Ethan Sharygin Jennings
Ph.D. Student, U. Penn. Population Studies Center
239 McNeil Building, 3718 Locust Walk Philadelphia, PA 19104-6298
f: 215-898-2124 e: garba@pop.upenn.edu

Abstract

This paper introduces a new marriage projection model to study the demographic consequences of the impending bride shortage in China. Combined with low fertility, the high sex ratio of cohorts entering the marriage market in the near future will cause unprecedented competition among males for available spouses. The model presented in this paper projects marriage rates by age into the future and tests the sensitivity of the share of males who will remain unmarried above a given age to the sex ratio of new births, the age gap between spouses, assortative preferences, and aggregate fertility. A variety of policies are being discussed to address both the social and economic consequences of these "missing girls" as well as the root causes of sex ratio bias. The results suggest that policies focused on reducing the sex ratio of new births and increasing the age gap between spouses will have the most success.

Introduction

The demographic destiny of China has already been altered by the high sex ratios of cohorts born in the past two decades. The chilling effect on the marriage market depends on how long the imbalance lasts. Evidence from exogenous shocks to the number of marriageable men suggests that increases in the age gap at marriage will quickly revert to normal once the affected cohorts move through their marrying years, but prior experiences in other countries may not be comparable to the Chinese context (Goodkind 2006). The impending marriage squeeze in China is unique on account of the length of the gender imbalance, as well as the fact that there exists a surplus instead of a shortage of males. Very little is known about the consequences of widespread failure to marry, in part because it is rarely observed. The phenomenon of demographic translation (Ryder 1964) applies in this case, since the characteristics of matches might be changing, both in terms of the mean and variance. In particular, tighter marriage markets might lead to higher variance matches. For this reason, simulations of the marriage market which do not account for flexibility of spouse characteristics are bound to over-estimate the prevalence of singlehood among men. In fact, this principle accounts for the lack of a significant marriage squeeze at many times in history where one might have been expected (Ni Bhrolchain 2001).

The objective of this research is to inform the current policy debate over the best course of action to take to mitigate the anticipated negative consequences of the “missing girls.” The alarming increases in sex ratios at birth revealed in the 2000 census spurred the Chinese government to action, mostly through efforts aimed at reducing the sex ratio imbalance. In 2004, President Hu Jintao declared reducing the sex ratio of future births 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 3–5 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 levels.[1] 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-

[1] 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.

child policy is subject to periodic review, its current fertility targets were recently reaffirmed despite the desirability of higher fertility for several reasons.[2]

An earlier iteration of this population projection model appeared in Ebenstein & Jennings 2009 (forthcoming). However, in order to calculate marriage failure rates that avoids this bias by allowing dynamic preferences in marriage markets during a marriage squeeze, this paper will present in detail a population projection model that calculates marriage failure rates overall and by specific level of education, while that projection model used a static age gap at marriage and did not use assortative preferences. Also, better data on age specific fertility rates have since become available and will be incorporated into the current paper. The marriage sorting algorithm now matches according to the following variables, in the following order: female age (from high to low), male education (from high to low), and male age (from high to low). The program currently assumes no change in relative mortality or the distribution of educational outcomes of marriage-age adults from the achievement or current status of the 23-year-old population in the 2000 Census, and allows for changes in fertility (at present, results are generated for no change, gradual change (linear increase in all age-specific fertility rates up to a cap on TFR), and a sudden increase (equally distributed across all age-specific fertility rates) in a specified year). Mortality rates used are from Banister and Hill (2004); fertility is from the most recent age specific fertility rates from the China population statistical yearbook (2007).

II. Educational preferences and progression

A major contribution of this projection model over previous attempts is the introduction of assortative preferences for educated marriage partners on the part of females, which enables calculation of marriage failure rates for males by single years of age or by educational level. In order for this to function, it is necessary to project educational attainment forwards in order to create an educational distribution for males whose education is not directly observed because they are generated by the fertility model. Options for doing so are discussed, and for now the distribution of educational attainment among males age 23 in the 2000 Census is applied. This assumes that educational status at age 23 (counting students as graduates equal to the level of education they were enrolled in at age 23) roughly approximates the completed education of males, and allows the model to use the most recent years of data in the 2000 Census. Because the projection of education-specific marriage failure rates is so sensitive to changes in enrollment patterns or government education campaigns, it may be important to revisit this portion of the projection model. Yet, to the extent that these programs are implemented, the results may in some sense be externally validated. The model assumes no assortative constraints on males' search for female partners, thus there is no need to apply an educational distribution to women who have not completed their education as of the 2000 Census (including those who are created by the projection model).

III. Female-centered marriage market

In a market where females are scarce, the decision to think about marriage in terms of women's partner search rather than men's seems justified. Because this paper assumes no assortative mating preferences on the part of men, females are aggregated into a single sum by year, age, and ever-married status and any pre-existing information on their educational characteristics is discarded. The number of single females of

[2] 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.

a given age is calculated, and then if it is greater than zero, those women are ‘married off’ to men according to some age function. Thus the oldest females are married first, to the best educated and oldest men. The last to be married are the youngest women to the youngest and least educated men. The education level of the males is assigned higher priority than their age. Theoretically, this has little effect on the overall marriage failure rate since women can be fully married off, but it has important consequences for the education-specific marriage failure rate. In conversations with Chinese sociologists, I’ve gotten the sense that females’ age of ‘betrothal’ or even marriage has experienced downward pressure as a result of the incipient female shortage; that being the case, I’ve decided it is prudent to build in the ability to vary the age at which females enter the marriage market. Also, comments to early drafts suggested to examine the effects of removing males under age 30 from the marriage market on the ever-married above age 30 rate. Therefore, I have added an option to set the age of male entry into the marriage market as well. In effect, the model can now provide an answer to the pressing question, “is there an age gap at which universal or near-universal marriage can be achieved?” by varying the age at which females and males enter the marriage market.

There can be very, very many possible permutations depending on the complexity of the age function. Two types of age preference functions can be specified: age-independent, and dynamic or age-dependent. The age independent function specifies a set age band for marriages to occur, and the band remains constant with the female’s age. The second type might use a formula to calculate the permissible age gap for a female of any given age. One such choice is the “(n/2)+7” rule, shorthand that specifies that the maximum socially acceptable age gap between female age f and male age =((f-7)*2)-f.

IV. Vital processes

The fertility and mortality processes are the most straightforward of the number of inputs to the projection model. The model uses age-specific fertility rates from the 2004 Sample Survey of Population Changes and the 2007 Population Statistical Yearbook. The latest sex-and-age-specific mortality rates are from Banister& Hill 2004. The sex ratio of post-2000 births prior to 2006 is pre-set based on data from the 2005 0.1% Inter-censal population estimate, and thereafter dependent on options set in the program. The program assumes perfect mortality after age 101. Fertility and mortality are applied before the marriage model, and fertility is assumed not to vary by marital status (although this is not an important assumption, since female marriage rates remain near-universal). The projection assumes no further change in relative mortality rates and currently supports three alternate scenarios of fertility change: no change, gradual change (linear function of fertility at all ages, with a cap on TFR), and immediate change.

V. Variable inputs into the projection model

Some data is created from the 2000 Census before the running of the projection, including educational attainment by marital status and by sex for given age intervals. The crude sex ratios between specific ages and at specific education levels from the 2000 Census are also calculated.

The primary component driving the results is the marriage matching algorithm. The program runs several alterable subroutines:

- female age of entry into the marriage market. Females below this age are not ‘married off’
- number of years of females to marry in each round of the simulation. Females above age F+N are married only in the initial round.
- male age of entry into the marriage market. Males below this age are not ‘married off’.

- sex ratio of births after 2006 (before 2006, known sex ratio is applied)
- number of years (iterations) to extend the simulation
- late: options for fertility trajectory (or none): late means that there is a sudden change in the fertility level in a given year;
  -late y r: multiply fertility rates above year `y' by factor `r'
- slow: option for fertility trajectory (or none): slow assumes a linear increase in TFR through linear increases in fertility rates at all ages, up to some limit.
  -slow y r l: multiply fertility rates each year after year `y' by cumulative factor `r', capped at total fertility of `l'

In addition to these options, the programmer can also specify an educational distribution for males reaching age 23 after year 2000, as well as an age preference function for females (an upper limit on the age of males to which a given age of females can be possibly married, in addition to the lower limit set at the command line).

The output includes the following statistics, among others, for each year that the population is aged forward:

- total count of females/males age >=*
- total count of married females/males age>=*
- total count and count of married "young [guang] guns" – males age 20 to 39.
- mnompc*: percent of males who are unmarried age>=*

VI. Initial results; sensitivity analysis

In each of these graphs, the Y-axis shows the marriage failure rate for males above age 25. The variables are not labeled, but the names contain all the important parameters (f*=min. female age; mnompc25=male marriage failure rate above age 25; slow=gradual change in fertility scenario (capped at replacement); 118=sex ratio of 118 boys to 100 girls born each year after 2006; m25=min. male age of 25 years old before entering marriage market).

The data exhibit great deal of sensitivity in the short term (less in the long term) to the marriage failure rate depending on the minimum female age at marriage (Fig 1). The two lines in Fig 1 represent competing scenarios that are identical except for the higher minimum female age of marriage in the higher (red) line.

The data exhibit somewhat lower (but still highly significant) sensitivity in the near term, and greater sensitivity in the long term, to the scenarios of change in the sex ratio of additional births (Fig 2):

The data show the least sensitivity to changes in fertility alone at the current sex ratio at birth (Fig 3). There is some reduction due to the possibility of men marrying from marginally larger pools of younger woman than in a low-fertility setting, but this strategy is clearly insufficient to address the problem of increasing marriage failure for men.

The paper will discuss each of these results in detail and present more alternative specifications. Also, I will include a discussion of the current policy efforts being made by the Chinese government and the findings of the research on the efficacy of the official response.

References

Bhrolchain, Maire Ni. 2001. "Flexibility in the Marriage Market." *Population: An English Selection* 13(2): 9–47.

Ryder, Norman. 1964. "The Process of Demographic Translation." *Demography* 1(1): 74–82.

Li, Shuzhuo. 2007. "Imbalanced Sex Ratio at Birth and Comprehensive Intervention in China." Paper prepared for 4th Asia Pacific Conference on Reproductive and Sexual Health and Rights, October 29–31, Hyderabad, India.

Banister, Judith, and Kenneth Hill. 2004. "Mortality in China 1964-2000." *Population Studies* 58(1): 55–75.

China National Population and Family Planning Commission. 2007. Population Statistical Yearbook.

China National Bureau of Statistics. 2000. China Population Census in 2000 0.1% Microdata Sample.

Ebenstein, Avraham Y. & Sharygin. 2009. “The Consequences of the “Missing Girls” of China” World Bank Economic Review (December 2009, forthcoming).

Goodkind 2006. “Marriage Squeeze in China: Historical Legacies, Surprising Findings.” Paper presented at the 2006 Meeting of the Population Association of America

Figure 1: Sensitivity of Male Marriage Failure Rate under Alternate Scenarios of Female Age of Entry to Marriage Market

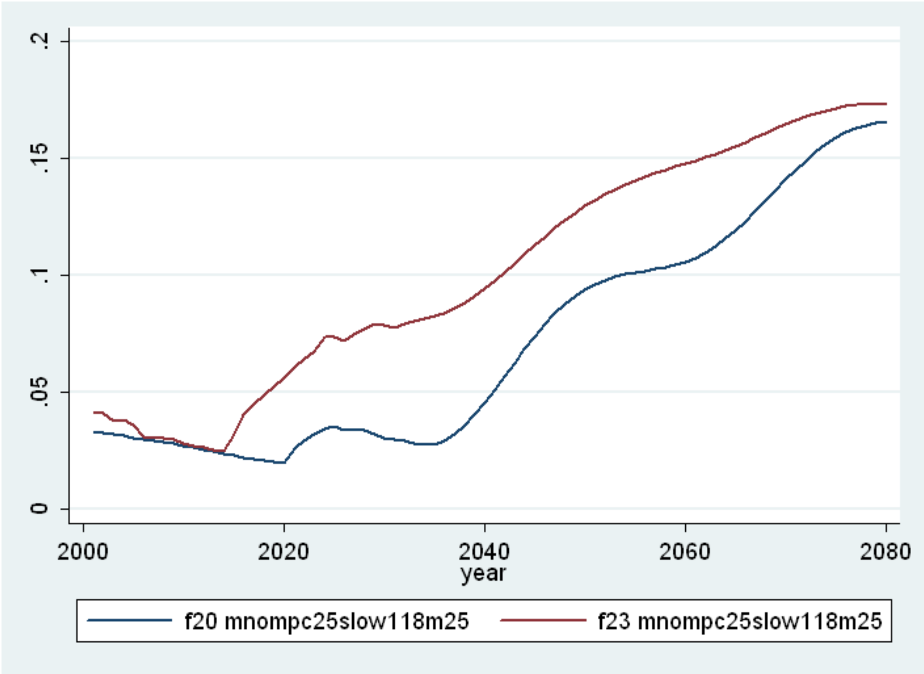

Figure 2: Sensitivity of Male Marriage Failure Rate under Alternate Scenarios of Sex Ratio of Future Births

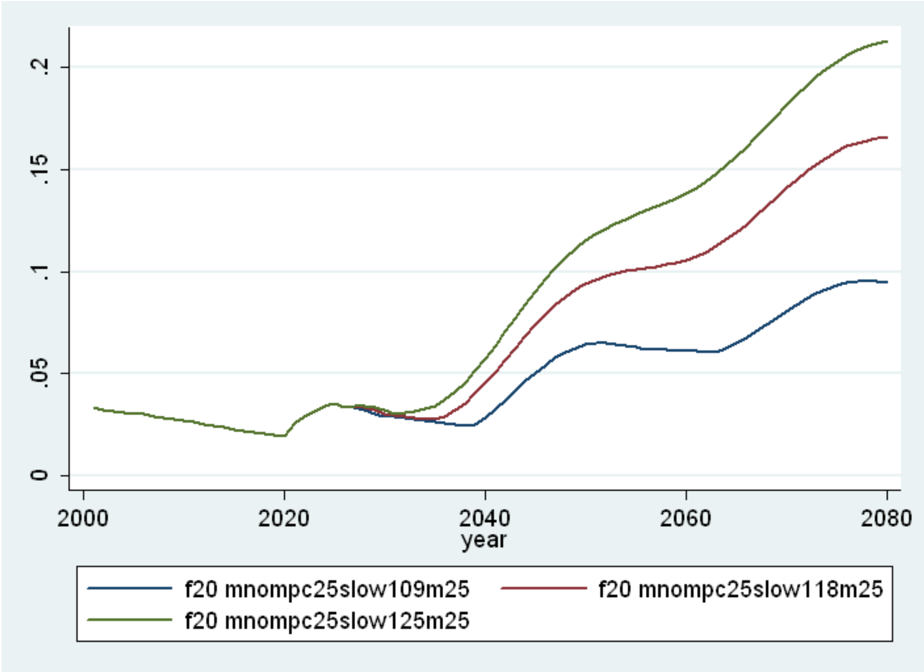

Figure 3: Sensitivity of Male Marriage Failure Rate under Alternate Scenarios of Fertility Change