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China's Marriage Market and Upcoming Challenges for Elderly Men

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Abstract

Fertility decline has fueled a sharp increase in the proportion of 'missing girls' in China, so an increasing share of males will fail to marry, and will face old age without the support normally provided by wives and children. This paper shows that historically, China has had nearly-universal marriage for women and a very competitive market for men. Lower-educated men experience higher rates of bachelorhood while women favor men with better prospects, migrating if needed from poorer to wealthier areas. The authors examine the anticipated effects of this combination of bride shortage and hypergamy, for different regions of China. Their projections indicate that unmarried males will likely be concentrated in poorer provinces with low fiscal ability to provide social protection to their citizens. Such geographic concentration of unmarried males could be socially disruptive, and the paper's findings suggest a need to expand the coverage of social protection programs financed substantially by the central government.

This paper—a product of the Poverty and Inequality Team, Development Research Group—is part of a larger effort in the department to study socio-political processes and development outcomes. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The authors may be contacted at "Monica Das Gupta" mdasgupta@worldbank.org or mdasgupta@gmail.com; "Avraham Ebenstein" <aviebenstein@gmail.com>, and "Ethan Jennings-Sharygin" garba@pop.upenn.edu.

China's Marriage Market and Upcoming Challenges for Elderly Men*

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1 Introduction

In the wake of the One Child Policy of 1979, China's fertility declined dramatically as intended. As fertility rates fell, however, the male fraction of births began to rise (Zeng et al. 1993). This is consistent with China's history of intensified sex selection during periods when parents were faced with sharper choices about whether to invest in raising girls (Das Gupta & Li 1999). Sex selection also became easier with the spread of ultrasound technology from the 1980s,[1] enabling a shift from postnatal to prenatal sex selection (Goodkind 1996).[2] The continued rise in the sex ratio, however, has surprised and alarmed observers worldwide. The Chinese census in 2005 reflected a staggering sex ratio at birth of 119, implying that each year there are roughly 1 million more boys born than girls.[3] For cohorts born between 1985 and 2005, we estimate that there are 27 million more men than women,[4] implying a large number of men will fail to marry.

A "marriage squeeze" of this magnitude and duration can be expected to generate social change. Studies indicate several pathways of social change. A growing literature suggests that it increases women's bargaining power. Where marriage market sex ratios are higher, women exercise greater bargaining power within the marriage (Porter 2009a, 2009b, Edlund et al. 2009). Households in regions with a greater bride shortage are also found to have higher savings rates if they have a son (but not if they have a daughter) than matched households in other regions (Wei & Zhang 2009). The authors conclude that as much as half of the increase in the household savings rate during 1990-2007 can be attributed to efforts to enhance households' competitiveness in the marriage market. Consistent with this, Edlund et al. (2009) find that households in regions with higher sex ratios invest more in their sons' educations. A study in Taiwan, China finds that with the sudden shortage of brides caused by the influx of the Nationalist army and government from the mainland in 1949, bride prices rose and women's bargaining power within the household increased (Francis 2009).

Some have also suggested that high levels of enforced bachelorhood may raise levels of crime and violence. There are reports of abduction and forced marriage of some women in the Chinese media,[5] and also in some studies (Banister 2004). Edlund et al. (2009) have exploited time and geographic variation in the introduction of China's One Child Policy to estimate the impact of high sex ratios on crime rates; they find significant effects.

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[1] Anonymous sources reported 100,000 ultrasound machines in China in 1990 (Kristof 1993).

[2] Postnatal selection continues to be an issue in China. Recent work by Das Gupta et al. (2009) finds that the child mortality differential between boys and girls has widened in recent years.

[3] The calculation of SRB is somewhat disputed, with credible estimates ranging from 118 to 120. The figure for births in the prior year may be subject to biases – see Cai 2008 for a full discussion. However we find that the sex ratios are relatively consistent, with approximately the same ratio of males to females among 5-9 year olds in 2005 as among ages 0-4 in 2000. The figure we refer to here is the ratio of male to female children from birth to exact age 1.

[4] Hesketh et al. (2008) report a higher figure of 32 million, but we believe this to be an overcount. Our estimate of 27 million takes better account of the available data and is more in line with previous estimates of 23.5 million by Poston and Glover (2005) for the twenty year period ending in 2000.

[5] See for example the recent article in the China Daily reporting on a study by the Chinese Academy of Social Sciences, and relating the skewed sex ratio to abduction and trafficking of women and infants (http://bbs.chinadaily.com.cn/viewthread.php?gid=2&tid=657774).

On balance, however, empirical evidence on the social and economic consequences of widespread marriage delay for males remains an underdeveloped literature.[6] Even less is understood regarding the specifics of this impending collapse: which men will fail to marry, where these problems will emerge, and what should be done now to prepare. Studies have projected China's sex ratio in future years and imbalances in the marriage market (Tuljapurkar et al. 1995, Zeng et al 2007), but no study to our knowledge has examined the spatial distribution of the predicted problems in China's marriage market, and the possibility that geographical clustering of bachelors may alter the impact of the national bride shortage. This paper attempts to provide answers to these questions.

We demonstrate two key facts regarding the Chinese marriage market using historical census microdata from 1990 and 2000. First, economic status is a crucial predictor of marital probability for men in China. We use years of education as the closest proxy for status, and document that while there is almost universal marriage for highly educated men, lower rates of marriage prevail among men of lower education. By contrast, the marriage market for women cleared: women across the educational distribution enjoy nearly universal marriage, and are able to engage in hypergamy, choosing spouses of higher status and income. Second, since many women migrate for the purpose of marriage, it seems very likely that in the coming decades the collapse of marital prospects for men will occur in poor areas of the country with low educational attainment.

Recognizing these patterns observed historically for marriage in China (Table 1), we apply a macro-simulation of China's marriage market in the 21st century (Ebenstein & Sharygin 2009). Our marriage rule assumes hypergamous partner preferences on the part of women, meaning that women will marry men of higher education and income when possible, and will migrate to wealthier areas in pursuit of higher status males. Using this framework, and the known relative distribution of educational attainment of males, we project the geographic distribution of the unmarried men and calculate a forecast of the proportions of adult men who are married overall and by education, casting light on the impending demographic pressures on China's marriage market.

The results paint a grim picture for China's ability to care for these men under the current policy structure of social assistance and social insurance programs that are primarily locally funded (Wang 2006, World Bank 2009). We estimate that in the absence of major redistribution of education and employment opportunities across China, the marriage squeeze will be in China's poorer regions with large minority populations.[7] Thus it will not necessarily be the more prosperous eastern regions of China with the most skewed sex ratio at birth that will experience high marriage failure rates among men. Rather, the poorer provinces ─ with more balanced sex ratios at birth ─ will bear a disproportionate share of the social and economic burden of China's unmarried and childless men.

[6] A surplus of young single men may generate economic benefits the result is fewer dependents and more time spent working; however, downstream costs may outweigh benefits if such men become a cost to society through increased problem behaviors or costs for old age support. We refer the reader to extensive literature regarding demographic dividends (Wang & Mason 2005), through which a population's age distribution plays a role in economic growth.

[7] Province-level results are calculated by applying education-specific rates of male marriage failure to the distribution of males age 6+ by education within each province from the China 2000 Census 0.1% microdata, which is biased slightly upwards due to the higher percentage of males with uncompleted education.

Very few first marriages occur after age 30; we therefore prefer to refer to the share never married above age 30 or between 30-39, since this represent a realistic picture of the percent of years spent single in the adult male population. In the near term, this reflects proportions remaining single for life, as long as marriage rates above age 30 remain at their present very low levels.

Our findings indicate that China's looming problems in the marriage market, and the failure of men to marry, will be exacerbated by the unequal distribution of marriage outcomes by male 'quality'. It will be the men with the least access to financial security ─ through access to jobs, social assistance, and social insurance ─ that will also be faced with the prospect of having no familial support network. Moreover, these men will tend to cluster in the rural areas of a few provinces, creating the possibility of social instability. Our results suggest that China's current social assistance and social insurance framework needs a radical overhaul if it is to respond adequately to projected needs. Given that China's population is very young today but projected to age rapidly, revenue set-asides to capture economic surplus in the near future are more appealing than pay-as-you-go options.

The paper is laid out as follows. In the next section, we examine historical patterns in marriage in China. In section 3, we describe China's current social assistance and social insurance programs. In section 4, we present the results of our macro-simulation of China's marriage market. In section 5, we conclude with a discussion of the policy implications of our findings, and the need for China to drastically revise its method of providing and funding social assistance and insurance in both urban and rural areas.

2 Marital Prospects and Status in China

In China, men of higher status enjoy significantly higher rates of marriage. The closest proxy to social standing or economic status that is available in the census is education. As shown in Table 1, over 98% of college graduates successfully marry by age 35 whereas the proportion is under 90% for men with less than a primary education. In contrast, women enjoy nearly universal marriage – across all education groupings and across all birth cohorts. The table also reflects an improvement in the marriage prospects for men. After highly male-skewed cohorts born during the civil wars and Japanese invasion of the 1930s, sex ratios at birth became less skewed. During the 1950s and early 1960s, the communal provision of livelihood reduced parents' need to channel resources towards sons rather than daughters, so sex ratios at birth were more normal except for a small rise during the Great Leap Forward Famine. However, across all three demographically divergent samples, the centrality of completed education in predicting marital status is clear.[8] With the current rise in sex ratios at birth, the sex ratio of the marriage market will increase precipitously (as shown in Figure 1) – and consequently, the share of men who fail to marry will do the same. Regardless of how China's sex ratio changes in the immediate future, there will be absolutely no effect on the marriage market until after 2025, as the men and women already born reach maturity and pass through the marriage market. Appreciable differences in

[8] The birth cohort of the Great Leap Forward has recently been found to have lower lifetime probability of marriage, controlling for educational attainment, which the authors attribute to the reduced availability of spouses and the reduced health or attractiveness of the cohort (Brandt et al. 2009; Almond et al. 2007).

marital attainment by the assumed sex ratio of births that are occurring today only begin to appear mid-century. As a result, aggregate spousal availability will hit an all-time low before recovering, regardless of the fertility and sex ratio scenarios considered. The implications of these patterns in the 21st century are discussed further in the next section.

In the China 1990 and 2000 Census cross-section, prefectures with the highest sex ratios had 5-10 percentage points more males and females in the unmarried state at age 25.[9] The observation that men have worse marital prospects in areas with higher sex ratios has an ambiguous interpretation. It may be that men and women marry in the prefecture in which they are born, and so areas with higher sex ratios will consequently have lower marriage rates for men. A second explanation that is fully consistent with the figure is the exact opposite conclusion: if people in China are willing to migrate for marriage, it will be that women will out-migrate from poorer areas and migrate into wealthier areas. This implies that the areas of China where we will observe unmarried men are not the areas with high sex ratios at birth. Rather, the average status of men will be the more critical predictor of where problems will emerge. We present evidence in favor of this second explanation in Figure 2**.**

In Figure 2a, we map the net migration of women by prefecture for the purpose of marriage in absolute terms.[10] The areas shaded darker are experiencing inflows of women, and these areas overlap substantially with areas with a higher proportion of educated males (Figure 2b). The regressions shown in Table 2 demonstrate that prefectures with more-highly-educated males experience in-migration of females for marriage. In this table, we examine the relationship between variation in prefecture characteristics and the number of women who have migrated into the prefecture for the purpose of marriage (as a share of the total number of women). The results indicate that each year of additional average education among men is associated with an additional 0.196% of women who have relocated to the prefecture for the express purpose of marriage. The magnitude of this result is modest, but the implication is that even within a province, wealthier prefectures are able to attract women and mitigate problems associated with a skewed sex ratio at birth. In columns 2 and 3, we add control variables for the share of the prefecture with urban registration and the sex ratio of children aged 0-4. The results indicate that more urbanized prefectures attract females, possibly since urbanization reflects status and wealth in the area. Areas where sex ratios among young children are more skewed are also attracting females, highlighting a key pattern in China. Areas with skewed sex ratios are often wealthier than other parts of the country, and are able to mitigate their marriage market sex ratio by attracting women from outside the prefecture. If one considers sex-selective abortion a form of injustice which leads to problems for the next generation, then one also recognizes that there is a certain injustice to the location-specific burden of the unmarried men. As an analogy, it would be considered unfair if one country were to create large amounts of environmental pollution but ship the problem to poorer neighboring countries. In essence, this is what we observe in China's marriage markets.

[9] Authors calculations from the China 1990 and China 2000 Census. Prefectures were divided into quintiles based on the ratio of males 22-32 to females 20-30, The share of males and females by marital status by age for each cross-section was compared across the highest and lowest quintiles. High sex ratio areas showed earlier marriage for females (~5 percentage points more females married among 25 year olds) or later marriage for males (~10 percentage points more males unmarried among 25 year olds).

[10] See appendix for counts and ranks by province.

The implication for many remote provinces is that while their sex ratio at birth is relatively low compared with other provinces (Ebenstein & Sharygin 2009), they should anticipate high sex ratios in their marriage markets due to female out-migration and in-migration of single males. In Figure 2, we report the net female migration patterns by province and it is evident that richer provinces with high sex ratios, such as Jiangsu, have been benefiting from importing women from less-wealthy provinces such as Yunnan. With ever fewer restrictions on internal migration, it seems very likely in the coming decades that marriage outcome disparities will become even more pronounced, as the relative scarcity of women allows for increasingly hypergamous pairings.

Given the migration of women for marriage, it follows that the geographic distribution of social assistance and social insurance programs in China is important for gauging the adequacy of policy in dealing with the coming demographic tide. In the next section, we examine these programs and how they relate to China's ability to care for this emerging pool of unmarried men.

3 The Geographic Distribution of Poverty and Programs for Social Assistance and Social Insurance in China

In this section we present a review of the existing programs for social assistance and insurance, and their adequacy for coping with the anticipated growth in the population of unmarried men.

Poverty in China is heavily concentrated in the rural areas. Different measures of poverty all paint the same picture: while nearly 30 percent of the rural population was poor in 2005, this applied to only 5 percent or less of the urban population (Cai et al 2009: Table 2). The vast majority of the poor in 2003 lived in rural areas, and poverty is most heavily concentrated in the northwestern and southwestern regions (World Bank 2009: Table 4.21). Both rural and urban incomes have continued to grow, but the rural-urban gap has continued to widen (World Bank 2008: 65-66).

Recent efforts on rural social protection in China can be summarized as three major sets of programs. The first set sought to alleviate poverty and encourage growth, with subsidized loans, food-for-work programs, and grants, but careful evaluation suggests these programs have had little impact (World Bank 2009). The second set of programs is social assistance programs, which seek to supplement the incomes of the poor through direct transfers. The *Te Kun* program provides cash assistance to very poor and incapacitated residents of less-developed areas, at the discretion of the local officials. The *Wu Bao* program, dating from the 1950s, sought to ensure that no section of the population remained destitute.[11] In 2006, the State Council issued regulations that shift financing responsibility for *wubao* from village reserves to local fiscal budgets (World Bank 2008:79-80). The *Di Bao* program, also known as the Minimum Living Standard Scheme, provides subsidies and in-kind transfers to those living below a certain poverty

[11] The *Wu Bao* program targeted the "three no's" population – those with no work capacity, no income, and no source of external support. *Wu Bao* provided "five guarantees": food, clothing, housing, medical care, and funeral expenses.

line. The *Di Bao* program was expanded to cover all provinces by 2007, and its beneficiaries expanded from 4.5 million in 2004 to 34.5 million by the end of 2007 (World Bank 2009) — though the average benefit per person dropped slightly from 76 to 70 yuan per person (World Bank 2008:79).[12] It is now the single most important social assistance program in rural areas (World Bank 2009). The program is designed to be mainly financed by local governments, with inputs from the provincial and central governments if needed (World Bank 2008:78). Finally, the Medical Assistance program (launched in 2003) initially aimed to help households who cannot otherwise meet the financial burden of medical care expenses, but is now geared to helping poor or other eligible households with the enrolment costs and co-payments associated with the national rural cooperative medical insurance scheme (NRCMS). This program is financed mostly from central, provincial and county-level sources. By the end of 2007, 29 million persons in rural areas benefited from this Medical Assistance program, the number nearly tripling since 2005.

The third set of programs consists of social insurance programs, which seek to provide greater security against health shocks and old age. The rural health insurance system (NCMS) is a voluntary health insurance scheme where the household and local governments contribute 40 percent each of the revenues, and the central government contributes 20 percent. Reimbursement used to be difficult to obtain, and covered little of the costs incurred for health care (World Bank 2009:126-7). Expansion of the program over the years has extended coverage and participation, and covers more of the costs incurred, though reimbursement rates remain low (Wagstaff et al 2009a, 2009b). As of 2007, it still met a small part of the needs for catastrophic coverage ─ on average, only 15% of the costs of inpatient treatment were reimbursed, and the reimbursement rate fell as the total costs of care rose (Yi et al 2009). This, then, offered highly inadequate protection against being pushed into poverty by illness, and studies have shown that uninsured health shocks reduce household disposable incomes and labor supply (World Bank 2009; Wagstaff et al. 2009b).

Significant proportions of urban workers are covered by formal social insurance programs: in 2007, around half of workers had pension coverage, 45 percent had Basic Medical Insurance, and 40 percent had unemployment insurance and work injury insurance (World Bank 2009: Table 6.71). These programs covered far lower proportions of the poor than the non-poor (World Bank 2009: Figure 6.74), but they were clearly in place for many urban workers. The rural pension system (funded mainly by personal contributions and collective subsidies) covered only about 10-11% of the rural labor force (World Bank 2009: Table 6.65), and coverage of the farm-based elderly population appeared to be particularly limited. Beneficiaries were highly concentrated in a few (mostly wealthy) provinces.

Rural social insurance for old age care has been particularly inadequate. In 2005, while nearly half of urban residents have pension income, this share is less than one in twenty in rural areas (Table 4). The customary pattern has been for sons to support their aged parents, except during the couple of decades when communes were responsible for all their members. In 1986, China began to explore alternative means to the traditional family-based old age support systems in rural areas (Wang 2006).[13] The Rural Elderly Social Insurance Program (*nongcun shehui*

[12] By 2009, the Di Bao program reached 47.59 million rural beneficiaries and the average benefits per person rose to 101 yuan (World Bank personal communication from a report under preparation).

[13] Whereas consistently growing urban old age security systems have been in place since 1951, as a part of the nation building and socialist rhetoric of the Mao era, old age programs have been largely inaccessible to the rural

yanglao baoxian)[14] was initiated under the supervision of the Ministry of Civil Affairs, and aimed to develop an institutional framework for administering a pension scheme based on voluntary contribution, defined-contribution, and fully-funded individual accounts (Shi 2006). In 1991, the Ministry launched successful pilot programs in five counties within Weihai and Yantai municipalities in Shandong Province (Leisering et al. 2002). These programs did not provide a complete social safety net, but allowed individuals to contribute to the pension scheme with tax-exempt earnings, and supplemented these contributions with subsidies from employers and local communities. Subsequent programs incorporated the results of these early pilot programs. In 2006, a three-year pilot was launched in eight counties/ districts (funded largely from individual and local contributions), with the aim to increase the rural pension participation rate to 60 percent nationwide by 2020 (World Bank 2008:76-77). [15] It will, however, be some time before evaluations become available to indicate the actual reach and impact of these programs.

In sum, the social assistance programs have been weak through much of this decade. These programs have covered a low percentage of the population, varied little in coverage between richer and poorer regions, and offered significantly lower average benefits per capita in the poorer regions than in the richer ones (Table 3). And social insurance programs have catered primarily to the urban areas, and to the better-off there. Fortunately, the coverage of the social assistance programs has been sharply increased, and plans are underway for expanding coverage of the social insurance programs.

The implications for the rural elderly are not reassuring. They have had little access to social assistance, pensions and other forms of social insurance, and have depended heavily on their own labor income and family support, in the form of transfers or support through co-residence (Table 4). The need for family support rises sharply as they age since their labor income falls and safety nets remain a trivial source of food or income security. Unfortunately, the surveys used in the study of the incomes of China's rural elderly (Cai et al 2009) did not ask about dependence on one's own savings in old age. Other data indicate that rural households have high savings rates on average, which enables families to cope with risks and support their elderly (World Bank 2009: Table 2.15). However, these data also show that those below the poverty line are unable to save. The poor also receive fewer transfers than others (ADB 2004:40). This suggests that the poor elderly are unlikely to be able to draw on savings or transfers for significant support.

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areas. Access to any old age security program is further limited by the extremely rigid urban/rural hukou registration that largely prevents rural residents from re-registering as urban residents.

[14] Occasionally translated as "endowment insurance" or "social insurance." Many Western scholars refer to the program as a "pension," which more or less accurately describes the design of the program. Some have hypothesized that the use of the term "insurance" represents a conscious choice to avoid the word "pension," and there are reports of some villages intentionally promoting these "insurance" programs to tempt pensioners into believing that they there is a larger element of government protection involved than is in fact the case (see Leisering et al. 2002).

[15] The World Bank (personal communication from a report under preparation) says that efforts to increase rural pension coverage are being intensified. During much of the past decade, the rural pension system covered around 11 percent of the rural labor force, mostly in a few coastal provinces. In September 2009, the State Council issued a policy guidance document for a new rural pension scheme on a nationwide basis. The most novel feature of the scheme is the major role of central government financing of a basic pension. This scheme is being piloted in 2010, and aims to achieve full coverage by 2015.

The problems of old age support are compounded by two other trends. First, increasing proportions of China's elderly will be concentrated in rural areas, where old age dependency ratios are projected to rise sharply (Zeng et al 2008, Cai et al 2009). Given that rural areas are poorer than urban areas, this will further stress the resources available at both household and local government levels for elderly support.

Second, unmarried men will be concentrated in poor rural areas. Their prospects in old age are likely to be much bleaker than those of married men. Since men who are not as educated, healthy, and able to earn well tend to fail to attract a bride, they are likely to be heavily represented among those who are unable to save adequately for their old age, or labor heavily into their old age. They are the most vulnerable to income and illness shocks, since they cannot smooth fluctuations in household income by pooling earnings from spouses or children. Unmarried individuals are also more likely to be living without family to serve as caregivers (Table 5). For example, in the 2000 census, 65% of those aged 65-80 who had ever-married were co-residing with younger kin, compared with only 20% of those never-married. Moreover, levels of co-residence have dropped sharply in recent decades (Table 5), and this trend can be expected to continue. The men who fail to marry are among the least likely to be able to save for their old age, to work in their old age, and to have access to old age support from family members.

Even controlling for education, place of residence, and minority status, men who have never married have lower incomes and savings than those who have married, and also report themselves to be in poorer health (Table 6). While it is beyond our analysis here whether this disadvantage is due to selection into marriage or due to the direct impact of marriage on male earnings or ability to save (Korenman and Neumark 1991), the implication is clear that unmarried men are quite significantly financially disadvantaged compared with married men. Moreover, we find below that single men will tend to be clustered in the rural areas of poorer provinces, further disadvantaging them in terms of access to economic opportunities and social support. For a multiplicity of reasons, single men will represent a vulnerable population relative to married men.

4 Simulating China's Marriage Market

4.1 Assumptions

The assumptions we make, and the sensitivity of our projections to these assumptions, are discussed in detail in the appendix. Key assumptions include the fertility rate, direction of change in the sex ratio of new births, the age preferences of men and women for their spouses, the age at which women enter the marriage market, and the criteria by which men and women choose their mate. Among these, our sensitivity analysis finds that the percent never marrying is most sensitive to the sex ratio of recent and future births and the age at which males and females debut on the marriage market. Most importantly, the sensitivity analysis confirms that correcting the sex ratio is not a panacea; the share of unmarried males will remain high well into the future even in the case of an immediate correction. Our baseline projections adopt the age-specific fertility schedule from the 2006 Sample Survey on Population Changes, with each rate adjusted

uniformly upward to generate a total fertility rate of 1.65 in 2005, in line with other estimates.[16] We subject the age-specific fertility rates to varying assumptions about fertility growth. Fertility is allowed to vary between three scenarios: no change, uniform increase in all age-specific fertility rates such that TFR increases to 1.96 in 2012 and remains there (the "late" growth scenario), and linear increase in each age-specific fertility rate starting in 2010 such that the NRR equals 1 under the current sex ratio of 1.18 (replacement fertility) by 2030 (the "slow" or "gradual" growth scenario).

The potential trajectories for the sex ratio at birth in China are summarized by two scenarios. The first assumes that the government's policy is effective at stabilizing the SRB at 1.09 for all births since 2005, identified as a policy target for the near future (Li 2007). The second scenario assumes that the SRB persisted indefinitely at 1.18, close to its 2005 level. We find that alternate assumptions regarding the sex ratio at birth and the possibility of fertility growth would lead to the same basic outcomes (shown in Table A2). It is worth noting that *none* of these assumptions about future fertility patterns affect our predictions for marriage markets through 2030, since these cohorts have already been born. Even if a lower sex ratio at birth was achieved immediately, the percentage of unmarried adult men age 30+ and 30-39 in 2050 would remain high (Tables 7 and A2). Sensitivity analysis to account for the possibility of fertility growth (either slow growth beginning immediately or rapid growth in the near future) projects that a change in fertility could lower the share never married in 2050 by no more than 1.8 percentage points (Table A2). Correcting the sex ratio is the most prudent course of action, but even immediate improvements are insufficient to relieve the demographic squeeze in the short- to mid-term.

Flexibility in spousal age gaps can be understood through the lens of demographic translation as a mechanism for ensuring clearing of the marriage market in the context of skewed sex ratios (Ni Bhrolchain 2001). In recognition of this fact, we allow for an age gap between spouses of 8 years, which is one of the largest observed average age gaps for marriages among men or women of any age (Lloyd 2005; Casterline et al. 1986), and which would represent a significant break from Chinese cultural norms.[17] This wide age gap is an alternative to a world in which males must marry women of the same age, in which case the never-married rate for males

[16] This is based on age specific fertility rates from China NBS Sample Survey on Population Changes (2004). The fertility rate in China is the subject of much debate. Some have argued that official statistics are distorted due to the tendency of parents to mislead census officials out of a fear of punishment for violations of the One Child Policy. The lowest estimate in currency is that of the China NBS, which estimated TFR in 2005 at 1.38. The highest mainstream estimate is by the CIA Factbook, estimated at 1.79 in 2009. Cai (2008) summarizes the debate and estimates a value of 1.5-1.6, in line with other third party calculations. See also Goodkind (2008) and Lutz et al. (2007) for current discussions of competing estimates and Zeng et al (2008) for an implementation of a similar upward fertility adjustment.

[17] The current average age gap between spouses is under 2.5 years, and has remained under 3.5 years for as many years as China's modern Census data can be projected backwards (Ebenstein & Sharygin 2009). 8 years is in excess of the average age gap among marriages of men or women 20-30 of all world populations for which DHS surveys have been conducted (with the exception of some countries in West Africa; see Lloyd 2005) and among the highest in populations included in the World Fertility Survey (Casterline et al. 1986). The age gap between spouses is highly sensitive to the male's age. Marriages among males age 30+ tend to have a large age gap between spouses, largely but not entirely due to remarriages. In order to account for the possibility that the average age gap might increase further, we additionally used a dynamic (increasing with age) gap that generated an age gap of 8 years at female age 22 and increasing thereafter; our results with this method were consistent with these estimates. We opted to use the 8-year age gap in order to be consistent with earlier estimates produced from our population projection model.

would equal the sex ratio at birth, adjusted for mortality by sex and age. The downside to choosing a narrower gap would be the increasing possibility that the model is too restrictive, while a wider age gap may risk becoming divorced from reality. While the age gap serves to reduce the share failing to marry, the reason share of males in a particular age group such as 30-39 can be higher than the SRB due to the fact that females' preference for educated spouses means that younger men (males enter the marriage market at age 25) can take brides first. In an education-naive model, the share never-married should never exceed the SRB (in fact it should be predictably below the SRB due to the age gap between spouses).

The marriage model is female dominant: in order to maximize the matches generated, males are not attributed any preference function for females.[18] We assume that females prefer the most educated males, and prefer older males to younger males. Since sex ratios at birth rose only after the 1980s, older men faced little bride shortage. Therefore, we report projections for men aged 30-39 in order to reflect more closely the never-married rates experienced by male cohorts entering the marriage market today and in coming years. Where shares never married cannot be calculated for closed age groups, we report statistics for share unmarried limiting the population to men above 30, by which age the rate of first marriage historically observed in the Census drops to minimal levels. Here a distinction should be made – although marriage for males in China is rare above age 30, we continue to hold males on the marriage market until age 40 (although it is unlikely for women to remain single through age 32, the minimum age for marriage to a male age 40).

Our simulation makes the assumption that ethnicity does not affect likelihood of marriage. In the model, a man of the Han majority ethnicity has no preference between a Han woman and one of a minority ethnicity. Similarly, women's preferences are based solely on economic and social status. A woman will prefer an educated man of a different ethnicity to an uneducated man of her own ethnicity. Outcomes from the marriage simulation are very similar when the sample is restricted to Han men and women. A Han man in a poor minority area like Xinjiang, Ningxia, and Tibet will still do poorly in the marriage market due to his educational background, since Han men living in minority provinces tend to be of similar educational levels as non-Han in the same place.[19] We believe that this is a tenable assumption, because sociological research indicates that a potential mate's ethnicity is not a first-order consideration in mate selection in China today, including in rural areas (Wei 2007). In addition, many who identify as minorities are actually of mixed ethnicity and may have more cultural affinity with the Han majority (Wei & Cao 2007). The marriage market for minority populations in China is a

[18] We use the calculated national-level education-specific marriage failure rates for men, and apply it to the current age and education distribution observed in 2000. This highlights areas where a large percentage of the males have education below junior-middle school (*xiao zhong*) level. The results are illustrated in the map. Higher educated men have lower rates of overall marriage failure for males, but the problem of unmarried males is widespread and located in peripheries, especially in Xinjiang, Xizang (Tibet), Qinghai, Sichuan, Yunnan provinces and nearby areas. Our projections assume no ethnic preferences of Han males for or against minority females (and vice versa). However, the results are robust to limiting to the Han population only.

[19] Historical precedent exists for high rates of non-marriage in Tibet due to the customary practice of fraternal polyandry. As recently as the 1990 and 2000 Census, non-marriage in Tibet, which is more prevalent for males than for females, exceeds the national average (suggesting that polyandry is insufficient to explain high rates of non-marriage in Tibet, and that educational, economic, and other population characteristics may also play a role).

promising area for future research, and our projection model highlights the harsh inequalities in educational attainment between Han and minority regions.

Simulating changes in a population as large and complex as China's is a challenging task that has not been attempted by many other authors. Zeng et al. (2008) have constructed a detailed probabilistic model of population growth in China with extremely promising results. We have adopted some of Zeng et al.'s assumptions about future changes in fertility. Our projection model requires a more limited number of data inputs and restricting assumptions, making it potentially more robust to unanticipated social changes. Although approached in very different ways, both modeling strategies agree on some of the urgent issues in China's demographic future.

4.2 National Results

In Table 7 we present the baseline results of our cohort-component projection of share married by education in the 21st century. Because we employ data from 100% summary tabulations of the China 2000 Census, statistics at the national level can be calculated for open-ended and closed age groups (30+ and 30-39 respectively). In comparing these numbers, two issues need to be highlighted.

First, results differ sharply between those for the closed age group of men 30-39 and those for the open-ended age group 30+. China has low levels of adult mortality and very low fertility, meaning that the open-ended age group includes a significant proportion of older men who did not face a shortage of brides. Sex ratios at birth began to rise sharply from the mid-1980s, so men born after 1990 are the first projected to face a significant squeeze on the marriage market. Thus, 78 percent of those aged 30+ in 2030 and 42 percent of those aged 30+ in 2050 are old enough to have faced little marriage squeeze.[20] As a result, while one-fifth of men aged 30-39 are estimated to remain single in 2030, only 7 percent of those in the open-ended age group 30+ are estimated to be unmarried. The estimates for the age-group 30-39 is arguably more important, since people's perception of how bride shortage will affect their lives is likely to be shaped more by the experience of their own age peers than by that of much older cohorts of men whose circumstances are very different.

Second, we find that the bride shortage is only somewhat mitigated even if the sex ratio at birth had dropped sharply to 1.09 immediately after the most recent births observed in the 2005 census. Once again, this is due to the momentum of births from earlier cohorts reaching marriage age. Problems in the marriage market would persist well into the future as the men and women already born reach maturity and pass through the marriage market. As a result, aggregate spousal availability will hit an all-time low before recovering, regardless of the fertility and sex ratio scenarios considered. By 2030, an estimated 20.8 percent of men aged 30-39 will never have married, even if the sex ratio at birth had fallen to a normal level of 1.06 in 2006.[21] The

[20] Percent of males too old to have faced a marriage squeeze come from projections of the population age distribution in China from the UN Population Division (2008).

[21] The timing of the peak of cohort share of males never married is highly sensitive to the age at which males and females begin their search for a marriage partner. Models with late entry to the marriage market exhibit later peaking behavior, but the cross-cohort average share never married in the closed-interval age group is highly consistent.

effect of change in the sex ratio is more significant in the decades thereafter, with 18.2 percent of men remaining single in 2050 under current conditions, which would have been nearly 9 percentage points lower if the sex ratio had been successfully contained at 1.09 in 2006 (Table 7).

Men with less education will face even more daunting challenges in the marriage market (Figure 3): over 10 percent of men with less than primary school education aged 30+ in 2030 are projected never to marry, and this figure increases to almost half in 2050 (assuming that these men are last in line when it comes to choosing a mate, as discussed above). The core result is highly robust as discussed below, finding that substantial proportions of men in China will fail to marry at very high rates during the next several decades as the cohorts born during the One Child Policy reach marriage age.

4.3 Province-level Results

At the provincial level, we present the results of simulations for the open-ended age group 30+ for the year 2030. In interpreting these results, we emphasize again that 78 percent of the men aged 30+ were born in more gender-balanced cohorts and faced little if any marriage squeeze. Due to limited data on sub-national geographies, it is difficult to simulate the marriage market for closed age-groups. Our focus here is therefore not on the *actual proportions* of men projected to remain single, but on their *geographic distribution*.

Figure 4 maps the projected proportion of unmarried men aged 30+ in 2030 in each prefecture by quintile.[22] While the proportions of ever-married in the coastal region will remain close to those observed today, many more men are predicted to remain single in the areas with dark shading, primarily in the less affluent inland and western provinces.

Poor provinces are hit hardest by the marriage squeeze (Table 8). Provinces in the lowest quintile of income per capita are projected in 2030 to have unmarried shares among men aged 30+ that are 50% higher than in the wealthiest provinces. A mother in Shaanxi province, ranked 20th out of China's 31 provinces based on 2006 GDP per capita, explains that "in our village, when a boy is older than 24, 25, it is a shame on him for not marrying." This comment is suggestive of widespread attitudes in rural areas throughout China. Incidents of bride flight in Shaanxi are already becoming widespread. In one widely reported scandal, 11 families in one village were reportedly scammed for approximately $4,800 each by a group of brides who fled after receiving cash bride-prices from families desperate to marry off their sons (Fong 2009).

Poorer provinces provide a "demographic subsidy" to richer ones, through two routes. The first is the flow of female marriage migration within central and coastal China, from the poorer to the more developed parts (Figure 2). By contrast, little female marriage migration takes place from the Western provinces, which have larger ethnic minority populations. Indeed, these

[22] The underlying simulation technique is unchanged, but tabulations of population by sex by educational level by age are not published for geographical levels smaller than national. To more accurately calculate share never married for closed age groups in geographical areas smaller than the province would require such a tabulation, or a larger sample of the China 2000 Census microdata from which we could create our own estimates.

Western provinces are small net importers of women, and yet they are projected to have high proportions of unmarried men. This is due to the second route for providing a "demographic subsidy" — there is a net inflow to the Western provinces of lower-educated Han men from central and coastal China, helped by (sometimes informal) policies to promote migration to less developed minority areas (Bhattacharji 2009). Of males who had ever moved from one province to another by the time of the China 2000 Census, Xinjiang was the fourth most popular destination, but the in-migrants had less education than the average male resident in 2000 (Table 9). And Tibet was the eighth most popular destination, and in-migrants there also have very low levels of education, though higher than the average resident. In comparison, over 30% of male migrants to Beijing and Tianjin (the first and sixth choices) -- and over 20% to Shanghai and Guangdong (the second and third choices) -- had completed senior middle education or higher.[23]

Our simulations indicate a high concentration of unmarried men in poor areas, and areas with high proportions of ethnic minorities. The majority of prefectures with the highest predicted percentages of never-married males aged 30+ in 2030 are located in Guizhou, Qinghai, Tibet, and Yunnan. High fractions of unmarried males are also predicted for Ningxia, Sichuan and Xinjiang. The predicted percentages of unmarried men are lowest in China's richest provinces. Several of the provinces with high predicted numbers of unmarried men contain large minority populations and large numbers of rural males with few years of formal education. Some prefectures will be especially hard hit. For example, two out of nine prefectures in Guizhou are projected to exceed 20% non-marriage among males 30-39 by 2030, and all but one may exceed 50% by 2050.[24]

This geographic concentration of unmarried men raises the potential for social instability, as entire cohorts of men perceive that they and their peers face a high likelihood of enforced bachelorhood. This is unlike other areas that have historically had high levels of non-marriage such as Ireland — where there was no shortage of women and men could have a sweetheart whom they aspired to marry once they had saved enough — or small rich countries such as South Korea which can attract enough foreign-born brides to significantly offset the shortage of local brides, as discussed below.

Another source of concern is the aging into retirement of China's working class. Provinces with high dependency ratios will have to strain even more to support their elderly while being confronted with large numbers of unmarried men. The implications of this will be discussed in the next section.

5 Conclusions and Policy Implications

The proportion of never-married men aged 30-39 is projected to grow rapidly as the birth cohorts of the One Child Policy begin to saturate the marriage markets. A high sex ratio means that

[23] Authors calculations from the China 2000 Census 0.1% sample.

[24] Percent unmarried for sub-national areas calculated by applying the rate for age 30-39 to the population by prefecture by educational level, which is only available for age 6 and higher. Thus, the population will be more heavily weighted towards primary and junior middle level education, and the resulting overall share never married biased upwards.

partners of the same age will be scarce, while below-replacement fertility reduces the chance of finding a spouse among younger cohorts. Squeezed by the persistently high sex ratio and low fertility for the past 20 years, the effects will begin to show as the estimated unmarried share of 30-39 year old males will rapidly rise from near-zero today to over 20% in 2030 before receding to more moderate levels that depend on the direction of future changes in fertility and the sex ratio. The overall share of males 30+ that are unmarried will rise more steadily ─ reflecting the demographic momentum built into this open-ended age group ─ from approximately 3% in 2010 to double by 2030 and triple by 2050. Reducing the sex ratio at birth is an aggressively pursued policy solution, but it is projected to have the most significant effect when combined with increases in fertility, and only in the mid- to long-term.

As in the past, the poorer parts of China will subsidize wealthier areas demographically, with women moving from poorer areas to marry men in richer areas. We have documented that historically, women have enjoyed nearly-universal marriage and that women have selected husbands partly on the basis of wealth, and are willing to relocate to find husbands of greater wealth. We anticipate that this pattern will continue, with women leaving poorer parts of the country for the wealthier coastal and central region. Unmarried males are likely to be clustered in these poorer areas in the Southwest and Northwest, with low fiscal capacity to offer support. Guizhou is presented as an example of these areas, with 20% of males 30-39 unmarried in 2030 and up to half likely to remain unmarried by mid-century. Even controlling for education, place of residence and minority status, single men in China have lower incomes and assets and poorer self-reported health than married men. They are also less likely to co-reside with younger kin. Their vulnerability is further compounded by being clustered among the least educated, living in poorer areas, as our projections indicate. All these factors converge to raise unmarried men's likelihood of needing support, especially in their old age, while reducing their access to support from family or the state.

People have argued that high levels of bachelorhood in China may cause social unrest, based on national averages of the problem. We show that the national averages hide a great deal, and that the problem is highly clustered geographically in the rural areas of poor provinces. Such high concentrations of men facing enforced bachelorhood and vulnerable old age could significantly increase the potential for disaffection and social unrest, perhaps even more so since many of the poorer provinces also have large populations of ethnic minorities where demographic imbalances can add to other sources of social tension.

Our conclusions are based on the assumption that the sheer numbers of surplus men ─ 27 million already born 1985-2005 ─ in China will make it difficult to resolve much of the problem through international migration. Some bachelors might emigrate to other countries, but there are practical barriers to large-scale emigration. In small rich economies, such as South Korea and Taiwan, China, foreign-born brides from poor Asian neighbors have helped mitigate the shortage of domestic-born wives. With their compact geography and high level of development, even the poorer farmers of these countries can offer good living standards and access to good schools and services. If China's poorer provinces are able to raise their living standards quickly enough, this could be an option for some men, but the potential demand for foreign-born brides is likely to far outstrip supply in China's setting.

For its part, Chinese policy must focus both on the short-run and long-run. Efforts to normalize the sex ratio at birth through advocacy and incentives such as the "Care for Girls"

campaign may prove important in lowering the prevalence of sex-selective abortion. Other options include a relaxation of the One Child Policy, which may allow parents to have a son without resorting to sex selection (Zeng 2007). Our projections show that these measures will help, but only in the longer term. The more immediate need is to strengthen social assistance and social insurance programs, especially in rural areas where the percent elderly is projected to rise most rapidly, Zeng et al. (2008) project that rural areas, when compared to urban areas, will have twice the share of over-80 population (4% in 2030; 13% in 2050), and approximately 1.5 times the share of over-65 population (22% in 2030; 33% in 2050).

China's social protection programs are growing quite quickly, but from a low base (World Bank 2009). Coverage up until recently has been low, especially in rural areas. Wealthier provinces even now are better served than poorer ones, because the programs rely substantially on local financing. The World Bank (2009) recommends strengthening of social protection programs that provide safety nets against destitution, and help people afford health insurance. They also point out that despite improvements in social protection administration, most programs will remain very fragmented and poorly managed unless an effective national social insurance administration is developed (World Bank 2008: 86). Given the analysis of this paper, special attention could also usefully be paid to areas which are projected to have large numbers of unmarried men. The impending explosion in the childless population is likely to require significant changes in how China cares for its elderly.

There is hope for the timely establishment of the type of insurance program that could address this issue effectively. At a September 2009 meeting of the World Economic Forum, Premier Wen Jiabao stated that China's economic stimulus package includes a trial old-age insurance program, covering 10% of counties and 90 million people (Wen 2009). If this program is adequately financed by the central government and avoids the problems of existing social protection programs in China, this program, and others like it, could help China's growing population of poor, unmarried men. Such programs should eventually be spread across all provinces, using the resources of the wealthy areas to finance the insurance of the poor areas. A progressively-structured national old age pension program could do much to reduce the vulnerabilities of the enforced bachelors. Help may be nigh: the World Bank[25] notes that the central government plans to provide some funding to the rural pension scheme, and expand it to cover the whole population. Such programs may also be useful in lowering the prevalence of sex-selective abortion, insofar as this behavior is exacerbated by a lack of adequate social insurance programs for elderly care (Ebenstein & Leung 2009).

Fortunately China has time to act, since the marriage squeeze resulting from current high sex ratios at birth will manifest itself only after a couple of decades. Meanwhile, the country is generating large surpluses with the help of its large working-age population. Both the time and the resources are available for establishing well-targeted and progressive programs for old age support and social protection. These could mitigate the hardships faced by the emerging population of bachelors, and reduce the potential for future social instability.

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Appendix

The cohort component projection model used in this paper is an adaptation of the model developed in earlier work on the marriage market in China (Ebenstein & Sharygin 2009). The model calculates share of males and females never married overall and by specific ages or level of education, with a number of options to set the age at which males and females enter the marriage market, the age preference function of women for spouses, and the trajectory of fertility change and change in the sex ratio of births since the 2005, the date of the China 1% inter-Census survey. The main engine of the population simulation is marriage, fertility, and mortality, and the factor that is of most interest for this discussion is marriage. The marriage sorting algorithm matches females to males 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. The model also assumes perfect mobility between geographical areas, so that there is no implicit preference for nearer males over more distant potential spouse.

This model is the first to our knowledge to introduce educational preferences of females on the marriage market, which enables calculation of ever-married status by single years of age or by educational level, or some combination of age and education. 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. We address this issue by calculating the distribution of educational attainment among males age 23 in the 2000 Census. We assume 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 us to use the most recent years of data in the 2000 Census.[26]

Once the model has calculated national-level education-specific marriage failure rate for men, we apply it to the current age and education distribution last observed in the 2000 Census. This admittedly synthetic measure highlights areas where a large percentage of the males have education below junior-middle school (*xiao zhong*) level. Education may improve after 2000 without compromising the applicability of the results as long as the relative gaps in education between areas remain stable. 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 when changes in the spatial distribution of education become significant. Yet, to the extent that these programs are implemented in areas which we identify as 'hotspots', our results may in some sense be externally validated. We assume no assortative constraints on males' search for female partners, thus we did not apply educational progression to females generated by the fertility steps. Our projections assume no ethnic preferences of Han males for or against minority females (and vice versa). However, the results are robust to limiting to the Han population only.

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 we have assumed no assortative mating preferences on the part of men, we aggregated females into a single sum by year, age, and ever-married status and any pre-existing information on their educational characteristics is disregarded. The number of single females

[26] The result is that the overall level of education in China improves until the point at which ergodicity dominates when those born on or after 1977 comprise the entirety of the population. Thus, the average level of education will rise at an arithmetic instead of geometric rate.

of a given age is calculated, and then if it is greater than zero, those women are 'married off' to men according to some specifiable 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 share never married rate since women can be fully married off, but it has important consequences for the share never married by education. We are reassured by our conversations with Chinese sociologists, through which we get 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, we deemed it prudent to build in the ability to vary the age at which females enter the marriage market. We use the age of 23 for females, although we also generated numbers for women 25 and higher, which is closer to the actual average age at first marriage. We have also developed the model further to include an option to set the age of male entry into the marriage market. In effect, we can now formulate a response to the 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.

Two types of age preference functions can be specified: age-independent, and dynamic or age-dependent. The age independent function used in this paper 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. The current paper uses the static age preferences, capping the age gap between male and female at 8 years (females matched to males 0 to 8 years above their own age). Females age 25, for example, are first married to males age 33through age 25, by education across ages before by age. Thus the total number of possible iterations is 9 years of age gap by 9 levels of education for a total of 81 maximum possible calculations for each single age of females in a given year.

The fertility and mortality processes are updated to reflect more recent fertility and mortality schedules. We use age-specific fertility rates from the Sample Survey of Population Changes (China NBS 2007), which applies to childbirth during 2006, and we inflate all age specific fertility rates by a factor such that the aggregate fertility level equals approximately 1.65 (following Zeng et al. 2008 and others). This results in slightly older ages of peak fertility compared to the previously published estimates for age specific fertility from the same survey in 2004. We previously used sex-and-age-specific mortality rates from Banister and Hill (2004). However, in this paper we use more recent data from the WHO (2006) which shows mortality improvement since the 1999-2000 period discussed by Banister and Hill. The sex ratio of post-2000 births prior to 2006 is pre-set based on data from the 2005 1% inter-Census 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 remains 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 growth function for fertility at all ages, with a cap on TFR), and immediate change (specifiable multiplier for fertility at all ages).

Table 1: Marriage and Education by Birth Cohort in China

	Male Cohorts Born			Female Cohorts Born		
	1935-1945	1945-1955	1955-1965	1935-1945	1945-1955	1955-1965
Sex Ratio of Cohorts	1.13	1.08	1.04			
Total cohort size	569,588	873,505	1,024,910	504,251	809,753	987,090
	Cohort Share Never Married by Education (%)					
Total share never married	5.64	5.41	3.95	0.20	0.28	0.38
Less than Primary	12.41	13.21	27.74	0.21	0.24	0.64
Primary	4.00	3.84	8.11	0.13	0.22	0.18
Secondary	1.82	1.21	2.15	0.51	0.98	0.40
College and Higher	0.79	0.66	1.30	0.67	2.30	1.56
	Educational Attainment by Cohort (%)					
Less than Primary	22.41	20.23	2.12	57.81	42.83	8.28
Primary	67.60	67.45	22.00	37.61	50.57	35.48
Secondary	7.48	11.64	69.45	3.64	6.32	52.81
College and Higher	2.51	0.68	6.43	0.94	0.27	3.43

***Source*:** China 1982 Census (1% sample), China 1990 Census (1% sample), China 2000 census (0.1% sample).

***Notes*:** The share never married and the sex ratio of the cohorts in each column is calculated using data on individuals observed in these cohorts in the 0.1% samples of the 1982 Census, 1990 Census, and 2000 Census, respectively. The observed sex ratios are slightly lower than when the individuals were of marrying age due to higher adult mortality among men. Ever married status is calculated using the 2000 Census, and so the sample is restricted to those still living at the time of the 2000 Census. First marriage above age 35 is extremely rare for all cohorts.

Table 2: Prefecture Characteristics Associated with In-Migration of Females

	% In-Migration of Females		
Variable	(1)	(2)	(3)
Years of Education (Men 20-30)	0.00196***	0.00145***	0.00139***
	(0.0003)	(0.0005)	(0.0005)
Urban (1=yes)		0.00453	0.00572*
		(0.0033)	(0.0034)
Sex Ratio (children 0-4)			0.0160***
			(0.0050)
Observations	345	345	345
R^2	0.346	0.354	0.394

***Source*:** China 2000 Census (0.1% sample).

***Notes*:** Asterisks indicate significance at 10%, 5%, and 1% levels. Robust standard errors are listed in parentheses under coefficients. Sample consists of all 345 prefectures in China in 2000. The dependent variable is the fraction of women in the prefecture who report having in-migrated for marriage from another prefecture (35% of these migrations occured within the 5 years previous to the 2000 Census). All models include province fixed effects.

Table 3: Coverage and Benefit Levels of Social Assistance Programs in Rural China, 2004

Region	Per capita income (2004 yuan)	Percent below poverty line	Percent of population receiving benefits			Average benefit per capita (yuan/person/year)			
			Wu Bao	*Di Bao*	*Tekun Hu*	*Wu Bao*	*Di Bao*	*Tekun Hu*	Medical assistance
Coastal	4309	5.7	0.9	1.6	3.0	244	136	70	99
Northeast	3481	13.5	1.2	2.3	4.3	270	71	72	7
Central	2663	13.5	1.4	1.6	3.8	141	36	32	30
Southwest	2265	21.3	1.2	0.8	4.4	139	50	41	16
Northwest	1898	34.8	0.6	1.6	4.4	105	34	34	31
Total	3076	14.3	1.1	1.5	3.7	172	65	45	42

***Source*:** World Bank 2009: Table 6.63 and 6.64. Per capita income and poverty incidence are based on the Rural Household Survey (China NBS 2004). Program coverage and benefits are from the NBS-World Bank Village-Level Survey (2004).

***Notes*:** Poverty refers to consumption poverty using the World Bank poverty line.

Table 4: Sources of Support for the Elderly Population by Age Group, China 2005

(Share of income in percent)

	Urban	Rural					
	60+	60+	60-64	65-69	70-74	75-79	80-84	85+
Family Support	37.0	54.1	28.6	46.6	66.9	79.1	87.2	91.1
Labor income	13.0	37.9	64.3	45.1	24.4	12.0	4.3	1.7
Property income	0.5	0.2	0.1	0.2	0.2	0.2	0.1	0.1
Pensions	45.4	4.6	4.7	5.1	4.7	4.4	3.8	2.6
Dibao	2.4	1.3	0.8	1.2	1.5	1.9	2.0	2.1
Insurance and subsidy	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Other	1.5	1.8	1.2	1.7	2.2	2.3	2.4	2.3

***Source*:** Cai et al. 2009: Table 1A-1B (derived from the 1% Inter-census survey, China NBS 2005).

Table 5: Cohabitation of Elderly with Younger Family Members Other than a Spouse

	1982 Census		1990 Census		2000 Census	
	Never Married	Have Married	Never Married	Have Married	Never Married	Have Married
Fraction Cohabiting						
Elderly, Age 65-80	0.366	0.746	0.426	0.732	0.195	0.653
Elderly, Age 80+	0.409	0.733	0.433	0.751	0.275	0.730

***Source*:** China 1982 Census (1% sample, China 1990 Census (1% sample), China 2000 Census (0.1% sample).

***Notes*:** Cohabitation is defined as having a member of the household who is younger than age 60 and of kin (excluding a spouse).

Table 6: Differentials in Income, Assets, and Reported Health Status by Men's Marital Status, Rural China 2002

	(1) Personal Income	(2) Financial Assets	(3) Good Health
Never Married	-760.2***	-3,686**	-0.105***
	(261.960)	(1,685.664)	(0.027)
Age	-44.0***	25.2	-0.011***
	(3.528)	(22.701)	(0.000)
Years of Education	230.2***	529.3***	0.009***
	(15.722)	(101.168)	(0.002)
Minority	30.5	-1,221	0.024
	(219.562)	(1,412.844)	(0.023)
Constant	7,801.9***	56,119***	1.108***
	(371.892)	(2,393.058)	(0.039)
Observations	10,033	10,033	10,033
R^2	0.26	0.37	0.16
Sample Average	2,184	24,085	0.76

Standard errors in parentheses
*** $p \leq 0.01$, ** $p \leq 0.05$, * $p \leq 0.1$

Notes: Based on responses among male rural participants in the China Household Income Survey (2002) who are age 30 and older. Good health is defined by respondents reporting themselves as "very healthy" or "healthy".

The regressions are calculated by Ordinary Least Squares in which each column examines the partial correlation of each welfare measure with the demographic characteristics of the survey participants, shown in the rows of the table. The regressions are executed with prefecture-level fixed-effects to control for regional variation in the outcomes.

One caveat to these results is that they are taken from a household survey, where the composition of households may be different than the composition of households where unmarried men usually reside. In fact, these results probably understate the welfare differences in household characteristics, since the average household size in the census for men age 30 and older is 3.01 for unmarried men and 4.03 for married men. In the CHIS, the average is 4.38 for unmarried men and 4.30 for married men. In reality, the unmarried men will on average be in smaller households and less able to rely on family assets for support.

Table 7: Projected Share Never Married among Males

	Percent Never Married, by scenario of SRB change							
	Already Born		SRB=1.09			SRB=1.18		
Overall	2010	2020	2030	2040	2050	2030	2040	2050
Males 30-39	2.19	2.15	20.80	11.10	11.46	20.80	14.75	18.21
Males 30+	3.47	3.12	6.69	8.11	9.74	6.69	8.81	11.88

Source: Authors' projections from China 2000 Census data, according to scenario of change in SRB after 2005. For overall shares of never-married males age 25+, see Ebenstein & Sharygin 2009.

***Notes*:** These projections assume female entry into marriage market at age 23 and male entry at age 25, female preference for educated males before males of similar age, and an age gap for spouses of up to 8 years. SRB change under each scenario is effected after 2005. Age-specific fertility rates from China NBS 2006 are adjusted to reflect TFR=1.65 in 2005. Table 6 and Figure 3 assume no change in age-specific fertility rates from 2006. Share never married among 30-39 year olds is highly turbulent due to movement of cohorts of highly skewed sex ratios through the age distribution, and is highly sensitive to the age preferences of females for partners.

Table 8: Marriage Failure by Provincial per capita Income

	Provincial Income Category				
	Highest	High	Middle	Low	Lowest
GDP per capita (2006)	38,557	22,119	16,083	13,627	10,772
% Rural (2006)	37.78	51.29	60.93	62.45	67.25
Dependency Ratio (2006)	36.06	40.26	46.52	46.65	45.41
% College Educated (2006)	9.62	6.20	5.86	5.23	3.80
% Illiterate (2006)	7.19	6.67	8.45	9.90	15.63
Life Expectancy (2000)	74.30	72.45	71.07	70.41	68.81
% Men 30+ Never Married (2030)*****	6.09	6.76	7.11	7.65	9.42

Source**:** 2006 GDP per capita (yuan per person) from China Yearly Macro-Economics Statistics, Provincial (China NBS 2007b). Percent College Educated (of population over age 6), Percent Illiterate (of population over age 15), and Dependency Ratio (ratio of population under 15 and over 65 to population 15-64) in 2006, and Life Expectancy in 2000 from the National Sample Survey on Population Changes (China NBS 2007a). Table 8, Figure 4, and Table A1 show relative share of guang gun (unmarried males) reported based on education-specific rates of non-marriage from authors' projections in 2030 applied to the distribution of males by education in the China 2000 Census (SRB=1.18, 'late' fertility growth scenario).

Notes**:** * Table 8, Figure 3, Figure 4, and Table A1 report projected share of males never married for an open-ended age group, so the estimated share never married is relatively low due to the older age composition of the group (see Table 7 and Table A2 for comparisons of open-ended with closed-interval estimates). Population-weighted averages reported. Provinces are stratified into groups by GDP per capita, and population-weighted means reported for each figure. The highest-income group consists of Shanghai, Beijing, Tianjin, Zhejiang, Jiangsu, and Guangdong provinces. The high income group includes Shandong, Fujian, Liaoning, Neimenggu, Hebei, Jilin, and Heilongjiang provinces. Xinjiang, Shanxi, Hubei, Henan, Chongqing and Ningxia are middle-income. Shaanxi, Hainan, Hunan, Qinghai, Sichuan and Jiangxi are low-income. The lowest-income group consists of Guangxi, Xizang, Anhui, Yunnan, Gansu, and Guizhou.

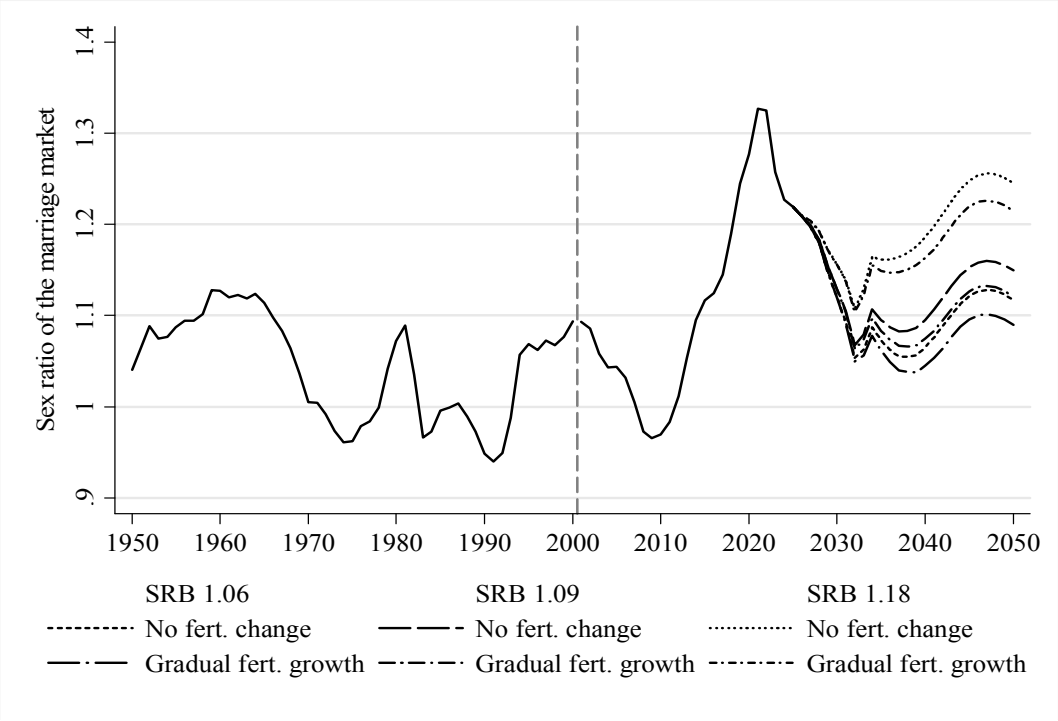
Table 9. Male Migration to and from Selected Provinces

	Province of Origin or Destination				
	Beijing	Tianjin	Xinjiang	Ningxia	Xizang
GDP per capita (2006)	58,204	46,122	16,999	14,649	12,109
Male migrants 6+ (1995-2000)					
Total in-migrants	1,135,000	249,000	724,000	55,000	44,000
% in-migrants completed Sr Middle	32.1	33.3	12.8	16.4	13.6
Total out-migrants	145,000	55,000	120,000	36,000	39,000
% out-migrants completed Sr Middle	50.3	65.5	53.3	52.8	23.1
All Males 6+ (2000)					
Total males 6+	6,600,000	4,556,000	9,155,000	2,496,000	1,036,000
% completed Senior Middle	42.2	32.2	19.5	18.7	6.4
% In-migrants	18.4	5.5	8.6	2.3	4.0

***Source*:** 2006 GDP per capita (yuan per person) from China Yearly Macro-Economics Statistics, Provincial (China NBS 2007b). Population count, migration and education from China 2000 Census (0.1% sample).

***Notes*:** Migration refers to movement between provinces during the 5 years preceding the 2000 Census for any reason, at any age 6 or above. Data refers to male migration only; for female migration, see Figure 2 and Table A1.

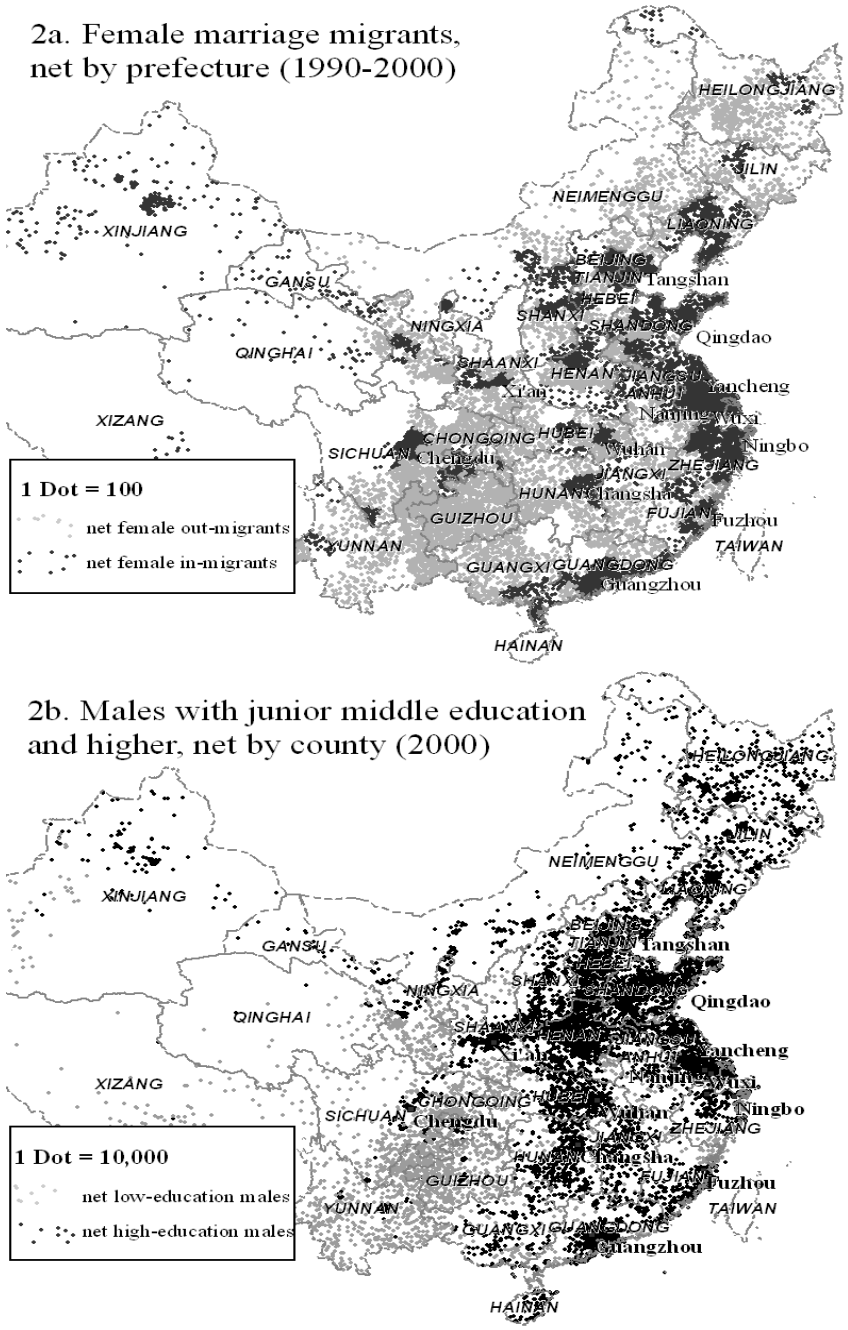
Figure 1: Projected Sex Ratio of China's Marriage Market



***Source*:** Authors calculations from simulations using China's 2000 census.

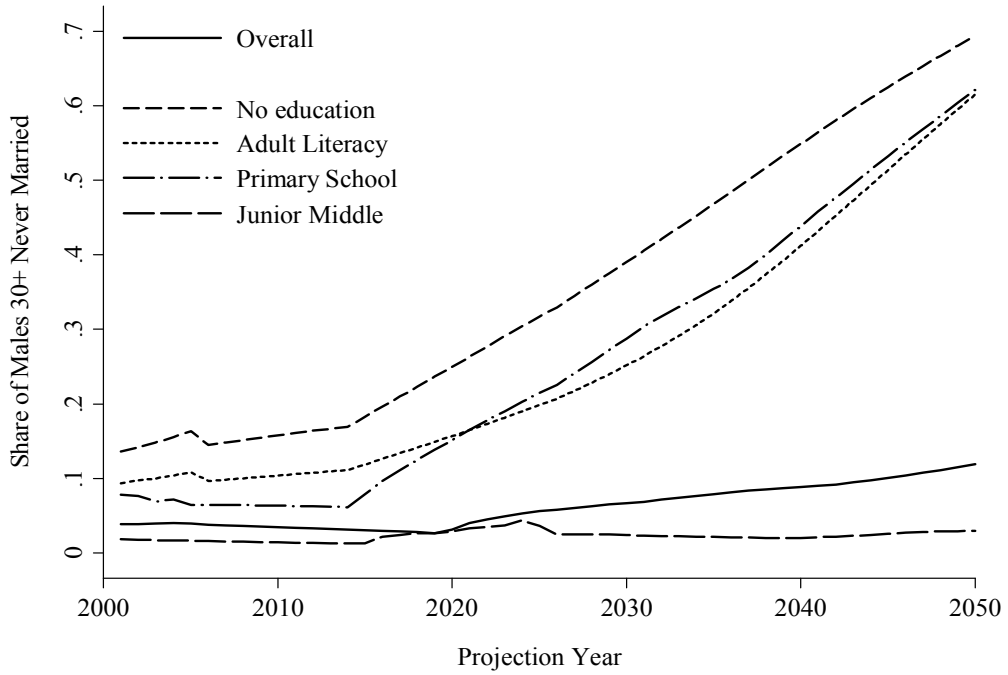
***Notes*:** Marriage market defined as males 22-30 to females 20-30. SRB refers to scenario of change in sex ratio of births after 2005.

Figure 2: Marriage Migration Patterns



***Source*:** (a) China 2000 Census (microdata 0.1% sample); (b) China 2000 Census (100% tabulation).
***Notes*:**
Women are classified as "marriage migrants" if they responded positively to the census question about whether they had migrated in the preceding 5 years, and then gave "marriage" as the reason for migration.
High education males defined as those with senior middle school (*gaozhong*) education or higher.

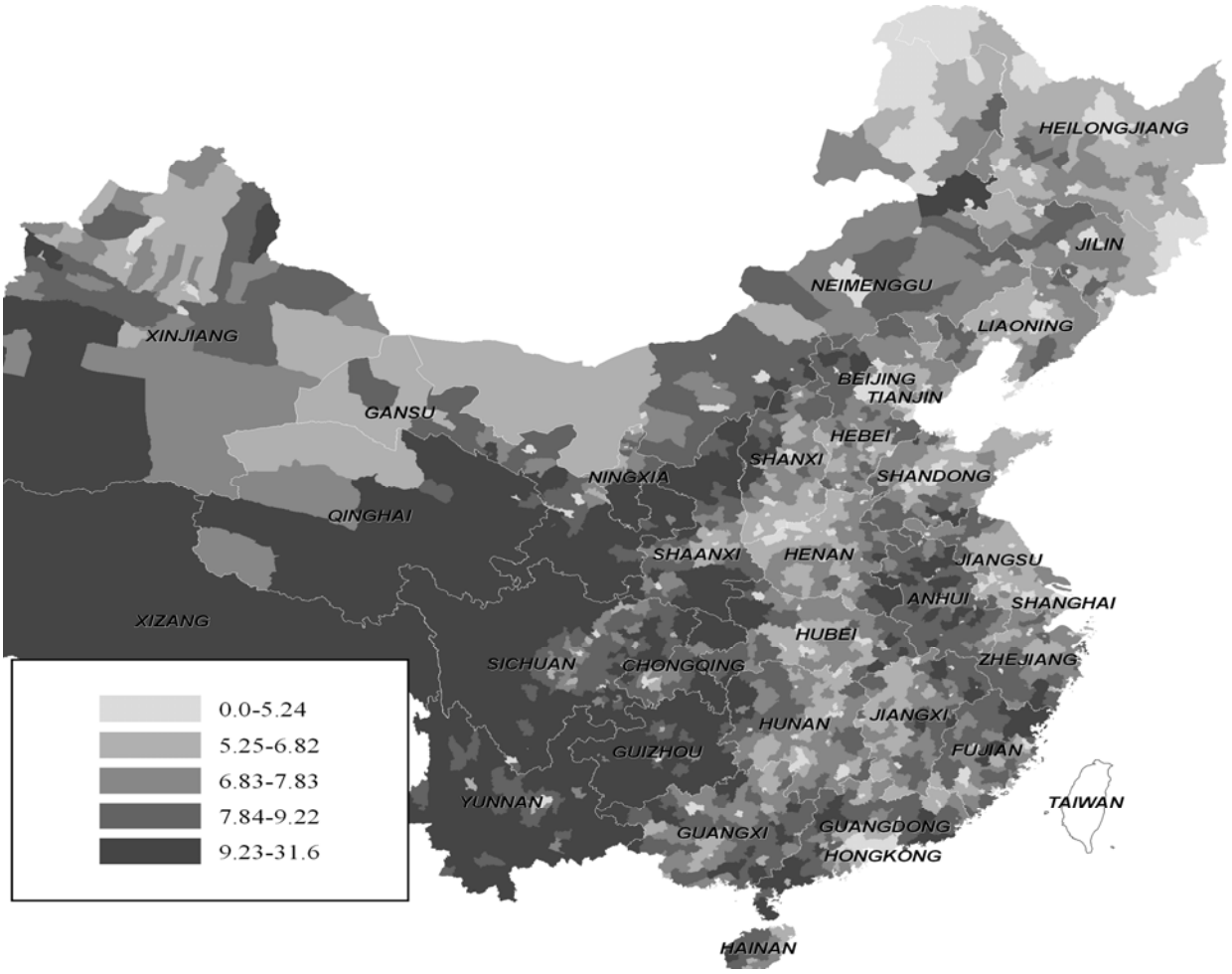
Figure 3: Projected Share Never Married by Completed Education



Source: Authors calculations from simulations using China's 2000 census.

Note: This figure reports the projected share of males never married for an open-ended age group, so the estimated share never married is relatively low due to the older age composition of the group (see Table 7 and Table A2 for comparisons of open-ended with closed-interval estimates). Table 7 and Figure 3 assume no change in age-specific fertility rates from 2006. Figure 3 further assumes no improvement in sex ratio of births after 2005 (SRB=1.18). For other assumptions of the simulation, see text and appendix.

Figure 4: Regional Patterns in Share of Males 30+ Never Married in China, 2030



Source: Authors' calculations from China 2000 Census (0.1% sample).

Notes: This is the projected share of males never married for an open-ended age group, so the estimated share never married is relatively low due to the older age composition of the group (see Table 7 and Table A2 for comparisons of open-ended with closed-interval estimates). Table 8, Figure 4, and Table A1 show relative share of guang gun (unmarried males) reported based on education-specific rates of non-marriage from authors' projections in 2030 applied to the distribution of males by education in the China 2000 Census (SRB=1.18, 'late' fertility growth scenario). For more details on simulation, see text and appendices.

Table A1: Net Female Migration by Province and Provincial Characteristics

Province	Net Female Marriage Migrants (1995-2000)	GDP Per Capita (2006) Nominal	GDP Per Capita (2006) Quintile	Dependency Ratio (2006)	Percent Rural (2006)	Life Expectancy at Birth (2000)	Percent of Males 30+ Never Married* (2030)
Jiangsu	176,000	33,928	1	12.4	48.1	73.9	6.14%
Guangdong	99,000	33,151	1	8.9	37.0	73.3	5.67%
Zhejiang	96,000	37,411	1	12.2	43.5	74.7	7.58%
Shandong	65,000	27,807	2	11.4	53.9	73.9	6.33%
Beijing	62,000	58,204	1	10.8	15.7	76.1	3.13%
Liaoning	43,000	25,729	2	10.6	41.0	73.3	5.92%
Shanghai	42,000	66,367	1	15.0	11.3	78.1	3.98%
Tianjin	30,000	46,122	1	11.2	24.3	74.9	4.60%
Hebei	29,000	19,877	2	10.0	61.6	72.5	6.73%
Xinjiang	26,000	16,999	3	6.9	62.1	67.4	8.44%
Fujian	22,000	25,908	2	9.5	52.0	72.6	8.09%
Shanxi	13,000	16,945	3	9.3	57.0	71.7	6.38%
Chongqing	7,000	14,660	3	11.4	53.3	71.7	8.24%
Hainan	4,000	14,555	4	10.2	53.9	72.9	6.68%
Ningxia	2,000	14,649	3	6.7	57.0	70.2	8.78%
Tibet	1,000	12,109	5	7.4	71.8	64.4	19.54%
Henan	0	16,012	3	10.6	67.5	71.5	6.80%
Qinghai	-3,000	14,257	4	6.7	60.7	66.0	10.94%
Shaanxi	-5,000	14,607	4	8.9	60.9	70.1	7.33%
Anhui	-9,000	12,045	5	11.4	62.9	71.9	8.31%
Gansu	-13,000	10,346	5	7.7	68.9	67.5	9.96%
Jilin	-21,000	19,383	2	8.1	47.0	73.1	6.16%
Hubei	-23,000	16,206	3	9.1	56.2	71.1	6.81%
Jiangxi	-27,000	12,633	4	9.2	61.3	69.0	7.07%
Hunan	-31,000	14,492	4	10.6	61.3	70.7	6.82%
Neimenggu	-43,000	25,393	2	7.5	51.4	69.9	6.84%
Guangxi	-47,000	12,555	5	11.0	65.4	71.3	7.68%
Heilongjiang	-62,000	18,478	2	7.4	46.5	72.4	5.80%
Sichuan	-66,000	12,893	4	10.8	65.7	71.2	8.66%
Yunnan	-119,000	10,540	5	9.0	69.5	65.5	10.71%
Guizhou	-177,000	6,915	5	9.3	72.5	66.0	10.96%

***Source*:** GDP per capita (yuan per person) from China Yearly Macro-Economics Statistics, Provincial (China NBS 2007b). Percent College Educated (of population over age 6), Percent Illiterate (of population over age 15), Elderly Dependency Ratio, Percent Rural, and Life Expectancy (both sexes combined in 2000) from National Sample Survey on Population Changes (China NBS 2007a). Table 8, Figure 4, and Table A1 show relative share of guang gun (unmarried males) reported based on education-specific rates of non-marriage from authors' projections in 2030 applied to the distribution of males by education in the China 2000 Census (SRB=1.18, 'late' fertility growth scenario).

***Notes*:** * Table 8, Figure 3, Figure 4, and Table A1 report projected share of males never married for an open-ended age group, so the estimated share never married is relatively low due to the older age composition of the group (see Table 7 and Table A2 for comparisons of open-ended with closed-interval estimates). Elderly dependency ratio refers to the ratio of the population age 65+ to the population 15-64. Share unmarried reported under SRB=1.18 and 'late' fertility growth scenario.

Table A2: Sensitivity of Share of Males Never-Married to Sex Ratio and Fertility Assumptions

Males 30-39

Year	No Change in Fertility: TFR	SRB after 2005: 1.06	1.09	1.18	"Slow growth" in fertility +1.2% annually in 2010 (to 2.18): TFR	SRB after 2005: 1.06	1.09	1.18	"Late growth" in fertility +19% in 2012 (to 1.96): TFR	SRB after 2005: 1.06	1.09	1.18
2010	1.65	2.19	2.19	2.19	1.67	2.19	2.19	2.19	1.65	2.19	2.19	2.19
2020	1.65	2.15	2.15	2.15	1.88	2.15	2.15	2.15	1.96	2.15	2.15	2.15
2030	1.65	20.8	20.8	20.8	2.18	20.8	20.8	20.8	1.96	20.8	20.8	20.8
2040	1.65	0	0	0	2.18	0	0	0	1.96	0	0	0
2045	1.65	9.78	11.1 0	14.7 5	2.18	9.25	10.7 4	14.4 1	1.96	7.33	8.49	13.7 1
2050	1.65	8.96	11.4 6	18.2 1	2.18	7.02	9.43	16.3 4	1.96	7.96	10.6 6	16.3 3

Males 30+

Year	No Change in Fertility: TFR	SRB after 2005: 1.06	1.09	1.18	"Slow growth" in fertility +1.2% annually in 2010 (to 2.18): TFR	SRB after 2005: 1.06	1.09	1.18	"Late growth" in fertility +19% in 2012 (to 1.96): TFR	SRB after 2005: 1.06	1.09	1.18
2010	1.65	3.47	3.47	3.47	1.67	3.47	3.47	3.47	1.65	3.47	3.47	3.47
2020	1.65	3.13	3.13	3.13	1.88	3.13	3.13	3.13	1.96	3.13	3.13	3.13
2030	1.65	6.69	6.69	6.69	2.18	6.69	6.69	6.69	1.96	6.69	6.69	6.69
2040	1.65	7.86	8.11	8.81	2.18	7.76	8.04	8.74	1.96	7.40	7.62	8.61
2045	1.65	8.97	9.74	11.8 8	2.18	8.45	9.25	11.4 9	1.96	8.28	9.12	11.4 4

Source: China 2000 Census; authors' calculations. Simulations described in detail in the text and appendix.

Notes: Age of entry to marriage market at 23 for females and 25 for males. Marriage occurs each round between females age 23-32 and males 25-40. Figures reported are percent of males age 30-39 in the never-married state. TFR=2.18 results in Natural Rate of Reproduction of 1.0 under the post-2005 SRB=1.18 scenario.