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Do skewed sex ratios among children promote parental smoking? Longitudinal evidence from rural China

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Abstract

China and some other Asian countries have experienced skewed sex ratios, triggering intense competition and pressure in the marriage market. Meanwhile, China has more smokers than any other country, with half of men smoke while few women smoke. Men are the major income earners in most Chinese families and thus bear much of the financial burden in preparation for children's marriage. This paper investigates how a demographic factor – a large number of surplus men in the marriage market in China – affects their fathers' smoking behavior. We utilize a household longitudinal survey as well as a random subsample of the China Population Census to examine fathers' smoking in response to skewed sex ratios. Strikingly, fathers smoke more for families with a son living in counties with higher sex ratios. In contrast, those with a daughter do not demonstrate this pattern. Coping with the marriage market pressure is a most plausible pathway linking skewed sex ratios and intense smoking among fathers. Considering worsening sex ratios and highly competitive marriage market in the coming decade as well as lasting health impacts due to smoking, policies suppressing unbalanced sex ratios could lead to welfare gains.

Keywords

Sex Ratios; Marriage Market; Paternal Smoking; Stress

1. Introduction

Tobacco use is prevalent and addictive, imposes health impacts, impairs labor market performance, and raises negative externalities within society through increased use of public health care and addiction treatment services. Understanding and suppressing the determinants of tobacco use could lead to substantial welfare gains, especially in countries like China that is still in early stage of a tobacco epidemic (Yang et al. 1999). China has more smokers than any other countries in the world, generating significant health problems due to both firsthand and secondhand smoking that result in about a million premature deaths each year (Hu et al. 2006).

This paper aims to examine how demographic factors, particularly a large number of excess men in the marriage market, affect smoking. The widely available ultrasound technology in

recent decades and the ingrained culture of son preference, together with one of the most radical birth control policies in history, lead to highly skewed sex ratios favoring women in contemporary China. According to the China Population Census, sex ratio at birth (SRB) in China has increased from 106.32 in 1975 to 118.06 in 2010. Rural areas possess more skewed sex ratios than urban areas (Appendix Figure 1). The scale of involuntarily single men is frightening. According to the 2005 inter-census China national survey, the number of excess Chinese men under age 20 exceeded 32 million, which is greater than the entire male population of Italy or Canada (Zhu, Lu, and Hesketh 2009). Ebenstein and Sharygin (2009) simulate that at least 10.4 percent of these additional men will fail to marry.

Faced with the pressure to marry sons, parents improve sons' relative attractiveness via investing more in education, spending more on positional goods, throwing extravagant wedding parties, paying high bride prices, and buying high priced houses for marriage (Wei, Zhang and Liu 2012), which occupy a great proportion of lifetime income (Foreign Policy 2012). However, almost none of these expenses are incurred by the brides' families. To make ends meet, men have to work harder (Wei and Zhang 2011a), take more risky jobs (Robson 1996; Hopkins 2011), save more and amass more assets (Chang and Zhang 2012). The savings rate for grooms' families peaks in the year before the wedding, while it is almost always lower for brides' families (Wei and Zhang 2011b). Multi-country evidence suggests that skewed sex ratios widen the dispersion of marriage market rewards, males of low socioeconomic status who fail to marry often bear grave consequences, such as lack of care in old age (Ebenstein and Sharygin 2009), committing crimes (Edlund et al. 2007), vulnerability to social instability (Den Boer and Hudson 2004), being infected sexually transmitted diseases (Ebenstein and Sharygin 2009), suffering from psychological distress (Pearlin and Johnson 1977), and having high mortality rate (Hu and Goldman 1990).

Despite a growing literature on the consequences of gender imbalance, few studies investigate its impact on stress coping behavior, especially for the parental generation. This study aims to make two main contributions to the literature. First, it is among the first to examine parental smoking behavior in response to skewed sex ratios; second, we for the first time carefully explore potential mechanisms through income generation and marriage market stress that may promote smoking.

Nicotine is a psychoactive (mood altering) drug, and tobacco use may make the subjective effects of stress (such as feelings of frustration, anger, and anxiety) less severe (Peski 2013). Psychological studies link increasing psychosocial strain with more tobacco use to self-medicate anxiety disorders (Shaw et al. 2011). Consequently, we might observe more frequent smoking as a stress coping strategy among the grooms' families, while brighter prospects for marriage among females reduce their parents' tobacco use (Umberson 1987).

We study parental smoking behavior in response to skewed sex ratios of their children's generation in rural China. Our empirical investigations focus on paternal smoking behavior for two reasons. First, smoking by men is deeply ingrained in Chinese culture, while social norms are against women smoking. In China, men smoke at a much higher rate than women (53% vs. 2%) (The Economist 2012). Second, men are the major income earners in most

Chinese families and thus naturally bear much of the financial burden in preparation for children's marriage.

The rest of the paper is organized as follows. Section 2 introduces our method and data sets. Section 3 presents the main results. Section 4 concludes and discusses the main implications of our findings.

2. Method

We utilize a Chinese national longitudinal survey, i.e. China Health and Nutrition Survey (CHNS), between 1991 and 2009 to examine paternal smoking in response to skewed sex ratios. CHNS covers nine provinces in China with a wide range of nationally representative counties. Each province is drawn following a multistage, random cluster process. Stratified by income, a weighted sampling scheme was used to randomly select four counties in each province. Villages and townships within the counties were selected randomly. For the purpose of this study, only the rural sample of CHNS is employed. Each wave surveyed around 4,200 rural households. We utilize the information on cigarette consumption per day in seven waves of the survey between 1991 and 2009. Table 1 suggests that around half of the fathers smoke.

We merge the survey with sex ratios at the county level based on a 1‰ sample of the 2000 China Population Census. The county level sex ratios increase from 109 males (per 100 females) to 118 males (per 100 females) between 1991 and 2009 (Table 1). Together with the worsening skewed sex ratios, their standard deviations increase as well, suggesting that the gender gap among counties may widen. The population census data suggests that the national average county sex ratios at the 1st, 2nd and 3rd birth parities are 108.4, 143.2 and 152.9, respectively.

Using the merged dataset, we focus on comparing families with the first child being a son versus being a daughter. Much evidence suggests that there is little gender selection at the first birth parity in rural China (Scharping 2003; Ebenstein 2009; Ebenstein 2010; Chen, Li and Meng 2010). In a competitive marriage market (i.e. places with higher male-to-female sex ratios in the marriage market), fathers with a son should feel more economic pressure to get son married and therefore smoke more. This pattern should be especially salient for poor families due to their weaker ability to cope with the pressure. In contrast, those with a daughter should not demonstrate this pattern. Specifically, in the regression of determinants of paternal smoking, the interaction term between sex ratios and first child being a son is hypothesized to be positive and statistically significant. When separately estimate the determinants of paternal smoking in two subsamples, i.e. families with the first child being a son versus being a daughter, we should find significant positive effect of sex ratios on paternal smoking in the first subsample but not in the second subsample.

All regressions control for a rich set of covariates, including price of cigarettes at the village level (in USD), household income per capita (in USD), fathers' years of education, household head's gender and age, marital status (dummy), shares of the elderly and the youth (percentage), household size (number of members), major diseases (dummy),

ethnicity (dummy), year and household fixed effects. Standard errors are clustered at the county level.

Stress coping is likely a pathway between skewed sex ratios and paternal smoking. Besides using smoking as our main outcome, we test stress as a result of having a son and living in a county with skewed sex ratios. Given that stress is not directly measured in CHNS, we make use of self-rated life satisfaction and hedonic happiness in all waves of CHNS survey.

To test the potential pathway of increase in income through which skewed sex ratios may promote paternal smoking, we regress per capita income on sex ratios and compare the effects for families of different demographic compositions.

3. Results

Our first set of results in columns (1) through (4) of Table 2 regress log number of cigarettes fathers smoke per day (the dependent variable) on sex ratios of 5–19, 5–9, 10–14, and 15–19 age cohorts, respectively. There is a much stronger association between sex ratio of the 15–19 age cohort and number of cigarettes an average father smokes per day, suggesting that skewed sex ratios exert a bigger impact on families with a son approaching marriage age.

Next, we restrict the analysis to households with at most two children. Calculating sex ratios for age cohort 10–19, column (1) of Table 3 shows that having a son first does not affect tobacco use. However, the combination of having a son and living in a county with more skewed sex ratios, identified by the interaction term between sex ratio for age 10–19 and first child being a son, is associated with more smoking among fathers. Dividing the analytic sample into a set of age intervals from 1–5 to 26–30, Appendix Figure 2 further plots heterogeneous effects identified by the interaction term between sex ratios for age 10–19 and first child being a son. The largely increasing effect over age intervals once again indicates that the marriage market stress may become more intensified as a son grows up.

Moreover, Appendix Figure 3 plots the relationship between sex ratios and paternal tobacco use and distinguishes by child gender composition. Specifically, nuclear families with only a son show a positive association between male-to-female sex ratios and paternal tobacco use. However, no clear association is found for families with only a daughter. More rigorous regressions in columns (2) and (3) of Table 3 confirm this finding.

Table 3 also presents the result of a falsification test that replaces the sex ratios (for age cohort 10–19) by the sex ratios of less relevant age cohort 30–40. The effects disappear, which indicates the combination of having an unmarried son and living in an area with skewed sex ratios at marriage age, rather than unobserved factors, promote fathers' tobacco use. This test also rules out a potential inverse relationship that fathers who smoke more may select to live in male-dominant communities in which smoking is more prevalent. No significant effect is found using sex ratios for age cohort 30–40, a measure of if a community is male-dominant.

Appendix Table 1 Panel A finds no significant effect of interaction between sex ratios and first child being a son on income. Similarly, there is no significant effect of sex ratios on

income either for families with a son (column 2) or for those with a daughter (column 3) when the sample is restricted to families with only one child.

Appendix Table 1 Panels B and C show that stress, indicated by life satisfaction and hedonic happiness, is likely the pathway between skewed sex ratios and paternal smoking. For families with one or two children, first child being a son and experiencing more skewed sex ratios favoring females indeed predict lower life satisfaction and happiness. This pattern is salient for families with a son but not for those with a daughter when restricted to families with one child.

Finally, having a son and living in places with skewed male-to-female sex ratios, the poor families tend to be more responsive to sex ratios. Appendix Figure 4 compares families with a son versus those with a daughter, and families in high sex ratio counties versus those in low sex ratio counties. First, the left figure suggests that poor families with a son living in high sex ratio counties smoke more than their poor counterparts living in counties with low sex ratios. However, no similar pattern is found in the right figure for families with a daughter. Second, comparing between the left and the right figures of Appendix Figure 4, poor families in high sex ratio counties with a son smoke more than those with a daughter, while a comparison between the two types of families in low sex ratio counties generates no distinct pattern. More rigorous analysis in Appendix Table 2 re-estimates the main results in Table 3 but examines heterogeneity by income quartile. Results echo Appendix Figure 4 that smoking is indeed biased towards poorer families with a son in a high sex ratio county.

4. Discussions

This study provides first evidence that fathers with a son in the competitive marriage market favoring females smoke more, especially for the poor. In contrast, those with a daughter do not demonstrate this pattern. Results from two novel and careful falsification tests suggest that our identified effect is likely to be causal: the first test using sex ratios for age cohorts mostly not in the tightening marriage market shows no effect; the second test finds larger effect on paternal smoking as a son approaches marriage age.

Our study also pioneers the investigation of potential mechanisms. Coping with the pressure to marry sons in a gloomy marriage market (i.e. with high male-to-female sex ratio) is the most plausible pathway linking skewed sex ratios and tobacco use. Specifically, evidence on reduced paternal life satisfaction and happiness in counties with high male-to-female sex ratios indicates that stress matters to paternal smoking. Among all families, parents in poor families are especially stressed but are less capable of coping with the marriage market pressure.

No evidence is found about skewed sex ratios promoting tobacco use through working harder and earning more money for marriage. Moreover, the potential pathway that fathers having a son smoke more as there can be stronger intergenerational smoking interactions is not supported by our national sample. Specifically, compared to the high smoking rate among fathers in the CHNS national sample, only 4.8 percent of children start to smoke

before age 19. No positive association is found between paternal and son smoking in the CHNS national sample.

5. Conclusions

Chinese marriage market has been highly competitive, especially for poor parents of sons living in counties with skewed sex ratios. In the meantime, China has had more smokers than any other country in the world. Utilizing the CHNS national sample, it is found that for families with a son living in counties with higher sex ratios, fathers tend to smoke more. In contrast, those with a daughter do not demonstrate this pattern.

This study makes two key contributions to the literature: one, it provides the first evidence on parental smoking behavior in response to skewed sex ratios; two, a few plausible mechanisms are carefully explored. The study also attempts to inform public policy in two ways: first, investigating marriage market pressure and parental behavior consequences could help design effective policies that improve parental well-being through the rebalancing of skewed sex ratios; second, widespread tobacco use imposes large health costs, affects the labor market, and brings various negative externalities to society. Therefore, understanding and suppressing the determinants of tobacco use could lead to further welfare gains.

This analysis has some limitations or caveats. First, while this study tests a few possible pathways between skewed sex ratios and parental smoking and attributes marriage market stress to be the most plausible channel, the results are still inconclusive and open to further research about potential mechanisms. Second, investigations into consumption of other stress goods (e.g. alcohol drinking) and more direct measures of stress (other than life satisfaction and hedonic happiness) are required to verify marriage market pressure as the most plausible pathway. Third, more recent population census and CHNS survey are called for to check whether the effect persisted or even worsened as Chinese marriage market further tightened in more recent years. Finally, a caveat is that our results may underestimate the marriage market impact as rural China has been subject to less stringent family planning policy than urban China.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Summary Statistics for Key Variables

	Mean	Standard Deviation
<i>China Health and Nutrition Survey (CHNS) National Sample</i>		
Dummy for paternal smoking in 1991–2009	0.52	0.51
Paternal tobacco consumption in 1991–2009 (# cigarettes per day)	5.32	7.42
Life satisfaction (1=least satisfied, 5= most satisfied)	3.97	0.85
Happiness (1=least happy, 5=most happy)	3.17	0.71
<i>Sex ratios inferred from a 1‰ sample of the 2000 China Population Census</i>		
Sex ratio for the age cohort 10–19 in 1991 (# males per female)	1.09	0.16
Sex ratio for the age cohort 10–19 in 1993 (# males per female)	1.09	0.16
Sex ratio for the age cohort 10–19 in 1997 (# males per female)	1.10	0.16
Sex ratio for the age cohort 10–19 in 2000 (# males per female)	1.12	0.16
Sex ratio for the age cohort 10–19 in 2004 (# males per female)	1.13	0.17
Sex ratio for the age cohort 10–19 in 2006 (# males per female)	1.17	0.20
Sex ratio for the age cohort 10–19 in 2009 (# males per female)	1.18	0.20
Sex ratio at first birth (# males per female)	1.08	0.12
Sex ratio at second birth (# males per female)	1.43	0.12
Sex ratio at third birth (# males per female)	1.53	0.12

Source: China Health and Nutrition Survey (1991–2009); A 1‰ sample of the 2000 China Population Census.

Notes: The sex ratios for the age cohorts 10–19 in 1991, 1993, 1997, 2004, 2006 and 2009 are respectively inferred from the age cohorts 19–28, 17–26, 13–22, 6–15, 4–13, 1–10 in the 2000 population census. Sex ratios are defined as number of males per female.

Table 2**Baseline Results: Sex Ratios and Smoking**

	Ln(# Cigarettes Smokes Per Day)			
	5–19	5–9	10–14	15–19
Sex ratio	0.541*** (0.128)	0.090 (0.060)	0.115* (0.061)	0.104** (0.047)
Year FEs, HH FEs	Yes	Yes	Yes	Yes
Adjusted R ²	0.443	0.422	0.372	0.328
AIC	8310.47	8282.45	8300.67	8340.37
N	21321	21321	21321	21321

Source: China Health and Nutrition Survey (1991–2009).

Notes: Sex ratios are measured at the county level using a 1‰ sample of the 2000 China Population Census data. Sex ratios in columns 1–4 are calculated for 5–19, 5–9, 10–14, 15–19 age cohorts, respectively. A rich set of covariates are controlled for, i.e., price of cigarettes at the village level (in USD), household income per capita (in USD), fathers' years of education, household head's gender and age, marital status (dummy), shares of the elderly and the youth (percentage), household size (number of members), major diseases (dummy), ethnicity (dummy), year fixed effects and household fixed effects. Robust standard errors, clustered at the county level, are presented in the brackets. *, **, *** denote statistical significance at the 10%, 5% and 1% level, respectively.

Table 3**Sex Ratios, Family Composition and Tobacco Consumption**

	Ln(# Cigarettes Smokes Per Day)		
	(1) One or two children	(2) One son	(3) One daughter
<i>Using Sex Ratios for Age Cohort 10–19</i>			
Sex ratio for age cohort 10–19	–0.211 (0.133)	1.289*** (0.278)	–0.286 (0.226)
Sex ratio (10–19) *first child being a son	2.335*** (0.330)		
Year FEs, HH FEs	Yes	Yes	Yes
Adjusted R ²	0.465	0.425	0.483
AIC	2119.04	6057.94	2882.86
N	15380	3407	4136
<i>Falsification Test: Using Sex Ratios for Age Cohort 30–40</i>			
Sex ratio for age cohort 30–40	–0.433 (0.356)	–0.330 (0.396)	–0.381 (0.657)
Sex ratio (30–40) *first child being a son	0.053 (0.443)		
Year FEs, HH FEs	Yes	Yes	Yes
Adjusted R ²	0.066	0.178	0.143
N	15270	3407	4136

Source: China Health and Nutrition Survey (1991–2009), and 1% sample of the 2000 China Population Census.

Notes: All covariates follow Table 2.