to female infanticide in the gazetteers (Mungello, 2008, p9). To fully utilize the information in county gazetteers below the prefecture level, I use fraction of counties that report the practice of female infanticide in a prefecture as the proxy for the prevalence of female infanticide. This measurement is more precise than indicator of female infanticide in the sense it captures the variation within a prefecture <sup>8</sup>. I find female infanticide practice in 472 counties in 124 prefectures. A map of female infanticide expressed in fraction on the prefecture level are shown in Figure 1.

A potential measurement error is the number of omitted observations. In other words, if female infanticide existed in a prefecture but unreported in gazetteers, then this will make our estimation biased. First, it is worthwhile to mention that government officials had incentive to record female infanticide, as banning female infanticide was regarded as political achievements. Government officials in the Qing dynasty frequently launched campaigns to combat infanticide, in forms of official proclamations banning infanticide, publicly circulated essays condemning the practice and establishment of foundling hospices (Mungello 2008; King, 2014). These documents were recorded in local gazetteers. Also, my data is generally consistent with historians’ argument

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7 Data on Jiangxi Province comes from Xiao (2001) *qingdai Jiangxi ninv zhuangkuang yu jinjiewen*, Shilin, 2001 (1) p61.

8 An alternative approach, is to use an indicator variable for whether female infanticide was observed in the prefecture. I obtain the same result using this method. However, such method is less powerful in the sense that it does not account the variation within a prefecture (Results See Appendix).

female infanticide was more prevalent in south and east than the southwest and north (Chang, 2006; Wang, 2010).

Another important issue is whether the report of female infanticide may actually reflect the severity of such practice. If the most severe female infanticide occurs in counties in a prefecture, in which many other counties do not have such practices, then this may lead to a biased sample that underrepresents regions with more severe infanticide. However, based on historian comments, the most severe female infanticide were in Jiangxi, Fujian, Hunan and Zhejiang provinces (Wang 2010; Shi 2017). These provinces also have high prevalence of female infanticide (as shown in figure 1). In other words, based on historians' arguments, the prevalence of female infanticide largely reflects the severity of the practice.

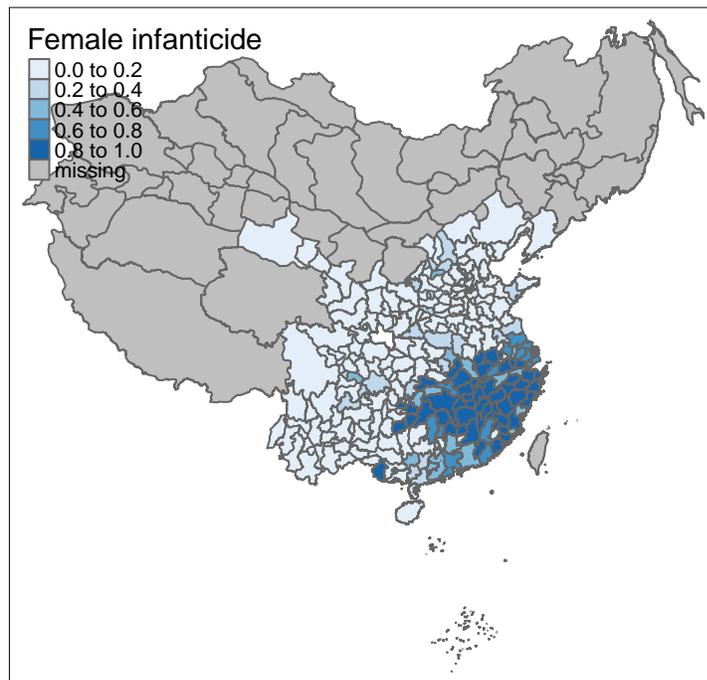


Figure 1: maps displaying female infanticide in Qing China

### 3.2 Measurements of clan

Following existing literature (Chen, Kung and Ma 2017; Zhang 2017; Greif and Tabellini, 2017), I use the number of clan genealogies to proxy the strength of clan. Clan genealogy is a book compiled for the clan that documents its history. Number of genealogies provides a good proxy

for clan density for several reasons. First, writing genealogy is closely associated with ancestral worship, which is a crucial belief in Chinese tradition. According to Feng (2009), writing genealogy is to determine the relationship between ancestor and clan members, and strengthen the cohesion among clan members. Second, writing genealogy itself implies the mobilizing power of the clan, because writing genealogy usually includes considerable effort in collecting information on clan history and clan members. Third, clan genealogy provides the basis of power for clan patriarch (Feng 2009, p429). The clan genealogy includes the code of conduct, including norms of behavior, conventions and punishment rules, which the clan patriarch relies upon to organize the clan. Hence, since recording genealogy is “essential to the existence of a lineage” (Bol, 2008, p. 241), clan genealogy provides a good measurement of clan density.

I obtain data on genealogies from *Huaren jiapu zongmu* (Genealogy Knowledge Service Platform) collected by the Shanghai library. This database is regarded as the most comprehensive database for Chinese genealogy thus far. It includes more than 54,000 genealogy books of 608 surname groups. Of all the compiled genealogies, over 25,000 were written the Qing dynasty. As some prefectures were more sizeable than others, I use the number of genealogies in each prefecture divided by its population as a measurement of clan density<sup>9</sup>.

Although number of genealogies has been used in many works thus far (Chen, Kung and Ma 2017; Zhang 2017; Greif and Tabellini, 2017), it is crucial to point out certain caveats with this measurement of clan. The number of clan genealogies essentially captures the number of clans, but does not provide information on clan population and the differences between strong and weak clans. As women generally have lower status in larger and stronger clans (Feng 2009), this measurement may not be ideal in capturing the particular effect of a strong clan, which may hold more collective property and have higher mobilization power of clan members. Also, if clans are so large that they cover the whole population, then the number of genealogies essentially captures clan fractionalization instead of population share of clan members<sup>10</sup>. These potential measurement

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<sup>9</sup> I use the average population in five population censuses (1776, 1820, 1851, 1880, 1910) in the Qing dynasty to reduce measurement error, following the method used by Chen Kung and Ma (2017). Number of genealogies normalized by land area essentially gives me the same result. See Appendix.

<sup>10</sup> A study in Liaoning province shows that the largest five clans covered 75% of population in the 18th century (Greif and Tabellini, 2017) Data based on Lee, James Z., and Cameron D. Campbell. China Multi-Generational Panel Dataset, Liaoning (CMGPD-LN), 1749-1909. ICPSR27063-v10. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2014-07-10. <http://doi.org/10.3886/ICPSR27063.v10>.

errors could be significantly improved with digitalization of genealogies in the future. Nevertheless, since genealogy relates to the essential nature of the Chinese clan, the number of genealogies probably provides the best possible measurement of clan at this point of time.

### 3.3 Measurement of Confucianism

It is a challenging task to measure Confucianism empirically, since it encompasses a wide variety of institutions, customs and social norms. Another difficulty specifically related to this topic, is that many Confucian norms and practices are entangled with those of other institutions such as the clan.

My major measurement of Confucianism is the number of chaste women who received “testimonial of merit” (“jingbiao”) from the imperial government in the Qing dynasty until the end of Jiaqing period (1820). In the Qing dynasty, the promotion of female chastity was taken to the extreme (Roselee, 2012, p137; Bailey 2012). Imperial and local government built chastity memorial arches to honor chaste women, and the cult of widowhood elevated chaste women to the role of cultural heroes (Adler, 2006). To promote chaste women as role models, the government kept systematic record of these chaste women, and divided them mainly in two categories “chaste widows” (*jiefu*) who did not remarry after their husband’s death, and “widow martyrs” (*lienü*), who died to resist rape, committed suicide out of shame after sexual assault, purposely mutilated themselves to reduce pressure to remarry, or sacrificed themselves after their husband or fiancée’s death. My calculation, based on *Jiaqing Daqing Yitongzhi* (Atlas of the Great Qing Dynasty) compiled by the Qing government and published in 1842, shows that at least 73,820 women have received the testimonial of merit from the emperor across 268 prefectures by the early 19<sup>th</sup> century<sup>11</sup>.

The number of chaste women likely provides a good proxy of the Confucian value on women for several reasons. First, as discussed in previous section, female chastity is among the core value

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11 My calculation excludes those women who received the award for casualty in war and mass rebellions, since these awards are arguably less related to the idea of women chastity. Also I do not include chaste women in frontier regions, which are not in my main sample. It is worth to mention that the number of chaste women enumerated in local gazetteers (awarded locally) far exceeds the enumeration in the Official Daqing yitong zhi. According to one compiler of local gazetteer, “first we list those who were recorded in the previous gazetteer. Next come those who have received testimonials of merit from the emperor. Next appear those reported by neighbors (linli), local groups (xiangdang), and lineages (qinzu), and verified by our editors”. Xinxing [Guangdong] xian zhi 1758, juan 24. I did not use enumeration in local gazetteers because local gazetteers did not provide consistent information on chaste women across regions.

of Confucian gender ideology. Chaste women are regarded as community honors and extensively praised in “local custom” (Mann 1987), functioning as the epitome of Confucian gender ideology (Rowe 2012). Moreover, the testimonial of merit was specifically aimed to award commoners (Elvin 1984). According to Emperor Yongzheng, even people living in “remote mountains and deep valleys” and the very poor could “receive imperial favor” (Lu 2014). This specificity of the system allows the number of chaste women to capture the effect of Confucian gender norms on common people, instead of only the privileged elites<sup>12</sup>. Another potential benefit, is that the number of awarded chaste women was unrelated to the clan at least in the selection process. Although the candidates were reported by local community, it was the Qing central government to evaluate these candidates case by case based on their deeds, and held decision to issue the award (Lu, 2014). Hence, the number of chaste women arguably provides a consistent proxy of Confucian gender norm across regions.

Since Confucianism also played fundamental roles in local education (Yao 2003), I also enumerate the number of Confucian academies to capture the effect of Confucianism on education. The data for Confucian academies is compiled from Ji’s (1996) *Zhongguo shuyuan cidian* (A Compendium on the Chinese Academies), which lists Confucian academies for the period up to 1904.

### 3.4 Measurement of dowry

Unfortunately, there are no existing systematic dataset documenting dowry system in premodern China. To empirically measure the heterogeneity of dowry system across China, I construct measurements of dowry practice based on qualitative descriptions of local marriage customs in gazetteers. Some local gazetteers mention marriage customs and dowry, primarily in the “fengsu” (custom) and “hunjia” (marriage) chapters, and also in biographies of local government officials. In total, I am able to find documentation of dowry practices in 105 prefectures. I ranked dowry practices on the scale from 1 to 3. If the custom of marriage includes little or no transfer of property or gifts from the bride’s family to the groom’s family, I code it as 1. If the custom of marriage includes dowry but varies depending on the economic condition of

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12 Since the Jingbiao system separated the Manchus and their associates (Mongols and Han Chinese in Eight Banners) with Han people, and recipients of testimonial of merits were disproportionately biased towards ethnically Manchus (Lu, 2012), I choose to exclude observations with significant Manchu recipients (Shuntian Fu, Fengtian Fu and Jinzhou Fu).

the bride's family, I code it as 1. If the custom strictly requires heavy dowry, I code it as a 3. I acknowledge that this measurement is certainly imperfect. It does not account for the variation of dowry system across classes, and also the relative price of dowry versus bride price, which may also be crucial, but it does provide a reasonable quantitative measure of dowry system across regions.

### **3.5 Other variables**

In my estimations, in addition to the key variables of clan, Confucianism and dowry, I control for a large number of covariates that may possibly affect premodern sex selection behavior. These controls include geographical and environmental controls, historical controls on economic prosperity, political importance and cultural covariates.

#### **3.5.1 Baseline geographical and environmental controls**

##### **Distance to coast and distance to river**

To deal with other potential effects of geography, I include measurements of distance to coast and distance to river from the prefecture capital. The data on historical geolocation of rivers and coast are provided by CHGIS (2016).

##### **Rainfall**

Rainfall may be associated with sex selection by affecting agricultural conditions or directly through child survival (Kim 2010). Chakraborty and Kim (2010) find higher rainfall is associated with higher sex ratios. I include aggregated annual rainfall into my analysis. The data on rainfall are obtained from University of Delaware Precipitation data.<sup>13</sup>

##### **Soil Quality**

Carranza (2014) emphasizes the importance of soil texture on female infanticide in India. To account for the potential effect of soil quality, I include a control for soil quality in my analysis.

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<sup>13</sup> the UDel\_AirT\_Precip data set are retrieved from their website, <https://www.esrl.noaa.gov/psd/>.

The measures of soil quality includes soil texture, soil moisture, soil nutrition availability and workability. Data are obtained from Harmonized World Soil Database<sup>14</sup>.

### **3.5.2 Historical controls**

#### **Agricultural suitability**

Agricultural suitability affects economic prosperity and many other human behavior, especially in agricultural societies in premodern times. Historians and economists have argued that sex selection may be a response to agricultural conditions (Fei, 1983). I thus employ two measurements for agricultural suitability. First, I control for the Caloric Suitability Index, developed by Galor and Ozak (2016), which captures the variation in potential crop yields across regions. This dataset estimates average caloric suitability for each cell of size 5'× 5' in the world and I match it to each prefecture. Second, I use registered cultivated land area in each prefecture enumerated in the “tianfu” (land tax) chapters in *Daqing yitong zhi* (1842) as an alternative measurement.

#### **Economic prosperity**

Some scholars have argued that poverty was a primary cause of female infanticide in traditional China (Wilkinson, 1926; Lee 1981). To capture the effect of economic prosperity, I employ two proxies for economic prosperity, namely population density and urbanization. For population density, I calculated prefecture population density using the average population in five national censuses (1776, 1820, 1851, 1880, 1910) in the Qing dynasty, divided by the area of the prefecture. This data is obtained from Cao (2000). For urbanization rates, there are no precise measurement for urbanization rate in the relevant period on the prefecture level. Thus, I turn to Rozman's (1974) classification of Chinese cities on four levels: very large (Beijing), large (population of 300,000 and above), mid-level (population between 70,000 and 300,000), small (population between 30,000 and 70,000) and others (population less than 30,000).

#### **Political importance of prefectures**

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<sup>14</sup> Harmonized World Soil Database, <http://webarchive.iiasa.ac.at/Research/LUC/External-World-soil-database/HTML/SoilQualityData.html?sb=11>.

I use official government designations of each prefecture on four levels in 1820: *zuiyao* (greatest importance), *yao* (considerable importance), *zhong* (middling importance) and *jian* (little importance). These designations are collected from the CHGIS (China Historical Geographic Information System) (2007).

## Religions

A vibrant existing literature have discussed the potential effect of religion on gender inequality. Cross-cultural studies have shown that religion has persistent effect on gender well-being outcomes (Dollar and Gatti, 1999; Seguino, 2011; Baliaoune-Lutz, 2006). In the context of China, before the spread of Christianity in China, the most important religions are Buddhism and Taoism. Buddhism, which emphasized karmic justice and opposed infanticide, may attenuate sex selection and biased sex ratios (Mungello 2008). Taoism, also opposes infanticide to a certain extent (Tierney, 1999). To understand their impact on sex selection, I use the number of their temples as a proxy for their strength. Data on Buddhist temples are obtained from CHGIS (2007), which geocoded 2,408 Buddhist temples across China before and in the Qing period. Data on Taoist temples are obtained from the “*siguan*” (temples) chapters in *Daqing yitong zhi* (1842).

## 4 Empirical results

### 4.1 Empirical setup

To examine the impact of clan on sex ratios, I use the following baseline regressions:

$$Y_p = \beta_0 + \beta_1 * Clan_p + \beta_2 * Confucian_p + \beta_3 * Clan_p * Confucian_p + \beta_4 * X_G + \beta_5 * X_H + \tau_p + \varepsilon_p \quad (1)$$

The dependent variable  $Y_p$  is sex selection practice of the population of a prefecture  $p$ . The key explanatory variables are  $Clan_p$ , the measurement of clan density proxied by number of genealogy books compiled in the Qing dynasty divided by land area, and  $Confucian_p$ , the number of chaste women normalized by land area in prefecture  $p$ . To explore the interaction between clan strength and Confucianism I add an interaction term between them.  $X_G$  is a set of baseline control variables, including distance to coast, distance to river and agricultural suitability.  $X_H$  is a set of historical

controls consist of three parts. The first part is historical economic prosperity. I use two proxies for this, population density and urbanization. The second part consists of political importance of a prefecture designated by the government. The last part is religion, consisting of measurements of strength of of Buddhism and Taoism.  $\tau_p$  is the province fixed effect controlling for unobservable effects related to provinces. I report robust standard errors clustered at the provincial level to deal with the potential within-province correlation of the error term.

To explore the effect of dowry, although on a subnational scale because of data limitation, I add dowry as explanatory variable in the above regression.

$$Y_p = \beta_0 + \beta_1 * Clan_p + \beta_2 * Confucian_p + \beta_3 * Dowry_p + \beta_4 * X_G + \beta_4 * X_H + \tau_p + \varepsilon_p \quad (2)$$

## 4.2 OLS results

Table 1: OLS estimates: clan and Confucianism on female infanticide

	Dependent variable is prevalence of female infanticide					
	(1)	(2)	(3)	(4)	(5)	(6)
clan density	0.065*** (0.018)	0.064*** (0.017)	0.045*** (0.015)	0.042*** (0.013)	0.046*** (0.012)	0.047*** (0.012)
chaste women					-0.015 (0.023)	-0.017 (0.024)
Clan density * chaste women						-0.002 (0.009)
Province Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Geographical controls	No	Yes	Yes	Yes	Yes	Yes
Environment controls	No	No	Yes	Yes	Yes	Yes
Economics controls	No	No	No	Yes	Yes	Yes
Culture controls	No	No	No	No	Yes	Yes
Observations	227	227	227	226	226	226
R <sup>2</sup>	0.739	0.746	0.771	0.791	0.795	0.795
Adjusted R <sup>2</sup>	0.717	0.721	0.742	0.759	0.759	0.758

*Notes:* Results are reported with robust standard errors. Standard errors are clustered on province level. The units of observation are prefectures. Clan density and chaste women density are normalized by population and then take natural log. \*\*\*, \*\* and \* indicate significance at the 1, 5 and 10 percent levels.

Table 1 reports the ordinary least square estimation. In all specifications, the result consistently shows that clan strength has significant and positive effect on female infanticide.

However, it is perhaps surprising to find that Confucianism, proxied by the number of chaste women in a prefecture, does not have a significant positive impact on female infanticide. Nor does its interaction term with clan has a significant positive effect. This result suggests that it is rather necessary to take a closer look of potential channels of Confucianism. In section VI, I will discuss potential explanations why Confucianism may not lead to more sex selection.

### **4.3 The role of dowry**

To understand the effect of dowry on practice of female infanticide, I add my measurements of dowry into the regression listed above in prefectures that I have dowry information. I report the regression results in Table 2. Table 2 shows that in my sample of 105 prefectures, dowry has a positive effect on female infanticide, but such effect is not significant when province fixed effect is included. Also, after the inclusion of dowry dummy variables, the effect of clan density on female infanticide remains significant.

Table 2: OLS estimates, Clan and Confucianism and dowry

	Dependent variable is prevalence of female infanticide				
	(1)	(2)	(3)	(4)	(5)
dowry	0.249*** (0.071)	0.080 (0.054)	0.083* (0.048)	0.088 (0.055)	0.080 (0.052)
clan density					0.081*** (0.027)
chaste women					0.024 (0.024)
Clan density * chaste women					-0.043 (0.032)
Province Fixed Effect	No	Yes	Yes	Yes	Yes
Geographical controls	No	Yes	Yes	Yes	Yes
Environment controls	No	No	Yes	Yes	Yes
Economics controls	No	No	No	Yes	Yes
Culture controls	No	No	No	No	Yes
Observations	105	105	105	105	105
R <sup>2</sup>	0.328	0.775	0.807	0.832	0.859
Adjusted R <sup>2</sup>	0.308	0.721	0.746	0.764	0.787

*Notes:* Results are reported with robust standard errors. Standard errors are clustered on province level. The units of observation are prefectures. Clan density and chaste women density are normalized by population and then take natural log. \*\*\*, \*\* and \* indicate significance at the 1, 5 and 10 percent levels.

## 4.4 Robustness checks

Given the results above, it is likely that the clan has a crucial effect on sex selection behavior. In this section I pursue a list of robustness checks to validate the argument.

### 4.4.1 Dropping regions with significant ethnic minorities

It is plausible that measurement errors of sex selection and various explanatory variables were greater in regions with significant ethnic minority, since the imperial government generally had weaker control and less record of these areas. Hence, I report the results of equation (1) in Table 3 excluding prefectures in Yunnan, Guizhou and Guangxi provinces, where ethnic minorities were important.

The results in Table (3) has slightly larger estimates of the coefficient, and the effect of clan on female infanticide remains significant, consistent with estimates in Table (1),

	Dependent variable is prevalence of female infanticide					
	(1)	(2)	(3)	(4)	(5)	(6)
clan density	0.072*** (0.018)	0.070*** (0.018)	0.048*** (0.017)	0.049*** (0.016)	0.053*** (0.017)	0.054*** (0.017)
chaste women					-0.014 (0.031)	-0.020 (0.034)
Clan density * chaste women						-0.008 (0.014)
Province Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Geographical controls	No	Yes	Yes	Yes	Yes	Yes
Environment controls	No	No	Yes	Yes	Yes	Yes
Economics controls	No	No	No	Yes	Yes	Yes
Culture controls	No	No	No	No	Yes	Yes
Observations	195	195	195	194	194	194
R <sup>2</sup>	0.761	0.769	0.793	0.815	0.817	0.817
Adjusted R <sup>2</sup>	0.741	0.747	0.766	0.785	0.783	0.783

Notes: Results are reported with robust standard errors. The units of observation are prefectures. Clan density and chaste women density are normalized by population and then take natural log. \*\*\*, \*\* and \* indicate significance at the 1, 5 and 10 percent levels.

Table 3: OLS regression excluding ethnically minority regions

#### 4.4.2 Sex ratio data

Current literature have shown that sex selection and sex ratios are strongly correlated, and sex selection is regarded as a major cause of missing women (Hesketh and Zhu, 2011; Almond, Li and Zhang, 2017). In the context of historical China, we would thus expect larger number of missing women in regions where female infanticide is more prevalent. To understand the effect of female infanticide on sex ratios, I thus collect sex ratio data based on population registration data in the Qing dynasty. Unfortunately the Qing government does not keep a systematic record of sex ratio data across China, thus preventing me to examine the relationship between sex ratio and female infanticide using statistical methods across China<sup>15</sup>. Nevertheless, I am able to find sex ratio of total population in 80 prefectures and 6 provinces that situates in different macro regions in China (South, Southwest, East, Northwest and North) from separate sources. Hence, the data provides an arguably representative sample.

<sup>15</sup> The population census is largely a local initiative in the Qing dynasty. Thus the data in different regions are mostly from different years.

Figure 2 describes the geographical distribution of sex ratios on prefecture level obtained in gazetteers. Table 3 presents province level sex ratio data obtained from imperial memorials. Both datasets provide consistent suggestions that the southwest and north have relatively normal sex ratios but sex ratio in the south and southeast are abnormally high. These data are also consistent with qualitative evidence that female infanticide in these regions may lead to high sex ratio<sup>16</sup>. For example, already in the 17<sup>th</sup> century, Fujian gazetteer (*Fujian tongzhi*) writes about female infanticide in Pucheng County, that “The prevalence of drowning girls here is more prevalent than other counties, and six or seven out of ten males are without wives”. In Guangxin prefecture in Jiangxi province, the local gazetteer writes “three or four out of ten baby girls are drown (by their parents) and thus females are outnumbered by males by thirty to forty percent.” (*Guangxin Fuzhi*, 1873[1]). Hence, my measurement of female infanticide is generally consistent with observations of population sex ratios, thus adding confidence to my main results.

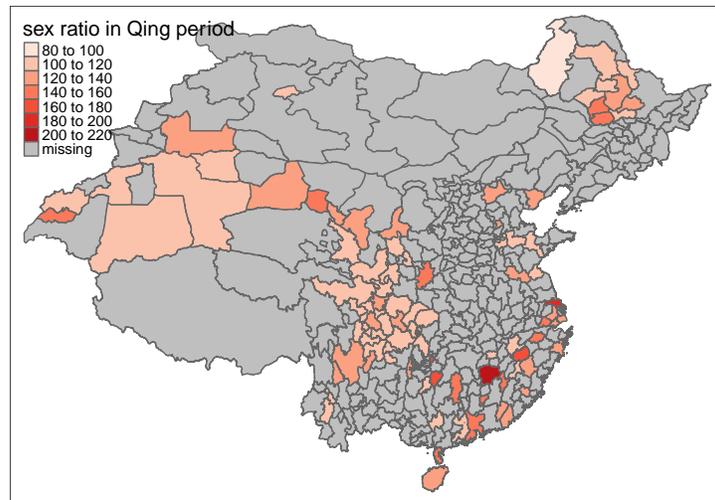


Figure 2: sex ratio in prefectures in Qing China mapped to 1911 boundary. Data are collected from local gazetteers

<sup>16</sup> In Guiyang county, Hunan, the governor writes “inspecting the pao-chia (household registration) and enumerating (persons) family by family, we found that males outnumber females by seven out of ten”. (refer to Guiyang Xianzhi, 1867[18]). For more records of sex ratio in gazetteers, see Wang (2006) for summary.

Year	Province	Macro Regio	Sex ratio
1751	Zhili	North	115.89
1755	Zhili	North	116.63
1763	Zhili	North	121.28
1787	Zhili	North	119.46
1755	Jiangsu	East	138.55
1765	Jiangsu	East	138.45
1773	Jiangsu	East	138.34
1787	Jiangsu	East	132.33
1751	Yunnan	Southwest	109.87
1755	Yunnan	Southwest	101.96
1763	Yunnan	Southwest	103.56
1751	Guangxi	Southwest	110.04
1763	Guangxi	Southwest	113.37
1782	Guangxi	Southwest	117.24
1812	Sichuan	Southwest	115.37
1751	Shaanxi	Northwest	129.93
1777	Shaanxi	Northwest	130.93
1782	Shaanxi	Northwest	131.63

Table 5: sex ratio data in six provinces. Data are retrieved from gongzhongdang Qianlong chao zouzhe [Official memorials of the Qianlong era] Taipei, National Palace Museum, 1982.

	max	min	mean	std	n	Provinces
Southwest	139.54	101.1	113.87	8.15	33	Guizhou, Yunnan, Sichuan, Guangxi
Northwest	146.59	107.84	123.02	12.22	13	Gansu, Shaaxi
North	128.23	111	118.39	7.47	6	Zhili, Shandong
Southeast	145.83	108.34	132.69	12.46	7	Fujian, Zhejiang
East	180.33	107.4	136.05	26.85	5	Jiangsu
South	215.22	112.2	145.58	28.17	16	Jiangxi, Guangdong, Hunan
Total	215.22	101.1	125.07	20.16	80	

Table 6: Summary statistics, prefecture level sex ratios grouped in macro regions.

#### 4.4.3 Instrumental variable approach

In this section, I pursue an alternative strategy by using instrumental variable approach. The choice of instrumental variables are based on historical determinants of clan development. Why did the clan differ across regions in China? Two explanations have been proposed to explain the geographical variation of clan strength (Hsiao 1960:326, Freedman 1958:1, Potter,1970). It is widely believed that the Chinese clan emerged in times of population migration (Feng 2009, Greif and Tabellini, 2017). Greif and Tabellini (2017) emphasize that military conflicts between Han Chinese political regimes and ethnically minorities in history triggered the migration of clans to the south. Specifically, they assert that the conflicts between the Jurchen Jin and Song dynasty in the 12th century, was a critical historical juncture that lead to mass clan migration and “forever

altered the territorial distributions of the Han people” (Greif and Tabellini, 2017, p29). It is plausible that the migration of clans were triggered by historical whether shocks such as drought and flood. Whether shocks may directly lead to migration in cases of large famines, or causes wars and conflicts which forces people to migrate (Ko 1997). These historical whether shocks could be ideal instruments. However, most clan migration preceded precise historical whether data became available, thus I am able to pursue this strategy in this setting<sup>17</sup>.

Another group of historians linked clan development to agriculture patterns. Several channels have been identified. According to Hu (1948:15), Hsiao (1960: 329) and Potter (1970), agricultural surplus is essential to finance lineage organization that provides many public services including education, defense and infrastructure. Freedman (1966: 159f) and Potter (1970) suggest that stronger lineages developed in regions with rice agriculture, because rice agriculture generates significantly larger annual surplus than other crops for clan activities. Freedman (1958) steps further and argues that the surplus accumulated in a highly productive rice economy leads to clan corporate property. Wetland rice agriculture demands intensive capital and labor in land reclamation, irrigation channels, planting, transplanting, and harvesting. While wet rice agriculture has higher yield than other crops, it was also much more risky as few other crops could be grown in submerged water (Chakraborty and Kim, 2008). Hence it is plausible that in rice growing areas the clan takes the responsibility in pooling and distributing resources as corporate property, which in turn “promoted the development of large agnatic communities” (Freedman 1958: 129-130) . Another channel discussed by Huang (1985), emphasizes the difference of collaboration required in wetland versus dryland cultivation. He notices that in northern China where dry land agriculture was the norm, agriculture required more animal power and less collaboration in families. Hence, dry land agriculture does not have “sufficient economic importance to form a basis for strong lineage organizations” (Huang, 1985: 235).

In light of the arguments by historians, I thus use the geo-climate suitability of wetland rice as an instrumental variable. I obtain data of the geo-climate suitability of wetland rice agriculture from the FAO’s Global Agro-Ecological Zones (GAEZ) database. The database contains suitability and potential yield for wetland rice for 5 arc minutes by 5 arc-minute grid-cell globally. Notice the potential yield calculated in this database is determined by natural conditions, including

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<sup>17</sup> Annual whether data on the prefecture level only starts from the 15th century in the Ming dynasty (State Meteorological Society, 1981). Most clan migration occurred before the Ming dynasty (Ko 1997).

temperature, precipitation, sunlight, soil quality, etc. These conditions are not determined by human activities and this instrument solves the issue of the endogenous choice of rice cultivation. I use the suitability of cultivating wetland rice with low input level. Low input level means production is based on “the use of traditional cultivars, labor intensive techniques, and no application of nutrients, no use of chemicals for pest and disease control and minimum conservation measures” (GAEZ database). This corresponds well to cultivation methods in premodern times. I construct the instrument by matching grid-cells to each prefecture and calculate the average estimated potential production of wetland rice in each province. To deal with the potential concern that rice suitability may also capture the suitability of crops, I include the average potential yield of all crops captured by the Caloric suitability index in analysis.

Table 4 reports the first stage of the instrumental variable estimates. In all specifications, the F statistics are mostly above 10 and thus arguably has a strong first stage. In table 5, the instrumented results confirm that the strong effect of clan strength on female infanticide.

Table 4: Instrumental variable estimates: first stage

	First stage: Dependent variable is clan strength				
	(1)	(2)	(3)	(4)	(5)
clan density	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
Province Fixed Effect	Yes	Yes	Yes	Yes	Yes
Geographical controls	No	Yes	Yes	Yes	Yes
Environment controls	No	No	Yes	Yes	Yes
Economics controls	No	No	No	Yes	Yes
Culture controls	No	No	No	No	Yes
F-statistic	14.55	13.85	11.67	9.72	9.191
Observations	220	220	220	219	219

*Notes:* Results are reported with robust standard errors. Standard errors are clustered on province level. The units of observation are prefectures. Clan density is normalized by population and then take natural log. \*\*\*, \*\* and \* indicate significance at the 1, 5 and 10 percent levels.

Table 5: Instrumental variable estimates: second stage

IV Estimates: Second Stage: Dependent Variable is female infanticide					
	(1)	(2)	(3)	(4)	(5)
Clan density	0.275*** (0.020)	0.261*** (0.020)	0.217*** (0.026)	0.204*** (0.029)	0.160*** (0.035)
Province Fixed Effect	Yes	Yes	Yes	Yes	Yes
Geographical controls	No	Yes	Yes	Yes	Yes
Environment controls	No	No	Yes	Yes	Yes
Economics controls	No	No	No	Yes	Yes
Culture controls	No	No	No	No	Yes
Observations	220	220	220	219	219
R <sup>2</sup>	0.301	0.354	0.477	0.511	0.580
Adjusted R <sup>2</sup>	0.298	0.345	0.457	0.480	0.552

*Notes:* Clan density is normalized by population and then take natural log. Standard errors reported in brackets are robust. \*\*\*, \*\* and \* indicate significance at the 1, 5 and 10 percent levels.

The results should be interpreted with caution. It is possible that rice suitability has a direct effect on the economic value of women, thus violating the exclusion restriction. Existing literature have discussed this possibility (Bardhan 1974; Quisumbing, 1995; Mahajan 2017). Bardhan (1974) argues that rice transplantation requires more intensive female labor, and survival chances of girls should be higher in rice growing regions than wheat growing regions. However, Jacoby (1993) finds the contribution of female labor in rice agriculture was less than male labor in a study of Cote d' Ivoire. Quisumbing (1995) suggests the relative role of males and females in rice agriculture may also depend on technology, which affects the nature of gender division of labor by task. However, this literature does not reach a consensus. The empirical analysis by Chakraborty and Kim (2008) also does not show rice cultivation directly holds a relationship with historical sex ratio in India. The discussions among these scholars mainly focuses on the economic effect of rice agriculture on women, but my analysis implies that rice agriculture may affect sex selection through an alternative channel of historical clan development. Given the positive relationship between rice agriculture and clan strength, this channel may be very important in China's context specifically. This instrumental variable may not be ideal, but it does shed light on the origin of clan development.

## 5 Discussion

### 5.1 Confucianism

As Confucianism does not hold a robust relationship with female infanticide as shown above, in this section I attempt to clarify Confucian view on female infanticide, and highlight several alternative explanations. According to Edlund and Lee (2013), Confucianism has “not only a unilineal view of descent emphasizing the male line, but also lack condemnation of infanticide”. It is undeniable that certain Confucian values were discriminatory against women. However, it is unclear that such discriminatory view works through the channel of female infanticide, nor is it evident that all aspects of Confucianism led to female infanticide uniformly. It is plausible that certain aspects of Confucianism may work on the other direction. Historians hold such doubts (Mungello, 2008, p45). In the setting of historical China, Mungello (2008) argues that “on one hand Confucianism encourages female infanticide by honoring age over youth and males over females. And yet the cruelty of drowning girls is at odds with the fundamental Confucian value of Benevolence (Ren)...one might compare Confucianism’s attitude toward infanticide to the conflicted role of Christianity in regard to slavery. Although some Christians claimed that African slavery was justified by certain passages from the Bible, others argued that it was a violation of the fundamental teaching of love that Jesus preached”. The conflict of female infanticide with the core Confucian doctrine, may be a key reason why the Qing literati repeatedly initiated combat against female infanticide, by issuing official proclamations, writing essays and establishing founding hospices. This could be one reason why the role of Confucianism is unclear.

Another potential reason is specific to the concept of widow chastity in Confucianism. The promotion of widow chastity may actually reduce female infanticide by increasing the value of women in (re)marriage market. The number of chaste women perhaps not only reflects the strength of Confucian gender norm, but also results in a large number of women missing from the marriage market. Rowe (2012) finds a large number of young women became widowed because of the prevalence of child marriage and high rate of child death. Guo (2000) estimates that chaste widows, counting only those who received official recognition, numbered over a million in the Qing dynasty. Because of the strict criteria for eligibility to receive the testimonial of merit<sup>18</sup>, apparently

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<sup>18</sup> “Any women who became widowed before age thirty and remain widowed until age fifty, or died before 50 and had been widowed for more than fifteen years, could be awarded the testimonial of merit and enshrined in the

a much larger number of women chose to remain in widowhood in reproductive age than those who were honored. Such a large number of women refusing (re)marriage potentially increases the comparative advantage of women over men in marriage market, and thus increase the value of women.

It is also possible, although counterintuitively, that chaste widowhood may increase the status of women and thus increase the potential value of having a daughter. According to Roselee (2008), remarriage for a widow, usually in the form of selling by her parents in law, entailed losing her right to inherit the property of her deceased husband on behalf of her sons, and also led to decrease in status from sons' mother to new bride in hierarchical families organized on the principle of seniority. On the other hand, chaste widows are regarded as community honors and formed the collective memory that represents "local custom" (Mann 1987). Chaste widowhood is thus a rare chance for a woman, who is excluded from the civil examination system and ritualistic recognition associated with being an official, to bring honor and real benefit to her family. The families of chaste widows may receive a gift of silver, and the chaste widow will be memorized in local history books, enshrined in temples along with filial sons.

These explanations are still thoughts that remain to be tested and verified. However, the empirical result, along with alternative explanations, indicate that various dimensions of Confucianism, and their interaction with social environment, may have heterogeneous effect on people's behavior of sex selection. Thus, besides understanding a cluster of institutions and cultural norms labelled Confucianism, it is also important to identify different underlying mechanisms that could lead to unanticipated results.

## **5.2 Clan and dowry**

While evidence suggests that the clan and dowry are more or less related to female infanticide, their institutional traits differ significantly. The clan may be classified as a slow-moving institution (Roland 2004). Historians and economists have not only noticed the persistence of the institution itself, but also the persistence of cultures associated with it (Feng, 2009; Greif and Tabellini, 2017). The clan's rigid gender hierarchy, unilineal view of ancestry, and roles in sustaining cooperation may both intervene people's economic decision making and infiltrate cultural norms. In other

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temple honoring chaste and filial person (jiexiao ci)" (Fang Dashi. Pingpingyan Sangcan tiyao, referring to Daqing Huidian, Hua'e lou zhihao cunban. Hefei, Li jingdianfanke, 1900.)

words, while the economic value of sons could be higher in clans because of its institutional traits such as patrilocal marriage and patrilineal descent, it is also likely that the clan leads to strong belief of son preference. Hence, given its inertia, the clan may also be relevant in explaining gender inequality today.

Dowry, on the other hand, is a relatively simple institution. Surely, the consideration of dowry cost influences the decision making in sex selection, but the impact likely only works through the economic channel. Local gazetteers even documented instances that local officials who were able to alter the custom of expensive dowry in several years. Hence, it is likely that dowry system does not persist as the social environment and customs change over time.

### **5.3 Other variables**

In previous sections, I have discussed the effects of institutions on female infanticide and emphasized the impact of the clan. However, this does not mean geographical or environmental covariates are not important. In fact, I find that soil texture, soil quality (nutrition) and rainfall are positively correlated to female infanticide (see Table 10). These findings are generally consistent with existing literature. Chakraborty and Kim (2010) finds higher rainfall is associated with higher population sex ratio, and Carranza (2014) finds loamy soil texture relates to higher deficits of girls in the context of India.

## **6 Lasting effect of clan on beliefs**

The lasting impact of clan is reflected in the persistence of son preference beliefs. According to Howarth and Leaman (2003) that female infanticide has its root in son preference. Although female infanticide has been banned for more than half a century, the clan survives until today, and thus may have effects on sexist beliefs or son preference these days. To measure this trait, I turn to national-wide attitude survey (China Family Panel Studies). CFPS is a project conducted by the Institute of Social Science Survey at Peking University. It covers 25 provinces in China, which represent about 95% of the Chinese population in mainland China. Through a multistage probability sampling procedure, CFPS completed interviews with 36,000 adults in 14,798 households. A particular question of interest that CFPS asks, is the number of religious buildings in the respondent's community. These questions include the number of lineage ancestral temples, Confucian or Buddhist or Taoist temples and Church or Mosque. Another question that it asks, is

the importance of continuing family line when the respondent considers to bear a child on the scale from 1 to 5. Since continuing family line essentially means have a male heir, this question enables me to estimate the belief of son preference.

I estimate the impact of clan proxied by ancestral temples, on son preference beliefs through the equation below <sup>19</sup>:

$$(2) F_{ik} = \alpha + \beta * L_{ik} + \delta * I_i + \tau * P_i + \varphi_k + \varepsilon_{ik}$$

Dependent variable  $F_{ik}$  is the importance of family line for individual  $i$  lives in province  $k$ .  $I_i$  is a vector of individual characteristics, including whether the person is urban resident, whether the person currently has a job, personal income, education level, gender and age.  $P_i$  is a vector of province controls, including urbanization rate, one child policy and fine rates.  $\varphi_k$  is the county fixed effect. Standard errors are clustered on the county level. The OLS estimates are reported in Table 4. Column (1) through column (3) include temples in different religions in order. While the impact of lineage ancestral temple is significantly related to the belief of continuation of family line, we do not observe such effect for other religions. In column (4), we include a vector that controls for the respondent's characteristics, the effect of having an ancestral temple on belief of continuation of family line remains positive.

Table 6: ancestral temple and son preference belief

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19 An alternative way is to use clan genealogy as an indicator instead of ancestral temples. This method provides consistent estimates, but I prefer the use of ancestral temples since this can provide a comparison with the effect of other religious buildings asked in the survey.

	Belief of continue family line			
	(1)	(2)	(3)	(4)
Lineage ancestral temple	0.022** (0.010)			0.014* (0.008)
Buddhist/Confucian/Taoist temple		-0.005 (0.016)		-0.010 (0.016)
Mosque/Church			-0.034 (0.037)	-0.003 (0.023)
County fixed effect	Yes	Yes	Yes	Yes
Personal controls	No	No	No	Yes
# of clusters	25	25	25	25
Observations	30,061	30,061	30,061	30,061
R <sup>2</sup>	0.084	0.084	0.084	0.103
Adjusted R <sup>2</sup>	0.079	0.079	0.079	0.098

*Notes:* personal controls include an indicator variable whether the person is an urban resident, an indicator whether the person currently has a job, gender, education level, income and age. \*\*\*, \*\* and \* indicate significance at the 1, 5 and 10 percent levels.

## 7 Conclusion

This paper attempts to disentangle institution and cultural factors, and explores their relationship with sex selection in premodern China. By collecting historical archival data and measuring these institutions, I suggest that a key factor that related to missing women problem in historical China is the Chinese clan, verifying existing hypotheses (Banister 2004; Das Gupta 2010) and provides evidences of its long run persistence. However, I show that the emphasis of female chastity in Confucianism, may not account for female infanticide *per se*. This finding suggests that different dimensions of Confucianism may have different impact on the economic behavior of sex selection.

As Li (2007) argues, socio-cultural factors may exert significant effect on childbearing-related decision making. Institutions such as the clan that originated in premodern times may have persistent effects on son preference beliefs, despite rising economic value of women and higher female labor participation rates in modern age. Hence, a better understanding of China's historical institutions likely will shed light on gender inequality today.

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## **Appendix**

### **A. Urbanization in the Qing dynasty**

Rozman (1974) originally uses three level classification of Chinese cities: level 1 (over 1,000,000), level 2 (300,000-899,999), level 3a (70,000-299,999) and level 3b (30,000- 69,999). In my analysis, I code 3a as 3, 3b as 4 and those prefectures without any classified city as 5.

### **B. Dowry system**

I ranked dowry practices on the scale from 1 to 3. If the custom of marriage includes little or no transfer of property or gifts from the bride's family to the groom's family, I code it as 1. If the custom of marriage includes dowry but varies depending on the economic condition of the bride's family, I code it as 2. If the custom strictly requires heavy dowry, I code it as a 3.

### **C. Sex ratio**

My sex ratio data are mainly from two sources. The prefecture-level sex ratio data are obtained from digitalized local gazetteers at Beijing Erudition Digital Research Center. This includes 80 observations in 14 provinces, year of observations range from 1660 to 1908, with most data from the period of 1741 to 1851. The provincial level data are obtained from *gongzhongdang qianlong chao zouzhe* [Official memorials of the Qianlong era] Taipei, National Palace Museum, 1982.

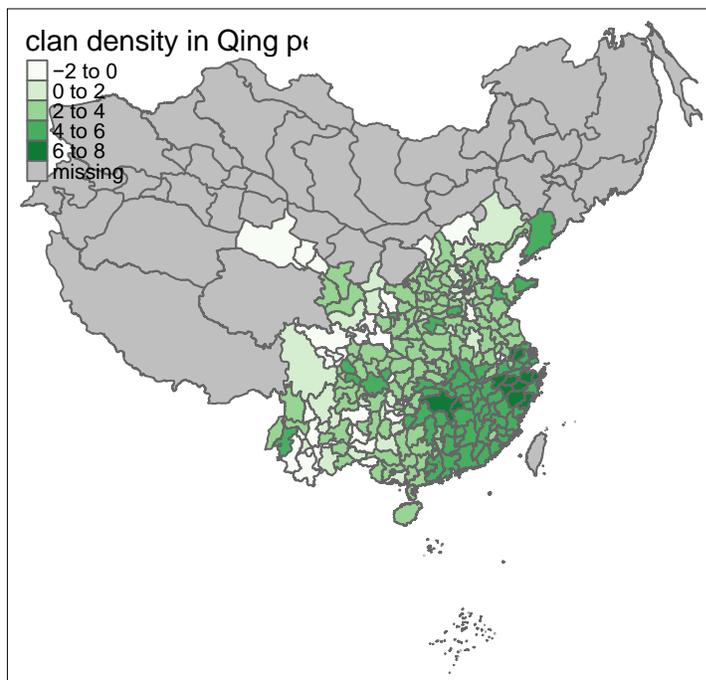


Figure 3: Clan density ( $\ln(\text{genealogy}/\text{population})$ ) mapped to administrative boundaries in 1820

廣州府志 卷一百一十一  
 趙家璧字城易姓崗都人性倜儻不治家人生產登萬曆四  
 十三年乙卯賢書因早孤寸帛不以加身誠心質行與人無  
 飭貌年且五十無子養族子為嗣未幾殂繼妻王氏年少族  
 屬欲奪其志泣曰吾不難從君子於地下將置此兒子何地  
 奈何欲狗彘我乎其堅貞如此據新甯志修

伍繩武字宜文萬曆十九年辛卯舉人選浙江平陽縣令浙  
 俗多溺女凡將婉者皆以木桶貯水婉後自長女外盡于桶  
 而淹之繩武出示嚴禁且作戒溺女文以曉諭之俗為漸變  
據新甯志修

李星一字繼碩其生之夕母見一星墜房遂以為名崇正十  
 二年己卯舉於鄉性豁達諳兵畧廣結納與東莞張家玉順  
據新甯志修

趙家璧字城易姓崗都人性倜儻不治家人生產登萬曆四  
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據新甯志修

Figure 4: The data on female infanticide. Example: female infanticided in Pingyang county, Zhejiang province, documented in biography in Gazetteer of Guangzhou (Guangzhou fuzhi) (1879), V127.

Variable	Mean.	Std.Dev.	Median.	Min.	Max.	Obs.
# chaste women	337.95	580.87	170	2	5391	227
# genealogy	187.75	525.41	31	1	5416	227
infanticide	0.32	0.38	0.14	0	1	227

Table 7: descriptive statistics

	Dependent variable is prevalence of female infanticide					
	(1)	(2)	(3)	(4)	(5)	(6)
clan density	0.065*** (0.017)	0.064*** (0.016)	0.045*** (0.016)	0.042*** (0.015)	0.046*** (0.016)	0.047*** (0.015)
chaste women					-0.015 (0.023)	-0.017 (0.028)
Clan density * chaste women						-0.002 (0.013)
Province Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Geographical controls	No	Yes	Yes	Yes	Yes	Yes
Environment controls	No	No	Yes	Yes	Yes	Yes
Economics controls	No	No	No	Yes	Yes	Yes
Culture controls	No	No	No	No	Yes	Yes
Observations	227	227	227	226	226	226
R <sup>2</sup>	0.739	0.746	0.771	0.791	0.795	0.795
Adjusted R <sup>2</sup>	0.717	0.721	0.742	0.759	0.759	0.758

*Notes:* Results are reported with robust standard errors. The units of observation are prefectures. Clan density and chaste women density are normalized by population and then take natural log. \*\*\*, \*\* and \* indicate significance at the 1, 5 and 10 percent levels.

Table 8: OLS Regression without clustered standard errors

	Dependent variable is prevalence of female infanticide				
	(1)	(2)	(3)	(4)	(5)
clan density	0.062*** (0.017)	0.062*** (0.017)	0.044*** (0.014)	0.046*** (0.012)	0.045*** (0.011)
chaste women	0.019 (0.022)	0.013 (0.021)	0.006 (0.020)	-0.022 (0.021)	-0.021 (0.022)
clan density * chaste women	0.007 (0.010)	0.005 (0.009)	-0.000 (0.008)	-0.003 (0.009)	-0.004 (0.010)
distance to coast		-0.000* (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
distance to river		0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
soil moisture			0.000 (0.001)	0.001 (0.001)	0.001 (0.001)
soil workability			-0.003 (0.063)	-0.040 (0.069)	-0.030 (0.069)
soil texture			0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
soil quality			0.093 (0.059)	0.112** (0.057)	0.114** (0.056)
rainfall			0.114** (0.047)	0.079* (0.041)	0.068 (0.044)
population density				7.137*** (2.161)	7.166*** (2.278)
urbanization				-0.007 (0.018)	-0.007 (0.018)
arable land				0.000 (0.000)	0.000 (0.000)
Caloric index				-0.000* (0.000)	-0.000 (0.000)
Political importance				0.013 (0.019)	0.017 (0.018)
Buddhism					0.001 (0.002)
Taoism					-0.010 (0.006)
Confucian academy					0.001 (0.001)
Province Fixed Effect	Yes	Yes	Yes	Yes	Yes
Geographical controls	No	Yes	Yes	Yes	Yes
Environment controls	No	No	Yes	Yes	Yes
Economics controls	No	No	No	Yes	Yes
Culture controls	No	No	No	No	Yes
Observations	226	226	226	225	225
R <sup>2</sup>	0.739	0.746	0.771	0.792	0.796
Adjusted R <sup>2</sup>	0.714	0.718	0.740	0.757	0.758

Notes: Results are reported with robust standard errors. Standard errors are clustered on province level. The units of observation are prefectures. Clan density and chaste women density are normalized by population density and then take natural log.

Table 9: OLS regression listing all covariates

	Dependent variable is prevalence of female infanticide				
	(1)	(2)	(3)	(4)	(5)
clan density	0.057*** (0.017)	0.058*** (0.016)	0.043*** (0.013)	0.041*** (0.012)	0.041*** (0.011)
chaste women	0.005 (0.017)	0.001 (0.017)	0.004 (0.017)	-0.027 (0.017)	-0.025 (0.018)
clan density * chaste women	-0.000 (0.000)	-0.000* (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
distance to coast		-0.000* (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
distance to river		0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
soil moisture			0.000 (0.001)	0.001 (0.001)	0.001 (0.001)
soil workability			0.003 (0.072)	-0.039 (0.072)	-0.031 (0.072)
soil texture			0.000** (0.000)	0.000*** (0.000)	0.000*** (0.000)
soil quality			0.105* (0.060)	0.118** (0.057)	0.119** (0.057)
rainfall			0.084* (0.046)	0.074* (0.043)	0.063 (0.045)
population density				6.788** (2.689)	6.669** (2.728)
urbanization				-0.008 (0.018)	-0.006 (0.018)
arable land				0.000 (0.000)	0.000 (0.000)
Caloric index				-0.000** (0.000)	-0.000 (0.000)
Political importance				0.013 (0.018)	0.017 (0.018)
Buddhism					0.001 (0.002)
Taoism					-0.010 (0.006)
Confucian academy					0.001 (0.001)
Province Fixed Effect	Yes	Yes	Yes	Yes	Yes
Geographical controls	No	Yes	Yes	Yes	Yes
Environment controls	No	No	Yes	Yes	Yes
Economics controls	No	No	No	Yes	Yes
Culture controls	No	No	No	No	Yes
Observations	226	226	226	225	225
R <sup>2</sup>	0.746	0.752	0.776	0.791	0.795
Adjusted R <sup>2</sup>	0.722	0.725	0.745	0.756	0.757

Notes: Results are reported with robust standard errors. Standard errors are clustered on province level. The units of observation are prefectures. Clan density and chaste women density are normalized by land area and then take natural log.

Table 10: genealogy normalized using land area instead of population, listing all covariates

	Dependent variable is prevalence of female infanticide					
	(1)	(2)	(3)	(4)	(5)	(6)
clan density	0.069*** (0.023)	0.069*** (0.023)	0.052** (0.025)	0.044* (0.026)	0.052* (0.027)	0.056** (0.027)
chaste women					-0.051 (0.043)	-0.073* (0.042)
Clan density * chaste women						-0.021 (0.017)
Province Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Geographical controls	No	Yes	Yes	Yes	Yes	Yes
Environment controls	No	No	Yes	Yes	Yes	Yes
Economics controls	No	No	No	Yes	Yes	Yes
Culture controls	No	No	No	No	Yes	Yes
Observations	227	227	227	226	226	226
R <sup>2</sup>	0.459	0.463	0.480	0.516	0.520	0.522
Adjusted R <sup>2</sup>	0.412	0.411	0.416	0.441	0.438	0.437

*Notes:* Results are reported with robust standard errors. The units of observation are prefectures. Clan density and chaste women density are normalized by population and then take natural log. \*\*\*, \*\* and \* indicate significance at the 1, 5 and 10 percent levels.

Table 11: OLS regression using indicator of female infanticide (1 if female infanticide is observed in prefecture  $i$ , 0 if not) instead of fraction of counties that observed female infanticide