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Demographic Consequences of Gender Discrimination in China: Simulation Analysis of Policy Options

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Abstract

The large number of missing females in China, a consequence of gender discrimination, is having and will continue to have a profound effect on the country's population development. In this paper, we analyze the causes of this gender discrimination in terms of institutions, culture and, economy, and suggest public policies that might help eliminate gender discrimination. Using a population simulation model, we study the effect of public policies on the sex ratio at birth and excess female child mortality, and the effect of gender discrimination on China's population development. We find that gender discrimination will decrease China's population size, number of births, and working age population, accelerate population aging and exacerbate the male marriage squeeze. These results provide theoretical support for suggesting that the government enact and implement public policies aimed at eliminating gender discrimination.

Keywords

Gender discrimination; Public policy; Simulation; Aging; Marriage market

Background

The strict patrilineal and patrilocal family system in China causes the Chinese family to exhibit son preference in childbearing behavior (Das Gupta and Li 1999). The strong son preference and discrimination against females produce rising sex ratios at birth (SRB) and excess female child mortality (EFCM). The recent increase in SRB is related to ubiquitous son preference, and is exacerbated by China's strict family planning program (Poston et al. 1997). EFCM is a consequence of discriminatory practices against female children in the context of this strong son preference (Li et al. 2004).

Abnormally high SRB and EFCM exert far-reaching effects on many aspects of China's demography, including population size, the number and well-being of the elderly, the

working age population, the number of births, and the marriage market (Cai and Lively 2003; Attané 2006). In addition to the attention paid by scholars to gender discrimination and its consequences, China's government at all levels has developed various direct or indirect policies to control the rising SRB and to improve the living environment for female children (Li 2007; Hvistendahl 2009). Public policies may affect the extent of gender discrimination and in turn China's SRB and female child mortality. However, insufficient attention has been paid to the effect of SRB and EFCM on other important features of China's demography (Cai and Lively 2003). This paper simulates China's demographic trends as functions of public policies concerning SRB and EFCM. In so doing we explore the effects of gender discrimination on China's population development, in order to provide a theoretical basis for policy suggestions aimed at lowering son preference and eliminating gender discrimination. The paper has four sections. First, we analyze the causes of gender discrimination and its demographic and social consequences. Second, we describe policies already taken by the Chinese government and those we propose in this paper. Third, we devise and analyze simulation models using demographic data. Finally we discuss these numerical results and their policy implications.

Causes and Consequences of Gender Discrimination

China's gender discrimination has profound social roots, and exerts far-reaching effects on China's population and social development. See Fig. 1 for the general outline.

Causes of Gender Discrimination

The strict patrilineal family system bestows on male descendants economic, socio-cultural, and religious benefits and obligations which create preference for sons. State policies also affect gender equity (Murphy 2003). Thus son preference and discrimination against girls are affected by institutions, culture, economy, and public policies (World Bank 2002, p. 40).

First, strict patrilineality, patriarchy, and patrilocality determine the dominant status of male children in inheriting property, in living arrangements, in continuity of families, and in family power structure. Women must depend on men, which results in women's low status within the family (Das Gupta and Li 1999). If male-dominated within-family power structure is replaced by institution of laws, ideologies, and resource allocation that are still dominated by males, then the control over women is transferred from the domain of private patriarchy to that of public patriarchy. Thus private and public patriarchy combine to produce a system which places women in a subordinate position (Chow and Berheide 2004, p. 313).

Second, China's traditional culture is based on Confucianism, which entails that continuity of the family line is an indispensable part of China's traditional childbearing culture, leading to the preference for male descendants. This cultural pressure of son preference exerts a more important effect than economic factors on childbearing decision-making; thus the problem cannot be solved solely by economic development (Chu 2001).

Third, in China, especially in rural China, the social security system is far from sound. In the countryside today, the family is still the dominant provider of old-age support. The traditional gender division makes women economically dependent on men (Chow and Berheide 2004, p. 142–143). Partly due to this economic dependence, married-out daughters provide mainly auxiliary help such as emotional support and help with daily activities for their parents, while sons provide the basic economic support (Sun 2002). The dire need for economic support in old age makes rural people favor sons.

Finally, the fertility control policies made and implemented by governments at various levels contribute to son preference. The reduced number of children, mandated by fertility control policies, entails a lower probability of having a son. In a society with such a strong son preference and unfavorable social status for females, when sex and number of children are in conflict, people turn to sex-selective abortion to ensure at least one son. With the stringent implementation of the one-child policy, China's sex ratio at birth (SRB) has risen continuously. In 2000, the SRB in those 1.5 children policy areas (namely, those areas where a second child was permitted if the first was a girl) was 124.7, which is 15.7% points higher than the ratio 109.0 in two-children areas, indicating clearly the impact of sex-selective abortions (Gu et al. 2007). Moreover, those parents who strongly desire a son often abandon female children or neglect daughters (Coale and Banister 1994; Das Gupta and Li 1999). At the same time, the enactment and implementation of some policies reinforce the ideas that sons are better than daughters and that the utility of a son to a family is much higher than that of a daughter, which also contribute to gender discrimination.

Demographic Consequences of Gender Discrimination

Strong son preference and discrimination against girls is still widespread in China, resulting in rising SRB and EFCM. The number of children, which is restricted by family planning policies, differs from the number desired by most people. If the number of children and ideal gender composition conflict, people first realize the goal of having a son, usually by technical means, which leads to the rising SRB (Tuljapurkar et al. 1995; Poston et al. 1997). Discrimination against girls in food, education, and especially in health care, with the extreme case of abandonment of female children, lead to EFCM.

Gender discrimination leads directly to missing females and the unbalanced sex structure of China's population, which affects important features of the country's demography, such as population size, rate of increase of the elderly, insufficient people of working age, declining number of births, and problems with the marriage market. "Missing females" decreases the current population size, and although this effect may currently be small, the effect of these missing girls and their female offspring on future population growth is important. The cumulative effect on population growth should not be underestimated (Cai and Lavelly 2003; Attané 2006). Missing girls decreases the number of births, and this will certainly affect the aging of China's population. The total number of working-age people will also be affected by a decrease in the population. The shortage of marriageable females has caused a squeeze on males in the marriage market (Tuljapurkar et al. 1995; Das Gupta and Li 1999).

The Effect of Gender Discrimination on China's Social Development

Gender discrimination has important social implications. The main one is its harm to the quality of life, by removing female children's rights of survival, participation in society, and economic advancement; it hinders productivity, efficiency, and economic progress while damaging the sustainable development of Chinese society. First, high SRB and EFCM have deprived female infants and children of the basic rights to birth and life. This violates not only China's *Constitution* and related laws, but also the *International Human Rights Pact*. Mothers suffer the psychological pressure and health risks of sex-selected abortions, which may affect both their physical and reproductive health (Li et al. 2004). Second, gender discrimination reduces resources allocated to women, interferes with women's educational and financial development, and hinders the society's economic development (Pritchett and Summers 1996). Finally, the unbalanced Chinese gender structure caused by "missing girls" results not only in marriage pressure on young males, but also a series of social problems, such as inferior physical and psychological health of the unmarried men, instability of marriages and families, births out of wedlock, problems of old age support for those who never married, increasing prostitution, and abduction of and trafficking in women. These

and related social problems are deleterious to the overall welfare of the society and harm the country's long-term sustainable development (Jiang et al. 2007).

China's Public Counter-Measures Against Gender Discrimination

International Experience

In most societies, males and females do not have equal social status. This inequality is reflected not only in the gender division of labor, both at home and in the workplace, but also by gender discriminatory practices in social systems. International organizations have worked hard to eliminate this inequality. In 1979, the UN released its *Convention on the Elimination of All Forms of Discrimination against Women*, while in 1995 the Fourth World Women's Congress passed the *Declaration of Beijing*, and Action Plan, which have become major principles for promoting gender equality internationally (World Bank 2002, p. 35).

Several Asian countries or regions have devoted considerable effort to the problem of high SRB. South Korea, India, and Taiwan all forbid fetal sex determination in any form, and the SRB in Korea has declined gradually since the mid 1990s. One reason for this is that the South Korean government passed a series of laws aimed at improving the rights of children and women, enhancing women's status, and protecting women from gender discrimination. Since the 1980s, prohibition of sex-selective abortion was included in these laws; use of ultrasound B devices to determine the fetus' sex would be financially punished or the medical license of the provider would be cancelled. In addition, the South Korean government promoted a social environment that pays special attention to girls and women, and made a series of interventions to reduce inequality (Chung and Das Gupta 2007). In India, because of the decreasing number of girls, the Indian government produced a new family planning policy that encourages giving birth to girls. It also introduced comprehensive programs to change social attitudes towards girls (Wei et al. 2009).

Taiwan, which shares with mainland China the same Confucian culture that values males more than females, severely punishes hospitals that practice sex selection. Taiwan has also stipulated that unmarried female children have the right to inherit family property, and it provides welfare and security for the aged through public agencies; these policies have led to reduction in the SRB since 2001 (CNP 2004).

China's Interventions to Lower Gender Discrimination

China has taken corresponding countermeasures. High SRB and EFCM have led the Chinese government to take various direct or indirect measures that attempt to return high SRB and EFCM to normal levels. In recent years, the Chinese government has adopted a series of policies; for example, the *Law on Maternal and Infant Health Care* in 1994, *Managing Stipulations on Family Planning Technical Services* in 2001, the *Law of Population and Family Planning* in 2002, *Stipulation on Forbidding Non-medical Aided Fetus Sex Determination and Sex-selective Abortion* implemented in 2003. It is clearly stipulated that all organizations and individuals are forbidden to perform non-medical sex determination or sex-selective abortion. Moreover, the nationwide *Care For Girls* program was launched with the goal of improving the living environment for girls (Li 2007; Hvistendahl 2009). But the SRB still fluctuates around a high level of 120, indicating that these direct measures have not been sufficient to solve the problem. Laws alone cannot alter the deep-rooted ideology of gender discrimination. An overall policy system is sorely needed, with the emphasis on implementation and monitoring.

Based on the causal analysis in Fig. 1, we propose public policies and concrete measures to lower gender discrimination in terms of institutions, culture, economy and policies, as shown in Fig. 2.

First, since resource allocation, opportunities, and relative power structure for males and females are mainly determined by social, legal, and economic institutions, the principal measure is to create an equitable competitive mechanism in institutions for males and females (World Bank 2002, p. 13). This would promote female social standing by clearly stipulating the rights of females in politics, economy, culture, and the family. China's laws stipulate that a child can take either his/her father's or mother's family name. Further, uxori-local marriage should be promoted in order to loosen the centrality of the clan, especially in rural China (Yan et al. 1999).

Second, the restoration of the production function of families under economic reform, as well as ancestor worship, has exacerbated son preference (Li and Lavelly 2003). Therefore, such programs as "New Culture of Marriage and Childbearing Entering into Thousand Families" and "Care for Girls" should be popularized nationwide to reverse the traditional culture of "Favoring Sons and Discriminating against Daughters" in order to improve the living environments for girls, to raise female social status, and to change attitudes and behaviors around childbearing. The Care for Girls Campaign, which was initiated in an experimental zone, now has been implemented nationwide and aims to combat gender discrimination against girls, high SRB and EFCM (Li 2007; Zheng 2007; Hvistendahl 2009).

Third, in order to eliminate son preference due in part to the need for family support for the elderly, the government should support the establishment of interest-oriented social security systems that favor girls and their families, by integrating social old-age support and family old-age support. This would eliminate the need for sons as the basis for old-age support. Meanwhile, discrimination in employment should be eradicated to assure equal job opportunities for males and females and equal access to economic resources (Wei et al. 2009).

Gender should be taken into consideration when enacting or implementing policies in order to prevent the emergence of any form of gender discrimination. Finally, after several decades of the stringent family planning program, it may be time to slightly loosen the restrictions (Zeng 2007).

Method for Policy Simulation

The policies already adopted by the Chinese government and proposed in this paper will certainly affect the present cultural foundation of son preference: "Favoring Sons and Discriminating against Girls", and therefore SRB and EFCM. However, it takes a long time for such policies to take effect. Policy simulation allows informed judgment of the effectiveness of such policies and has been used in demographic projection (Zeng 1999). In order to investigate the effect of implementing these policies on population development, we carry out a quantitative study using simulation. Since China's 2000 census provides abundant population data, we take 2,000 as the baseline year, and the 2,000 census data as the baseline data. Note should be taken that the age-sex-specific numbers in the population of the baseline year used here are adjusted.

The Effect of Public Policies on SRB

The continuously rising SRB will be affected by the aforementioned public policies. But the effect of those policies on future SRB cannot be exactly measured due to the deeply-rooted "Favoring Sons and Discriminating against Daughters" childbearing culture and the actual implementation of those policies. Attané (2006) assumes four scenarios for the future SRB, including both continuously rising, unchanged at the 2000 census level and declining. As a first example, we assume that the SRB remains as observed in the 2000 census:

Possible Trend 1—SRBs at different parities remain at the level of the 2000 census. With the notation SRB_i^j , where j represents birth order, i represents a future year with $i = 2001, 2002, \dots, 2100$,

$$SRB_i^1=107.1; SRB_i^2=151.9; SRB_i^3=159.4 \quad (1)$$

Possible Trend 2—The policies have a slight effect on people's ideology that diminishes their gender discrimination, resulting in a gradual decline in SRB:

$$SRB_i^1=107.1; SRB_i^2=151.9-0.4 \times (i-2000); SRB_i^3=159.4-0.5 \times (i-2000) \quad (2)$$

Possible Trend 3—These measures have a stronger effect than *Possible trend 2*. After 2030, SBR at all birth orders returns to normal at 106, and then remains at this level,

Before 2030

$$\begin{aligned} SRB_i^1 &= 107.1 - (107.1 - 106)/30 * (i - 2000) \\ SRB_i^2 &= 151.9 - (151.9 - 106)/30 * (i - 2000) \\ SRB_i^3 &= 159.4 - (159.4 - 106)/30 * (i - 2000); \\ &\text{for } i=2001, 2002, \dots, 2030; \end{aligned}$$

After 2030

$$SRB_i^1=SRB_i^2=SRB_i^3=106 \quad (3)$$

for $i=2031, 2032, \dots, 2100$

If the policies had an immediate effect and people accepted equality of males and females, and the SRB returned to normal after the 2000 census, then we might have:

Possible Trend 4

$$SRB_i^1=SRB_i^2=SRB_i^3=106 \quad (4)$$

The Effect of Public Policies on Mortality

Policies aimed at eliminating gender discrimination affect not only SRBs but also mortality patterns. Since the founding of PRC, mortality has continued to decline, but recently this decline has been slow. For EFCM, infant and child mortality rates are important. It has long been understood that infant and child mortality are always, or almost always, significantly underreported in China (Poston 1996). But according to China's Child Mortality Surveillance System, China's under 5 mortality rates have dropped rapidly from 61.0 deaths per 1,000 births in 1991 to 44.5 in 1995, with a further slow decline to 39.7 per 1,000 births in 2000. The data are regarded as an overestimate of actual mortality levels (Banister and Hill 2004). Banister and Hill (2004) estimated that in 2000, China's infant mortality rate for males was 22.66 per thousand and for females 33.51 per thousand. But according to Li et al.'s (2005) study based on China's 2000 census data, after being adjusted, the infant

mortality rates were 28.14 and 35.51 per thousand for males and females, respectively. No agreement has been reached on infant and child mortality rates, but Li et al.'s (2005) estimate is between that of China's Child Mortality Surveillance System and that of Banister and Hill (2004). Here we assume the West family of the Coale-Demeny model life tables and life tables from Li et al. (2005). The West family of the Coale-Demeny model life tables is gender-neutral for mortality (Coale 1991), while the 2000 China life tables of Li et al. (2005) exhibits EFCM. We assume that the effect of public policies determines the change in female mortality patterns. Then, corresponding to *Possible trends 1–3* of SRBs, there is at least some gender discrimination, and we take the life table of Li et al. (2005) as the mortality pattern and call it *Mortality Pattern 1*; it includes EFCM. Corresponding to *Possible Trend 4*, we take the West life table of the Coale-Demeny model series, and call it *Mortality Pattern 2*; it represents gender-neutral mortality.

The Simulation Model

In order to explore the different effects of gender discrimination under these different public policies on population development, we integrate the cohort-component method with parity-specific SRBs and fertility rates.

$$\begin{cases} x(t+1) = H(t) \cdot x(t) + \left(\sum_{j=1}^3 \frac{100}{100 + SRB^j} \cdot \beta^j(t) \cdot B^j(t) \right) \cdot (x(t) + x^*(t+1)) / 2 \\ x(0) = x(t_0) \end{cases}$$

where

$$x(t) = \begin{bmatrix} x_0(t) \\ x_1(t) \\ \vdots \\ x_M(t) \end{bmatrix} \quad x(t+1) = \begin{bmatrix} x_0(t+1) \\ x_1(t+1) \\ \vdots \\ x_M(t+1) \end{bmatrix} \quad x^*(t+1) = \begin{bmatrix} 0 \\ x_1(t+1) \\ \vdots \\ x_M(t+1) \end{bmatrix},$$

$x_a(t)$ denotes the number of females aged a in the year t , $x_{a+1}(t+1)$ represents the number of female population aged $a+1$ in the year $t+1$. M is the oldest age. $x(0)$ and $x(t)$ denote the population numbers in the baseline year t_0 and year t , respectively.

$$H(t) = \begin{bmatrix} 0 & \dots & 0 & 0 \\ \eta_0(t) & \dots & 0 & 0 \\ \ddots & \ddots & \vdots & \vdots \\ 0 & \dots & \eta_{M-1}(t) & 0 \end{bmatrix},$$

where $\eta_a(t)$ is the survival rate for females aged a in the year t . SRB^j denotes the SRB of birth order j , and $\beta^j(t)$ is the total fertility rate for birth order j in the year t .

$$B^j(t) = \begin{bmatrix} 0 & \cdots & b_{15}^j(t) & \cdots & b_{49}^j(t) & \cdots & 0 \\ \vdots & \cdots & \vdots & \cdots & \vdots & \cdots & 0 \\ 0 & \cdots & 0 & \cdots & 0 & \cdots & 0 \end{bmatrix},$$

with $b_i^j(t) = \eta_{00}(t)h_i^j(t)$, $i=15, \dots, 49$, where $\eta_{00}(t)$ is the female infant survival rate in the year t and $h_i^j(t)$ is the fertility rate of birth order j for a woman aged i at time t , normalized, so that $\sum_{i=15}^{49} h_i^j(t) = 1$. Formulas for the age structure of males are analogous to these.

We use five indicators to summarize the main demographic results; population size and structure, the annual number of births, the number of working age people, the proportion of people aged 65 and above, and the extent of the marriage squeeze.

Data

The above models are population projection models. It is important to have accurate input data, including data on population size, age structure, fertility rates, mortality rates and migration rates in order to produce accurate projection results. Below we introduce the population size and structure in the baseline year, as well as fertility and mortality data used in the model.

Every year, China's National Bureau of Statistics implements a sample survey to examine demographic changes, such as population size, crude birth rate and death rate, and numbers of births and deaths. Setting November 1, 2000 as the standard reference time, China implemented its fifth national census. China's family planning policies and their implementation motivate staff involved to underreport (Merli and Raftery 2000; Lavelly 2001); most statistics are underreported (Attané and Sun 1998; Banister 2004), so the data quality is flawed. The overall underreporting rate of the census was estimated at 1.81%, which was reasonable according to international standards (Walfish 2001). But there was serious underreporting for the young ages. The annual birth data are not consistent with those in the fifth census. For example, it was reported that in 1997, 1998 and 1999 the birth numbers are 20.38, 19.91 and 19.09 million, but in the census the number of children aged 0, 1, and 2 years are 13.79, 11.50 and 14.01 million; this discrepancy is too large. Even the annual sample survey data itself has conflicting data. After the 2000 census, the birth number for 2001–2009 fluctuates around 16 million, a sudden decline from the 19 million before the census. We adjusted the number in groups of age 0–7 in the 2000 census, based on annual population surveys before 2000, but we lowered the number of annual births, so as to make the number of young ages in the census decline smoothly and consistent with the subsequent birth numbers reported by the National Bureau of Statistics.

Fertility rates, SRBs, and fertility patterns are three indispensable factors. In some studies, China's population is projected with a total fertility rate around or above 1.8 during 2000–2050 (Attané 2006; United Nations 2009). In the fifth census, the total fertility rate (TFR) had declined to a very low level at 1.22, but no agreement has been reached on China's 2000 total fertility rate. Zhang and Zhao (2006), Gu et al. (2007), Cai (2008), and Morgan et al. (2009) estimated the TFR of year 2000 in the range 1.4–1.6. Some research claims that the total fertility rate would not rebound even if the strict one-child policy were terminated (Cai et al. 2010; Merli and Morgan 2010). Many scholars claim that since China has reached very low fertility level, the stringent fertility policy aiming at controlling births should be modified (Zeng 2007). But it is difficult to predict the future trend of China's fertility level, when even the current level is in debate. If we set TFR at 1.5 from 2000, the forecast births

are about one million less than the 16 million reported by the National Bureau of Statistics for the first several years after 2000. So we fix TFR at 1.6 in 2000, and reduce it by 0.01 annually. After 2010, we take a constant TFR of 1.50, with 0.99 for the first birth, 0.50 for the second birth, and 0.01 for the third birth. SRBs are as in *Possible trends 4*. The age-structured fertility is that of the fifth census (Census Office of the State Council 2002, p. 1700).

It is not easy to forecast mortality patterns (Lee and Carter 1992; Li and Lee 2005). According to Bongaarts (2006), from 1950 to 2000, the annual increases in life expectancies for males and females in some countries are 0.21 and 0.24 years, respectively. And from 2000 to 2050, the annual increase for males and females are forecast to be about 0.15. The higher the life expectancy, the smaller the annual increase. Here we adopt Bongaarts' (2006) estimate of an annual increase of 0.15 year in life expectancy for males and females during 2000–2050, and 0.1 year annual increase from 2050 to 2100. Li et al. (2005) estimated life expectancies for 2000 at 69.6 years for males and 73.2 for females. We assume an annual increase in life expectancy of 0.15 years from 2001 to 2050 and of 0.10 years from 2050 to 2100 for males and females. We use these annual life expectancies at birth, the life tables in Li et al. (2005), and the Coale–Demeny West model life tables with logit transformation to obtain the series of life tables and mortality patterns after 2000.

Scenarios

Combining the *Possible trends 1, 2, and 3* for SRBs and mortality pattern 1, we obtain simulation Scenarios 1, 2, and 3, while combining *Possible trend 4* with mortality pattern 2, we obtain Scenario 4. The four scenarios have the same fertility rates and patterns. Obviously, in scenario 1 the public policies have less effect and the discrimination against females is the strongest. In Scenario 4, the public policies have the strongest effect and the discrimination against females becomes weakest. Scenarios 2 and 3 give results between Scenario 1 and Scenario 4. These four scenarios illustrate the different effects of public policies on China's population development.

Simulation Results

Since it takes a long time for the effect of gender discrimination to have a major effect on population growth, we used a relatively long simulation period, namely, from 2001 to 2100. The results are as follows.

Population Size and Sex Structure

Different policies exert different effects on China's gender discrimination and lead to different future demographic profiles, as shown in Figs. 3 and 4.

For the first several decades, Scenarios 1, 2, 3, and 4 exhibit little difference, since they all assume the same fertility level, and all peak in population size at 2025. But in 2100, the total population numbers are 638.57, 650.47, 679.86, and 702.83 million, respectively. Even though the baseline population size is the same for all scenarios, in 100 years the population sizes for the four scenarios diverge markedly. Scenario 1 is 10% or 64.26 million less than Scenario 4 in terms of population size. Besides population size, the four scenarios differ in sex ratio of the total population from the beginning, and with time the difference grows. In 1980 China initiated the fertility policy, but if the total fertility really has declined to 1.5 and will remain at this level or decline continuously, the population size may be even less, which may cause severe problems, as seen currently in Russia (Shlapentokh 2005).

Scenario 1, which exhibits the strongest discrimination against females, produces a sex ratio of 107.10 in 2025, while for scenario 4 it is 103.45. In 2100, Scenario 1 produces a sex ratio of 111.72 for the total population, while for Scenario 4 it is 99.02.

The Number of Births

The more severe the gender discrimination, the smaller the number of births, as was illustrated by Attané (2006). In Fig. 5, for the first several decades, as the numbers of childbearing age women are fixed, the numbers of births in the four scenarios do not differ much. But after one generation, the birth numbers show some difference. In 2050, the numbers for Scenario 1, 2, 3, and 4 are 7.86, 7.96, 8.33, and 8.68 million, respectively, with 9.4% difference between Scenario 1 and Scenario 4. And in 2100, the numbers are 3.64, 3.94, 4.43, and 4.64 million. Scenario 1 has less births than Scenario 4 by one million, which is almost one third of the total births under Scenario 1 in 2000.

China still implements the stringent family planning policy, after almost 20 years of below replacement fertility. Experience from other low fertility countries indicates the irreversibility of low fertility, especially when the total fertility rate falls below 1.5. This drives the fall in fertility and increases the SRB, and decreases the number of births in two ways. It is really time to think about China's future family planning policy, as the number of births falls so dramatically in the future.

The Working Age Population

The more severe the gender discrimination, the smaller the number of working age people. In Fig. 6, all scenarios peak in the same year with almost equal numbers of working age people. In 2100, the numbers are 339.84, 347.20, 367.71, and 384.15 million, respectively, for Scenarios 1, 2, 3, and 4, respectively. In the long term, gender discrimination exerts a strong effect on the number of working age people. In 2100, the number of working age people in Scenario 1 is 44.3 million less than in Scenario 4, which accounts for 13% of that in Scenario 1. Moreover, the proportion of working age population in the total population is 68.17% in 2000, but declines to 53.22% in Scenario 1 and 54.66% in Scenario 4.

China's working age population, as with China's total population in the future, is mainly determined by the low fertility, but as indicated in Fig. 5, gender discrimination also plays a role. As China's demographic dividend period ends, the labor supply in China changes. In 2003, a shortage of migrant workers began to affect China's southeastern coastal areas; and by 2005 the shortage began to spread to the Yangtze River Delta and the northern coast. This shortage of migrant workers indicates that surplus labor in the rural areas of China is becoming limited (Wang et al. 2006). Gender discrimination can therefore affect the supply of working age laborers in the long run, and if the total fertility rate does not rebound, eliminating gender discrimination can help to alleviate the potential labor shortage in the future.

Population Aging

The more severe the gender discrimination, the faster is the aging process, as indicated in Fig. 7. For the first several decades, the aging process is almost the same for all scenarios. After 2040, the proportion of elderly in the four scenarios begin to diverge, but not significantly. In 2100, the proportions of elderly people according to the four scenarios are 37.15, 36.53, 35.15, and 34.43%, respectively. The proportion in scenario 1 is higher than that in Scenario 4 by about 3%.

China's rapid aging is astonishing, and although this is related to increased life expectancy, the decline in births, as indicated in Fig. 6, has resulted in a decrease in the working-age

population, which is a more important factor (Wu et al. 2008). Rapid increase in the proportion of the elderly will lead to a shortage of old age support and care in the future (Wang and Mason 2007). Support for the aged in the rural areas comes mainly from their families, and mainly from their adult sons, which in turn strengthens son preference (Ebenstein and Leung 2010).

The Extent of the Marriage Squeeze

China is experiencing and will be confronted in the future with a severe shortage of females, resulting in the impossibility for millions of young males to find spouses (Skinner 2002). How to measure a marriage squeeze is quite controversial. Many studies focus on sex imbalance, but according to Goodkind (2006), China's marriage squeeze is more a function of age structure than sex imbalance. However, like many previous studies, Goodkind (2006) calculated a sex ratio and limited the marriageable age to a 5 year interval, with the spouse age gap taken as 2 years. Such sex ratios are easily calculated, but they may not reflect the actual situation in the marriage market because marriage takes places between couples over a wider age range. Tuljapurkar et al. (1995) proposed an index for the sex ratio of potential marriage partners, computed as the ratio of age-specific male numbers weighted by age-specific first marriage frequencies for males to age-specific female numbers weighted by the corresponding frequencies for females. The age–sex-specific first marriage frequencies in a given year are defined as the ratio of the first marriage population of the specific ages and sex during a certain period to the corresponding total population of the same ages and sex. Jiang et al. (2007) suggested that the index in Tuljapurkar et al. (1995) ignores the age-specific sex ratios of males to females in the baseline year and that it would be appropriate to adjust the potential first marriage ratio index by introducing the age-specific sex ratios in the baseline year. The adjusted index restricts the first marriage frequencies to the age range from 14 to 60, taking into account both age structure and imbalance in the sexes. Using the adjusted sex ratio, Jiang et al. (2007) obtained the proportion of excess males in the marriage market. The extent of marriage squeeze, measured as the proportion of potential excess males in Jiang et al.'s (2007) study, is shown in Fig. 8.

We can see from Fig. 8 that due to the higher than normal SRB and EFCM, males have been and will be squeezed in the marriage market from 2000 onwards. The proportion of excess males first declines, and then rises steeply, to 15% in 2020. Afterwards, different scenarios result in different levels of the marriage squeeze for males. Scenario 1, the most severe gender discrimination, produces around 20% of surplus males during the whole period after 2020, and Scenario 2 first gives around 20% excess males, but after 2050 this declines to 15%. By contrast, under Scenarios 3 and 4, the excess declines after 2020 and fluctuates around 8% after 2050. The more severe the gender discrimination, the more severe is the extent of the marriage squeeze for males. In addition, setting the SRB of 106 as normal, the proportion of excess females should be around 5%. Scenarios 3 and 4, in part, confirm Goodkind's (2006) conclusion that age structure contributes to China's marriage squeeze too, as the proportion of excess females fluctuates between eight and 9%, if the sex ratios at birth return to normal in 2000 and 2030, but the number of births keeps decreasing as indicated in Fig. 5.

Conclusions

The deep-rooted traditional culture of “Favoring Sons and Discriminating against Daughters” and concomitant discriminatory practices still exist throughout China. Policies at various administrative levels should play the dominant role in eliminating son preference and gender discrimination. In order for this to happen, issues concerning gender must be integrated into public policies and their implementation. The goal must be to change the traditional ideology, to enhance female social status, to achieve equality for males and

females in social life, to optimize population size, structure, and distribution, all of which will help promote China's socially sustainable development.

Gender discrimination, in terms of higher than normal SRB and EFCM, will have a significant impact as demonstrated in the calculations presented above. Attané (2006) claimed that the impact would be relatively minor on total population growth and on the total number of births but somewhat greater on the sex structure of the population projected to 2050. But when we project the population to 2100, the impacts on population size, sex structure, number of births, and working age population, as well as on the male marriage, are significant.

As the effect of gender discrimination on population size and other demographic features have begun to be recognized, the marriage squeeze and surplus males have become causes for alarm. These surplus males, usually disadvantaged in social status, are inclined to commit crimes, accelerate STDs and pose a grave threat to social stability. If they congregate, for example in bare branch villages in poverty-stricken areas, they might be more ready to take collective measures, aimed at improving their own social status, which could be quite dangerous for the whole society (Hudson and den Boer 2004). China's media have recently reported many bare branch villages in many provinces, causing grave concerns for social stability.

Moreover, most rural Chinese rely on intra-household transfers for old age support in the absence of financial wealth or social insurance. As the marriage squeeze intensifies the need for programs that socially protect the elderly who have no children will grow (Das Gupta et al. 2010). Thus China needs to develop an effective social security system that helps all elderly, especially the rural elderly, who have no children to provide support. Together with the predicted fast expansion of aging in China, this places a heavy financial burden on governments at all levels.

The high sex ratios at birth are attributable to China's stringent family planning policy. After 30 years of implementation of this policy, the SRB keeps rising and recently reached around 120. The Chinese government has realized the seriousness of this problem and has taken a variety of measures, aimed at combating gender discrimination against girls, high SRB and EFCM (Zheng 2007; Hvistendahl 2009). But in the first decade of the 21st century, SRBs still fluctuate around 120: the problem remains serious and current countermeasures are insufficient. As can be seen from the above calculations, during the 21st century, the population size, birth numbers, and rapid aging, all suggest that China's fertility policy should be revised. In combating gender discrimination and high SRB, China should on one hand strengthen the countermeasures already taken in institutions, culture and economy, and on the other it should loosen or terminate the stringent fertility policy; the policy has successfully accomplished its task in controlling population growth and size, and it is now necessary to pay serious attention to its side effects, and to its careful modification.

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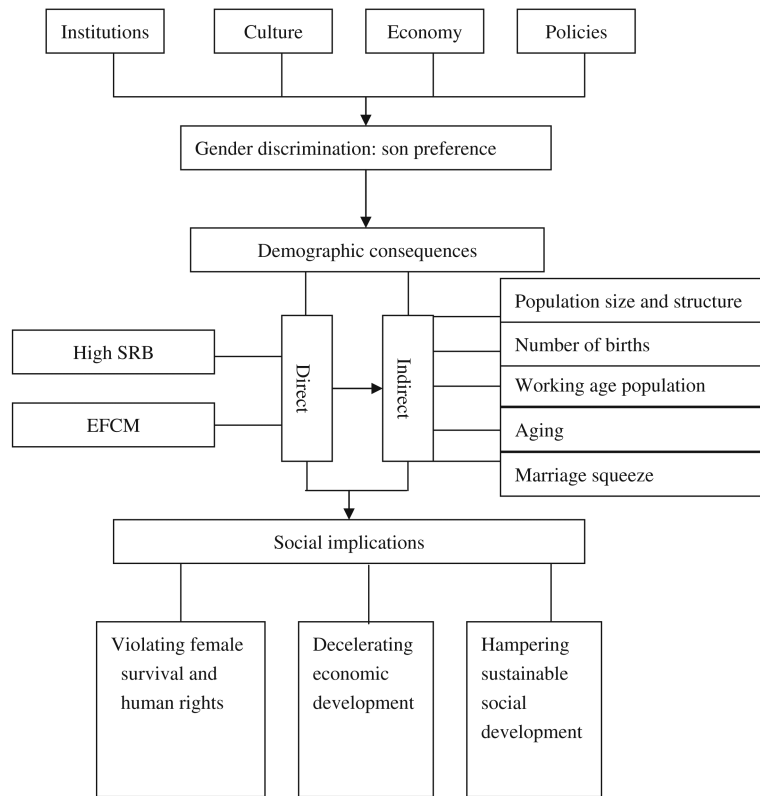


Fig. 1. Causes and implications of gender discrimination

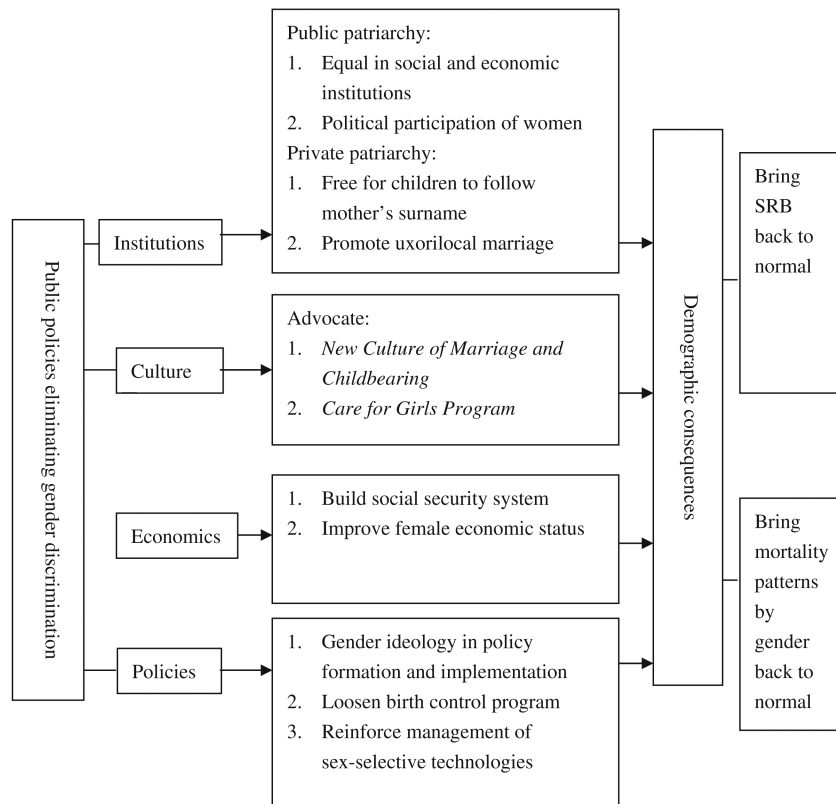


Fig. 2. Public policies eliminating gender discrimination

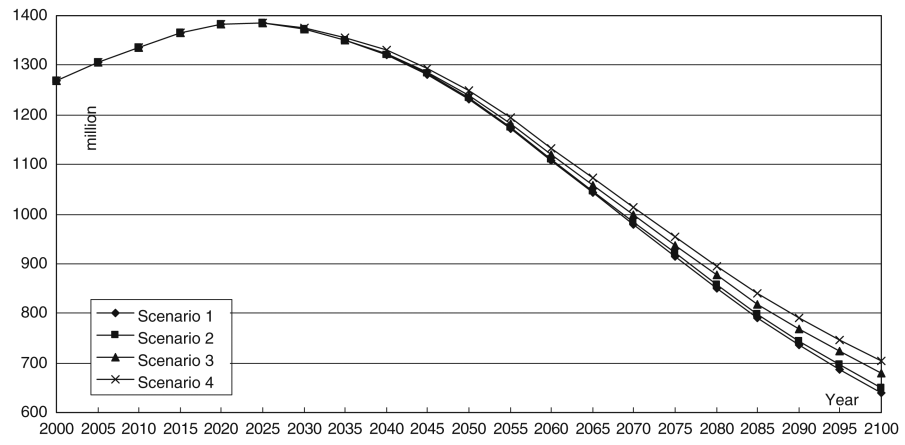


Fig. 3. Population size (in millions)

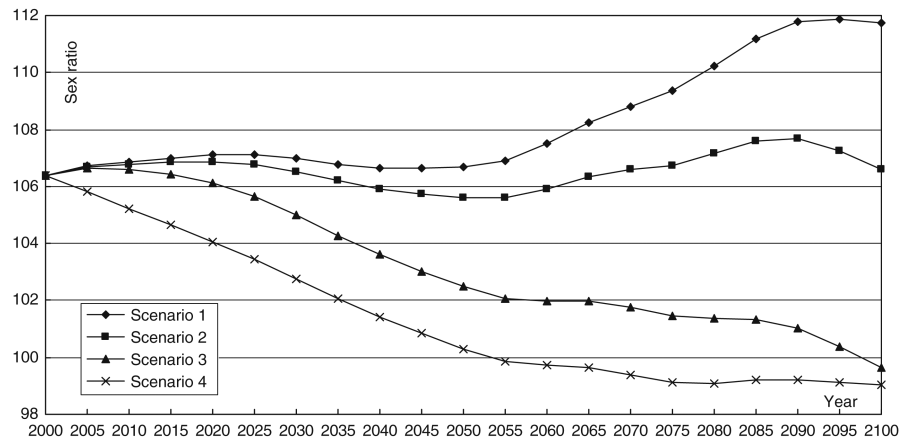


Fig. 4. Sex ratio of total population (female: 100)

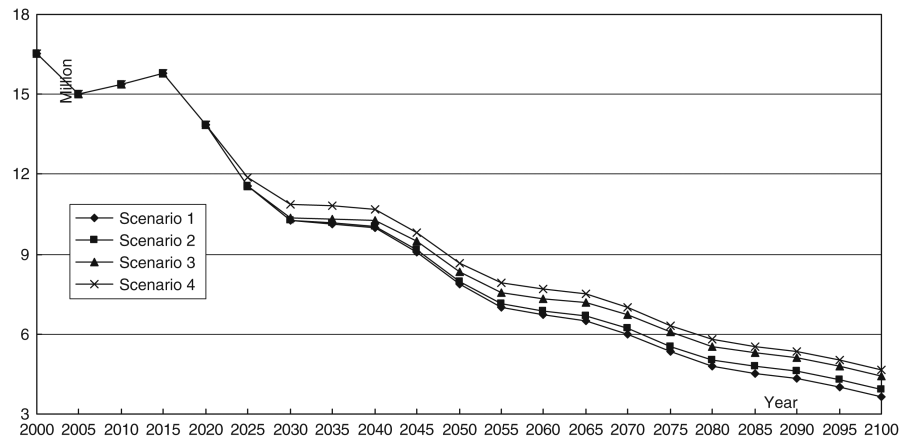


Fig. 5. Total numbers of births (in millions)

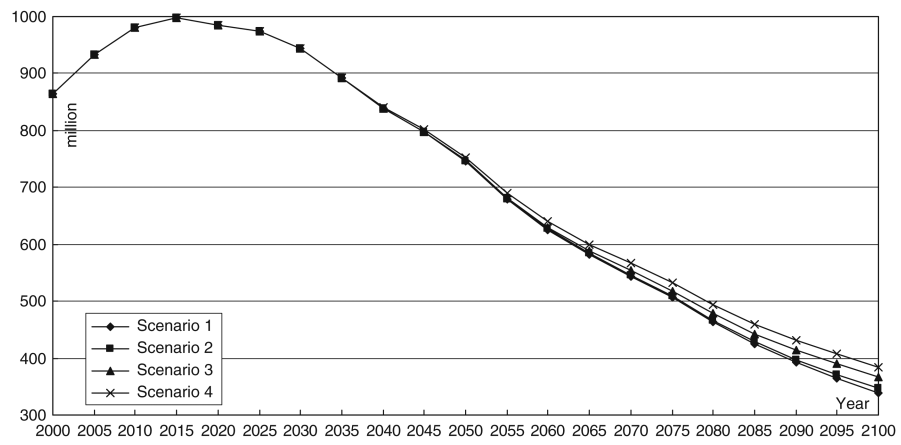


Fig. 6. Working age population (in millions)

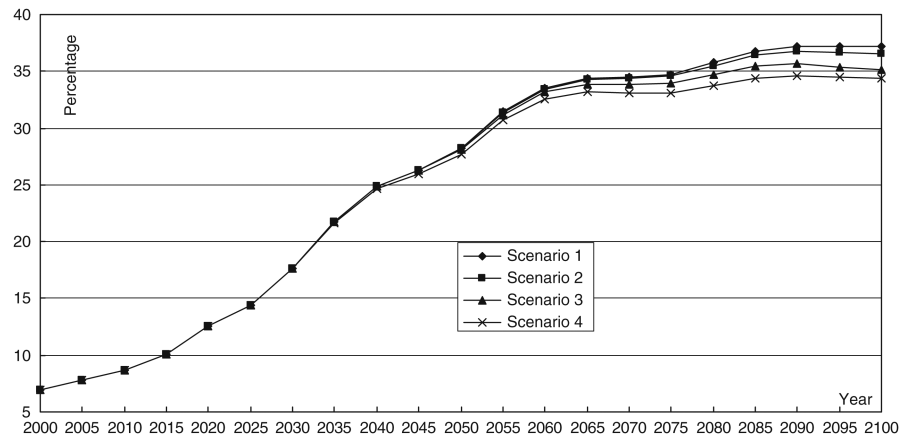


Fig. 7. Proportion of population aged 65 and over

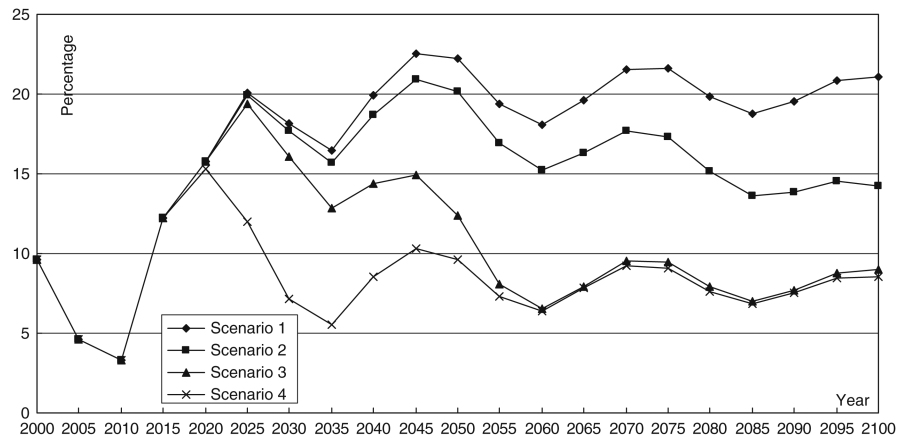


Fig. 8. Proportion of excess males