

The Consequences of the “Missing Girls” of China

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In the wake of the one-child policy of 1979, China experienced an unprecedented rise in the sex ratio at birth (ratio of male to female births). In cohorts born between 1980 and 2000, there were 22 million more men than women. Some 10.4 percent of these additional men will fail to marry, based on simulations presented here that assess how different scenarios for the sex ratio at birth affect the probability of failure to marry in 21st century China. Three consequences of the high sex ratio and large numbers of unmarried men are discussed: the prevalence of prostitution and sexually transmitted infections, the economic and physical well-being of men who fail to marry, and China's ability to care for its elderly, with a particular focus on elderly males who fail to marry. Several policy options are suggested that could mitigate the negative consequences of the demographic squeeze. JEL codes: I18, J11, J12, J13, J26, N35

In an attempt to halt explosive population growth in China, the framers of the one-child policy of 1979 projected that if every woman of childbearing age had an average of 1.5 children, China would reach a peak population of approximately 1.2 billion in 2030, slowly declining thereafter to an ideal level of 700 million by the late 21st century (Yu 1980, projection 4). While these projections were remarkably accurate considering the available information, officials did not fully anticipate the impact of the fertility controls on the sex ratio at birth (the ratio of male to female births) and the social consequences of high sex ratios.¹

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1. Song Jian, a leading scientist and politician credited with innovations in science and mathematics, was charged with developing policies to put China's population trajectory on the optimal path (Scharping 2003). This second-best scenario (after the ideal of one child per couple) was projected to result in a total population of 1.17 billion in 2025, declining to 777 million by 2080. While Song's projections did not incorporate the dramatic change in the sex ratio of births following introduction of the one-child policy, they did account for the already higher sex ratio of births in China.

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Government controls on marriage and childbirth instituted in the 1970s were intended to reduce population growth through delayed marriages, longer gaps between births, and lower lifetime fertility, a set of policies known as *wan xi shao* (later, longer and fewer). In 1979, a countrywide one child per couple policy was introduced. As the policy was codified and policy enforcement diffused throughout the country over the 1980s, parents unhappy with the prospect of never having a son became an increasingly common phenomenon. For many parents, intense son preference and the introduction of sex-selective abortion—made possible by the legalization of abortion after 1979 and the introduction of ultrasound technology in the early 1980s—led to a “merger of Eastern philosophy and Western technology.” As a consequence, cohorts born between 1980 and 2000 included 22 million more men than women, a phenomenon known as the “missing girls” of China. According to projections in this article, approximately 10.4 percent of the men in these cohorts can be expected to fail to marry.

The popular press is replete with predictions that the vast number of unmarried men will destabilize Chinese society and represent a “geopolitical time bomb.”² Hudson and den Boer (2004) argue that the high sex ratios in China will be associated with an increase in crime, since most violent crime is committed by unmarried young men. They also suggest that the poor marital prospects for these men may lead to China taking a more aggressive stance in world affairs, as happened before. In the 18th century, the Qing dynasty government responded to the rising sex ratios brought about by high levels of female infanticide by encouraging single men to colonize Taiwan. And in the 19th century, poor economic conditions in Shandong province led to rampant female infanticide and a subsequent rebellion when the unbalanced cohorts matured and organized an uprising against the Qing dynasty (Poston and Glover 2004).

The relevance of such examples to modern China is unclear, since empirical evidence is lacking on the connection between large numbers of single men and social upheaval. The potential consequences of this gender imbalance has spurred research in several disciplines, including demography, political science, and economics, but more work on the direct causal links between high sex ratios and social disorder is warranted.³

High sex ratios at birth have several predictable consequences, which this article analyzes. It finds that the growing population of unmarried men will affect the prevalence of commercial sex activity and the transmission of sexually transmitted infections, including HIV. And men who fail to marry may be worse off economically and will not have children to support them in their old age.

2. Michael Fragoso, “China’s surplus of sons: a geopolitical time bomb,” *Christian Science Monitor*, October 19, 2007. Retrieved from www.csmonitor.com/2007/1019/p09s02-coop.html

3. Edlund and others (2007), exploiting time variation in the introduction of China’s one-child policy to estimate the impact of high sex ratios on crime rates, find that the rising sex ratio explains a third of China’s recent increase in crime rates.

Understanding the social and economic consequences of high sex ratios in China is critical in light of the persistence of this phenomenon since the advent of the one-child policy. The high sex ratios of cohorts born in the past two decades have already altered the demographic destiny of China. The shortage of women lowers the reproductive potential of the population and accelerates the shrinking of the population in the 21st century, absent a return to replacement fertility rates (Cai and Lavelly 2005). Recent Chinese government figures indicate that the female deficit has actually worsened since the 2000 Census, with the official sex ratio at birth reaching 120 boys for every 100 girls in 2008 (China National Population and Family Planning Commission 2009).⁴ Unless action is taken to reverse this trend, the negative consequences appear all but inevitable.

This article is organized as follows. The first section presents background information on marriage and fertility and uses population simulations to assess how different scenarios for changes in the sex ratio at birth and the total fertility rate could affect the share of men who fail to marry in China over the next century. Section II discusses the expected consequences of the high sex ratios and the failure of men to marry for migration, commercial sex activity, and the prevalence of sexually transmitted infections, with a focus on HIV. Section III explores the implications of the sex imbalance on China's ability to care for its elderly in an aging population with a growing number of unmarried, childless men. Section IV briefly discuss the benefits of marriage using indicators of economic and physical well-being and examines the welfare impact of the failure to marry on health and financial outcomes. Section V briefly discusses current efforts by the Chinese government to address the consequences of the skewed sex ratio and summarizes several policy recommendations for China in light of the anticipated costs of this worrisome demographic pattern.

I. DEMOGRAPHIC CONSEQUENCES OF CHINA'S "MISSING GIRLS"

This section contains background information on marriage and fertility in China and presents several scenarios on how changes in the sex ratio at birth and the total fertility rate could affect the share of men who fail to marry in China over the next century

Marriage, Fertility, and Sex Ratios in China

The failure of men in China to marry because of a shortage of women is not an entirely new phenomenon. High sex ratios could be observed even in the 19th century, when missionaries reported that women they interviewed indicated very high rates of female infant mortality (Coale and Banister 1994). China's 1982 Census shows that nearly 6 percent of men born between 1935 and 1945 failed to marry, compared with less than 2 percent of the women

4. A discussion of alternative calculations of the sex ratio of new births is available in Goodkind (2008).

TABLE 1. Marriage Rates for Men in China, by Decadal Birth Cohorts, 1935–45 to 1955–65 (percent)

Category	1935–45		1945–55		1955–65	
	Men	Women	Men	Women	Men	Women
Share never married	5.88	0.18	5.49	0.29	3.82	0.38
Sex ratio of cohorts (ratio of men to women)	1.14	n.a.	1.08	n.a.	1.04	n.a.
Share illiterate, ever-married men	20.8	n.a.	7.7	n.a.	1.1	n.a.
Share illiterate, never-married men	48.6	n.a.	33.3	n.a.	12.7	n.a.

n.a. is not available.

Note: The share never married and the sex ratio of the cohorts in each column is calculated using data on individuals observed in these cohorts. The observed sex ratios are slightly higher than at the time these individuals were of marrying age, since adult mortality rates are higher for men than for women. Age at marriage is calculated using the 2000 Census, and so the sample is restricted to men born in these cohorts and still living at the time of the census.

Source: Authors' analysis based on data from China National Bureau of Statistics (1982, 2000) and China Population and Information Research Center (1990).

(table 1). Marriage prospects for men born between 1945 and 1955 were only slightly better, with 5.5 percent failing to marry.⁵ Chinese men who remain single are known as “bare branches” (*guang gun*), since they will fail to extend the family tree. In each cohort since 1935–45, unmarried men have lower literacy rates than men who marry. The concern over these “bare branches” is thus partly due to the distributional consequences of this phenomenon, since men with the worst economic prospects are generally forced to bear the additional burden of remaining single.

Relative to earlier (and later) cohorts, men born during China's baby boom of the 1950s and 1960s had better prospects. Higher fertility rates in these decades were associated with less distorted sex ratios, since parents were able to have a son without resorting to sex selection. This population growth allowed men to select brides from a larger group of younger women. The age gap between men and women at first marriage decreased as men were able to marry at a relatively younger age (figure 1).

China is on the cusp of a dramatic deterioration in men's marital prospects. The sex imbalance between potential spouses of the same age group is forecast

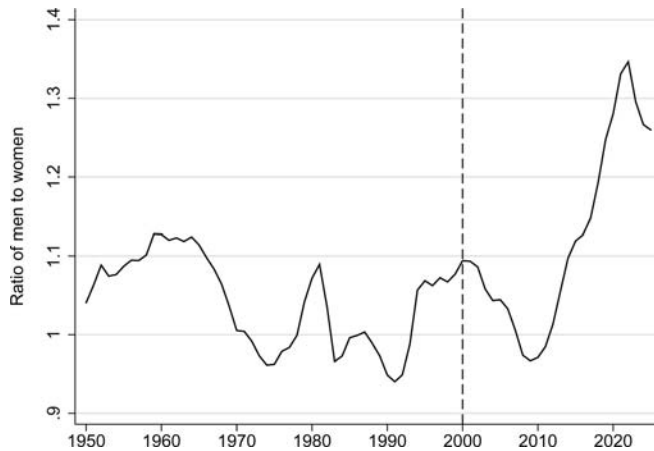
5. One surprising finding is that the marriage rate was very high for cohorts of men born between 1935 and 1944 (almost 95 percent), despite the high sex ratio in these cohorts. The ratio of men to women was roughly 1.14, so more men might have been expected to fail to find a spouse. One explanation for the high marriage rate among these men is that the sex ratios of cohorts entering the marriage market in the 1960s were falling. Many of the men from previous cohorts delayed marriage and married women from these younger cohorts. Intuitively, the observed increase in the age gap in spouses of a full year implies that on average men delayed marriage one year and thus had an additional cohort of women to choose from (given that women do not generally marry men their age or younger men). Men's ability to marry women in younger cohorts has the potential to mitigate sex ratio distortions in any particular cohort. Such adaptation was also observed in England following World War I and in other contexts where people feared a collapse in the marriage market, but none occurred (Bhrolchain 2001).

FIGURE 1. Average Age at Marriage by Sex and Spousal Age Gaps, China 1940–2000



Source: Authors' analysis based on data from China National Bureau of Statistics (2000).

FIGURE 2. Sex Ratio of Marriage-Age Adults in China, 1950–2030

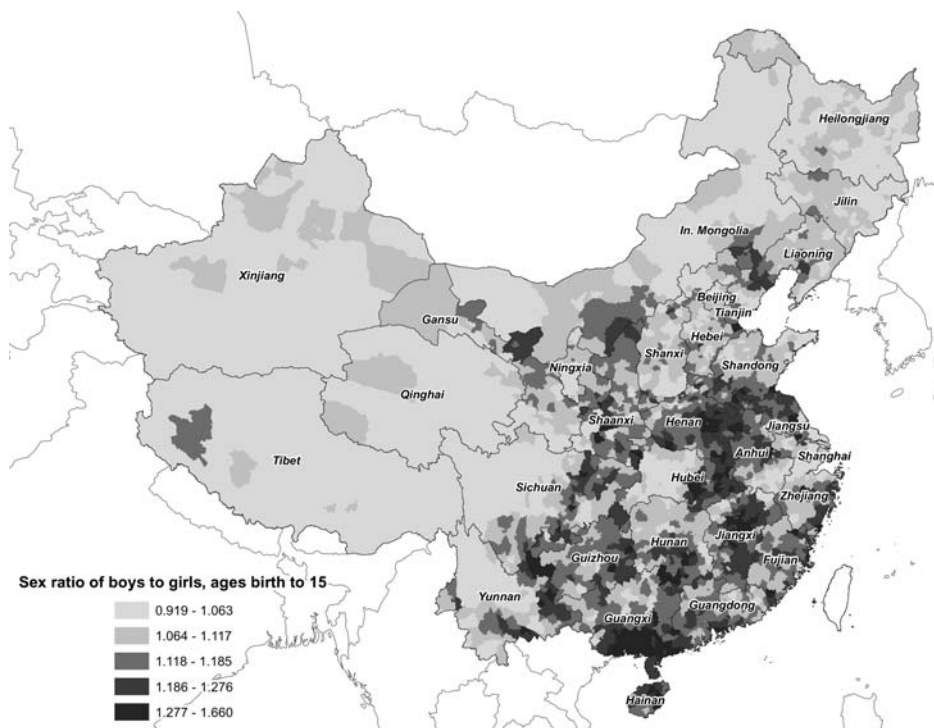


Note: The marriage market is defined as men ages 22–32 and women ages 20–30. The sex ratio for each year is calculated using data from the 2000 Census, modeling population changes with age–sex–year specific mortality rates. The population is simulated forward from 2000 using baseline fertility assumptions (explained in the text) and a sex ratio at birth of 1.09 from 2005 and beyond. The vertical dotted line indicates data from the 2000 Census.

Source: Authors' analysis based on data from China National Bureau of Statistics (1982, 2000).

to be at its worst by 2020, as the cohorts with the highest sex ratios (those born under the one-child policy) reach adulthood (figure 2). This projection holds under the conservative assumption that the campaign to achieve a target sex ratio of 1.09 has been successful in the most recent period for which no

MAP 1. Sex Ratio of Children, Ages Birth to 15



Source: China National Bureau of Statistics (2000)

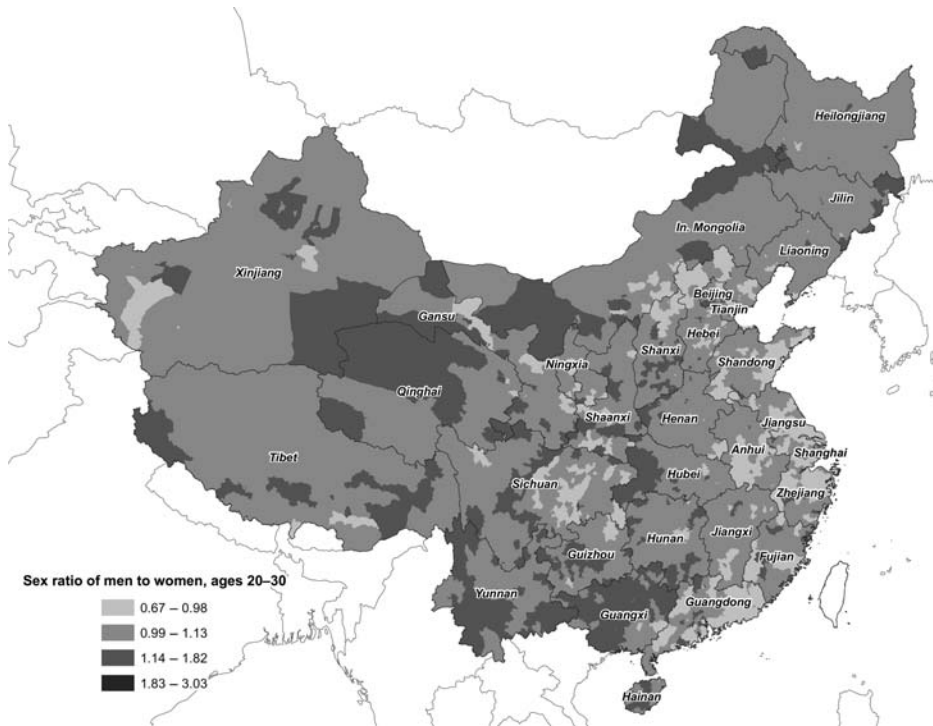
birth data are available.⁶ Fertility has been falling in China for decades, for a number of reasons. Improvements in health have improved the survival rates of children to adulthood, greater economic competition has increased the level of investment necessary for each child, and government policy has encouraged family planning to various degrees.⁷ This demographic transition, however, is made more profound by the policy climate in China, especially legislation regulating minimum age at marriage and the one-child policy. As birth cohorts age, they find that each successive generation is smaller than their own, giving rise to a kite-shaped age distribution in many Asian countries.

There is a discrepancy between the geographic areas with the highest sex ratios of children in China (map 1) and those with the largest shortage of women of marriageable age (map 2). The sex ratios of children—reflecting how strongly parents manifest a son preference—are highest in the Han majority areas of Eastern China. By contrast, the sex ratios at marriageable

6. In contrast, the 2008 revision of the UN *World Population Prospects* projection for China assumes that this level of sex ratio balance is not attained until 2050 (United Nations Population Division 2009).

7. Contraceptives, banned before 1953, became widely available after the government's first birth control campaign in 1957 (Hemminki and others 2005).

MAP 2. Sex Ratio of the Marriage Market, Ages 20–30



Note: The marriage market is defined as men ages 22–32 and women ages 20–30.
 Source: China National Bureau of Statistics (2000)

ages are highest in the non-Han regions to the west, south and north. These are also the more remote and poor regions of China, where employment opportunities have grown far more slowly than in Eastern China. If men living in regions with better economic prospects are able to draw brides from poorer areas, it would appear to provide additional evidence for the suggestion made by many observers that Chinese society tends toward hypergamy (marriage with a person of a higher social class or position; Parish and Farrer 2000).

Projecting the Number of Unmarried Men in China over the Next Century

Projecting the number of unmarried men in China depends on sex ratios in future marriage markets, which in turn depend on the sex ratios at birth of future cohorts and population growth rates. This section describes the derivation and results of population simulations that capture the anticipated effect of high sex ratios on the number of unmarried men over the 21st century.

Decline in fertility could exacerbate the impact of the sex ratio imbalance, since future cohorts of men would be unable to find brides in younger and

smaller cohorts. But fertility rates in China are still a matter of scholarly debate.⁸ The simulations presented here assume a total fertility rate of 1.45, based on China's National Bureau of Statistics (2005b) estimate from 2004 survey data, except where otherwise noted.⁹

The potential trajectories for the sex ratio at birth in China from 2006 to 2100 are summarized in four scenarios. The first scenario assumes an immediate correction in the sex ratio at birth to 1.06, which is overly optimistic but represents a lower bound for the analysis. The second scenario assumes that official policy such as the Care for Girls campaign is effective at stabilizing the sex ratio at birth at 1.09, a level identified as a government target, although there is no sign that this target will be achieved soon (Li 2007). The third scenario assumes that the sex ratio at birth in 2005 of 1.18 persists indefinitely, and the fourth scenario assumes a further deterioration of the ratio to 1.25.

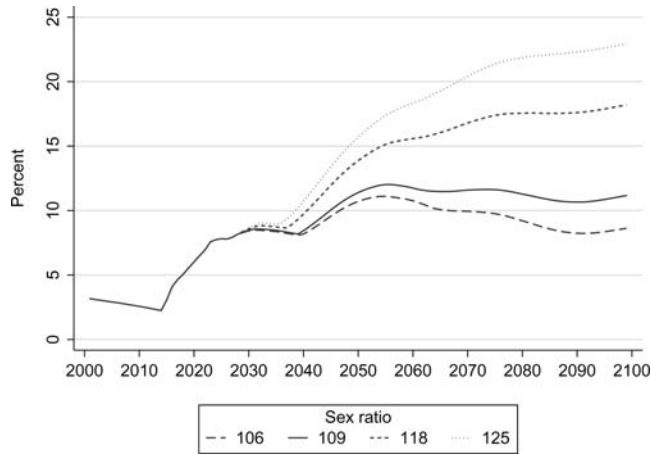
The simulation model allows for variations in fertility rates and the sex ratio of new births. The estimates here assume modest increases in fertility to 1.75 births per woman by 2010, although the choice of this date is not theoretically important. A return to replacement fertility without a concomitant adjustment in the sex ratio of new births will have only a minor effect in the long run on the percentage of the population failing to marry since it merely redistributes additional women to marginally older men (see Supplementary Appendix S1, at <http://wber.oxfordjournals.org/>, for additional fertility scenarios).

The simulations use age-specific mortality rates reported by Banister and Hill (2004) and essentially assume no improvement in life expectancy from 2000 onward. The marriage rule assumes that men marry all available women three years older or younger than they are until the supply of marriageable women is exhausted. Though a simplification of real marriage markets, the process nonetheless demonstrates the essential properties of a marriage market in which marriageable women become increasingly scarce because of both below-replacement fertility and an imbalanced sex ratio. The most realistic scenario that mitigates the serious consequences of the unmarried men

8. Data from the 2000 Census indicate a total fertility rate of 1.22 children in the prior year (China National Bureau of Statistics 2000). However, some argue that census officials were given misleading information out of a fear of punishment by parents who had violated the one-child policy (Retherford and others 2005). Such undercounting affects both fertility estimates and the observed sex ratio. However, Cai and Lavelly (2005) found that 71 percent of the missing girls in the 1990 census were still missing in 2000. Also, the sex ratio of children ages birth to 4 in 2000 conforms well to the male to female ratio of children ages 5–9 in 2005 (1.19) from the China National Bureau of Statistics (2005a) One Percent Inter-Census Population Survey of China. While not decisive, these findings suggest that the undercounting issue is surmountable. Additional values for these parameters were included in the analysis here because of the remaining uncertainty about the extent of the undercount phenomenon. Cai (2008) summarizes the debate on China's total fertility rate and estimates a value of 1.5–1.6, in line with other third-party estimates.

9. These projections forecast a continuation of current trends, including modest increases in fertility at all ages. Many forecasts predict a rapid return to replacement fertility rates (Peng 2004). A supplemental appendix to this article, available at <http://wber.oxfordjournals.org/>, explores the sensitivity of the results to different fertility scenarios (table S1.2). The crucial assumption is not how population changes, but how the relative supply of men and women will change as fertility changes, which will be affected by the population size but will be less important than the sex ratio at birth.

FIGURE 3. Share of Men Ages 25 and Older Who Fail to Marry, under Four Scenarios, 2000–2100



Note: The technical assumptions underlying marriage formation for the simulations are outlined in detail in Supplementary Appendix S1 available at <http://wber.oxfordjournals.org/>. The shares of unmarried men are evaluated for four possible trajectories for the sex ratio at birth, ranging from an immediate correction to 1.06 to a further deterioration to 1.25.

Source: Authors' analysis based on data from China National Bureau of Statistics (2000).

phenomenon is one that addresses both the sex ratio and fertility. To the extent that marriage norms may change, the simulations overestimate the percentage of men who fail to marry. However, assortative mating constraints are not imposed, so the failure to marry rate is underestimated. In the end, these competing influences should largely cancel each other out. The details of the matching algorithm and alternative specifications testing the sensitivity of these results are described in Supplementary Appendix S1.

The results of the simulation are presented in figure 3. Under baseline assumptions, the share of men ages 25 and older who fail to marry will exceed 5 percent by 2020. As the cohorts born in recent years enter the marriage market and some share inevitably fail to marry, the population of unmarried men will rise well beyond this level. In the most optimistic scenario, where the sex ratio returns to normal immediately in 2006, the share of men who fail to marry will stabilize at just below 10 percent in 2060. In the second scenario, unmarried men will represent roughly 10–12 percent of men ages 25 and older. In the third and fourth scenarios, where the sex ratio at birth persists at either 1.18 or 1.25, the share of men who fail to marry will peak above 15 or 20 percent.

To some extent, these outcomes can be mitigated by realistic increases in both the age at marriage and the age gap between spouses.¹⁰ This idea of demographic translation was introduced to describe the shift of the age-specific fertility distribution observed in the postwar baby boom era, but it also applies to the case of sex imbalance in marriage markets (Foster and Khan 2000; Ryder 1964). This view

10. Edlund (1999) demonstrates that son preference can account for increases in spousal age gaps and also the pattern of hypergamy.

holds that an excess of men over women in the marriage market can be fully compensated for by modest increases in men's age at marriage. Using an estimate of 15 percent excess men over women, it appears that the share of men who fail to ever marry can be kept close to the historical rate of 5 percent if the gap in age between spouses reaches eight years by 2050 (see also Supplementary Appendix S1).

This back of the envelope calculation neglects to consider that, because fertility rates are artificially held below natural replacement rates, each cohort of women entering the marriage market is smaller than the last. Indeed, the simulation results are highly sensitive to the assumption about the trajectory of fertility rates. With a return to a replacement fertility rate in the next decade, the impending problem of shortages of marriageable women can be averted, albeit by dramatic increases in both the age at marriage and the age gap between spouses.

However, there are few indications that the total fertility rate will rise to the natural replacement rate in the near future. The National Population and Family Planning Commission recently reaffirmed its intention to maintain the policy *status quo* for "at least another decade."¹¹ Moreover, the high sex ratios and smaller size of birth cohorts under the one-child policy imply that the age gap at marriage must increase until larger birth cohorts enter the marriage markets (some 25 years into the future, at the earliest), at which point any social upheaval associated with shortages of women and delay in marriage will already have occurred. In the more pessimistic scenarios, where the fertility rate remains around 1.45 and the sex ratio at birth remains above the natural rate, the age gap between spouses and age at marriage for men will necessarily rise *ad infinitum* as each cohort of men passes along the bride shortage to the next.

II. "BARE BRANCHES," HIV, PROSTITUTION, AND MIGRATION

In light of the large number of men who will delay marriage and who are anticipated to fail to marry, this section examines some of the potential negative impacts of high sex ratios.

In China during the early 1990s, growth in the number of people with HIV was concentrated among intravenous drug users and recipients of tainted blood transfusions. During the mid-1990s, however, HIV and AIDS began to spread to new regions and populations not previously considered at risk. As the population of single men rises, the transmission of HIV through risky heterosexual contact, particularly commercial sex activity, will become an increasingly severe problem.

Currently, the number of people who are HIV positive who contracted the disease through sexual contact is as large as the number who were infected through intravenous drug use. Individuals who contracted the virus from sexual activity represented half of all new infections in 2005 (China CDC and others 2006). The population that is HIV positive can be broken down into four groups. Intravenous drug users (90 percent of them concentrated in far western

11. Jim Yardley, "China sticking with one-child policy," *New York Times*, March 11, 2008. Retrieved from www.nytimes.com/2008/03/11/world/asia/11china.html?_r=1.

and southern provinces) account for 44.3 percent of infected people, and those infected through sex account for 43.6 percent (China CDC and others 2006).¹² The third group, those who donated or received blood from commercial blood donors, account for 10.7 percent, and the remaining 1.4 percent of infected people are those who were infected through mother-to-child transmission.

Considering the impending demographic pressures as heavily male birth cohorts enter adulthood and encounter shortages of marriageable women, female sex workers are an important at-risk group that has been understudied as an HIV vector. In the 1980s, sex workers represented a small share of the population, but between 1990 and 2000, prostitution expanded rapidly. Current estimates range from 1 million women whose primary income comes from commercial sex to up to as many as 10 million women engaging in paid sex of some kind.¹³

Recent evidence indicates that Chinese men are more likely than U.S. men to have paid for sex and that young Chinese men are more likely than older men to have visited a prostitute: 12.6 percent of men ages 21–30 and 8.8 percent of men ages 31–40 have been to a prostitute.¹⁴ Moreover, Chinese men are less likely than their U.S. counterparts to report that they use condoms regularly, which places them at higher risk of sexually transmitted infection. While HIV rates among prostitutes are difficult to measure, the HIV prevalence rate among sex workers in Guangdong, Guangxi, and Yunnan provinces was as high as 11 percent in 2000,¹⁵ and it seems reasonable to assume that the risky sexual practices of illegal sex workers place them at higher risk of exposure.¹⁶

While not all single men will patronize sex workers, and married men will also pay for sex, documenting the relationship between demographic change and commercial sex activity is important, as the population of single men will grow in the years to come.¹⁷ Identifying specific groups of men who are more prone to patronize sex workers is also important because of the need to target public health interventions to the groups most at risk.

To analyze the relationship between numbers of men in at-risk groups and commercial sex activity, data from the Chinese Health and Family Life Survey were used to calculate the percentage of men reporting having paid for sex, for

12. The provinces with the highest levels of intravenous drug use (90 percent of it heroin) are Yunnan, Xinjiang, Guangxi, Guangdong, Guizhou, Sichuan, and Hunan. The share infected through sex includes those who contracted HIV from sex with a sex worker (19.6 percent of the total number of people infected with HIV), from an infected partner (16.7 percent), and from sex with men (7.3 percent).

13. Maureen Fan, "Oldest profession flourishes in China," *Washington Post Foreign Service*, August 5, 2007. Retrieved from www.washingtonpost.com/wp-dyn/content/article/2007/08/04/AR2007080401309.html.

14. Authors' calculation from the Chinese Health and Family Life Survey data (Population Research Center 2000). For comparable estimates, see Parish and Pan (2006).

15. This calculation is based on sex workers in detention centers, since prostitution is illegal in China (Settle 2003).

16. See Merli and others (2006) for an epidemiological model of sexual transmission of HIV in China.

17. To date, research has not been conducted on the relationship between the size of the single-male population and the supply of sex workers. While most researchers assume that the population of sex workers will increase as demand for their services increases, it could also be the case that the marriage squeeze for men may improve the marriage prospects of female sex workers and thereby take them off the sex market. This is a promising area for future research.

six regions (Population Research Center 2000). Paying for sex was most common in the coastal southern region, encompassing the provinces of Fujian and Guangdong, followed by the coastal eastern region including Jiangsu, Shanghai, and Zhejiang Provinces and the far northeastern provinces bordering the Democratic People's Republic of Korea and the Russian Federation. The majority of counties where a high percentage of men report having paid for sex tend to be counties with high percentages of single men. (Data on commercial sex activity are unavailable for Inner Mongolia, Tibet, and Xinjiang provinces.)

Among single men, young migrant construction workers make up a distinct at-risk population who are particularly likely to pay for services from low-cost female sex workers and are less likely to be educated about sexually transmitted infections and condom use (Garfinkel and others 2005). A pronounced relationship is found between the density of construction activity and the prevalence of commercial sex activity. In the urban provinces of Guangdong, Fujian, Jiangsu, Shanghai, and Zhejiang, more than 7 percent of men report having ever paid for sex. These and other areas of dense concentration of the construction industry, such as northern Shandong Province and the counties surrounding Beijing, merit particular attention from public health policy.¹⁸

The potential for an increase in HIV infection rates fueled by migrant workers has attracted the attention of many researchers. Tucker and others (2005) present compelling evidence that rising rates of sexually transmitted infection in cities are due to the sexual practices of migrant workers, who are demographically similar to the men who are projected to fail to marry: poor, uneducated, and single. Chen and others (2007, p. 1658) analyze HIV rates among a sample of patients being treated at 14 Guangxi clinics for sexually transmitted infections and conclude that "China's imbalanced sex ratios have created a population of young, poor, unmarried men of low education who appear to have increased risk of HIV infections." A multivariate analysis of factors that affect HIV status yields an odds ratio of 1.7 for single people relative to those who are married and 1.4 for men relative to women.

To determine how migration might affect the transmission of HIV, especially migration to China's growing urban centers, it is helpful to examine current and expected migration patterns. Comparing the geographic distribution of sex ratios at birth with the distribution of sex ratios among the current adult population reveals the regions from which migration is likely to occur in the future (see maps 1 and 2). Particular attention should be paid to counties where the sex ratio is abnormally high and where HIV prevalence is also high, such as the southwestern provinces of Guangdong, Guangxi, and Yunnan (Lu and others 2006). As the cohorts of men younger than 15 enter adulthood and experience demand–supply imbalances in marriage markets, the likelihood of commercial sex encounters and other risk-taking behavior increases. This dynamic is likely to be strongest in areas where the risk of contracting HIV is highest. At the same time, as women migrate

18. The results for men in the construction industry are included in Supplementary Appendix S2.

TABLE 2. Share of Men Ages 25 and Older Paying for Sex, and Simulated HIV Prevalence in the Entire Population, by Sex Ratio at Birth, 2000–30, 2050, and 2070 (percent)

Category	Sex ratio at birth									
					1.06		1.09		1.18	
	2000	2010	2020	2030	2050	2070	2050	2070	2050	2070
Paid for sex	6.28	6.92	7.78	8.35	8.36	8.26	8.42	8.40	8.59	8.76
HIV prevalence	0.031	0.046	0.065	0.076	0.093	0.095	0.094	0.097	0.097	0.103

Note: The simulations profile behavior based on the age, sex, and marital status of the population. Rates of having paid for sex in these groups are imputed using calculations from the 1999/2000 Chinese Health and Family Life Survey (Population Research Center 2000). The HIV simulations assume an odds ratio of 1.4 of men to women and a 1.7 odds ratio of single to married individuals (Chen and others 2007). The total count of HIV positive population in 2000–10 by this method is between the low and medium estimates of the Joint United Nations Program on HIV/AIDS (UNAIDS, various years). Results before 2030 do not differ appreciably by sex ratio at birth because of known characteristics of the population in 2000.

Source: Authors' analysis using data from China National Bureau of Statistics (2000).

to wealthier coastal cities to maximize their marriage prospects, these young men will also face pressure to migrate to cities, and both groups could bring HIV from the countryside to cities. Results by Yang (2006) confirm fears that male migrants experience elevated rates of HIV infection.¹⁹

The connections between cohort-specific sex ratios, prostitution rates, and HIV transmission are complex, but it is clear that these factors are all responsible for the rising HIV rates in China. Given the correlation between percentages of unmarried men and commercial sex activity, how will the increase in sex ratios and the ensuing failure of many men to find marriage partners affect markets for sex? The results of a simple simulation show how the incidence of prostitution might evolve (table 2). The simulation projects the share of men who pay for sex, assuming that the gender, marital status, and age-specific rates of having paid for sex found in 2000 persist during the 21st century. The Chinese Health and Family Life Survey finds that 14.7 percent of single men and 7.3 percent of married men admit to having paid for sex in 2000

19. A study by Parish and Pan (2006) found no significant difference in the risk of HIV contraction between urban men and low-status male migrants. If confirmed, this could mean a reduced likelihood that male migrants will carry HIV to cities, although female migrants may still play the same role. Many migrants may eventually marry, which could decrease the spread of HIV (by reduced prevalence of commercial sex or by containing the geographic spread of HIV if migrants return home to marry). Many men will lack the means to migrate to urban regions or will leave the city after a time with new wealth and marry at home. An anonymous reviewer noted that poor rural men have been less likely to migrate and that those that do migrate are still more likely to partner with women in their home region. Going forward, it can be expected that rural men who migrate to cities will be forced to compete with urban men for sex and mates and therefore will be more likely to visit prostitutes, presenting a problem even if these men eventually return home with wealth and marriage prospects. The conflicting results leave room for further study.

(Population Research Center 2000).²⁰ That information, plus the age profile of commercial sex activity, can be used to calculate a hazard rate of the chance of visiting a prostitute over the life cycle.

Although this calculation is admittedly imprecise, in that current rates of having paid for sex represent a lower bound on the future prevalence of prostitution (due to increased levels of future migration from rural to urban areas), the results show an increased demand for commercial sex among Chinese men. Assuming continuation of current behavior patterns, increases in the sex ratio at birth will create a modest increase in the share of men paying for sex. Changes in policy, income, or sexual culture will likely be more important in the future. Nevertheless, the simulations indicate that, almost immediately, demographic change alone will contribute to 2–3 percentage point increase in the share of men paying for sex in the next 30 years.

The simulations of how demographic change will affect China's HIV infection rate in the 21st century assume that the unknown hazard rate for HIV infection by age and sex generates 650,000 cases (the current estimated number of HIV cases in China) when applied to the population ages 22–40 in 2006. The share of the population that is HIV positive is then imputed to each cohort by sex, age, and marital status using the odds ratios from Chen and others (2007). Thus, these simulations attempt to model how HIV infection rates will change driven solely by changes in the demographic structure of China as cohorts with higher percentages of single men enter their sexually active years. The results indicate that the infected population will increase precipitously over the next 30 years and stabilize at a higher rate of infection. As with the results for patronage of commercial sex, the effect of variation in the sex ratio at birth on HIV transmission is limited. Variation in the sex ratio at birth between 1.06 and 1.25 (not shown) results in HIV infection rates in 2050 of 0.93–1.05 per 1,000. The greatest increase in HIV incidence, from 0.3 infections per 1,000 in 2000 to 0.76 per 1,000 in 2030, is a result of momentum from the known characteristics of the population in 2000.

While these projections do not incorporate increases in the probability of contracting the disease that might result as more people become infected, they also do not assume any improvement in preventive behavior. Since the Chinese government is beginning to respond to the impending HIV crisis, there is reason to hope that these projections are overly pessimistic. The central government and local authorities show signs of recognizing the growing role of sex workers in HIV transmission, and several pilot projects promoting safer sex (practices such as condom use) are in place in Beijing, Fujian, Hubei, Jiangsu, and Yunnan. Government budget allocation for HIV/AIDS efforts grew from approximately \$12.5 million in 2002 to about \$100 million in 2005 and \$185

20. These percentages are derived from a regression of an indicator for having paid for sex on several demographic control variables, including marital status. See also the discussion of similar results for these data in Parish and Pan (2006).

million in 2006.²¹ The government is also treating more cases of HIV, with projects such as the China Comprehensive AIDS Response (CARES) campaign, a program initiated in 2003 to supply domestically manufactured antiretroviral AIDS medication free to anyone who contracted the disease through tainted blood transfusions. The effectiveness of such efforts will be critical in containing the virus as the sex ratio rises and the percentage of those who are married falls among the sexually active population.

III. SUPPORT OF THE CHILDLESS ELDERLY

This section examines the impact of China's changing demographic structure, with a growing population of unmarried and potentially childless men, on its ability to care for its elderly. China's age distribution in 2000 exhibits two pronounced spikes, both emerging as a legacy of its demographic transition (figure 4). In the 1960s, the total fertility rate exceeded 6, and this baby boom resulted in a large cohort of people ages 30–40 in 2000.²² The second baby boom occurred when these cohorts began to have children, and so the number of children born in the 1990s was also large. However, in the wake of government-mandated fertility control, each successive cohort in China has been smaller than the previous one.

Although China's population is more than four times that of the United States, it has less than three times as many births.²³ In 2030, the children born in the second baby boom of the 1990s will still be in their most productive working years and presumably will provide support (fiscal or otherwise) for the elderly. However, by 2050, the population forecast for China is far worse than that for the United States (see figure 4).²⁴ The elderly dependency ratios will be alarmingly high in China, with large numbers of people entering old age without young workers to replace them. In contrast, even without further immigration, the United States can anticipate a more favorable age distribution by 2050, with a relatively young workforce and very few baby boomers left in the population of elderly.

While retirement funding for social security programs in urban areas is receiving research and analysis, the looming problems among the population of rural peasants—who make up roughly 70 percent of China's 1.3 billion

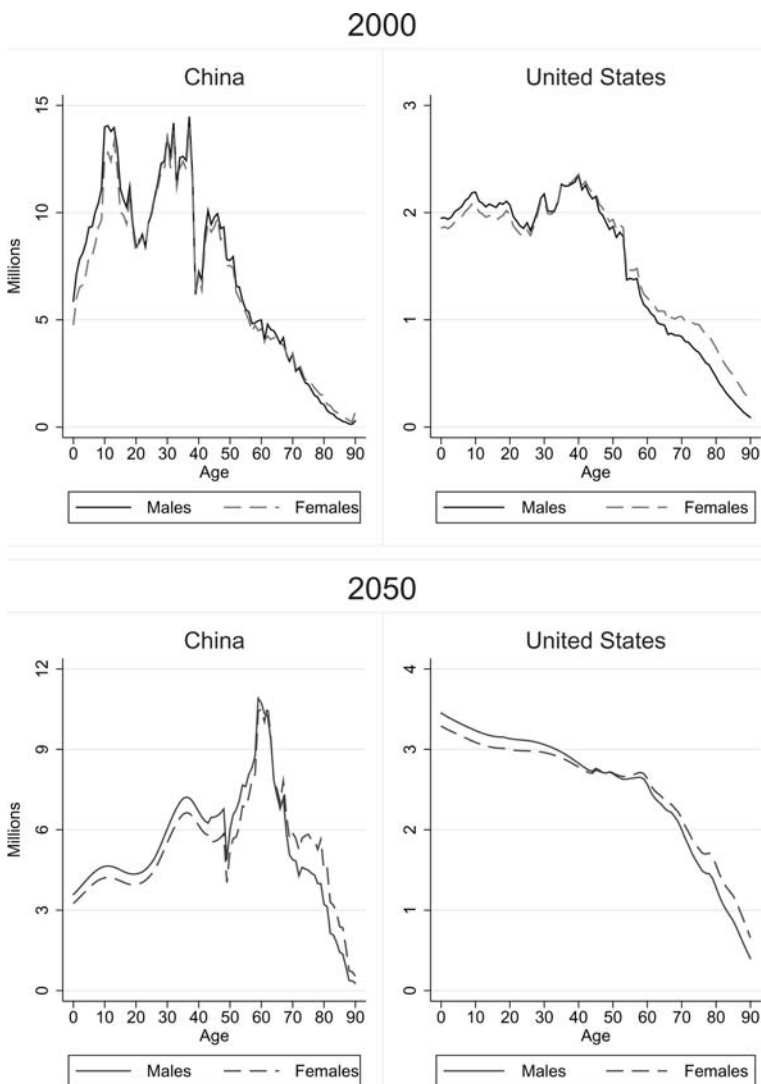
21. "Spending on HIV/AIDS prevention set to double," *China Daily*, December 28, 2005. Retrieved from www.chinadaily.com.cn/english/doc/2005-12/28/content_507212.htm.

22. Some researchers identify this bulge in the population as one explanation for China's recent rapid economic growth. This phenomenon, when a large cohort of workers, preceded and followed by smaller cohorts reaches its most productive period in the labor force, is known as the "demographic dividend."

23. In China, only 10.6 million children were born in 1999 (and survived to 2000) compared with 3.8 million in the United States.

24. As projected in Alternative Scenario I of the 2007 Trustees Report by the U.S. Social Security Administration (U.S. SSA 2007).

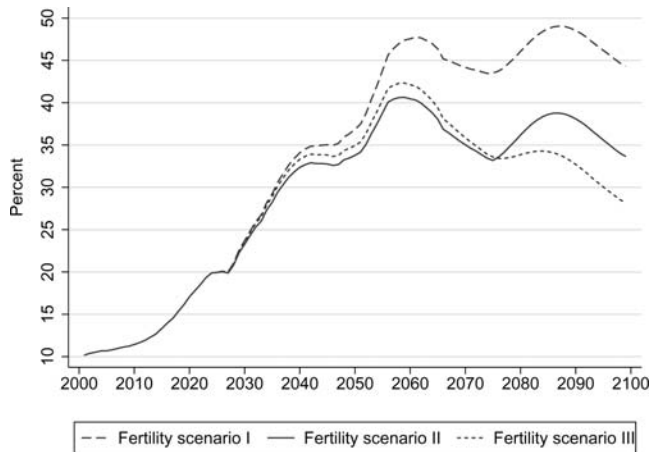
FIGURE 4. Age Structure in China and the United States in 2000 and 2050



Source: For China, authors' simulations based on data from China National Bureau of Statistics (2000); for the United States, authors' analysis based on data from 2000 Census and projections by the U.S. Social Security Administration (U.S. SSA 2007).

people—are potentially much larger, even though there are no explicit financial promises to this population, such as social security or government-provided medical care. As Lee (1994) discusses, the allocation of resources for old age support can be mediated by financial markets, public sector programs, or intra-household transfers. In the absence of financial wealth or social insurance, most of the elderly in rural China rely on intrahousehold transfers. A recent

FIGURE 5. Share of China's Population Ages 65 and Older, 2000–2100



Source: Authors' simulations as described in the text.

survey of heads of rural households found that 62 percent anticipate that their children will be the primary source of elder care, while only 29 percent list personal savings as the anticipated source of support.²⁵ Inadequate preparation for old age among the rural peasant population may lead to severe financial hardship and consequently to political instability. Already, China's growing income divide between urban and rural residents is arousing concern. Differences in access to financial resources and social insurance may well contribute to this problem as the population ages and the need to provide for the elderly becomes more pressing.

Combined with the findings in the following section on asset accumulation by marital status, the failure to marry could have severe consequences for the distribution of wealth among elderly men. Men who are able to marry and have children will be distinctly advantaged over those who must delay their marriages until old age or who remain unmarried. The financial markets and public sector programs necessary to guarantee equity by replacing the intrahousehold transfer system are not in place. Thus an important area for future development is the creation of public or private investment mechanisms for men facing extended singlehood to provide for their health and financial well-being in advanced age.

The share of elderly in China will rise dramatically during the 21st century (figure 5). By 2060, when the very large cohorts come of age, China's over-65

25. Authors' calculation from the 2002 Survey of Rural Households in China (China National Bureau of Statistics 2002). A smaller share of people ages 20–30 list children as their primary source of old age support, but the share is still over half (51.3 percent).

population will exceed 35 percent of the overall population.²⁶ This aging of the population occurs against the backdrop of an emerging generation of unmarried, childless men.²⁷ China's traditional cultural assumption is that the elderly are cared for by their children, and living patterns and fertility decisions are predicated on the presumption of familial support. The state has made some effort to promote retirement homes (*yang lao yuan*), especially in rural areas, but these efforts have met limited social acceptance or private investment interest.²⁸

China's population aging over the next 50 years has already been determined by the current age structure. It will coincide with the emergence of a new group of permanently unmarried men that will impose a large and increasing cost on Chinese society, especially in 2050 and beyond. This problem, common to all countries with a below-replacement fertility rate, is especially acute where selective abortions have altered the sex ratio. A preference for sons in China is at least partly economic, since sons have traditionally been the most important source of old age support. Increased acceptance of daughters could reduce welfare in old age if the additional girls are a couple's only child and if virilocality remains a social norm. In China, however, unlike in Italy or Japan, for example, the possibility of fertility returning to the replacement level seems much brighter because in China fertility may be significantly more responsive to public policy changes.²⁹ Actions taken today to allow Chinese to have larger families could improve the support ratio and might also allow more couples to have a son without resorting to sex selection, thus helping to reduce the number of unmarried men in these cohorts.

IV. MARITAL STATUS AND WELFARE

This section examines the relationship between welfare and marital status, documenting the greater poverty, poorer health, and shorter life expectancy among men who fail to marry, and possible developments in household bargaining between spouses.

The Census and the China Household Income Survey indicate that failure to marry is associated with lower income, less financial wealth, and poorer health (table 3 and Supplementary Appendix S2, table S2.1). The selection of healthier, higher earning men into marriage is partly responsible,³⁰ although there

26. The 2008 revision of *World Population Prospects* projects that 23.3 percent of the population will be 64 or older in 2050 (United Nations Population Division 2009). The comparable figures for the United States are 20.8 percent in 2050 and 21.6 percent in 2060 (U.S. SSA 2007, Scenario II).

27. Divorce or out of wedlock births are uncommon in China, so for most of these men, a failure to marry because of a shortage of women will imply a failure to have children.

28. "China vows to promote home care for elderly" *Xinhua News Agency*, February 22, 2008.

29. Supplementary Appendix S1 presents results of the model for several scenarios that assume a more rapid or slower pace of fertility growth, reaching replacement level at different dates.

30. Lillard and Panis (1996) present evidence that, in the United States, less healthy men marry earlier and remarry more quickly following divorce, suggesting that negative selection into marriage by health is also a potential confounding factor.

TABLE 3. Marital Status and 10-Year Mortality Rates of Men, by Age Groups

Age group	Ever-married men (percent)	Never-married men (percent)	Difference (percentage point)
55–59	14.3	15.2	–0.9
60–64	25.7	39.1	–13.4
65–69	41.3	51.3	–10.0
70–74	59.6	67.5	–7.9
75–9	77.1	86.1	–9.0

Source: Authors' analysis based on data from China Population and Information Research Center (1990) and China National Bureau of Statistics (2000).

is some evidence in other countries that men's wages rise after marriage, suggesting a causal link (Korenman and Neumark 1991).

Even after controlling for a respondent's age, education, ethnicity, and prefecture of residence, men in China who fail to marry have a third less income, live in households with an eighth less wealth, and are 11 percentage points less likely to describe themselves as being in good health than are men who marry. While the causal link between marriage and welfare outcomes has not been established in China in the period of interest,³¹ marriage could theoretically improve health among married men through reductions in risky behavior and economies of scale in household welfare (Drèze 1997; Lanjouw and Ravallion 1995; Lillard and Panis 1996). A link between marriage and welfare is especially likely in China, because social insurance programs are limited and familial support is correspondingly critical to welfare.

The poor financial and health status of unmarried men observed in the survey particularly manifest in perhaps the most important measure of welfare—life expectancy. Implied mortality rates of men who married and those who did not between 1990 and 2000 were calculated by comparing the number of men in the 1990 and 2000 census data by marital status and calculating the survival of the artificial cohort (table 3).³² Never-married and ever-married men who were ages 55–59 in 1990 had similar mortality patterns, but at older ages the never-married men had higher mortality rates. For example, among men ages 65–69, the mortality rate was 10 percentage points higher for never-married men, and less than half of the never-married men survived to the 2000 Census.

The welfare cost of poor health and high mortality for this population of unmarried men suggests that the high sex ratio at birth could indirectly reduce

31. For other countries, Hu and Goldman (1990) find significant mortality differentials by marital status (China is not included in their analysis).

32. This calculation assumes that men do not marry for the first time past the age of 55. First marriage beyond 50 is not observed among any of the respondents in the 0.1 percent sample of the 2000 Census (China National Bureau of Statistics 2000).

the quality and shorten the duration of the lives of never-married men. While the Chinese preference for sons results in high mortality rates for girls during pregnancy and infancy, if the relation between marriage and health proves to be causal, the outcome could be elevated mortality in later years for men unable to marry because of the shortage of women resulting from the earlier high mortality rate for unborn and infant girls.

It could also be the case that the shortage of female partners could lead to increased competition for brides, which could result in behaviors, including investment in education, that improve the health and well-being of men.³³ As the marriage market tightens, competition for scarce women may increase the bargaining power of married women as well as single women. Evidence from outside China has shown that greater bargaining power of women, which can result from gender mismatch in the marriage market, can positively affect family health and welfare outcomes. These benefits, of course, would accrue to men who find marriage partners but not to those who remain single throughout their adult years.³⁴

The evidence presented here suggests that China's demographic change in the 21st century will be dramatic and that difficulties in supporting China's large elderly population will be compounded by high sex ratios, which will deny childless men intergenerational support.

V. POLICY RESPONSES TO THE SHORTAGE OF FEMALES IN CHINA

This section briefly summarizes the Chinese government's policy response to the problems associated with the high sex ratio and discusses its consequences and possible alternatives.

When the one-child policy was introduced in 1979, China was only 20 years removed from the Great Leap Forward and the associated famine. Today, China is rapidly industrializing and experiencing the growth of a country that can easily feed its estimated 1.3 billion people. If current trends continue, the population is set to begin declining within the next 20 years. While overpopulation is no longer a pressing concern in China, the potential consequences of the legacy of missing girls is of immediate importance.

The alarming increases in sex ratios at birth revealed in the 2000 census spurred the Chinese government to action, and several programs were

33. An alternative strategy to reduce this uncertainty by identifying the causal direction for marriage and health involves finding a factor that affects marriage probability but otherwise has no influence on welfare. An instrument for marriage is difficult to find in China, since the factors affecting marital success are so closely related to factors that affect welfare. Panel data would also be useful in disentangling causality. The regression model presented in table S2.1 in Supplementary Appendix S2 includes controls that are important determinants of marital outcome and explain a good deal of variation in marital probability in reconstructed cohorts from cross-sectional data.

34. For details, see Lundberg and Pollack (1996) and Rao and Greene (1996).

implemented to address the female deficit. The government's response can be classified into two primary strategies: increasing the value of girls in the minds of parents and reducing the availability of sex-selection technology. The Care for Girls campaign identified 24 counties with extremely high sex ratios and provided incentives to reduce the female deficit, including free public education for girls. Preliminary indications are that these programs are having an effect. In a joint venture of the Ford Foundation and the United Nations Children's Fund (UNICEF), the Chaohu Experimental Zone Improving Girl-Child Survival Environment, established in 2000, succeeded in lowering the sex ratio at birth from 125 in 1999 to 114 in 2002 (Li 2007). The government is currently expanding the Care for Girls campaign to a national initiative. In 2004, President Hu Jintao declared that the campaign was a top priority and that the government would work strongly to stop any further rise in the country's sex ratio at birth over the next three to five years (Li 2007). Zhang Weiqing, director of China's population ministry, estimated that it would take 10–15 years to return China's sex ratio to natural level.³⁵

In a second strategy, China is cracking down on sex-selective abortion. Several legislative initiatives aim to curb the practice and to punish offenders. The first statutory prohibition on sex-selective abortion came in 1989, and the most recent family planning law of 2002 bans the use of ultrasound or other technologies to determine fetal sex. If parents are caught aborting a child on the basis of sex, health professionals performing the operation are penalized and parents forfeit any right to have another child (Hemminki and others 2005). In 2006, the government shuttered several fertility clinics for violating the policy.³⁶ Despite these efforts, however, the sex ratio at birth was 1.18 in 2005, near the all-time high. Enforcement has been weak and uneven, possibly due to the overriding obligation of local governments to meet stricter population growth targets. The perceived need for a national policy campaign hints at an acknowledgment that sex-selective abortions have occurred, and the timing of higher parity births is further evidence that the practice has continued (Ebenstein forthcoming).

Efforts to improve funding for old-age security programs have been limited in scope and have focused on urban areas (Wang 2006). Very limited efforts have also been made to provide insurance in rural China, but they are insufficient for dealing with the looming old age crisis. In light of this concern, policy efforts should be made in two directions. First, China must acknowledge the implicit obligation to the large elderly rural population forecast for the next generation, since this generation's fertility has been too low to enable reliance on the traditional intrahousehold mechanisms of elderly support. Expanding

35. Interview transcript "Xinwenban jiu jiaqiang jisheng gongzuo he renkou fazhan zhanlv deng dawen," *Zhongguo zhengfu wang* of January 23, 2007. Retrieved from www.gov.cn/zhibo49/wzsl.htm.

36. Joseph Kahn, "China: crackdown on abortion of girls," *New York Times*, June 1, 2006. Retrieved from www.nytimes.com/2006/06/01/world/asia/01briefs-brief-003.ready.html?_r=5.

efforts to provide old age support and to collect the revenue to fund these initiatives is a top priority. Second, the Chinese government might want to consider revising its fertility policy. The simulations presented here suggest that the situation will deteriorate precipitously under the current policy, and higher fertility in the next decade would help smooth China's age distribution. Allowing extra births today will slow China's demographic decline and establish a larger supply of workers who could be taxed to fund the baby boom generation when they reach retirement.

The Chinese government's recent actions to provide contraception and care for those infected with HIV are promising developments, but actions to contain the spread of the disease must focus on the large and growing number of unmarried men who are at risk. China's legacy of missing girls will have a dramatic effect on Chinese society in the 21st century, with increased internal migration and rising demand for commercial sex all but unavoidable. Government action is unlikely to effectively reduce the prevalence of commercial sex, and so policy should aim to reduce the danger of this activity by raising awareness of the risk of contracting HIV and increasing the availability of condoms, especially in regions that attract unmarried men. Although China's HIV rates are still low, failure to act soon could prove costly, and HIV might be difficult to contain once it spreads to these unmarried men.

The future course of Chinese policy is yet to be determined. Central government planners, acknowledging the need to address the son preference, have chosen to do so through education campaigns, punishment for sex-selective abortions, and economic incentives for raising daughters. Although the one-child policy is subject to periodic review, its current fertility targets were recently reaffirmed despite the desirability of higher fertility for several reasons.³⁷

The results presented here on some of the potential negative welfare consequences to having large numbers of men who fail to marry suggest at least two strategies: increasing fertility, thereby reducing the demand for sex-selective abortions and slowing population aging, and increasing legal and social incentives for raising daughters.³⁸ The discussion on revising the one-child policy has begun (Wang 2005). Many scholars have identified clear links between the one-child policy and the high sex ratio at birth over the last 20 years, and so an associated benefit of allowing higher fertility could be a mitigation of the costs presented here. The simulations presented here also suggest that an impending imbalance between working age and elderly cohorts in China could be offset somewhat by higher fertility rates. The simulations also indicate the need to act quickly. Even if action is taken immediately, China will still have to manage

37. Alexa Olesen, 2007, "China sticking to one-child policy," Associated Press, January 23, 2007. Retrieved from www.washingtonpost.com/wp-dyn/content/article/2007/01/23/AR2007012300398.html.

38. And reducing incentives for bearing sons, as might be expected to occur with increased institutional support for elderly and retired workers.

the highly skewed sex ratios in cohorts born over the last 20 years. Addressing this problem for the second half of the 21st century requires action today.

VI. CONCLUSION

The most significant unexpected consequence of China's one-child policy is the decline in the number of female children born to parents who are subject to strict fertility limits. In time, these missing girls will result in increasing tightness of the marriage market, with mixed consequences. This article attempts to establish the magnitude of the expected imbalance as boys born during the years of abnormally high sex ratios at birth and below-replacement fertility rates enter the marriage market and find a dearth of female partners. Three of the most important consequences of this phenomenon are the impact on prostitution, internal migration, and HIV transmission; the undermining of traditional old-age support mechanisms; and the impact on the health and well-being of men in the event of an increase in the failure to marry or, in demographic terms, in the lifetime celibacy rate.

As sons born during the years of skewed sex ratios reach adulthood and are unable to find marriage partners, the dangers associated with increased commercial sex may translate into higher HIV incidence. Simulations, using what is known about sexual preferences and practices, extrapolated increases in patronage of sex workers and the incidence of HIV. The imbalance in sex ratios of adults of marrying age will result in increased opportunities for women who migrate from rural areas to marriage markets in wealthier areas but will also put pressure on the men who are left behind to migrate to cities or to engage in risk-taking behaviors, such as drug use and commercial sex. The result could be the transmission of HIV from areas of high prevalence in southwestern and central China to urban centers that have been insulated so far. The share of men ages 25 and older who have paid for sex is projected to rise from 6.5 percent to 8–9 percent, and the HIV incidence rate is projected to rise from 0.3 per 1,000 to 0.8–1.1 per 1,000. Because of demographic changes already in motion, variation due to future fluctuation in the sex ratio at birth is likely to be minor compared with that due to government policies.

China has historically relied on family support systems for the elderly, with parents residing with their adult sons. Although the one-child policy might generate economic benefits in the short term, as a relatively larger group of young men are employed, in the longer run it means that a growing share of aging, never-married men will have no family to support them in their old age. The share of the population ages 65 and older is projected to peak between 2050 and 2060 at more than 35 percent. Without initiatives to fund the retirement of childless men, a large share of today's young men will face a tenuous existence as they age. There are additional concerns about the welfare of single men

before they retire, as research has found positive mental and physical health effects associated with marriage, regardless of marital fertility.³⁹

Central government planners have tried to use incentives to encourage families to have daughters without increasing fertility. These measures will ease but cannot solve the problem of marriage market tightening for generations born since 1982. Without a suitable policy response, improvements in the sex ratio will not address the problems faced by retirees without family to provide support in advanced age. Of all of the demographic consequences of China's missing girls, the possibility of an AIDS epidemic has attracted the most attention among policy planners.⁴⁰ In the near term, major adjustments in marriage market matching behavior are likely, and absent a comprehensive policy response, a historically unprecedented population of men will likely suffer health and income setbacks as a result of their failure to marry.

This article finds considerable room for government policy to improve the likely effect of demographic trends on the spread of HIV. Also, vigorous efforts to reduce son preference are showing initial success (Das Gupta, Chung, and Li 2009). Without timely reform of elderly support systems to capitalize on the current surplus of working-age population, adjustments in total fertility and a substantial shift toward equalization of the sex ratio of new births will be crucial while these trends are still reversible, or the impending problems for China's *guang gun* will not be averted.

SUPPLEMENTARY MATERIAL

Two supplemental appendixes to this article are available at <http://wber.oxfordjournals.org/>.

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