Historical Violence and China's Missing Women

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Abstract

Since Amartya Sen's coining of the term, "missing women"—the unusual shortfall of females in the population—has attracted increasing attention from policymakers, academics, and the general public. Here we examine the role of historical violence as a cause of missing women, using China as a case study. We first employ cross-sectional data to show that Chinese counties that experienced sustained local disorder or ethnic tension in the early modern period have higher contemporary juvenile sex ratios. Second, in an experimental setting, we expose subjects randomly to prime stimuli of either weapon or non-weapon pictures and find that subjects from historically violent counties exhibit stronger son preference when exposed to weapon pictures. By contrast, subjects from historically nonviolent counties are unaffected by weapon priming. Our results contribute to a better understanding of the ramifications of violence and call attention to the role of violence and local disorder in aggravating son preference. More generally, our study sheds light on the historical origins of gender inequality.

1 Introduction

Missing women, or an unnatural shortfall of women in the population, is one of the most accurate indicators of gender inequality (Sen, 1990, 2003). The phenomenon of missing women likely existed in many parts of the world for centuries due to the historical prevalence of female infanticide in many cultures and unequal access to nutrition and care (Williamson, 1978). In recent decades, the number of missing women—especially missing girls—has increased in major developing countries due to the availability of ultrasound scanning that enables prenatal sex selection. In China, against the biologically normal range of 103–106 boys per 100 girls, sex ratio at birth has risen steadily from 108.5 in 1982

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to 111.3 in 1990 to 117.7 in 2010. In India, too, the sex ratio under 5 years old is higher today than it was in 1901. The development is of concern to policymakers worldwide, as the promotion of gender equality is one of the Millennium Development Goals laid out by the United Nations. The emerging huge army of surplus males with no hope of finding a mate in the developing world has also raised alarm among researchers who worry about the threat to political stability in the affected countries and the potential spillover effects on international order and world peace (Hudson and den Boer, 2004).

Given that rising affluence in developing countries appears to have contributed to the increase in juvenile sex ratios instead of mitigating it, recent research has highlighted the importance of cultural beliefs, rooted in historical events, in explaining the persistence of gender discrimination. One popular theory emphasizes the role of historical agricultural practices in explaining gender inequality today. The basic idea is that agricultural societies, particularly the ones that cultivated cereals (as opposed to root crops) or relied heavily on the plough, placed a premium on physical strength and therefore developed patriarchal cultural norms that persist till today despite the decline in importance of agriculture (Boserup, 1970; White et al., 1981; Ember, 1983; Alesina et al., 2013, 2018; Hansen et al., 2015). Another theory, put forth by the anthropologist Marvin Harris, suggests that warfare was an important driver of gender inequality in human history (Harris, 1974). By putting pressure on communities to raise males to fight for group survival, warfare exacerbated the cultural forces that favor sons over daughters.

We follow this line of research and postulate that societies with a history of local violence and disorder have stronger son preference today. We test the hypothesis using (1) a cross-sectional study that examines the effect of historical violence on contemporary juvenile sex ratios across counties in China; and (2) a survey experiment involving 864 subjects from 23 provinces in which we use weapon prime stimuli to elicit the son preference of subjects from areas that were exposed to prolonged violence and disorder in early modern history and areas that did not.

Our hypothesis builds on the premise that the preference for sons is shaped by the household's view of their importance. Since males typically have stronger upper and lower bodies (Miller et al., 1993), boys are more prized than girls in a violent and disorderly environment because parents, including mothers, can expect to receive more help and protection from their sons when they grow into adults. Over time, these socioeconomic considerations will foster patriarchal values and beliefs that continue to promote son preference even after the premium on physical strength has abated.

Apart from investigating a hitherto much overlooked cause of the missing women

phenomenon, our study also speaks to the literature on the consequences of violence. Recent work has shown that violent conflicts destroy social capital and impede economic activities (Rohner et al., 2013). And they are likely to hit women harder because men are better able to physically defend themselves (Gutierrez and Gallegos, 2016; La Mattina, 2017). Our study highlights another sex-biased implication of violence. It also suggests that the ramifications of violence and local disorder may last for many generations and could be even more persistent than previously assumed.

2 The Case of China

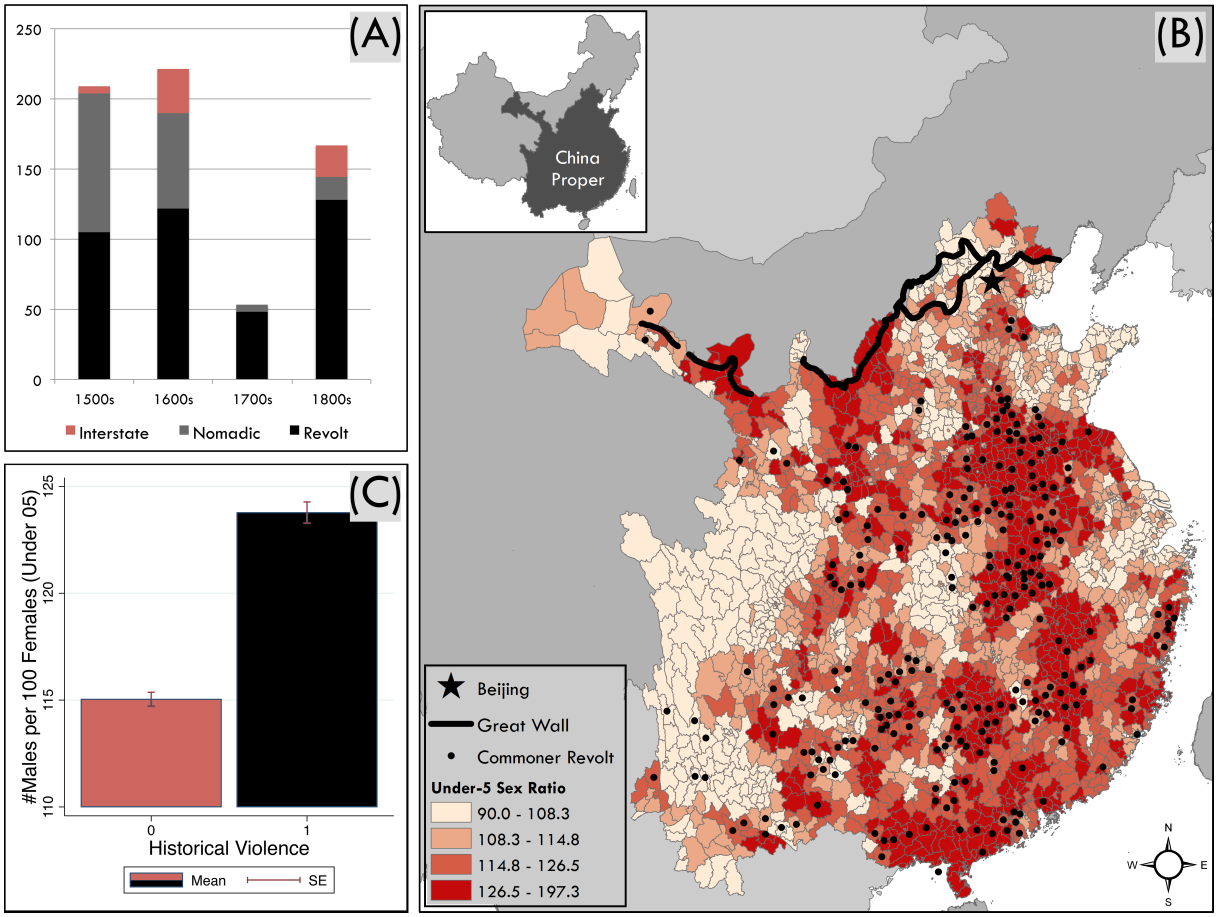
Since our proposed mechanism operates through cultural channels, which are difficult to compare across countries, we use China as a test case and exploit the fact that it is a large country that is relatively homogeneous in history, ethnicity, and political institutions to mitigate the problem of unobserved confounders. With 42 million more males than females in the country today, China is also an important case to study in itself given the sheer number of its missing women.

We focus on China proper, the traditionally agrarian part of China populated by Han Chinese, who make up more than 90% of China's population. While non-Han ethnic minorities were allowed to have two or more children under the one-child policy (1980–2015), the Han Chinese faced stringent family planning restrictions under the policy. Since son preference is typically manifested through a male-skewed sex ratio of last births (due to fertility-stopping behaviors Jayachandran, 2015) and a single child is by default the last birth, the sex ratio of Han Chinese born after the one-child policy provides a good measure of the son preference of China's largest ethnic group.

Although China proper was politically unified for much of the last millennium, it was not spared from recurring violent conflicts and social disorder. As Figure 1A illustrates, there were two major sources of violence in pre-twentieth century China: (1) the structural tensions between nomads from the steppe and the agrarian Han Chinese and (2) local disorders, which were often manifested in the form of commoner rebellions.

Throughout history, China was repeatedly invaded by nomads from the grasslands of Central Asia, especially during periods of cold weather when droughts wiped out vast herds of livestock and triggered subsistence crises in the steppe (Bai and Kung, 2014). The Great Wall, built by the Han Chinese to keep the invaders at bay, overlaps with the 400mm isohyet line, which approximates the northern limit of rainfed agriculture. Conflicts between the nomads and the agriculturalists typically took place along this

Figure 1: Historical Violence and Sex Ratio in Year 2000



ecological fault line.

Banditry, piracy, and social disorders in weakly administered regions constituted another major source of violence in early modern China (China's Military History Committee, 2003). During the Qing dynasty (1644–1912), some 20,000 central and local officials ruled over a population that had reached 300 million in 1800 (Feuerwerker, 1984, 39). Local administration was handled by about 1500 counties, which constituted the lowest level of government. With each county administering a population of 200,000 on average, administrative resources per head was extremely low: Macauley (1998) estimates that only one-third of all filed lawsuits were resolved in formal court sessions in the late eighteenth and early nineteenth centuries due to administrative resource constraints.

The problem of undergovernment was especially acute in frontier societies. Historical records suggest that social tensions were high and violence was prevalent in these places as the state was too weak to adjudicate disputes and maintain order (Chen, 1827; Naquin and Rawski, 1987). For instance, in parts of Jiangxi, Fujian, Guangdong, and Guangxi

provinces, lineages resorted to violent feuding (*xie dou*) to settle conflicts between their members. To increase their chance of winning, these lineages purchased male children from impoverished families for adoption and then sent them to fight in the armed feuds (Lipman and Harrell, 1990). In other areas where kinship networks were weak, marginalized people turned to secret societies, religious cults, and other underground groups for mutual aid and protection, thereby leading to further lawlessness (Ownby, 1996; Wang, 2014). Some of these areas eventually developed into the hotbeds of social unrest that fermented the great rebellions of early modern China, including the White Lotus Revolt (1796–1804), the Taiping Rebellion (1850–64), and the Nian Rebellion (1851–68).

Figure 1B presents the sex ratios for juveniles under 5 years old of Chinese counties in year 2000, the location of the Great Wall, and places that were home to communities that participated in armed commoner rebellions during the Qing dynasty. The map shows that despite the supposed homogeneity in culture and political institutions in China proper, juvenile sex ratios vary considerably across space. We divide the counties into four quartiles based on their under-5-year-olds sex ratios and assign darker shades to counties with higher sex ratios. Visually, the sex ratios of counties that neighbor the Great Wall and are far from the national capital Beijing seem relatively high. There is also an apparent positive association between contemporary juvenile sex ratio and the pre-twentieth-century hotbeds of social unrest.

As further corroboration, we compare the "historically violent" counties, defined as counties in cities that either neighbor the Great Wall or were home to communities that participated in piracy or armed commoner rebellions during the Qing dynasty, with other counties in China proper. Figure 1C displays the means and standard errors of the under-5 sex ratios of these two groups. As it illustrates, the sex ratios in counties that were exposed to historical violence are generally higher.

3 Data And Variables

Our cross-sectional data set comprises 2,199 counties in China. The dependent variables are the sex ratios of the population under 5, 10, and 15 years old, based on China's Year 2000 population census. The main explanatory variable of interest is historical violence. Building on historical research that highlights the high prevalence of violence in frontier societies, we first explore using a county's distance from its provincial seat during the Qing dynasty as a proxy for historical violence. Separately, we also attempt to measure historical violence more directly by constructing a dummy variable that takes

the value of 1 if a county either neighbors the Great Wall or was home to communities that participated in piracy or armed commoner rebellions during the Qing dynasty. Our data on piracy and commoner rebellions are drawn from (1) *A Chronology of Warfare in Dynastic China* (China's Military History Committee, 2003), (2) *A Historical of Warfare in China* (Historical Warfare Committee, 1972), and (3) publications in Chinese historical journals that discuss the origins of the various rebellions.

We employ a large set of control variables including GDP per capita, secondary sector's share of GDP, tertiary sector's share of GDP, present-day bureaucrat-to-population ratio, ratio of rural population, ratio of illiterate population, ratio of in-migrant population, population shares of ethnic groups that make up more than 1% of China's population (Han, Zang, Miao, Yi, Zhuang), altitude (mean and standard deviation), annual precipitation (mean and standard deviation), annual temperature (mean and standard deviation), and the suitability indices of China's main staple crops (wheat, rice, and sorghum). The socioeconomic and ethnicity variables are drawn from China's 2000 Population Census; the crop suitability indices from the United Nations Food and Agriculture Organization GAEZ data portal (IIASA/FAO, 2012), and the annual temperature and precipitation data from http://www.worldclim.org. The elevation data are computed using SRTM 90m Digital Elevation Database version 4.1. Table 1 provides the summary statistics.

4 Cross-County Study

We first conduct a cross-sectional empirical study to investigate the relationship between historical violence and contemporary juvenile sex ratio in year-2000 China. Since the one-child policy was officially implemented in 1980 and was adjusted in 1982 and again in 1984, we focus on three age categories representing juveniles who were born after the policy took its eventual shape: under-5, under-10, and under-15.

Historical research highlights that during the Qing dynasty, communal violence was relatively common in frontier societies because of the absence of an effective state to adjudicate disputes between local groups (Chen, 1827; Naquin and Rawski, 1987; Lipman and Harrell, 1990). Building on this literature, in Table 2 we use the log distance of every Chinese county in year 2000 from its provincial seat during the Qing dynasty as a proxy for historical violence and local disorder. In Column (1) of Table 2A, we regress the under-5 sex ratio against this proxy. Controlling for provincial fixed effects, we find that sex ratio is indeed positively associated with distance from Qing dynasty provincial seat.

Table 1: Summary Statistics, Chinese Counties in Year 2000 (N=2066)

Variable	Mean	S.D.	Min.	Max.
Under-5 Sex Ratio	119.16	14.40	90.00	197.29
Under-10 Sex Ratio	116.00	10.90	94.76	166.23
Under-15 Sex Ratio	112.36	7.49	97.67	153.81
Historical Violence	0.47	0.50	0	1
Distance to Qing Dynasty Provincial Seat (km)	195.33	117.88	0.21	935.10
GDP Per Capita	6261.79	8455.18	49.64	165803.20
Secondary Industry (%)	15.59	15.01	0.36	81.18
Tertiary Industry (%)	18.43	13.53	2.23	96.70
Bureaucrat Ratio (%)	0.08	0.07	0.01	0.63
Rural Ratio (%)	66.27	28.80	0	100
Illiterate Ratio (%)	10.86	8.62	0.55	75.65
Migrant Ratio (%)	9.83	10.47	0.15	92.04
Migrant From Same City Ratio (%)	5.03	4.54	0.03	27.37
Migrant From Other Cities Ratio (%)	4.80	7.43	0.06	91.18
Ethnicity Han (%)	88.74	24.84	0.72	100
Ethnicity Zang (%)	1.48	10.69	0	97.70
Ethnicity Miao (%)	1.28	6.67	0	95.39
Ethnicity Yi (%)	1.37	7.40	0	97.81
Ethnicity Zhuang (%)	1.91	11.31	0	99.15
Altitude (Mean)	612.24	770.79	0.15	4486.95
Altitude (S.D.)	163.11	162.72	0.67	1165.97
Precipitation (Mean)	1011.20	427.85	35.09	2436.60
Precipitation (S.D.)	36.95	33.24	0	261.81
Temperature (Mean)	14.49	4.30	-1.62	24.81
Temperature (S.D.)	0.87	0.88	0	6.33
Wheat (Suitability Index)	5.52	0.91	2.14	8.01
Rice (Suitability Index)	6.73	1.00	3	8.29
Sorghum (Suitability Index)	5.46	1.30	1.10	8.00

Since contemporary juvenile sex ratios may be higher in areas where the present Chinese authority is less capable of preventing illegal pre-natal sex selection, in Column (2) we use bureaucrats-to-population ratio to control for modern-day state presence. We also control for a host of other socioeconomic conditions, including GDP per capita, the weights of non-agricultural sectors (i.e., manufacturing and service) in the economy, the proportions of rural residents, migrants, and illiterates in the population, and the ratios of the five largest ethnic groups in China. In addition, to account for research showing that geography and climate may have an influence on sex ratio at birth (Catalano et al., 2008; Navara, 2009), we include geographical and climatic factors such as elevation, ruggedness, annual temperature, and annual precipitation as controls. Despite the challenge of multicollinearity associated with having a large number of controls, the estimated coefficient of interest remains in the same order of magnitude and is statistically significant.

According to Talhelm et al. (2014), the parts of China where the main crop is paddy rice have historically developed a more collective mindset due to the irrigation needs of rice cultivation. This is of relevance to our study as a collectivist value system could have helped reduce local violence and promote social order (Greif and Tabellini, 2017), thereby

Table 2: Historical Violence and Juvenile Sex Ratio

	A. Under-5 Sex Ratio			B. Under-10 Sex Ratio			C. Under-15 Sex Ratio		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Historical Violence	7.831***	6.524***	7.014***	6.249***	5.521***	5.833***	4.230***	3.828***	4.014***
	(0.601)	(0.593)	(0.593)	(0.454)	(0.447)	(0.447)	(0.312)	(0.306)	(0.306)
Bureaucrat Ratio	-45.40***	-37.12***	-36.18***	-30.64***	-27.84***	-27.01***	-19.62***	-18.36***	-17.63***
	(3.310)	(5.797)	(5.818)	(2.486)	(4.437)	(4.445)	(1.722)	(3.164)	(3.147)
GDP Per Capita		-1.99e-05	-2.76e-05		-1.38e-05	-1.94e-05		-1.12e-05	-1.56e-05
		(2.66e-05)	(2.67e-05)		(2.34e-05)	(2.36e-05)		(1.97e-05)	(2.01e-05)
Secondary Industry		-0.151***	-0.167***		-0.102***	-0.112***		-0.0528***	-0.0585***
		(0.0321)	(0.0323)		(0.0254)	(0.0256)		(0.0189)	(0.0191)
Tertiary Industry		-0.0567	-0.0466		-0.0577	-0.0513		-0.0455	-0.0422
		(0.0439)	(0.0446)		(0.0360)	(0.0365)		(0.0283)	(0.0284)
Rural Ratio		0.0178	0.0253		0.0101	0.0151		0.00447	0.00758
		(0.0237)	(0.0239)		(0.0185)	(0.0185)		(0.0136)	(0.0136)
Illiterate Ratio		0.111***	0.163***		0.0876***	0.118***		0.0801***	0.0948***
		(0.0423)	(0.0418)		(0.0328)	(0.0328)		(0.0242)	(0.0243)
Migrant Ratio		0.101*	0.111**		0.118**	0.125***		0.108***	0.112***
		(0.0527)	(0.0542)		(0.0462)	(0.0474)		(0.0389)	(0.0396)
Ethnicity Han		0.0733***	0.0574***		0.0520***	0.0407**		0.0289**	0.0210
		(0.0189)	(0.0189)		(0.0163)	(0.0165)		(0.0131)	(0.0131)
Ethnicity Zang		-0.0240	-0.0295		-0.0157	-0.0146		-0.0385***	-0.0329**
		(0.0229)	(0.0241)		(0.0191)	(0.0200)		(0.0149)	(0.0156)
Ethnicity Miao		0.0429	0.0323		0.0333	0.0269		0.0325	0.0294
		(0.0488)	(0.0484)		(0.0483)	(0.0484)		(0.0385)	(0.0387)
Ethnicity Yi		-0.0259	-0.0155		-0.0106	-0.00458		-0.0110	-0.00747
		(0.0251)	(0.0257)		(0.0231)	(0.0235)		(0.0191)	(0.0191)
Ethnicity Zhuang		0.0606	0.0579		0.0389	0.0362		-0.00753	-0.0101
		(0.0389)	(0.0384)		(0.0366)	(0.0362)		(0.0305)	(0.0302)
Log Altitude (Mean)		-1.745***	-1.638***		-1.427***	-1.381***		-1.225***	-1.205***
		(0.416)	(0.413)		(0.307)	(0.309)		(0.213)	(0.215)
Log Altitude (S.D.)		-0.218	0.00129		-0.0352	0.116		0.365**	0.467***
		(0.350)	(0.353)		(0.263)	(0.268)		(0.175)	(0.179)
Log Precipitation (Mean)		2.014*	2.240**		1.615**	1.751**		1.121**	1.174**
		(1.057)	(1.039)		(0.762)	(0.761)		(0.520)	(0.523)
Log Precipitation (S.D.)		-0.0537	0.185		0.00782	0.141		0.124	0.179
		(0.398)	(0.398)		(0.301)	(0.304)		(0.219)	(0.222)
Log Temperature (Mean)		1.309*	0.285		0.931	0.299		0.577	0.236
		(0.760)	(0.713)		(0.579)	(0.545)		(0.402)	(0.386)
Log Temperature (S.D.)		-0.313	-0.527		-0.331	-0.450		-0.199	-0.247
		(0.374)	(0.375)		(0.284)	(0.285)		(0.198)	(0.198)
Wheat			1.628***			0.688			0.0462
			(0.540)			(0.419)			(0.297)
Rice			-2.029***			-1.188***			-0.665***
			(0.447)			(0.347)			(0.244)
Sorghum			-3.034***			-1.765***			-0.852***
			(0.464)			(0.353)			(0.247)
Observations	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066
Provincial Fixed Effects	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
R-squared	0.143	0.375	0.393	0.140	0.347	0.359	0.131	0.299	0.309

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

dampening the need to produce male offspring for self-defense. Meanwhile, Alesina, Giuliano, and Nunn (2018) have argued that son preference is typically enhanced in plough-using societies. To account for these confounding factors, we add controls for the suitability of land for cultivating China's three main staple crops: rice (to account collective mindset), wheat (a plough-positive crop), and sorghum (a plough-negative crop). As Column (3) shows, the magnitude of the estimated coefficient of interest barely changed after the inclusion of these controls.

In Columns B and C of Table 2, we replace under-5 sex ratio with under-10 and under-15 sex ratios as the dependent variable, respectively. The results with these age groups are consistent with the under-5 findings. We continue to observe a positive association

between sex ratio and distance from Qing dynasty provincial seat.

Table 3: Distance from Historical Prov. Seat, Historical Violence, and Juvenile Sex Ratio

	A. Under-5 Sex Ratio			B. Under-10 Sex Ratio			C. Under-15 Sex Ratio		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Log Distance Prov. Seat	0.898***	-0.120	-0.216	0.674***	0.0603	0.00763	0.558***	0.209	0.194
	(0.244)	(0.301)	(0.299)	(0.185)	(0.226)	(0.225)	(0.131)	(0.159)	(0.159)
Historical Violence	6.990***	6.538***	7.058***	5.770***	5.472***	5.802***	3.968***	3.739***	3.929***
	(0.615)	(0.607)	(0.611)	(0.462)	(0.459)	(0.461)	(0.314)	(0.313)	(0.314)
GDP Per Capita		-1.77e-05	-2.61e-05		-1.31e-05	-1.93e-05		-1.09e-05	-1.57e-05
		(2.69e-05)	(2.70e-05)		(2.36e-05)	(2.39e-05)		(1.98e-05)	(2.03e-05)
Secondary Industry		-0.150***	-0.167***		-0.102***	-0.112***		-0.0515***	-0.0575***
		(0.0326)	(0.0328)		(0.0257)	(0.0259)		(0.0190)	(0.0192)
Tertiary Industry		-0.0657	-0.0603		-0.0631*	-0.0596		-0.0449	-0.0428
		(0.0455)	(0.0461)		(0.0366)	(0.0369)		(0.0285)	(0.0286)
Bureaucrat Ratio		-38.51***	-36.98***		-28.41***	-27.19***		-18.95***	-17.95***
		(6.022)	(6.061)		(4.629)	(4.641)		(3.295)	(3.279)
Rural Ratio		0.00818	0.0143		0.00264	0.00691		0.000619	0.00333
		(0.0238)	(0.0239)		(0.0182)	(0.0181)		(0.0133)	(0.0132)
Illiterate Ratio		0.113***	0.171***		0.0886***	0.122***		0.0785***	0.0943***
		(0.0432)	(0.0429)		(0.0336)	(0.0337)		(0.0248)	(0.0251)
Migrant Ratio		0.0890*	0.0988*		0.110**	0.117**		0.104***	0.108***
		(0.0530)	(0.0545)		(0.0463)	(0.0475)		(0.0390)	(0.0397)
Ethnicity Han		0.0720***	0.0575***		0.0517***	0.0411**		0.0294**	0.0218
		(0.0193)	(0.0192)		(0.0167)	(0.0168)		(0.0134)	(0.0134)
Ethnicity Zang		-0.0233	-0.0305		-0.0155	-0.0149		-0.0386***	-0.0324**
		(0.0229)	(0.0242)		(0.0191)	(0.0201)		(0.0149)	(0.0156)
Ethnicity Miao		0.0438	0.0346		0.0341	0.0286		0.0333	0.0308
		(0.0490)	(0.0484)		(0.0485)	(0.0485)		(0.0388)	(0.0390)
Ethnicity Yi		-0.0269	-0.0171		-0.0107	-0.00496		-0.0101	-0.00661
		(0.0252)	(0.0257)		(0.0232)	(0.0235)		(0.0191)	(0.0191)
Ethnicity Zhuang		0.0612	0.0606		0.0379	0.0363		-0.00962	-0.0118
		(0.0392)	(0.0387)		(0.0368)	(0.0364)		(0.0305)	(0.0302)
Log Altitude (Mean)		-1.783***	-1.675***		-1.441***	-1.389***		-1.222***	-1.194***
		(0.420)	(0.418)		(0.309)	(0.311)		(0.214)	(0.215)
Log Altitude (S.D.)		-0.174	0.0540		-0.0260	0.131		0.347**	0.450**
		(0.358)	(0.361)		(0.267)	(0.272)		(0.177)	(0.179)
Log Precipitation (Mean)		2.343**	2.554**		1.786**	1.910**		1.209**	1.248**
		(1.051)	(1.030)		(0.760)	(0.757)		(0.519)	(0.522)
Log Precipitation (S.D.)		-0.0739	0.201		0.0561	0.208		0.202	0.260
		(0.439)	(0.440)		(0.346)	(0.350)		(0.246)	(0.248)
Log Temperature (Mean)		0.911	-0.0719		0.700	0.111		0.491	0.195
		(0.669)	(0.646)		(0.507)	(0.493)		(0.352)	(0.348)
Log Temperature (S.D.)		-0.283	-0.522		-0.320	-0.453		-0.226	-0.278
		(0.368)	(0.371)		(0.282)	(0.285)		(0.195)	(0.196)
Wheat			1.685***			0.698*			0.00509
			(0.547)			(0.424)			(0.300)
Rice			-2.033***			-1.205***			-0.680***
			(0.448)			(0.348)			(0.246)
Sorghum			-3.079***			-1.778***			-0.819***
			(0.471)			(0.359)			(0.251)
Observations	2,199	2,047	2,047	2,199	2,047	2,047	2,199	2,047	2,047
Provincial Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.256	0.374	0.391	0.246	0.344	0.356	0.222	0.298	0.308

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Next, in Table 3, we include the dummy variable *Historical Violence* as an additional explanatory variable and repeat, specification by specification, the empirical analysis in Table 2. In every specification, the coefficient estimate of distance from Qing dynasty provincial seat decreases toward zero. This constitutes evidence that distance from Qing dynasty provincial seat is correlated with juvenile sex ratio through historical violence.

Since distance from Qing dynasty provincial seat is uncorrelated with juvenile sex ratio once historical violence has been accounted for, we use distance from Qing dynasty provincial seat as an instrument for historical violence to tease out causal effects. Table

4 presents the IV analysis. We obtain estimates in the same order of magnitude. Using the specification in columns (3) as benchmark, we estimate that the numbers of males per 100 females in historically violent areas are, on average, 5.3, 5.9, and 5.5 higher than in the non-violent areas for the age groups under-5, under-10, and under-15 respectively.

Table 4: Historical Violence and Juvenile Sex Ratio: Instrument Variable Analysis

	A. Under-5 Sex Ratio			B. Under-10 Sex Ratio			C. Under-15 Sex Ratio		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Historical Violence	2.683	5.767**	5.404**	3.342*	5.767**	5.893***	3.779***	5.767**	5.536***
	(2.661)	(2.515)	(2.381)	(1.996)	(2.515)	(1.800)	(1.412)	(2.515)	(1.308)
Bureaucrat Ratio	-62.05***	-37.34***	-36.70***	-41.82***	-37.34***	-26.99***	-23.53***	-37.34***	-17.14***
	(4.388)	(5.710)	(5.734)	(3.110)	(5.710)	(4.382)	(1.980)	(5.710)	(3.138)
GDP Per Capita		-2.28e-05	-3.34e-05		-2.28e-05	-1.92e-05		-2.28e-05	-1.01e-05
		(2.78e-05)	(2.74e-05)		(2.78e-05)	(2.42e-05)		(2.78e-05)	(2.06e-05)
Secondary Industry		-0.155***	-0.174***		-0.155***	-0.112***		-0.155***	-0.0520***
		(0.0343)	(0.0338)		(0.0343)	(0.0264)		(0.0343)	(0.0198)
Tertiary Industry		-0.0572	-0.0481		-0.0572	-0.0513		-0.0572	-0.0408
		(0.0436)	(0.0443)		(0.0436)	(0.0362)		(0.0436)	(0.0284)
Rural Ratio		0.0167	0.0225		0.0167	0.0152		0.0167	0.0102
		(0.0242)	(0.0244)		(0.0242)	(0.0188)		(0.0242)	(0.0138)
Illiterate Ratio		0.114***	0.166***		0.114***	0.118***		0.114***	0.0918***
		(0.0430)	(0.0422)		(0.0430)	(0.0327)		(0.0430)	(0.0241)
Migrant Ratio		0.102**	0.114**		0.102**	0.125***		0.102**	0.110***
		(0.0521)	(0.0535)		(0.0521)	(0.0467)		(0.0521)	(0.0394)
Ethnicity Han		0.0728***	0.0572***		0.0728***	0.0407**		0.0728***	0.0211
		(0.0189)	(0.0190)		(0.0189)	(0.0163)		(0.0189)	(0.0129)
Ethnicity Zang		-0.0287	-0.0394		-0.0287	-0.0143		-0.0287	-0.0235
		(0.0267)	(0.0272)		(0.0267)	(0.0223)		(0.0267)	(0.0173)
Ethnicity Miao		0.0466	0.0405		0.0466	0.0266		0.0466	0.0216
		(0.0499)	(0.0494)		(0.0499)	(0.0491)		(0.0499)	(0.0395)
Ethnicity Yi		-0.0221	-0.00762		-0.0221	-0.00488		-0.0221	-0.0150
		(0.0279)	(0.0280)		(0.0279)	(0.0248)		(0.0279)	(0.0198)
Ethnicity Zhuang		0.0566	0.0499		0.0566	0.0365		0.0566	-0.00255
		(0.0405)	(0.0395)		(0.0405)	(0.0367)		(0.0405)	(0.0304)
Log Altitude (Mean)		-1.724***	-1.592***		-1.724***	-1.382***		-1.724***	-1.248***
		(0.408)	(0.406)		(0.408)	(0.309)		(0.408)	(0.222)
Log Altitude (S.D.)		-0.237	-0.0487		-0.237	0.118		-0.237	0.514***
		(0.345)	(0.350)		(0.345)	(0.270)		(0.345)	(0.185)
Log Precipitation (Mean)		2.072*	2.345**		2.072*	1.747**		2.072*	1.074**
		(1.061)	(1.037)		(1.061)	(0.756)		(1.061)	(0.525)
Log Precipitation (S.D.)		-0.0391	0.204		-0.0391	0.141		-0.0391	0.161
		(0.395)	(0.395)		(0.395)	(0.301)		(0.395)	(0.222)
Log Temperature (Mean)		1.236	0.182		1.236	0.303		1.236	0.334
		(0.763)	(0.694)		(0.763)	(0.549)		(0.763)	(0.413)
Log Temperature (S.D.)		-0.318	-0.527		-0.318	-0.450		-0.318	-0.247
		(0.371)	(0.373)		(0.371)	(0.282)		(0.371)	(0.196)
Wheat			1.579***			0.690*			0.0922
			(0.541)			(0.419)			(0.299)
Rice			-1.972***			-1.190***			-0.720***
			(0.448)			(0.345)			(0.245)
Sorghum			-2.900***			-1.770***			-0.978***
			(0.506)			(0.382)			(0.271)
Observations	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066
Provincial Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F-stat. on ex. instruments	86.56	103.68	110.53	86.56	103.68	110.53	86.56	103.68	110.53

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

How could the effects of historical violence persist over centuries to distort contemporary sex ratio? There are two potential explanations: the persistence of violence, or cultural transmission through generations. If violence is persistent, historically violent areas would also experience more violence today, and this may place a premium on physical strength that induces a preference for male offspring today, as it did in the past. However, this explanation is unlikely as China now has one of the lowest violent crime rates in the

world. According to United Nations Office on Drugs and Crime, in 2010 China's rate of intentional homicide per 10,000 residents is 1.0. It fares better not only against India (3.5), another major developing country, but also many developed countries, including UK (1.2), Ireland (1.2), and the United States (4.7) (UNODC, 2013). These statistics suggest that even the most violent areas in China today are likely to be relatively well-ordered by the standards of the rebellion-plagued early modern China.

Nonetheless, we conduct a further check and use the in-migration population to distinguish between persistence of violence and cultural transmission. If higher juvenile sex ratios in historically violent cities are driven by the persistence of violence, we should observe migrants residing in a historically violent county to exhibit a preference for sons, since they, like the natives, are constantly exposed to violence in daily life. However, if son preference is transmitted through cultural norms, migrants who came from another city will exhibit weaker son preference since they were less likely to be exposed to patriarchal cultural norms in their formation years.

Specifically, we break down the migrants of every county into migrants who came from the same city and migrants who came from other cities. We then replace the control variable "proportion of migrants" in Table 3 with four variables: proportion of migrants from the same city, proportion of migrants from other cities, the interaction term between historical violence and proportion of migrants from the same city, and the interaction term between historical violence and proportion of migrants from other cities. If the persistence of violence is driving higher juvenile sex ratios in historically violent counties, the coefficient of both interaction terms should be close to zero, since the present-day violent environment in historically violent counties will induce son preference among migrants and natives alike. However, if son preference is culturally transmitted, we expect the interaction term between historical violence and proportion of migrants from the same city to be close to zero, and the interaction term between historical violence and proportion of migrants from other cities to be negative, since only locals and migrants from the vicinity are exposed to the same cultural norms.

As Table 5 illustrates, the estimated coefficients of the interaction term between historical violence and proportion of migrants from the same city are generally small and statistically insignificant, while the estimated coefficients of the interaction term between historical violence and proportion of migrants from other cities are negative and statistically significant in every specification and age category. For instance, Columns 3 of Table 5A–C estimate that if two counties, J (with historical violence) and K (without historical violence), both experience an influx of migrants from other cities that increases their

migrant-to-population ratios by 10 percentage points, the under-5, under-10, under-15 sex ratios of county J will decrease by 2.62, 1.99, and 1.38 respectively, relative to county K. These results suggest that cultural transmission rather than violence persistence is driving the observed relationship between historical violence and contemporary juvenile sex ratio.

Table 5: Persistence of Violence or Cultural Transmission? Evidence From Migration

	A. Under-5 Sex Ratio			B. Under-10 Sex Ratio			C. Under-15 Sex Ratio		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Historical Violence	7.831***	8.722***	9.249***	6.249***	7.055***	7.382***	4.230***	4.848***	5.025***
	(0.601)	(0.853)	(0.847)	(0.454)	(0.638)	(0.633)	(0.312)	(0.436)	(0.432)
Bureaucrat Ratio	-45.40***	-37.17***	-36.10***	-30.64***	-27.55***	-26.66***	-19.62***	-18.11***	-17.34***
	(3.310)	(5.718)	(5.768)	(2.486)	(4.374)	(4.401)	(1.722)	(3.072)	(3.064)
Migration (Same City)		0.0746	0.0497		-0.00107	-0.0149		0.0144	0.00778
		(0.100)	(0.100)		(0.0805)	(0.0801)		(0.0627)	(0.0623)
Migration (Other Cities)		0.216***	0.243***		0.229***	0.247***		0.187***	0.197***
		(0.0579)	(0.0583)		(0.0538)	(0.0543)		(0.0501)	(0.0505)
H. Violence×Migration (S.C.)		-0.229**	-0.206*		-0.142	-0.124		-0.0887	-0.0743
		(0.115)	(0.114)		(0.0921)	(0.0912)		(0.0711)	(0.0706)
H. Violence×Migration (O.C.)		-0.233***	-0.263***		-0.179***	-0.199***		-0.125**	-0.137**
		(0.0828)	(0.0830)		(0.0680)	(0.0681)		(0.0563)	(0.0565)
GDP Per Capita		-4.91e-05**	-6.00e-05***		-4.30e-05**	-5.04e-05***		-3.19e-05**	-3.70e-05**
		(2.31e-05)	(2.18e-05)		(1.89e-05)	(1.81e-05)		(1.46e-05)	(1.45e-05)
Secondary Industry		-0.151***	-0.169***		-0.108***	-0.119***		-0.0575***	-0.0634***
		(0.0323)	(0.0324)		(0.0260)	(0.0261)		(0.0195)	(0.0196)
Tertiary Industry		-0.0305	-0.0163		-0.0275	-0.0189		-0.0240	-0.0197
		(0.0419)	(0.0422)		(0.0334)	(0.0335)		(0.0254)	(0.0254)
Rural Ratio		0.0149	0.0214		0.00274	0.00743		-0.00106	0.00199
		(0.0242)	(0.0242)		(0.0192)	(0.0190)		(0.0141)	(0.0140)
Illiterate Ratio		0.107**	0.162***		0.0861***	0.119***		0.0793***	0.0956***
		(0.0421)	(0.0416)		(0.0326)	(0.0327)		(0.0241)	(0.0242)
Ethnicity Han		0.0761***	0.0604***		0.0552***	0.0440***		0.0312**	0.0233*
		(0.0188)	(0.0188)		(0.0162)	(0.0164)		(0.0131)	(0.0131)
Ethnicity Zang		-0.0195	-0.0279		-0.0154	-0.0167		-0.0386***	-0.0346**
		(0.0230)	(0.0242)		(0.0190)	(0.0200)		(0.0148)	(0.0155)
Ethnicity Miao		0.0408	0.0294		0.0331	0.0260		0.0325	0.0288
		(0.0493)	(0.0489)		(0.0484)	(0.0486)		(0.0386)	(0.0388)
Ethnicity Yi		-0.0268	-0.0170		-0.0118	-0.00607		-0.0118	-0.00846
		(0.0250)	(0.0256)		(0.0229)	(0.0233)		(0.0188)	(0.0189)
Ethnicity Zhuang		0.0701*	0.0681*		0.0465	0.0441		-0.00236	-0.00479
		(0.0392)	(0.0387)		(0.0368)	(0.0363)		(0.0306)	(0.0303)
Log Altitude (Mean)		-1.723***	-1.633***		-1.362***	-1.328***		-1.177***	-1.167***
		(0.427)	(0.423)		(0.315)	(0.317)		(0.218)	(0.220)
Log Altitude (S.D.)		-0.218	0.00504		-0.0526	0.102		0.352**	0.457**
		(0.351)	(0.353)		(0.263)	(0.268)		(0.175)	(0.178)
Log Precipitation (Mean)		1.277	1.530		1.063	1.227		0.749	0.826
		(1.080)	(1.061)		(0.779)	(0.778)		(0.528)	(0.533)
Log Precipitation (S.D.)		-0.0618	0.200		-0.0117	0.142		0.110	0.179
		(0.396)	(0.395)		(0.301)	(0.304)		(0.220)	(0.223)
Log Temperature (Mean)		1.441*	0.373		1.039*	0.367		0.653	0.284
		(0.767)	(0.710)		(0.589)	(0.549)		(0.411)	(0.392)
Log Temperature (S.D.)		-0.258	-0.490		-0.279	-0.415		-0.163	-0.222
		(0.372)	(0.372)		(0.282)	(0.283)		(0.197)	(0.197)
Wheat			1.816***			0.853**			0.158
			(0.539)			(0.418)			(0.297)
Rice			-1.991***			-1.171***			-0.656***
			(0.443)			(0.345)			(0.244)
Sorghum			-3.239***			-1.938***			-0.969***
			(0.464)			(0.353)			(0.248)
Observations	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066	2,066
Provincial Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.143	0.382	0.400	0.140	0.355	0.367	0.131	0.307	0.317

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

5 Survey Experiment

It is known that male births in the United States and some European countries increased marginally during and after the two world wars, the Korean War, and the Vietnam War. Possible explanations include heightened stress, increased frequency of coitus, and other biological and hormonal factors (MacMahon and Pugh, 1954; Martin, 1997; Graffelman and Hoekstra, 2000; Ellis and Bonin, 2004; Hesketh and Zhu, 2006). Our findings are unlikely to be driven by these factors for at least two reasons. First, the effect of historical violence on juvenile sex ratio that we detect is large in magnitude. Second, it persisted over centuries and is in no sense temporary. A larger concern is that historical violence may be correlated with environmental factors such as pollution, diseases, and smoking habits, which are known to affect sex ratio at birth (Vartiainen et al., 1999; Anderson and Ray, 2010; Lichtenfels et al., 2007). To verify if our findings are indeed driven by individual preference rather than by environmental factors, we conduct an online survey experiment in which we elicit the son preference of survey subjects in China by applying weapon prime stimuli and the item count method.

In our experiment, the subjects are randomly assigned into two conditions: weapon and non-weapon. Those in the weapon condition are shown pictures of 9 weapons, for which they are asked to categorize as either a gun, club, or sword. Those in the non-weapon condition are shown pictures of 9 plant parts, for which they are asked to categorize as either a flower, tree, or fruit. Subsequently, we ask the subjects to respond to a few statements, which may include reporting one's preference for sons. Exposure to the weapon condition has been shown to evoke violence and aggressive behaviors compared with exposure to the non-weapon condition (Berkowitz and LePage, 1967; Anderson et al., 1998). If the skewed sex ratios in counties with historical violence are driven by preference, we expect weapon prime stimuli to induce differential responses from subjects according to where they were born—in areas with or without historical violence. However, if the skewed sex ratios in counties exposed to historical violence are not preference-driven—for example, the skewness is caused by environmental factors such as diseases—weapon prime stimuli should have no effect on the subjects' tendency to report a preference for sons.

Since some subjects may not wish to reveal their true preferences on a sensitive issue like gender, we employ the item count method to elicit truth telling (Glynn, 2013). Specifically, on top of and orthogonal to assigning the subjects into the weapon and non-weapon conditions, we also randomly assign them to respond to either 4 or 5 statements in the survey. Subjects in the 4-statement condition are shown 4 non-sensitive statements,

for instance "I ate at a restaurant yesterday", and are asked to indicate the number of true statements. Meanwhile, subjects in the 5-statement condition are shown the same 4 non-sensitive statements plus another statement on son preference, "I prefer a son to a daughter", and are asked to indicate the number of true statements. The reported number of true statements in the 5-statement condition provides a measure for son preference since an individual with strong son preference is more likely to report a higher number of true statements. The number of true statements in the 4-statement condition provides a control condition as it remains possible that priming could also affect the responses to these 4 "non-sensitive" statements.

We recruited 864 subjects from 23 provinces in China and randomly assigned them into this 2 by 2 design, of which 50% (50%) of the subjects are assigned to the weapon prime stimuli condition (non-weapon prime stimuli condition) and one third (two thirds) of them are assigned to the 4-statement condition (5-statement condition). In the survey, they were also asked to provide their gender, age, place of birth, education, education of parents, height, weight, ethnicity, marital status, and number of children, which we control for in our analysis. Table 6 provides the summary statistics and checks that the two groups of subjects from historically violent and non-violent counties are largely balanced.

Table 6: Comparison of Survey Subjects from Counties With and Without Historical Violence

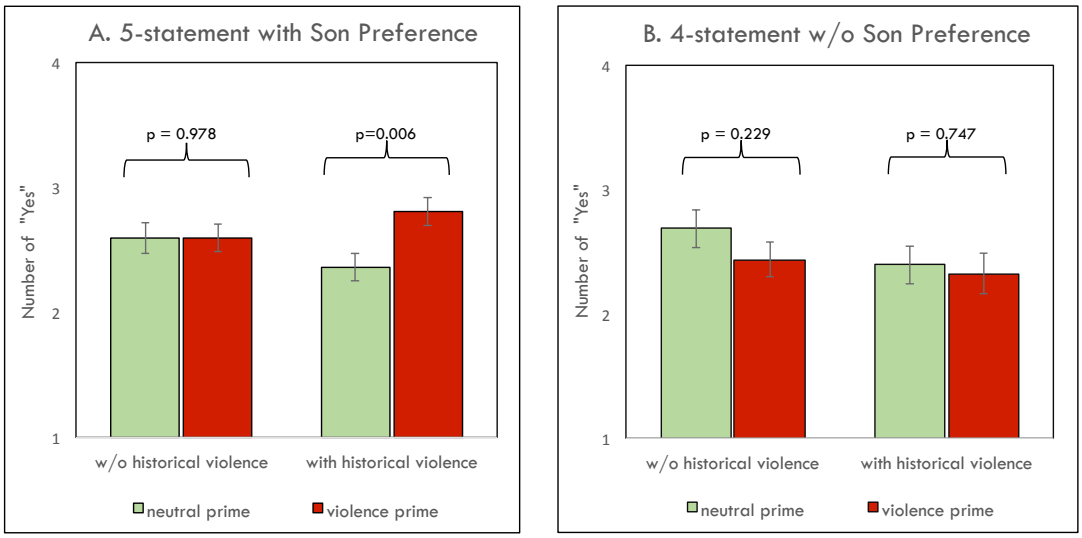
	All (Mean)	With Historical Violence	W/O Historical Violence	Difference
Number of "Yes" Responses	2.54	2.51	2.58	-0.08
Received Weapon Priming	0.50	0.47	0.53	-0.06
Female	0.46	0.44	0.47	-0.02
Age	29.5	29.0	29.9	-0.9
Education	3.26	3.21	3.31	-.10
Education, Father	2.73	2.65	2.82	-0.17*
Education, Mother	2.35	2.31	2.39	-0.08
Height	170.8	170.4	171.2	-0.7
Weight	69.1	68.7	69.4	-0.7
Minority	0.06	0.07	0.04	0.03*
Marriage	0.60	0.58	0.62	-0.04
No. of Children	0.74	0.73	0.75	-0.02
N	864	428	436	-

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Figure 2 plots the average number of true statements by priming condition (weapon and non-weapon) and by whether subjects were born in historically violent areas. In the 5-statement condition (Panel A), we observe that subjects born in historically violent areas are significantly more likely to have a higher number of true statements when they are primed with weapon stimuli than when they are primed with non-weapon stimuli ($p < 0.006$). By contrast, we do not observe significant priming effect for subjects born in

the historically non-violent areas. Furthermore, in the 4-statement condition (Panel B), we do not observe significant priming effect regardless of whether subjects were born in counties with historical violence or not.

Figure 2: Survey Response Patterns



In Table 7, we further examine the interaction between weapon priming and historical violence using a ordered probit analysis. We find that the interaction term has a statistically significant effect on the responses in the 5-statement condition measuring son preference (Column 1), but not on the responses in the 4-statement condition (Column 2). The results are similar if we further control for socioeconomic conditions (Columns 3 and 4). Overall, these results show that those who were born in the historically violent areas exhibit a stronger preference for male offspring upon receiving weapon priming.

6 Conclusion

Unlike Europe, where violent conflicts often took the form of interstate warfare, the most prominent form of warfare in China in the last millennium were the steppe-agrarian resource conflicts and commoner rebellions. Since both ethnic tensions and commoner rebellions represented weak local order in the affected areas, China offers a useful test case to investigate how sustained exposure to violence and disorder in history may affect a local society's son preference today.

At first glance, our finding on the persistent effect of historical violence on sex ratio may appear counter-intuitive. A skewed juvenile sex ratio ought to be temporary: a short-

Table 7: Ordered Probit Analysis of Survey Response

	5-statement	4-statement	5-statement	4-statement
	(1)	(2)	(3)	(4)
VARIABLES	Number of "Yes" Responses			
Weapon Priming	-0.0110	-0.213	-0.0416	-0.208
	(0.125)	(0.175)	(0.129)	(0.181)
Historical Violence	-0.170	-0.245	-0.168	-0.239
	(0.125)	(0.185)	(0.128)	(0.192)
Weapon Priming×Historical Violence	0.351**	0.153	0.412**	0.175
	(0.173)	(0.252)	(0.177)	(0.262)
Female			-0.00411	-0.202
			(0.119)	(0.191)
Age			0.00644	0.0292***
			(0.00564)	(0.00884)
Education			0.0156	0.0271
			(0.0488)	(0.0685)
Education, Father			0.0220	0.0347
			(0.0454)	(0.0675)
Education, Mother			-0.00258	-0.0135
			(0.0425)	(0.0695)
Height			0.00338	0.000284
			(0.00703)	(0.0121)
Weight			0.00163*	-0.00392
			(0.000928)	(0.00329)
Minority			0.147	0.234
			(0.195)	(0.304)
Married			0.360***	-0.0915
			(0.130)	(0.209)
No. of Children			0.0515	0.0554
			(0.0810)	(0.127)
Observations	576	288	576	288

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

age of girls will lead to excess males in the future, which increases the bargaining power of females in the marriage market, thus triggering the self-correction mechanism (Grossbard and Amuedo-Dorantes, 2007). Given the environment of relatively low violence in China in recent decades, the finding does not appear to be driven by the persistence of violence. Instead, analyzing the in-migrants' cities of origins provides some evidence that the preference for sons to protect oneself in a violent environment was passed down through generations by cultural transmission. In our survey experiment, we use violence-oriented prime stimuli to directly verify the existence of son preference in areas exposed to historical violence. The experiment also allows us to show that the skewed juvenile sex ratios observed in these areas are not driven by environmental factors, while are unlikely to induce responses to weapon prime stimuli.

Overall, our results suggest that the missing women phenomenon cannot be adequately addressed by faster economic growth or better law enforcement. The underlying cultural factors need to be dealt with too. In particular, improving governance and strengthening law and order ought to be an integral part of women empowerment: a decline of violence

over time should have the effect of reducing son preference, however slowly.

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