

Demographic Change, Prostitution, and Sexually Transmitted Infection Rates in China

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In the wake of the One Child Policy (1979), China has experienced an explosion in the sex ratio at birth, and there are 25 million more men than women below the age of 20 (2005 census). In this paper, we examine the implications of large numbers of men failing to marry on the supply and demand dynamics of sex work, with a focus on how this may affect the prevalence of sexually transmitted infections (STIs). We begin with a brief history of prostitution in China, and present an account of the massive increase in sex work following the economic reforms in the late 1970s. We then analyze the current dynamics of demand and supply for sex work in China, using both national census data and detailed microdata on sex workers. We find a clear link between high population sex ratios, the prevalence of sex work, and STI rates. We conclude our analysis with projections for the future, and a discussion of policy responses in light of an anticipated increase in sex work.

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1. Introduction

Prostitution in China is widespread and has increased dramatically in recent years. Following Deng Xiaoping's campaign for economic reform in the late 1970s, the market for sex work increased dramatically, as migration of both men and women to urban areas provided both increased demand and supply. Current estimates indicate that between 3 and 10 million women participate in this market, a steep increase from the hundred thousand estimated as recently as 1989.¹

In a parallel and alarming trend, China has experienced a steep increase in the syphilis infection rate, with maternal transmission rates to newborns increasing by a factor of five between 2003 and 2008 in Shanghai (Tucker et al. 2010). While sex work may have ambiguous welfare consequences, in the Chinese context, where it is often risky, the concern is clear. As we will argue in this paper, China is on the brink of an even steeper increase in the prevalence of sex work. China's fertility decline in the wake of the One Child Policy (1979) has led to an astonishing increase in the male fraction of births. The 2005 census reflected that sex ratios have perhaps not even peaked: the ratio of males to females among newborns reached 118, and the number of males outnumbered females by 25 million. These demographic patterns suggest that a large number of men can be expected to fail to marry in the next century. We will argue that this portends a large increase in the demand for sex work, and a supply of women willing to participate will meet this demand. As such, a critical examination of China's market for sex both historically and currently is warranted.

This chapter is organized as follows. We begin in section 2 with a brief history of prostitution in China, focusing on the aspects of the market for sex that are particular to China. As we will describe, China's market for sex work over time has been highly responsive to the economic regime in place. We then proceed in section 3 with an examination of supply and demand dynamics of sex work in China today, where male migration away from homes and families is common and rising incomes provide workers more to spend on sex work. We present evidence that the supply of women willing to engage in sex work is also unlikely to diminish due to an increasing sex ratio. Our data indicates that many prostitutes are in fact married, implying that women can participate in both the market for sex and have families, suggesting that supply of sex work will potentially be elastic. As such, it may be no surprise that in recent data we find a clear link between high population sex ratios, the prevalence of sex work, and STI rates. In section 4, we present our projections for the future quantity of unmarried men in China, and the implied increase in STI prevalence and demand for paid sex. We conclude in section 5.

2. History of Prostitution in China

The history of Chinese prostitution can be classified into three distinct periods. The first period, from the pre-modern period until the Communist revolution is marked by a 'normal' amount of prostitution. The second period, from the rise of Communism to the economic

¹ For example, Chinese officials estimate that there are 3 million prostitutes nationwide, whereas the U.S. state department reports as many as 10 million (French 2006). Usually the number given is an estimate based on the amount of woman arrested for prostitution which may help explain why the estimates differ relatively significantly.

reforms of Deng Xiaoping in 1978 is marked by a very limited amount of prostitution; it was even claimed that prostitution had been eliminated completely in China. The third period, from 1978 to the present is marked by the resurgence and growth of prostitution in China.

2.1. Pre-modern to Early Modern Period

In ancient China, pre-marital sexual encounters resulted in strict opprobrium for both genders. In the distant past, young males often had their first sexual experiences with household servants, or commonly with prostitutes (Levy 1971). The division of marital duties and pleasure-seeking was institutionalized in the form of concubines, the acquisition of which was celebrated as a mark of male achievement. Access by men to courtesans was also considered a “class privilege”, despite the *de jure* criminality of adultery and abetting or engaging in illicit sexual intercourse since the early 18th century (Davis 1993; Sommer 2002).

In China’s first encounters with the West, the European missionaries observed high rates of prostitution. However, prostitution was rarely scrutinized in China and no initiatives were taken to curb the practice until the late 19th century.² Prostitution was outlawed by the new Nationalist government in 1929, with an outright ban that proved ineffective due to the infeasibility of enforcement under the prevailing social conditions. While early marriage was widely promoted in Europe as a solution to the spread of venereal diseases, (VD) marriage was not a guarantee of male monogamy in China: “Married men represent the largest group among VD patients with the highest rates of infection... even when accompanied by their families, married men continued to have extramarital sexual relations, mostly with prostitutes” (Henriot 1992). Prostitution was considered an extremely challenging public health problem by the medical community at the time, and syphilis rates were estimated to be 10-15% of the urban population across China. While public clinics were opened to deal with the situation, STI rates in China remained high and efforts to curb prostitution were limited.

2.2. Communist transition and crackdown

The accession to power of the Chinese Communist Party in 1949 created conditions whereby anti-prostitution campaigns could be effective. The Communists viewed eradication of prostitution as fulfilling multiple policy goals: ending a quintessentially capitalist model of transactional sex, liberating prostitutes from dangerous and degrading work, and ending the primary mode of transmission of sexually transmitted infections. The crackdown began in urban centers in 1949, and spread nationwide in 1951. By 1958, virtually all brothels had been closed and all former prostitutes detained. In 1964, the government proclaimed total eradication of all venereal diseases, which appears not to have been far from the truth (Haterm 1966). Clinics closed and venereal diseases disappeared from the curricula of medical schools, ushering in a period of nearly two decades of limited prostitution and low STI rates.

² Notable exceptions are Shanghai, Canton, and Hong Kong, where Western administrations instituted independent municipal controls starting in 1857.

2.3. Reform period and resurgence

The reappearance of prostitution on a widespread scale is usually linked to the changes occurring in the decade following the social and economic reforms introduced by Deng Xiaoping in 1978. During the 1980s, prostitution grew rapidly, as reflected by an increasing number of arrests of women for soliciting sex work.³ In 1988, anonymous drop-in medical centers opened nationwide and government organizations openly described prostitution as a major problem (Jeffreys 2004).

Estimates of the number of sex workers currently in China abound and fluctuate wildly depending on the definition of sex work, the date, and the source of the estimate. Recent estimates place the number of Chinese women regularly engaging in prostitution at 3 to 10 million, and possibly twice that many who engage in paid sex irregularly (Wei 2000; Lin 2005; USDS 2010). An international survey estimated that 11-14% of males aged 18-60 in China have paid for sex (Cavael et al 2008). Informal prostitution rackets are common throughout China, sometimes involving high-school girls (Hewitt 2002). Government response is generally limited in China, however. Authorities attempt crackdowns through controversial 'shame parades' where Chinese prostitutes are forced to endure the shame of being marched down a street (Pickard 2010).

The frequency with which Chinese men ages 20-30 visit prostitutes, and their reluctance to wear condoms, are both causes for concern. Recent evidence indicates that Chinese men are more likely than US men to have paid for sex: 12.13 percent of Chinese men ages 20–30 versus 8.99 percent of US men have visited a prostitute (See Table 1).⁴ Moreover, Chinese men are less likely than US men to report that they use condoms regularly, which places them at higher risk of sexually transmitted infection. Since a great share of commercial sex encounters occur without condoms prostitution has been linked to increasing prevalence of STIs. From virtually zero in 1979, the number of STIs rose to 204,000 in 1990 (Gil et al 1996). With the share of new HIV cases resulting from intercourse growing from 5.3% in 1995 to 44% in 2007 (Cheng et al 1995; China CDC 2007), and with HIV seropositivity nationwide among incarcerated prostitutes at approximately 0.8%, controlling prostitution is closely connected to China's public health agenda. However, efforts to curb prostitution thus far have been unsuccessful: crackdowns have led to sex workers reducing prices (due to skittish customers) and condom use (due to profiling) during periods of high enforcement (Lee 2008; Xin & Yang 2005), and public shaming of prostitutes has led to public backlash (Pan 2008; Pickard 2010). As a result, estimates of the number of sex workers remain stable and many believe that the government is unwilling or unable to seriously tackle the problem (Liu and Fickenauer 2010).⁵

³ In 1982, 11,500 prostitutes were arrested; arrest counts grew to 46,500 in 1983 and over 243,000 in 1989; 216,660 in 1999; 225,693 in 2000; 242,053 in 2001, and has presumably remained close to that figure today (Evans 1997; Huang 2009).

⁴ Authors' calculation from the Chinese Health and Family Life Survey data (Population Research Center 2000). For comparable estimates, see Parish and Pan (2006).

⁵ Liu and Fickenauer present several hypotheses as to why prostitution is not dealt with in a more serious fashion: (a) *Prostitution has a positive function*: containing prostitution may discourage foreign investment and negatively affect economic development. (b) *Prostitution is no big deal*: Sex services will not affect social stability of the country and are legal in many countries. (c) *Prostitution is unavoidable*: Prostitution exists far and wide and is an unavoidable consequence of development and greater incomes. (d) *Prostitution is hard to eradicate*: The effort and resources necessary to displace it would be better spent elsewhere.

As we will discuss in the next section, a major factor in the resurgence in sex work is migration, enabled by China's economic reforms, which allowed rural inhabitants to seek out employment opportunities far from their original residences. The increase in sex ratios is another a factor that appears to be responsible for the resurgence in sex work. We argue that the increase in the sex ratio of the adult population during the next century will be a future driver of demand for sex work, as the cohorts born under the One Child Policy reach sexual maturity in the next decades. .

3. Supply and Demand Dynamics of Sex Work in China

In this section, we describe the trends in China that explain the recent increase in prostitution. We argue that migrant workers are responsible for China's expanding market for sex work, but that increasing numbers of single men have also led to increased demand for sex work. We begin this discussion with an examination of the sex workers themselves, which reveals that married women often engage in sex work – suggesting that supply may be relatively elastic in this context.⁶ We include a statistical analysis of the relationship between population sex ratios and STI rates among sex workers, and conclude with a discussion relating these trends to the potential for increase in demand for paid sex and the prevalence of sexually transmitted infections.

3.1 Supply of sex workers: Evidence from microdata

Sex in China is characterized by extremely low rates of condom use. In a 2000 survey of the general population of males age 20-30, 74% of males used condoms never or rarely, and only 26% used always or usually (Table 1). Among 31,000 sex workers surveyed in detention centers, just 53% reported that they had consistently used condoms in commercial sex transactions in the past month, although a slightly higher percentage (81%) reported condom use in the most recent encounter.⁷

Single and married sex workers are different along a variety of dimensions. While sex work is risky for all women, the riskiest forms of prostitution are undertaken by married or cohabiting prostitutes. Relative to single women, married prostitutes have lower condom use rates while cohabiting prostitutes have a larger numbers of clients. Another difference between single and married sex workers is that the typical married prostitute tends to be older than her non-married counterpart (See Figure 3). The average age for a married prostitute is 29, which is significantly older than the average single prostitute who is 22. This fact may be interpreted in two ways. This may reflect that married sex workers were formerly single sex workers, and continued to participate in the market for sex. Alternatively, it may be that single and married prostitutes are from different sub-populations entirely, and that single prostitutes will generally marry and not return to sex work. For example, sex workers who are migrants may return to their province of origin and not act as prostitutes in the future. Our

⁶ It is worth noting that in certain industrial areas, the high sex ratios are due to high sex ratios among migrants. We cannot fully disentangle the two phenomena in many areas, such as large Chinese cities. However, it is worth noting that the China 2000 census reflects that the sex ratio of migrants is close to 1 (1.046), indicating that China's high sex ratio in certain areas is not totally driven by migration.

⁷ Choi and Holroyd (2007) suggests there is low condom use among female sex workers in part due to the large number of sex workers who are concurrently using drugs, and therefore unable to negotiate condom use with uncooperative clients.

data suggests that this second hypothesis is more likely the case, by virtue of the large class difference we observe between single and married prostitutes, where single women are engaging in less-risky and more lucrative forms of prostitution. Single prostitutes have higher education and begin having sex at an earlier age, both of which suggest that they are likely drawn from a different population than their married counterparts (Table 2).⁸

This distinction between forms of prostitution is further highlighted in Table 3. The table indicates that married prostitutes are less likely to work at the prestigious escort services.⁹ The table indicates that these contexts have higher condom use rates and fewer average clients. The high share of prostitutes at less formal markets (such as roadside encounters) that are married and their generally low rates of condom use in these venues is a public health concern. The combination of these factors suggests that married women who are having sex concurrently with both their husbands and clients are a pathway for prostitution to affect STI rates that is still poorly understood.

3.2 Demand from migrant workers and unmarried men

On the demand side, several economic factors have been identified that have contributed to the resurgence of prostitution. One factor is the large-scale migration which has swept the country. Migration from the more rural areas to the cities in search of work and a higher standard of living is widespread in China, and has created a floating class of people. The population of migrants, over 80% of whom are aged 15-35 and most of whom are migrating from rural to urban areas, increased from 11 million in 1982 to 70 million in 1990 and 140 million by 2000 (PDO 2005).¹⁰ Many of these migrants, after moving into developed cities, are limited to jobs that are physically demanding, such as construction and manufacturing.. They may also be a selected population that is more inclined towards risk-taking behavior. Migrants usually have no family at their destination (Gil et al 1996); while male migrants outnumber female migrants, marriage between rural males and urban females is extremely rare. Instead, male migrants, with more disposable income than their non-migrating peers but who are usually either single or far from their wives and girlfriends for extended periods of time, find paid sex an attractive option.

Migrants are referred to in Chinese as the ‘floating’ (*liudong*) population, with most migration being characterized by cycles of rural-urban returns. Many of the places where male migrants originate are poorer areas that tend to have lower rates of condom use as reported by incarcerated female sex workers (Figure 1). Surveys of migrants find the same: Yang (2006) finds that migrants are twice as likely as non-migrants to be drug users and four times as likely to have unprotected casual sex.¹¹ While condom use tends to be higher in the

⁸ It is worth noting that these patterns could be driven by cohort effects as well, as women born recently in China are generally better educated and having sex at an earlier age.

⁹ One of the defining and most discussed features of Chinese prostitution is its stratification by venue. Prostitution in China occurs in two strata: the simple street prostitute versus the prestigious escort services. While the prestigious escort services attract from all sectors of society, including the better educated and upper classes, the poorer women tend to work on the street or at small hotels (Gil et al. 1994).

¹⁰ The published dates in PDO refer to the date that Census results were tabulated; we have preferred to refer to the date that the Census was conducted.

¹¹ In Yang’s (2006) sample, 13.0% of migrants reported unprotected casual sex and 1.6% reported drug use, compared to 3.7% and 0.7% for non-migrants, respectively. After controlling for demographic and

urban and wealthy areas that attract migrants, the places with the highest net outmigration of males show more risky sex. Habitual risky sex practices among migrants, combined with high HIV prevalence among female sex workers at migration hotspots, may lead to higher STI rates in the context of increasing demand for sex work.

3.3 The role of sex ratios

China's high and rising sex ratio is another factor responsible for the resurgence of prostitution, and represents a potential driver of future increases in demand. Demographic explanations of increasing sex work have been posed but the literature is under-developed.¹² We argue that a shortage of females may motivate more males to seek transactional sex. Highly masculine sex ratios and the increase in unmarried young males (known as 'bare branches') will have serious supply and demand consequences for the prevalence of sex work.¹³ We propose that the increase in unmarried males in the future will be a significant driver of growth in demand for paid sex, and that there will be serious supply-side consequences as well.

There are a number of suggestive data on the relationship of the sex ratio to sex work. In Table 4, we present data on STI rates among sex workers (taken from blood samples) and their relationship with local sex ratios. We present the results of a regression of the prevalence of syphilis and HIV at detention centers across China by the adult sex ratio in the surrounding prefecture (the ratio of males to females age 20-29). Columns (1) to (4) measure syphilis rates among sex workers while column (5) to (8) measure HIV positive rates among sex workers. In column (1), we report the results of our syphilis model without any controls, and the results indicate that increasing the adult sex ratio by 1 male per 100 females is associated with a 2.3 percentage point increase in the sex worker syphilis rate, statistically significant at the 1% level. The results are unaffected by the introduction of controls indicating urban areas and average level of education. Relative to the rate of syphilis among sex workers (2.4 percent), the adult sex ratio is a critical predictor of rates of syphilis, with our coefficient implying that increasing the sex ratio by 10 males per 100 females would roughly lead to a doubling of the sex worker syphilis rate.

Columns (5) to (8) indicate a similar relationship between the adult sex ratio and the HIV positive rate among sex workers. In column (5) we report we report the results of our model without any controls, and the results indicate that increasing the adult sex ratio by 1 male per 100 females is associated with a 0.08 percentage point increase in the HIV positive rate among sex workers, statistically significant at the 1% level. In the controlled model, we find that increasing the sex ratio by 10 males per 100 females is associated with an 0.83 percentage point increase in the HIV rate among sex workers. Relative to the HIV positive rate among our sample of sex workers (0.8 percent), this implies that the number of HIV-infected sex workers could also double. While these crude estimates are not intended to function as epidemiological projections, taken at face value they suggest that a large increase

psychological characteristics, migrants were still two to three times as likely to have unprotected sex with multiple sexual partners in the same time window.

¹² It should be noted that many have predicted that unmarried men will lead to a plethora of social problems in China, including an increase in prostitution (Edlund and Korn 2002; Jiang 2009; Tucker et al. 2005; Hudson and den Boer 2004; Hesketh and Ding 2006; Merli and Hertog 2010).

¹³ In Chinese known as the *guang gun* – bare branch(es) – since without marriage growing new branches on the family tree is impossible.

in the male fraction of the population will exert pressure for a large increase in HIV via increased incidence of paid sex. As a complement to Table 3, Figure 4 shows the regional patterns of the adult sex ratio (age 20-29) and syphilis rates among sex workers.

The regression and GIS results suggest that localities with higher sex ratios also have higher rates of STI infection among female sex workers. In a spoke-and-hub model of a sexual infection network, increasing demand for sex will yield higher rates of STI among prostitutes if the average number of clients per FSW increases. We see above that the sex ratio is positively associated with the rate of STIs such as syphilis and HIV among sex workers. HIV is an imperfect proxy for the prevalence of sex work due to the possibility of an unobserved correlation between sex work and drug use, as needle sharing during IDU is a primary mode of HIV transmission in China. However, syphilis is transmitted only sexually among adults, and the robustness of the sex ratio result is highly suggestive that FSW in high sex ratio areas have more clients on average.

The relationship between the sex ratio and the supply of sex workers is theoretically ambiguous since there are reasons why sex work may *decline* in the context of an elevated sex ratio. There is some empirical evidence suggesting that a surplus of males may result in a decrease in prostitution since an improved marriage market for women may make women more reluctant to enter the prostitution market (Rossiaud 1988). Recent theoretical work has considered the market for sex work in a Becker-Ian framework in which sex is consumed much like any other commodity, with men purchasing and women selling (Edlund and Korn 2002).¹⁴ A key assumption in their model is that women choose to operate in either the reproductive market for sex (marriage), or the non-reproductive market (prostitution), and that engaging in one largely precludes the other. In the Chinese context, where 99.7% of women are married by 30 (Ebenstein and Sharygin 2009) the implication for China's supply of sex workers is particularly relevant: if women are forced to operate in one market and not the other, this will imply that a sufficiently-attractive marriage market may induce a large decline in the supply of sex workers. Conversely, if women can operate in both markets, an increase in the sex ratio of the population will unambiguously lead to an increase in the quantity of sex work, with this prediction holding under mild assumptions.

As discussed in Section 3.1, the majority of sex workers currently detained in China (54.2 percent) are either married or cohabiting. This finding contradicts a fundamental assumption of the Edlund-Korn model that a majority of sex workers are single, but is consistent with evidence from other countries that prostitutes are often married (Arunachalam and Shah 2008). An appropriate model for sex work need not fundamentally distinguish between married and single women in terms of supply.

4. Demographic projections of marriage markets and the consequences for sex work and STI rates

In this section, we examine the current and future market for sex work in light of demographic forecasts. We have shown above that: paid sex frequently does not use condoms,

¹⁴ It should be noted that the central discussion in Edlund and Korn (2002) is to develop a model which explains the high wages for prostitution. In their analysis, high sex ratios can make prostitution more profitable relative to marriage and hence support a higher fraction of women in prostitution instead of marriage. The richness of the Edlund-Korn model has made it a useful starting point for economists' discussions of sex work (Arunachalam and Shah 2008).

and that paid sex from married women is both common and extremely risky. We have also presented evidence that paid sex and STIs are more common among migrants, and in areas with a high adult sex ratio; further, that migration frequently occurs between high and low sex ratio areas, bridging the populations. We argue that the demand for paid sex is likely to increase, based on what we know about how sex ratios will change in the future. Given the current status of condom use by sex workers, this provides reasons to be concerned about the prevalence of HIV as well.

4.1 Sources of the marriage squeeze

In light of the empirical connection between sex ratios, sex work, and the prevalence of STIs, we exploit demographic projections for the sex ratio in the coming decades to predict marriage rates, changes in the demand for sex work, and how it may affect population STI rates. It is worth noting that the simulations are crude, and ignore general equilibrium changes in China that may occur in response to male dominated cohorts. Marriage norms could change over time in response to the marriage squeeze. Men may seek to marry into much younger cohorts; some men will be able to attract brides from poorer neighboring countries, and other kinds of adjustment are possible.¹⁵

Given the scale and imminence of China's bride shortage, it seems unlikely that social norms regarding marriage will change or evolve rapidly enough to offset it significantly. Public estimates of the number of unmarried men in China are alarming. The Chinese Academy of Social Sciences estimates that, by 2020, there will be 24 million men unable to find a spouse (CASS 2009). There will therefore be as many unmarried males in China as there are total females in Korea or Vietnam (UN 2008). The share of years spent single by males age 25-34 is expected to increase dramatically as a result of higher sex ratios between potential marriage partners (Das Gupta et al 2010). Many argue that these unmarried men (known as the 'bare branches') will pose social problems.¹⁶

Two sources of pressure are likely to affect the future markets for commercial sex via the marriage market. The first is low fertility. Fertility has been falling in China for decades, for a number of reasons. Improvements in health have improved the survival rates of children to adulthood, greater economic competition has increased the level of investment necessary for each child, and government policy has encouraged family planning to various degrees. This demographic transition, however, is made more profound by the policy climate in China, especially the one-child policy. China's fertility level fell below replacement level (by both TFR and NRR standards) between 1985-1990 (UN 2008). In a stable population at below-replacement fertility, the cohort of births will become smaller with each year.¹⁷ In a marriage

¹⁵ Child betrothal was one way of securing a bride in China in the past, but it has been actively prohibited since 1950. Sommer (2005) documents cases of men resorting to polyandrous contracts in the past, but this seems to have been rare. Greenhalgh (2010) suggests these practices may reassert themselves, but radical changes in current social norms and government policies would be needed for this to happen on a scale large enough to affect the marriage squeeze.

¹⁶ In Chinese known as the *guang gun* – bare branches, since without marriage growing new branches on the family tree is impossible. It should be noted that many have predicted that the 'bare branches' will lead to a plethora of social problems in China including an increase in prostitution (Edlund and Korn 2002; Jiang 2009; Li 2007; Tucker et al. 2005; Hudson and den Boer 2004; Hesketh and Zhu 2006; Merli and Hertog 2010).

¹⁷ In unstable populations, there can still be a larger cohort of a lower age if there are sufficiently more women of childbearing age to compensate for a lower per-woman fertility rate than in the past. China

market where males tend to marry younger females, a consequence of below replacement fertility is to guarantee that there will be more males of any given age than females of any younger age. Second, the ratio of boy to girl births (SRB) in China has been skewed in favor of males for at least as long as fertility has been below replacement.¹⁸ Thus, at any given age there will be more males than females of the same age. The age gap between husbands and wives at marriage tends to grow during periods where the adult sex ratio is high (Ebenstein & Sharygin 2009). However, postponement of marriage can only occur so long before it converts to a permanent state of non-marriage. Together, below-replacement fertility and an elevated sex ratio will combine to create a class of males who will be unable to marry as a consequence of persistent scarcity of females.

The preference of females for men of higher social status in China has been discussed elsewhere (Parish & Farrer 2000). Men living in regions with better economic prospects are able to draw brides from poorer areas, leaving men in rural areas at a disadvantage. We surmise that, as in the past, rural and uneducated males will be the group most severely affected by the imbalanced marriage market. This group is already the most likely to seek paid sex and not to use condoms. Given our knowledge about the demographics of prostitutes in China, we also believe that a significant share of the increased demand for sex work will be met by married FSWs.

4.2 Projecting Unmarried Men in China

Projecting the number of unmarried men in China depends on sex ratios in future marriage markets, which in turn depend on the sex ratios at birth of future cohorts and population growth rates. This section describes the derivation and results of population simulations (Ebenstein & Sharygin 2009) that capture the anticipated effect of high sex ratios on the number of unmarried men over the 21st century.

Decline in fertility could exacerbate the impact of the sex ratio imbalance, since future cohorts of men would be unable to find brides in younger and smaller cohorts. But fertility rates in China are still a matter of scholarly debate.¹⁹ The simulations presented here assume a total fertility rate of 1.75, based on data from China's National Bureau of Statistics (2005b), except where otherwise noted. The simulation model (described in detail in the appendix) allows for variation in fertility rates and the sex ratio of future births.

The results of the simulation are presented in Figure 3. Under baseline assumptions, the share of men ages 25 and older who fail to marry will exceed 5 percent by 2020. As the cohorts born in recent years enter the marriage market and some share inevitably fail to marry, the population of unmarried men will rise well beyond this level. In the most optimistic scenario, where the sex ratio returns to normal immediately in 2006, the share of men who

has one such 'baby boom echo' that coming of age imminently, albeit not on a large enough scale to avert a marriage squeeze (Das Gupta et al, forthcoming).

¹⁸ Goodkind (2008) discusses alternate TFR and SRB estimates. See also notes to section 4.2.

¹⁹ The raw TFR from the 2004 China NBS data is 1.45 children. Data from the 2000 Census indicate a total fertility rate of 1.22 children in the prior year (China National Bureau of Statistics 2000). However, some argue that census officials were given misleading information out of a fear of punishment by parents who had violated the one-child policy (Retherford and others 2005). Such undercounting would affect both fertility estimates and the observed sex ratio. Cai (2008) summarizes the debate on China's total fertility rate and estimates a value of 1.5–1.6, in line with other third-party estimates. We have opted to use the figure of 1.75, the ceiling of academic estimates, in order to make our estimates more conservative.

fail to marry will stabilize at just below 10 percent in 2060. In the second scenario, unmarried men will represent roughly 10–12 percent of men ages 25 and older. In the third and fourth scenarios, where the sex ratio at birth persists at either 1.18 or 1.25, the share of men who fail to marry will peak above 15 or 20 percent.²⁰ This core 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 – is highly robust to alternative assumptions regarding changes in fertility, the sex ratio at birth, and the preference function and marriage sorting algorithm (Ebenstein & Sharygin 2009; Das Gupta et al, forthcoming).

4.3 Consequences of unmarried males on prostitution

While not all single men will patronize sex workers, and married men will also pay for sex, documenting the relationship between demographic change and commercial sex activity is important, as the population of single men will grow in the years to come. To analyze the relationship between numbers of men in at-risk groups and commercial sex activity, data from the Chinese Health and Family Life Survey were used to calculate the percentage of men reporting having paid for sex, for six regions (Population Research Center 2000). Paying for sex was most common in the coastal southern region, encompassing the provinces of Fujian and Guangdong, followed by the coastal eastern region including Jiangsu, Shanghai, and Zhejiang Provinces and the far northeastern provinces bordering the Democratic People's Republic of Korea and the Russian Federation. The majority of counties where a high percentage of men report having paid for sex tend to be counties with high percentages of single men.

The connections between cohort-specific sex ratios, prostitution rates, and STI rates are complex, but it is clear that these factors are all responsible for the rising STI rates in China. Given the correlation between percentages of unmarried men and commercial sex activity, how will the increase in sex ratios and the ensuing failure of many men to find marriage partners affect markets for sex? The results of a simple simulation show how the incidence of prostitution might evolve (Table 5). The simulation projects the share of men who pay for sex, assuming that the gender, marital status, and age-specific rates of having paid for sex found in 2000 persist during the 21st century. The Chinese Health and Family Life Survey finds that 14.7 percent of single men and 7.3 percent of married men admit to having paid for sex in 2000 (CHFLS 2000).²¹ That information, plus the age profile of commercial sex activity, can be used to calculate a hazard rate of the chance of visiting a prostitute over the life cycle. The results show an increased demand for commercial sex among Chinese men. Assuming continuation of current behavior patterns, increases in the sex ratio at birth will create a

²⁰ To some extent, these outcomes can be mitigated by realistic increases in both the age at marriage and the age gap between spouses. Edlund (1999) demonstrates that son preference can account for increases in spousal age gaps and also the pattern of hypergamy. This idea of demographic translation was introduced to describe the shift of the age-specific fertility distribution observed in the postwar baby boom era, but it also applies to the case of sex imbalance in marriage markets (Foster and Khan 2000; Ryder 1964). This view holds that an excess of men over women in the marriage market can be fully compensated for by modest increases in men's age at marriage. However, changing the age gap between spouses without addressing the sex ratio and fertility issues results only in changes to the timing, not the peak, of the share of males failing to marry (Das Gupta et al, forthcoming).

²¹ These percentages are derived from a regression of an indicator for having paid for sex on several demographic control variables, including marital status. See also the discussion of similar results for these data in Parish and Pan (2006).

modest increase in the share of men paying for sex. The simulations indicate that demographic change alone will contribute 2 percentage points to an increase in the share of men paying for sex in the next 30 years.

The potential for an increase in STI infection rates fueled by migrant workers has attracted the attention of many researchers. Tucker and others (2005) present compelling evidence that rising rates of sexually transmitted infection in cities are due to the sexual practices of migrant workers, who are demographically similar to the men who are projected to fail to marry: poor, uneducated, and single. Chen et al. (2008) analyze HIV rates among a sample of patients being treated at 14 Guangxi clinics for sexually transmitted infections and conclude that “China's imbalanced sex ratios have created a population of young, poor, unmarried men of low education who appear to have increased risk of HIV infections.” A multivariate analysis of factors that affect HIV status yields an odds ratio of 1.7 for single people relative to those who are married and 1.4 for men relative to women. Using these odds ratios and the projected share of males failing to marry, we present the implications for the prevalence of HIV of greater shares of males unmarried (further details are provided in the appendix). Unfortunately, the available data on syphilis preclude estimation of a similar rate for that disease. The simulations indicate that increasing sex ratios in partial equilibrium will exert upward pressure on the HIV rate, alone contributing an additional 0.05 percent share—nearly doubling the current prevalence.

It is worth noting that these simulations do not address potential general equilibrium effects of a high sex ratio on cultural norms and other responses. The results should be interpreted as “back of the envelope” calculations of the number of men entering the marriage market who will we expect to lack a female match (under generous assumptions about flexible preferences) and to anticipate their response based on current behaviors. Although the calculations are admittedly imprecise due to partial equilibrium assumptions, the results show an increased demand for commercial sex among Chinese men. Changes in policy, income, or sexual culture will likely be more important in the future in determining the general equilibrium response of commercial sex supply and demand in a tight marriage market situation. Likewise, while the HIV projections do not incorporate increases in the probability of contracting the disease that might result as more people become infected, they also do not assume any improvement in preventive behavior. In 2009, HIV/AIDS became the leading cause of death among infectious diseases.²² Since the Chinese government is beginning to respond to the impending HIV crisis, there is reason to hope that these projections are overly pessimistic. The central government and local authorities have in recent years recognized the growing role of sex workers in HIV transmission, and several pilot projects promoting safer sex practices, such as condom use, are in place in Beijing, Fujian, Hubei, Jiangsu, and Yunnan. Government budget allocation for HIV/AIDS grew from approximately \$12.5 million in 2002 to about \$100 million in 2005 and \$185 million in 2006.²³ The government is also treating more patients who have AIDS, through programs such as the Comprehensive AIDS Response (CARES) campaign and the “Four Free and One Care” program.

An increase in the trafficking of women to supply sex to unmarried males is another potential consequence of the forecasted rise in migration. China has experienced an increase in the trafficking of women for both prostitution and marriage, and some have linked this

²² McGivering, Jill. 2009. “AIDS takes deadly toll in China.” <<http://news.bbc.co.uk/go/pr/fr/-/2/hi/asia-pacific/7896133.stm>>.

migration to the rising sex ratio (Zhao et al. 2003). These trends indicate that the negative welfare consequences of high sex ratios can also be borne by women. Casual observers often predict an increase in the status of women in response to their scarcity, but this presumes that women have agency over their life circumstances. In many circumstances, the women who engage in sex work are illiterate, impoverished, and misled into participating in commercial sex (Hodge and Lietz 2007).

5. Conclusion

This chapter has examined the current patterns in China's demographic data, and in recently collected data on sex workers. We find that several factors in China contribute to the recent increase in the practice of sex work. First, increased migration has led to increased demand and supply. Second, China's high sex ratio implies that unmarried men will represent an increasingly powerful demand-side force, which will serve to increase the quantity of sex work. Third, since women in China can both marry and engage in sex work, it seems reasonable that the rising sex ratio will not reduce the supply of women willing to engage in sex work to offset completely the increase in demand from men. Fourth, since sex work in China is often dangerous – prostitutes often have unprotected sex with clients and married sex workers proceed to have sex with their spouses shortly thereafter – a problem of epidemic proportions is possible. All of these problems are further compounded by the likelihood that unmarried men will be of lower social status, and may be less likely to wear condoms. Our simulations reflect these expectations, and the results indicate that demographic changes will create pressure for demand for sex work and for the prevalence of STIs to increase.

Considering the impending demographic pressures as heavily male birth cohorts enter adulthood and encounter shortages of marriageable women, relatively little is known about factors that influence the total number of sex workers in a population. To date, not much empirical research has been conducted on the relationship between the size of the single-male population and the supply of sex workers. While most researchers assume that the population of sex workers will increase as demand for their services increases, it has also been argued that the marriage squeeze for men may improve the marriage prospects of female sex workers and thereby take them off the sex market. Our findings regarding the supply of sex work from married females suggests the former, but more research is called for on this subject.

In the near term, policymakers should consider public health initiatives aimed at reducing the quantity of sex work in high risk areas and making it safer. In the long run, policies aimed at correcting China's sex ratio at birth, such as a relaxation of the One Child Policy, could provide relief. However, for the next several decades, China's demographic destiny has been set. Millions of Chinese men will fail to marry, while very few Chinese women will remain single. The implication is that the market for sex will almost undoubtedly increase, and efforts should be directed towards education and advocacy regarding the risks of unprotected sex in order to contain the negative externalities.

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Appendix S1: Projecting Unmarried Males

We employ a cohort component projection method to age the population and generate births according to a schedule of hypothetical future age-specific fertility and mortality rates, as well as sex ratios for new births. The estimates here assume modest increases in fertility since 2005 to 1.75 births per woman by 2010, although the choice of this date is arbitrary. A return to replacement fertility without a concomitant adjustment in the sex ratio of new births will have only a minor effect in the long run on the percentage of the population failing to marry since it merely redistributes additional women to marginally older men (see Ebenstein & Sharygin 2009 for additional scenarios and details on the projection model).

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

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

Appendix S2: Projecting STI Prevalence

The simulations of how demographic change will affect China's HIV infection rate in the 21st century assume that the unknown hazard rate for HIV infection by age and sex generates 650,000 cases (the current estimated number of HIV cases in China) when applied to the population ages 22–40 in 2006. The share of the population that is HIV-positive is then imputed to each cohort by sex, age, and marital status using the odds ratios from Chen et al. (2007). A multivariate analysis of factors that affect HIV status yields an odds ratio of 1.7 for single people relative to those who are married and 1.4 for men relative to women. Using these odds ratios and the projected share of males failing to marry, we present the implications for the prevalence of HIV of greater shares of males unmarried. Thus, these simulations attempt to model how HIV infection rates will change driven solely by changes in the demographic structure of China as cohorts with higher percentages of single men enter their sexually active years. The results indicate that the infected population will increase precipitously over the next 30 years and stabilize at a higher rate of infection. As with the results for patronage of commercial sex, the effect of variation in the sex ratio at birth on HIV transmission is limited. Variation in the sex ratio at birth between 1.06 and 1.25 (not shown) results in HIV infection rates in 2050 of 0.93–1.05 per 1,000. The greatest increase in HIV incidence, from 0.3 infections per 1,000 in 2000 to 0.76 per 1,000 in 2030, is a result of momentum from the known characteristics of the population in 2000.

Sexually transmitted infections (STIs) have been recognized as major public-health problems in China since they re-emerged with the introduction of the open door policy and economic liberalization; they rapidly spread throughout the country from the early 1980s onwards [1, 2]. Although syphilis had been eliminated from China in the 1960s by making free screening and treatment available to all. There are a few cohort studies among MSM and FSWs that observe incidence rates of STIs in China. However, all of these studies focus on syphilis as shown in Table 1 [12–18]. Sex work or prostitution is illegal in China, although there is still heated debate among scholars on the current crackdown policy on the sex industry [55]. Primary prevention.