

MATE AVAILABILITY AND WOMEN'S SEXUAL EXPERIENCES IN CHINA*

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November 2010

Word count: 7493

Number of Tables: 2

Running Head: Mate Availability and Women's Sexual Experiences

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Abstract

We use data from the 1999-2000 Chinese Health and Family Life Survey merged with community-level data from the 1982, 1990, and 2000 Chinese censuses to examine the relationship between the local sex ratio (number of men per 100 women) and sexual outcomes among women. Consistent with hypotheses derived from demographic-opportunity theory, logistic regression analyses show that women are more likely to have had recent and nonmarital sexual intercourse, to have been forced to have sex, and to test positive for a sexually-transmitted infection when there is a relative abundance of age-matched men in their local community. Education, birth cohort, and geographic location also emerge as significant predictors of women's sexual experiences.

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The relative number of young men and women in the People's Republic of China has undergone remarkable change over recent decades. China's one-child policy, precipitous declines in fertility, a cultural preference for sons, and sex-selective abortion, have led to a surplus of men in recent decades (Banister 2004; Goodkind 2004). Many scholars have pointed to an unusually high sex ratio at birth in China (e.g., Cai and Lavelly 2003; Coale and Banister 1994; Gu and Roy 1995; Hull 1990; Johansson and Nygren 1991; Lavelly 2001; Murphy 2003; Peng and Huang 1999; Secondi 2002; Yi et al. 1993; Yuan and Tu 2004). A normal range of the sex ratio at birth (number of males per 100 females) is considered to be between 103 and 107. In 1982, China's sex ratio at birth—between 107 and 108—was already at the high end of this range, and it has increased dramatically since that time. By 1990 the sex ratio at birth had grown to 111.3, by 2001 it was 118 (Poston and Glover 2005), and by 2005 it had reached 120.5 (Li 2007).

Given these changes in the sex ratio at birth, China is expected to experience a pronounced surplus of adult men relative to adult women as these birth cohorts age (Tuljapurkar, Li, and Feldman 1995). Some observers suggest that this increasing population of excess men will have far-reaching social and demographic consequences, contributing to the spread of HIV and other sexually transmitted infections (STIs). Poston and Glover (2005) suggest that an increase in commercial sex will hasten the spread of HIV/AIDS. Tucker and colleagues (2005; see also Ebenstein and Jennings 2009) speculate that other high sexual risk behaviors among surplus men will facilitate transmission of HIV/AIDS and other STIs throughout the population.

However, there is little systematic empirical research on how imbalanced sex ratios influence sexual behaviors in China or in other populations. In this paper, we examine the effect of imbalanced sex ratios on several aspects of Chinese women's sexual experiences. Given

recent changes and substantial inter-community variation in its sex ratio, China represents an opportune case for examining the impact of imbalanced sex ratios on women's sexual outcomes. Our conceptual framework is grounded in demographic-opportunity theory, which broadly suggests that a surplus of men will shape both the frequency and form of women's sexual encounters. We test hypotheses derived from this theory using individual-level data from the Chinese Health and Family Life Survey (CHFLS) merged with community-level data taken from three Chinese censuses. From the Chinese censuses we create cohort-specific and community-specific sex ratios describing the number of men available to women, and we then attach these sex ratios to the individual records of the female respondents to the CHFLS. We then estimate logistic regression models linking four outcomes—whether women have engaged in recent sexual intercourse, have been victims of forced sex, have had nonmarital sex, and whether they test positive for an STI—to the sex ratio in their local community.

THEORETICAL BACKGROUND AND HYPOTHESES

A common theoretical framework from which to address the effect of imbalanced sex ratios on sexual and familial behavior is demographic-opportunity theory (South, Trent, and Shen 2001; Uecker and Regnerus 2010). Demographic-opportunity considers the distribution of the population by sex, as well as by other critical sociodemographic characteristics such as age and race, to be a defining characteristic of social structure (Blau 1977). A fundamental premise of demographic-opportunity theory is that the likelihood of social contact between people with different demographic attributes—for example, between women and men—is determined in part by the number of available out-group members with whom such contacts could occur. Thus, demographic-opportunity theory emphasizes how the sheer number of men available to women shapes the frequency and form of women's sexual encounters. When applied to women's sexual

experiences, demographic-opportunity theory suggests that the probability of engaging in recent or nonmarital sexual intercourse, of being the victim of forced sex, and of testing positive for a STI increases along with the number of men in the local population.

Prior tests of demographic-opportunity theory have focused primarily on how imbalanced sex ratios affect marital and familial behavior in the United States. We know that women's marriage rates are higher in geographic areas containing more eligible and economically attractive men (e.g., Fossett and Kiecolt 1993; Lichter et al. 1992; McLaughlin, Lichter, and Johnston 1993). A surplus of men has also been linked to young women's chances of "marrying up" educationally, although there is little evidence that sex ratios affect educational or occupational marital heterogamy (Lichter, Anderson, and Hayward 1995).

High sex ratios, indicating an excess of men relative to women, are also associated with an increase in women's risk of nonmarital childbearing (Billy and Moore 1992; South and Lloyd 1992). Ostensibly, a numerical surplus of men increases young women's risk of unmarried childbearing by increasing the likelihood that they will engage in premarital intercourse, although this association is likely tempered by an accompanying risk of early marriage (South 1996). Similar findings have been observed in cross-national studies (Barber 2001; 2004; South and Trent 1988). Imbalanced sex ratios have also been linked to marital dissolution and relationship quality. A surplus of women lowers relationship quality among unmarried parents (Harknett 2008), though not among married persons more generally (Trent and South 2003). Several studies suggest that married couples who are exposed to either a surplus of men or women are more likely to divorce, presumably because in these demographic contexts spouses are especially likely to encounter an attractive alternative to their current partner (McKinnish 2004; South, Trent, and Shen 2001).

The literature is sparser and less consistent regarding the influence of mate availability on sexual behavior. Consistent with demographic-opportunity theory, Billy, Brewster, and Grady (1994) find a positive association in the U. S. between the county-level sex ratio and young women's risk of engaging in premarital intercourse and the frequency with which they engage in intercourse. However, Brewster (1994) does not observe a significant association between the neighborhood-level sex ratio and the timing of young black women's transition to first sexual activity. And, contrary to the predictions of demographic-opportunity theory, Uecker and Regnerus (2010) find that young women are more likely to engage in sex when they attend college with comparatively few men. Browning and Olinger-Wilbon (2003) find that men engage in more short-term sexual alliances in neighborhoods that contain comparatively few women.

Imbalanced sex ratios have also been linked to the frequency of violence—and particularly sexual violence—against women. Although the literature is not entirely consistent (O'Brien 1991; Whaley 2001), several studies have shown that, within the U. S., rape victimization rates are higher in areas characterized by a surplus of men and an attendant deficit of women (Blau and Golden 1986; Messner and Blau 1987). In addition, the sex ratio is positively associated with female homicide victimization (Avakame 1999) and male-on-female intimate partner violence (D'Alessio and Stolzenberg 2010). Presumably, when women are scarce men lack the ability to form conventional sexual relationships and thus resort to violence to satisfy their sexual needs and maintain control over actual or potential mates. More generally, China's increasingly masculine sex ratio has been argued to be a partial cause of its increasing rate of crime (Edlund et al. 2007).

Hypotheses

Demographic-opportunity theory implies several hypotheses regarding the impact of the local sex ratio on the nature and consequences of women's sexual encounters. First, demographic-opportunity theory predicts that, when faced with a relative surplus of men, women will be more likely to engage in sexual intercourse. A relative abundance of men increases the likelihood that women will encounter an attractive sexual partner, particularly though not exclusively through marriage, thereby increasing their chances of engaging in sexual intercourse. In contrast, when men are scarce, women's opportunities to attract a sexual partner will be more limited, and hence women will engage less frequently in sexual intercourse. Thus, demographic-opportunity theory predicts a positive association between the local sex ratio and women's chances of having recently engaged in sexual intercourse.

Second, demographic-opportunity theory implies that women will be more likely to be forced to engage in sexual intercourse when they are exposed to a numerical surplus of men. When women are in short supply, many men in women's pool of eligibles will be unable to find sexual and marital partners through more conventional, socially-sanctioned means. Instead, these men will turn to illicit or criminal behavior such as visiting commercial sex workers or obtaining sex through physical force. A numerical deficit of women may also mean that women will be isolated from other women and thus more vulnerable to violence perpetrated by sexually aggressive men. Even among married persons, a numerical surplus of men—and accompanying deficit of women—may spur sexual violence by husbands, both because men will have few sexual opportunities outside of marriage and as a means of preventing women from exploiting the extramarital opportunities available to them (D'Alessio and Stolzenberg 2010). For all these

reasons, demographic-opportunity theory predicts a positive association between the community sex ratio and women's likelihood of being victims of forced sexual intercourse.

A third hypothesis implied by demographic-opportunity theory is that women's likelihood of engaging in nonmarital sexual intercourse is greater in communities containing relatively large numbers of men. A numerical surplus of men increases the chances that women will encounter an attractive sexual partner both prior to marrying and, once married, outside of the marital relationship. Moreover, although divorce is fairly rare in China, a surplus of men may also increase women's risk of divorcing and thus the duration of time women spend unmarried and hence at higher risk of engaging in nonmarital sexual intercourse. To be sure, there may be countervailing forces at work here, because an abundance of men may also increase the chances that women will meet a potential husband early in life, and marrying young limits the amount of time that women are exposed to the risk of having sexual intercourse prior to marriage. However, most Chinese women marry late in life (Sheng 2005), so it is likely that this offsetting influence will be minimal.

Finally, we extend demographic-opportunity theory to hypothesize that a numerical surplus of men will increase the risk that women will contract a sexually transmitted infection (STI). A surplus of men is likely to increase women's chances of contracting an STI through several pathways. First, a male surplus is likely to increase the sheer frequency with which women engage in sexual intercourse; in turn, and all else equal, more frequent intercourse increases the risk of contracting a sexually-transmitted infection. Moreover, a surplus of men likely influences the nature of women's sexual encounters beyond the frequency of intercourse. As argued above, a surplus of men is likely to increase women's risk of engaging in sexual intercourse outside of marriage and presumably with more lifetime partners. In addition, a surfeit

of men and concomitant shortage of women may also increase women's risk of being forced to have sexual intercourse and of engaging in sex with a partner who has visited commercial sex workers. All of these are risk factors for contracting an STI, including HIV/AIDS (Gil et al. 1996; Merli et al. 2006; Tucker, Ren, and Sapio 2010; Xiao et al. 2007). In contrast, when men are relatively scarce, women will have fewer opportunities to engage in sexual intercourse (or have intercourse forced upon them), so they will do so less frequently and with fewer different partners, thereby diminishing their risk of contracting an STI.

DATA AND METHODS

We test the hypotheses developed above using data from the Chinese Health and Family Life Survey (CHFLS) in conjunction with community-level data from three Chinese censuses. The CHFLS is a nationally-representative survey (with the exception of Hong Kong and Tibet) of 3,821 Chinese adults ages 20 to 64 (Chinese Health and Family Life Survey 2006). The CHFLS was administered between August 1999 and August 2000. Modeled in large part on the U.S. National Health and Social Life Survey (Laumann et al. 1994), the CHFLS focuses on sexual and family-related behaviors and attitudes (Parish et al. 2003).

For this analysis we select female CHFLS respondents between the ages of 20 and 44. We focus on this age range partly because women older than 44 are not likely to have experienced the numerical surplus of men experienced by younger cohorts. Moreover, our measurement strategy requires that we estimate the relative numbers of men "available" to these women when they were age 20. The earliest available China census containing the requisite information is for 1982, and thus it is not possible to estimate with confidence the community- and cohort-specific sex ratio for women who are older than 44 at the date of the CHFLS administration.

Dependent Variables: We examine the impact of the relative number of men available to the women CHFLS respondents on four dimensions of women's sexual encounters and their outcomes. All of these variables are dichotomous. *Recent sex* is a dichotomous variable scored 1 if the respondent reports having had sexual intercourse in the past year. *Forced sex* is a dichotomous variable scored 1 if the respondent reports ever having been forced to have sex against her will. *Nonmarital sex* is a dichotomous variable scored 1 for respondents who report having had sexual intercourse outside of marriage, i.e., either prior to marrying or, while married, with someone other than their husband. Finally, the CHFLS respondents were asked to provide a urine sample to be tested for the presence of gonorrhea, chlamydia, and trichomonas infections. Over 90% of the respondents provided a urine sample. The fourth dependent variable (*Has STI*) is a dichotomous variable scored 1 for respondents who tested positive for gonorrheal, chlamydial, or trichomoniasis infection.¹

Independent Variables: Our focal independent variable is the sex ratio, expressed here as the number of men per 100 women. The relevant pool of men available to serve as sexual partners for women is of course circumscribed both by geography and by age. To circumscribe these pools of eligible mates geographically, we have coded the county or county-equivalent (e.g., urban district, county-level city) for each of the CHFLS respondents. For county-level cities that are under prefecture-level cities and *shixiaqu*, we use data for the entire prefecture-level city (essentially a large city or metropolitan area). For county-level cities that are under the province and for non-city counties, we use data at the county level. These geographic approximations of community correspond to the spatially-defined marriage markets (e.g., metropolitan areas, labor market areas, or nonmetropolitan counties) used in much U.S. research on the impact of

imbalanced sex ratios (e.g., Lichter et al. 1992). The CHFLS respondents in our sample are distributed across 37 such communities.

To circumscribe the relevant pool of men by age, and to take into account the fact that the sexual behaviors that serve as dependent variables could have occurred many years before the administration of the CHFLS, we assign to each female respondent a seven-year sex ratio with a two-year staggering of the numerator (number of males) and denominator (number of females) when the respondent was age 20. This two-year staggering corresponds to the age difference between spouses in China (Porter 2006). Thus, the sex ratio is defined as the number of men ages 17 to 23 divided by the number of women ages 15 to 21. We use data from the full-count 2000 China census (China Data Center 2004) and the one-percent samples from the 1982 and 1990 censuses (China Population and Information Research Center 2008), along with standard techniques of interpolation and extrapolation, to estimate the value of this community-specific sex ratio for each female CHFLS respondent when she was age 20.²

We include several other explanatory variables in our models. Educational attainment is measured as a 6-point continuous variable ranging from never attending school (= 1) to attending university or graduate school (= 6). To capture age-related and/or historical trends in sexual behavior, the models include dummy variables for decadal birth cohort (1950s, 1960s, and 1970s, with the 1950s serving as the reference category). We include a dummy variable for whether respondents report residing in an urban area (county-level city or larger) when they were age 14. A separate dummy variable differentiates residents of the generally more modernized South and East coast of China from other areas. Table 1 presents definitions for all the variables used in our analyses.

Table 1 about here

Analytical strategy: We use logistic regression to examine the impact of the community- and cohort-specific sex ratio on women's sexual outcomes. Although the CHFLS respondents are nested, or clustered, within communities (as well as within single-year birth cohorts), the relatively small number of communities and the absence of hypotheses invoking cross-level interactions limits the potential utility of a complete hierarchical or multilevel modeling approach. However, we adopt the logic of the multilevel approach, and achieve one of its principal objectives, by adjusting the standard errors of the logistic regression coefficients for the clustering of observations within communities. Using STATA's cluster procedure (StataCorp 2005), we compute robust standard errors that derive from the Huber-White estimate of variance (Wooldridge 2002).

RESULTS

Table 1 presents (weighted) descriptive statistics for all variables used in the analysis. About 89% of the female CHFLS respondents aged 20 to 44 report having engaged in sexual intercourse in the past year. Almost 7% of the respondents report having been forced to have sex against their will at some point in their life. Nearly 17% of the respondents report having engaged in sexual intercourse outside of marriage. Of the respondents who agreed to provide a urine sample, fewer than 5% tested positive for a gonorrheal, chlamydial, or trichomoniasis infection.

Descriptive statistics for the primary explanatory variable indicate that, on average, there were about 108 men aged 17 to 23 per 100 women aged 15 to 21 in the respondents' communities when these respondents were twenty years old. Thus, on average these women tended to face a surplus of men in their local community during early adulthood. Average educational attainment falls between elementary school and junior high school. Fourteen percent

of the respondents were born in the 1950s (and were thus ages 40 to 44 at the time of the CHFLS administration), 44% were born during in the 1960s (and were thus ages 30 to 39 at the time of the survey), and 42% were born during the 1970s (and were thus ages 20 to 29 at the time of the survey). Fifteen percent of the respondents resided in an urban area at age 14, and 11% resided in a community in the East or South coast of China at the time of the CHFLS.

Table 2 presents a series of logistic regression models relating each of the four dimensions of women's sexual outcomes to the community- and cohort-specific sex ratio and the other explanatory variables. Model 1 shows the results for recent sex. The coefficient for the sex ratio is positive and statistically significant. As predicted by demography-opportunity theory, the greater the number of men available to women, the greater the likelihood that those women will have had recent sexual intercourse. To illustrate the magnitude of the effect, a one-unit difference in the male-to-female sex ratio increases the odds that women have had recent sexual intercourse by 3.6% [= $(e^{[.036]} - 1) * 100$]. Perhaps a more useful metric for assessing the magnitude of this effect is to use recent changes in the sex ratio at birth. Between 1982 and 2005 the sex ratio at birth in China increased by about 12.5 males per 100 females--from 108 to 120.5. A change of this magnitude in the young adult sex ratio would increase the odds that women have engaged in sexual intercourse during the past year by about 57% (= $[(e^{[.036][12.5]}] - 1) * 100$).

Table 2 about here

Of the other explanatory variables in the model, education is negatively and significantly (at a borderline level) associated with the odds of having engaged in recent sexual intercourse. The coefficients for the dummy variables for birth cohort indicate that the 1960s cohort is significantly more likely, and the youngest cohort (1970s) is significantly less likely, than the oldest cohort (1950s) to have had sexual intercourse in the past year. Members of the 1960s

cohort are probably more likely than members of the 1950s cohort to have had recent sex because the former are younger and less likely to be widowed or divorced. The difference between the youngest and the oldest cohort likely stems from the fact that many members of the youngest cohort have yet to marry and thus face a lower risk of sexual intercourse. Net of these effects, respondents who resided in an urban area at age 14 are significantly less likely than respondents with a rural childhood to have had recent sex. This difference, too, is likely a function of urban-rural differences in marital status; in China as elsewhere in the developing world, city residents marry later than their rural counterparts and are more likely to be separated or divorced.

Model 2 of Table 2 presents the results for the likelihood that the CHFLS female respondents have ever been forced to have sexual intercourse. The coefficient for the sex ratio is again positive and statistically significant. When women are faced with an abundance of men in their local marriage market, and correspondingly men are faced with comparatively few women, women are more likely to report having been forced against their will to engage in sexual intercourse. A difference of one man per 100 women raises the odds that women have been forced to have sex by 1.7% [= $(e^{.017} - 1) * 100$]. Applying the simulation described above, an increase in the sex ratio of 12.5 men per 100 women would increase the odds that women have been forced to have sex by about 24% (= $[(e^{.017}]^{12.5}) - 1] * 100$).

Several of the other independent variables also evince a significant association with the likelihood that women report having been forced to have sex. Education is significantly and positively associated with the likelihood of having experienced forced sex. Members of the youngest (1970s) cohort are significantly less likely than members of the oldest (1950s) cohort to have experienced forced sex, a possible function of the former cohort's shorter duration of

exposure to the lifetime risk of sexual violence. Residents of the South/East coast are significantly less likely than residents of other regions to report having had forced sex.

Model 3 presents the results of the logistic regression models of the odds that women have engaged in nonmarital sexual intercourse. As anticipated by demographic-opportunity theory, the coefficient for the sex ratio is positive and statistically significant. The more men who are “available” to women, the greater the likelihood that those women have engaged in nonmarital sexual intercourse, despite China's strong cultural proscriptions against sex outside of marriage. The effect of the sex ratio is moderate in strength. A difference of one man per 100 women increases the odds that women will have had nonmarital sexual intercourse by 1.4% [= $(e^{[.014]} - 1) * 100$], and an addition of 12.5 men per 100 women increases the odds by almost 20% [= $[(e^{[.014][12.5]} - 1) * 100]$).

The risk of having had nonmarital intercourse has increased monotonically across birth cohorts, a likely reflection of the secular liberalization of Chinese sexual mores (Parish, Laumann, and Mojola 2007). In addition, respondents who grew up in an urban area and who resided in the South or East coast of China at the time of the CHFLS administration are significantly more likely than others to report having engaged in nonmarital sexual intercourse.

The final model in Table 2 (Model 4) presents the results for whether the respondent tests positive for an STI. Once again, the coefficient for the sex ratio is positive and statistically significant. When faced with a relative abundance of men in their local marriage market, women are more likely to contract a sexually-transmitted infection. The apparent effect of the male-to-female sex ratio on the odds that women test positive for an STI is at least moderate in strength: An addition of one man per 100 women translates into a 2.3% increase in the odds that women test positive for an STI [= $(e^{[.023]} - 1) * 100$], and an addition of 12.5 men per 100 women, which

corresponds to recent changes in the sex ratio at birth, translates into a one-third increase in the odds of testing positive for an STI ($= [(e^{[.023][12.5]})-1] * 100$).

At a borderline significance level, education is inversely associated with the odds that women will test positive for an STI. The likelihood of having an STI is significantly higher for members of the 1960s birth cohort than for members of the 1950s birth cohort, and is significantly higher for residents of the South and East coastal areas than for residents of other regions.

Additional Analyses

We conducted several sets of supplementary analyses to check on the robustness of our results. One limitation of our analysis is that it is not possible to measure the sex ratio of the community that the CHFLS respondents lived in at age 20 if they migrated into their community after that age. The CHFLS does not record respondents' complete residential histories that would allow us to determine their community of residence—and thus the sex ratio that migrant women were exposed to—at age 20. The CHFLS does, however, ask respondents whether, at the time of the survey, they were living in the community that they grew up in. As a check on possible problems caused by inter-community migration, we re-estimated all of the models using only respondents who reported residing at the time of the survey in the same community (village, county, city, or prefecture) that they grew up in. This is a stringent check, because these analyses omit women respondents who migrated into their current community *before* turning age 20 and thus for whom the estimated sex ratio using our procedures does represent the appropriate number of men available to them in their young adult years. In models that omit these inter-community migrants, we found the same basic pattern of effects as observed in Table 2, but partly because of the reduced sample size, the coefficients for the sex ratio were not always

statistically significant.³ The general similarity in findings may result from the fact that, in China, migrants appear to differ little from non-migrants in their sexual risk behaviors (Merli et al. 2006) or rates of chlamydial infection (Parish et al. 2003).

We also estimated models in which we measured the sex ratio by the age-specific numbers of men and women (using seven-year age groups with the two-year staggering described above) at the time of the CHFLS interview. Measuring the sex ratio using this method assumes that sex differences in mortality and migration play negligible roles throughout a cohort's life course. That is, this measurement strategy assumes that the number of men that women are exposed to in the year 2000 (the date of the CHFLS) adequately proxies for the number of men that these women were exposed to earlier in their lives when they were at risk of experiencing the outcomes. This is probably a reasonable assumption for the younger respondents but is less tenable for the older respondents. However, this measurement strategy has the advantage of drawing entirely on the full-count 2000 census data, thus eliminating the influence of errors in the measurement of the sex ratio incurred by using the 1982 and 1990 1% samples. Moreover, the sex ratio encountered at the time of the CHFLS survey may be closer in time to the risk period for experiencing some of the events—particularly recent sexual intercourse and the contraction of an STI—that serve as outcome variables in our analysis. Results from these supplementary analyses were again quite similar to those we report in Table 2. We observed statistically significant positive effects of the sex ratio on all of the outcomes except for nonmarital sex. This result is perhaps not surprising because, of the outcomes examined, the risk of engaging in nonmarital sex is most likely to be influenced by the availability of men during women's young adulthood, that is, prior to marriage.

Third, we examined whether the associations between the sex ratio and women's sexual outcomes vary across birth cohorts. Members of the older cohorts grew up at a time in which nonmarital sexual behavior (Parish, Laumann and Mojola 2007) was strongly proscribed but in which violence against women was more tolerated (Tang and Lai 2008; Tang, Wong, and Cheung 2002). Thus, it is possible that among the older cohorts nonmarital sexual activity would be relatively unresponsive to sex ratio imbalances. Given limited freedom to engage in nonmarital sexual intercourse, older women may have been unlikely to engage in these behaviors even when afforded the opportunity to do so by a relative abundance of men in their communities. Conversely, the likelihood of being sexually victimized may have been comparatively more responsive to sex ratio imbalances among the older than younger cohorts. We explored these possibilities by adding to the regression models shown in Table 2 product terms representing the interaction between the sex ratio and birth cohort. However, we found no strong evidence that the associations between the sex ratio and women's sexual outcomes varies significantly across birth cohorts. Few of the coefficients for the relevant interaction terms were statistically significant, and their inclusion as a group failed to significantly improve the fit of the models.

DISCUSSION AND CONCLUSION

China has been experiencing a dramatic and growing imbalance between the number of women and men in its population, and the increasing surplus of men is thought to influence sexual behavior and the spread of sexually-transmitted diseases. However, few studies have closely examined this presumed impact of sex ratio imbalances on sexual outcomes. We address this issue by merging individual-level data from the CHFLS with census-derived measures of the numerical availability of men in women's age group and local community. We derive hypotheses

from demographic-opportunity theory positing effects of the sex ratio on four dimensions of women's sexual outcomes—whether they have engaged in recent sex, whether they have experienced forced sex, whether they have had nonmarital sex, and whether they test positive for an STI. We find statistically significant and moderately strong effects of the sex ratio on all four measures of women's sexual outcomes. Our findings support hypotheses derived from demographic opportunity theory that posit that the relative supply of men in local communities increases the frequency and form of women's sexual encounters.

We find that a surplus of men is associated with an increase in the odds that women will experience nonmarital sexual intercourse. China has witnessed substantial ideological and cultural shifts, as well as improvements in women's status, over recent decades. These shifts toward a less traditional social environment are reflected in changes in sexual behaviors such as more pervasive premarital sexual activity (Sheng 2005; Parish, Laumann, and Mojola 2007). Our finding suggests that this secular trend in women's nonmarital sexual activity may be steeper than what would have occurred in the absence of high sex ratios.

We also find that women are more likely to be forced to have sex when they are numerically scarce relative to men. In China, women's low status has made them particularly vulnerable in both their own households and the larger society (Tang, Wong, and Cheung 2002). The growing empowerment of Chinese women may help combat this vulnerability. At the same time, however, the positive effect of the sex ratio on women's victimization is problematic given the projected increase in male surplus over coming decades. Any reduction in women's risk of sexual victimization generated by movement toward a less traditional and patriarchal sociocultural climate may be at least partially offset by China's growing surplus of men.

Our results also suggest that China's impending surplus of adult males may lead to an increased risk of HIV/AIDS among women. Rates of HIV/AIDS and other STDs have been increasing rapidly in China (Grusky, Liu, and Johnston 2002; Hong and Li 2009), but the extent to which a growing abundance of men underlies these trends is not well understood. Our results indicating a positive association between the sex ratio and the probability that women have contracted an STI is instructive both because STIs are a risk factor for HIV/AIDS and because of likely similarity in their determinants and modes of transmission (Galvin and Cohen 2004; Yang et al. 2005). Our findings suggest that sex ratios may play a role in the spread of STIs and STDs among women because, among other reasons, women are more likely to experience recent, nonmarital, and forced sexual intercourse, and to test positive for at least some STIs, when they are exposed to relatively more men in their local marriage market.

We acknowledge that using these findings to project the future of Chinese women's sexual experiences in the face of a growing numerical surfeit of men is a risky undertaking. One important difference between the current cross-sectional inter-community variation in the adult sex ratio used here and the looming imbalance in adult sex ratios in China's future is that, currently, men can (at least theoretically) move from a community with few women to a community with more women; in the future, however, there will likely be few if any communities with an abundance of women to serve as destinations for potential internal migrants. It is also possible that China may adjust to its projected surplus of adult men through mechanisms such as male emigration or the importation of wives that would temper the impact of these sex ratio imbalances.

Our findings point to several possible directions for future research. That a surplus of men is associated with women's increased risk of sexual victimization could mean that, when

women are scarce, men exercise greater control and force over women in the society at large, that they maintain stricter control of their current partners in the private sphere, or both. Our measure of forced sex does not distinguish among physical coercion used by husbands, partners, or strangers, nor do we have information on the dynamics of interpersonal relationships. Future research should explore the underlying dyadic processes involved in how sex ratios alter men's and women's relative power.

Future research might also profit by exploring how the growing surplus of males (and attendant deficit of females) will affect the broader nature of social relations between men and women, and women's status more generally, in China. On the one hand, women may attain greater power in society when they are in short supply because men will need to offer more resources in order to strike a marital bargain (Guttentag and Secord 1983). On the other hand, under conditions of female scarcity, men may also more vigorously guard their mates and limit their participation in the broader society (South and Trent 1988). How these disparate processes balance out may be important for understanding more clearly the relationships between population sex ratios and family-related behavior. In China as well as elsewhere in the world, gender inequality is likely tied to mate availability in ways that are yet to be thoroughly investigated.

NOTES

¹ The majority of the positive test results are for chlamydial infection.

² A few communities could not be identified in the 1982 or 1990 censuses. For women in these communities, we substitute the age-specific sex ratio observed in the 2000 census. Substantive findings are unaffected by this substitution. We also observed some extreme values of the sex ratio, likely a consequence of sampling variability in the smaller communities. To limit the influence of these extreme values, we bottom-code and top-code the values of the sex ratio at 80 and 120, respectively.

³ Specifically, the coefficient for the sex ratio remained significant for recent sex and nonmarital sex, but not for forced sex or testing positive for an STI.

REFERENCES

- Avakame, Edem F. 1999. "Sex Ratios, Female Labor Force Participation, and Lethal Violence Against Women: Extending Guttentag and Secord's Thesis." *Violence Against Women* 5:1321-41.
- Banister, Judith. 2004. "Shortage of Girls in China Today." *Journal of Population Research* 21:19-45.
- Barber, Nigel. 2001. "On the Relationship between Marital Opportunity and Teen Pregnancy: The Sex Ratio Question." *Journal of Cross-Cultural Psychology* 32:259-67.
- Barber, Nigel. 2004. "Reduced Female Marriage Opportunity and History of Single Parenthood (England, Scotland, U.S.)." *Journal of Cross-Cultural Psychology* 35: 648-51.
- Billy, John O. G, Karin L. Brewster, and William R. Grady. 1994. "Contextual Effects on the Sexual Behavior of Adolescent Women." *Journal of Marriage and the Family* 56:387-404.
- Billy, John O. G., and David E. Moore. 1992. "A Multilevel Analysis of Marital and Nonmarital Fertility in the U.S." *Social Forces* 70:977-1011.
- Blau, Peter M. 1977. *Inequality and Heterogeneity: A Primitive Theory of Social Structure*. New York: Free Press.
- Blau, Peter M., and Reid M. Golden. 1986. "Metropolitan Structure and Criminal Violence." *Sociological Quarterly* 27: 15-26.
- Brewster, Karin L. 1994. "Neighborhood Context and the Transition to Sexual Activity among Young Black Women." *Demography* 31:977-1011.

- Browning, Christopher, and Matisa Olinger-Wilbon. 2003. "Neighborhood Structure, Social Organization, and Number of Short-Term Sexual Partnerships." *Journal of Marriage and Family* 65:730-45.
- Cai, Yong, and William Lavelly. 2003. "China's Missing Girls: Numerical Estimates and Effects on Population Growth." *The China Review* 3:13-29.
- China Data Center. 2004. *The Complete Collection of 2000 China County/District Population Census Data Assemblies* [MRDF]. China Data Center: University of Michigan.
- China Population and Information Research Center. 2008. *1% Sample of the 1990 China Population Census Data* [MRDF]. Accessed from the Texas A&M University China Archive, July 21, 2008.
- Chinese Health and Family Life Survey. 2006. <http://www.src.uchicago.edu/prc/chfls.php>. Accessed March 30, 2006.
- Coale, Ansley J., and Judith Banister. 1994. "Five Decades of Missing Females in China." *Demography* 31:459-79.
- D'Alessio, Stewart J. and Lisa Stolzenberg. 2010. "The Sex Ratio and Male-on-Female Intimate Partner Violence." *Journal of Criminal Justice* 38:555-61.
- Ebenstein, Avraham Y. and Ethan Jennings. 2009. "Bare Branches, Prostitution, and HIV in China: A Demographic Analysis." Pp. 71-94 in *Gender Policy and HIV in China: Catalyzing Policy Change*, edited by Dudley L. Poston, Joseph Tucker, Qiang Ren, Baochang Gu, Xiaoying Zheng, Stephanie Wang, and Chris Russell. Springer.
- Edlund, Lena, Hongbin Li, Junjian Yi, and Junsen Zhang. 2007. "More Men, More Crime: Evidence from China's One-Child Policy." IZA Discussion Paper No. 3214. Institute for the Study of Labor. Bonn, Germany.

- Fossett, Mark A. and K. Jill Kiecolt. 1993. "Mate Availability and Family Structure among African Americans in U.S. Metropolitan Areas." *Journal of Marriage and the Family* 55:288-301.
- Galvin, Shannon R., and Myron S. Cohen. 2004. "The Role of Sexually Transmitted Diseases in HIV Transmission." *Nature Reviews Microbiology* 2:33-42.
- Gil, Vincent E., Marco S. Wang, Allen F. Anderson, Guo Matthew Lin, and Zongjian Oliver Wu. 1996. "Prostitutes, Prostitution, and STD/HIV Transmission in Mainland China." *Social Science and Medicine* 42:141-152.
- Goodkind, Daniel M. 2004. "China's Missing Children: The 2000 Census Underreporting Surprise." *Population Studies* 58:281-295.
- Grusky, Oscar, Hongjie Liu, and Michael Johnston. 2002. "HIV/AIDS in China: 1990-2001." *AIDS and Behavior* 6:381-93.
- Gu, Baochang, and Krishna Roy. 1995. "Sex Ratio at Birth in China, with Reference to Other Areas in East Asia: What We Know." *Asia-Pacific Population Journal* 10:17-42.
- Guttentag, Marcia, and Paul F. Secord. 1983. *Too Many Women? The Sex Ratio Question*. Beverly Hills, CA: Sage.
- Harknett, Kristen. 2008. "Mate Availability and Unmarried Parent Relationships." *Demography* 45:555-71.
- Hong, Yan, and Xiaoming Li. 2009. "HIV/AIDS Behavioral Interventions in China: A Literature Review and Recommendation for Future Research." *AIDS and Behavior* 13:603-13.
- Hull, Terence H. 1990. "Recent Trends in Sex Ratios at Birth in China." *Population and Development Review* 16:63-83.

- Johansson, Sten, and Ola Nygren. 1991. "The Missing Girls of China: A New Demographic Account." *Population and Development Review* 17:35-51.
- Laumann, Edward O., John H. Gagnon, Robert T. Michael, and Stuart Michaels. 1994. *The Social Organization of Sexuality: Sexual Practices in the United States*. Chicago: University of Chicago Press.
- Lavelly, William. 2001. "First Impressions from the 2000 Census of China." *Population and Development Review* 27:755-69.
- Li, Shuzhuo. 2007. "Imbalanced Sex Ratio at Birth and Comprehensive Intervention in China." Presented at the 4th Asia Pacific Conference on Reproductive and Sexual Health and Rights 29-31 October 2007, Hyderabad, India.
- Lichter, Daniel T. Robert N. Anderson, and Mark D. Hayward. 1995. "Marriage Markets and Marital Choice." *Journal of Family Issues* 16:412-31.
- Lichter, Daniel T., Diane K. McLaughlin, George Kephart, and David J. Landry. 1992. "Race and the Retreat from Marriage: A Shortage of Marriageable Men?" *American Sociological Review* 57:781-99.
- McKinnish, Terra G. 2004. "Occupation, Sex-Integration, and Divorce." *American Economic Review* 94:322-25.
- McLaughlin, Diane K., Daniel T. Lichter, and Gail M. Johnston. 1993. "Some Women Marry Young: Transitions to First Marriage in Metropolitan and Nonmetropolitan Areas." *Journal of Marriage and the Family* 55:827-38.
- Merli, M. Giovanna, Sara Hertog, Bo Wang, and Jing Li. 2006. "Modelling the Spread of HIV/AIDS in China: The Role of Sexual Transmission." *Population Studies* 60:1-22.

- Messner, Steven F., and Judith R. Blau. 1987. "Routine Leisure Activities and Rates of Crime: A Macro-level Analysis." *Social Forces* 65:1035-1052.
- Murphy, Rachel. 2003. "Fertility and Distorted Sex Ratios in a Rural Chinese County: Culture, State, and Policy." *Population and Development Review* 29:595-626.
- O'Brien, Robert M. 1991. "Sex Ratios and Rape Rates: A Power-Control Theory." *Criminology* 29:99-114.
- Parish, William L., Edward O. Laumann, Myron S. Cohen, Suiming Pan, Heyi Zheng, Irving Hoffman, Tianfu Wang, and Kwai Hang Ng. 2003. "Population-Based Study of Chlamydial Infection in China: A Hidden Epidemic." *JAMA* 289:1265-73.
- Parish, William L., Edward O. Laumann, and Sanyu A. Mojola. 2007. "Sexual Behavior in China: Trends and Comparisons." *Population and Development Review* 33: 729-756.
- Peng, Xizhe, and Juan Huang. 1999. "Chinese Traditional Medicine and Abnormal Sex Ratio at Birth in China." *Journal of Biosocial Science* 31:487-503.
- Porter, Maria. 2006. "Imbalance in China's Marriage Market and Its Effect on Bargaining within the Household." Unpublished paper. Department of Economics, University of Chicago.
- Poston, Dudley L., Jr., and Karen S. Glover. 2005. "Too Many Males: Marriage Market Implications of Gender Imbalances in China." *Genus* 61:119-40.
- Secondi, Giorgio S. 2002. "Biased Childhood Sex Ratios and the Economic Status of the Family in Rural China." *Journal of Comparative Family Studies* 2002:215-34.
- Sheng, Xuewen. 2005. "Chinese Families." Pp. 99-128 in Bert Adams and Jan Trost (eds.) *Handbook of World Families*. Thousand Oaks, CA: Sage.
- South, Scott J. 1996. "Mate Availability and the Transition to Unwed Motherhood: A Paradox of Population Structure." *Journal of Marriage and the Family* 58: 265-279.

- South, Scott J., and Kim M. Lloyd. 1992. "Marriage Markets and Nonmarital Fertility in the United States." *Demography* 29:247-64.
- South, Scott J., and Katherine Trent. 1988. "Sex Ratios and Women's Roles: A Cross-National Analysis." *American Journal of Sociology* 93:1096-1115.
- South, Scott J., Katherine Trent, and Yang Shen. 2001. "Changing Partners: Toward a Macrostructural-Opportunity Theory of Marital Dissolution." *Journal of Marriage and Family* 63:743-54.
- StataCorp. 2005. *Stata Statistical Software: Release 9.0*. College Station, TX: Stata Corporation.
- Tang, Catherine So-Kum, and Beatrice Pui-Yee Lai. 2008. "A Review of Empirical Literature on the Prevalence and Risk Markers of Male-on-Female Intimate Partner Violence in Contemporary China, 1987-2006." *Aggression and Violent Behavior* 13: 10-28.
- Tang, Catherine So-Kum, Day Wong, Fanny Mui-Ching Cheung. 2002. "Social Construction of Women as Legitimate Victims of Violence in Chinese Societies." *Violence against Women* 8: 968-996.
- Trent, Katherine, and Scott J. South. 2003. "Spousal Alternatives and Marital Relations." *Journal of Family Issues* 24:787-810.
- Tucker, Joseph D., Gail E. Henderson, Tian F. Wang, Ying Y. Huang, William Parish, Sui M. Pan, Xiang S. Chen, and Myron S. Cohen. 2005. "Surplus Men, Sex Work, and the Spread of HIV in China." *AIDS* 19:539-47.
- Tucker, Joseph D., Xin Ren, and Flora Sapio. 2010. "Incarcerated Sex Workers, and HIV Prevention in China: Social Suffering and Social Justice Countermeasures." *Social Science and Medicine* 70: 121-129.

- Tuljapurkar, Shripad, Nan Li, and Marcus W. Feldman. 1995. "High Sex Ratios in China's Future." *Science* 267:874-76.
- Uecker, Jeremy E. and Mark D. Regnerus. 2010. "Bare Market: Campus Sex Ratios, Romantic Relationships, and Sexual Behavior." *The Sociological Quarterly* 51:408-35.
- Whaley, Rachel Bridges. 2001. "The Paradoxical Relationship between Gender Inequality and Rape: Toward a Refined Theory." *Gender & Society* 15:531-55.
- Wooldridge, Jeffrey M. 2002. *Econometric Analysis of Cross Section and Panel Data*. Cambridge, MA: MIT Press.
- Xiao, Yan, Sibylle Kristensen, Jiaping Sun, Lin Lu, and Sten H. Vermund. 2007. "Expansion of HIV/AIDS in China: Lessons from Yunnan Province." *Social Science and Medicine* 64: 665-75.
- Yang, Hongmei, Xiaoming Li, Bonita Stanton, Hongjie Liu, Hui Liu, Ning Wang, Xiaoyi Fang, Danhua Lin, and Xinguang Chen. 2005. "Heterosexual Transmission of HIV in China: A Systematic Review of Behavioral Studies in the Past Two Decades." *Sexually Transmitted Diseases* 32:270-80.
- Yi, Zeng, Ping Tu, Baochung Gu, Xu Yi, Li Bohua, and Li Yongping. 1993. "Causes and Implications of the Recent Increase in the Reported Sex Ratio at Birth in China." *Population and Development Review* 19:283-302.
- Yuan, Xin, and Edward Jow-Ching Tu. 2004. "Analysis of High Sex Ratio at Birth in Mainland China." *Journal of Population Studies* 29:147-81.

Table 1. Weighted Descriptive Statistics for Variables Used in Analysis of Sexual Experiences: Women Ages 20-44, Chinese Health and Family Life Survey

<u>Dependent Variables</u>	<u>Description</u>	<u>Percent</u>	<u>N</u>
Recent Sex	R reports engaging in sexual intercourse in past year	89.04	1369
Forced Sex	R reports having been forced to have sex against her will	6.65	1338
Nonmarital Sex	R reports having had sexual intercourse outside of marriage	16.86	1369
Has STI	R's urine test is positive for gonorrhea, chlamydia, or trichomonas	4.49	1241
<u>Independent Variables</u>		<u>Mean</u>	<u>SD</u>
Sex Ratio	Estimated number of men ages 17-23 per 100 women ages 15-21 in R's community when R was age 20	108.51	12.25
Education	R's level of education (1= never attended school; 2= elementary school; 3= junior high school; 4= senior high school; 5= junior college; 6= university/graduate school)	2.72	1.00
Birth Cohort 1950	R was born 1950 to 1959 (1= yes)	.14	
Birth Cohort 1960	R was born 1960 to 1969 (1= yes)	.44	
Birth Cohort 1970	R was born 1970 to 1979 (1= yes)	.42	

Table 1 (continued)

Urban Residence at Age 14	R resided in an urban area at age 14 (1=yes)	.15
<u>South/East Coast</u>	<u>R's community is on the South or East coast (1= yes)</u>	<u>.11</u>

Notes: Descriptive statistics for independent variables taken from largest sample (N= 1,369). Standard deviations for dummy variables not shown.

Table 2. Logistic Regression Analyses of Sexual Experiences: Women Ages 20-44, Chinese Health and Family Life Survey

<u>Independent Variables</u>	<u>Model 1</u> Recent Sex			<u>Model 2</u> Forced Sex			<u>Model 3</u> Nonmarital Sex			<u>Model 4</u> Has STI		
	<u>b</u>	<u>se</u>	<u>e^x</u>	<u>b</u>	<u>se</u>	<u>e^x</u>	<u>b</u>	<u>se</u>	<u>e^x</u>	<u>b</u>	<u>se</u>	<u>e^x</u>
Sex Ratio	.036**	.009	1.036	.017*	.008	1.017	.014*	.006	1.015	.023*	.009	1.023
Education	-.179 ⁺	.096	.836	.352**	.120	1.421	.087	.075	1.091	-.204 ⁺	.119	.816
Birth Cohort												
1950	Reference			Reference			Reference			Reference		
1960	.621*	.309	1.861	-.192	.230	.825	.325*	.154	1.384	.804*	.345	2.234
1970	-1.971**	.294	.139	-.746**	.279	.474	.462**	.157	1.588	.473	.392	1.605
Urban Residence at age 14	-.496*	.204	.609	.000	.218	1.000	.301 ⁺	.162	1.351	.256	.296	1.292
South/East Coast	-.002	.142	.998	-.641**	.229	.527	.695**	.138	2.003	.653**	.247	1.923
Constant	-.234	.943		-4.692**	.985		-3.867**	.607		-5.455**	.968	
N	1369			1338			1369			1241		
Pseudo R ²	.187			.042			.036			.029		
<u>Log-likelihood</u>	-464.225			-413.105			-717.293			-295.952		

Notes: See Table 1 for variable definitions. Standard errors adjusted for the clustering of observations within communities (N= 37).

+ $p < .10$ * $p < .05$ ** $p < .01$ (two-tailed tests)