DEMOGRAPHIC OPPORTUNITY AND MATE SELECTION IN INDIA

Scott J. South
Department of Sociology
Center for Social and Demographic Analysis
University at Albany
State University of New York
Albany, NY 12222
Phone: 518-442-4691
E-mail: s.south@albany.edu
Fax: 518-442-4936

Katherine Trent
Department of Sociology
Center for Social and Demographic Analysis
University at Albany
State University of New York
Albany, NY 12222
Phone: 518-442-4681
E-mail: k.trent@albany.edu
Fax: 518-442-4936

Sunita Bose
Department of Sociology
State University of New York at New Paltz
New Paltz, NY 12561
Phone: 845-257-2601
E-mail: boses@newpaltz.edu
Fax: 845-257-2970

*Direct correspondence to Scott J. South, Department of Sociology, University at Albany, SUNY, Albany, NY 12222. E-mail: s.south@albany.edu. This research was supported by a grant to the authors from the National Institute of Child Health and Human Development (R01 HD067214). The Center for Social and Demographic Analysis of the University at Albany provided technical and administrative support for this research through a grant from NICHD (R24 HD044943). We thank Michelle L. Barton and Hui-shien Tsao for research assistance and several anonymous reviewers for helpful comments.

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Abstract

We merge individual-level data from the 2004-2005 India Human Development Survey with district-level data derived from the 1991 and 2001 Indian population censuses to examine how the numerical supply of men to which married women were exposed during late adolescence affects various dimensions of mate selection. Multilevel models that control for an array of both individual and contextual characteristics reveal that among women with high levels of education exposure to a higher age-specific male-to-female sex ratio significantly lowers age at marriage, and that less educated women tend to marry comparatively younger men in more favorable than less favorable marriage markets. Moreover, exposure to a relative surplus of potential mates is associated with a higher likelihood that women will have little or no say in the selection of their husband and an increased probability that women will meet their husband for the first time on their wedding day. The implications of these findings for India's growing sex ratio imbalance are discussed.

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Significant changes in the population sex ratio are looming throughout much of South and East Asia and parts of Eurasia. A longstanding preference for sons has combined with the widespread adoption of sex-selective abortion technology to generate abnormally high—and frequently increasing—male-to-female sex ratios in several societies, including most prominently China and India but also Armenia, Azerbaijan, Georgia, Pakistan, Singapore, and Vietnam (Duthe et al. 2012; Guilmoto, 2009; Hvistendahl, 2011). As members of these birth cohorts age, these countries will experience numerical surpluses of men and attendant deficits of women in their adult populations.

Although the causes of sex ratio imbalances in India, China, and other Asian countries have been explored in considerable detail, much less is known about the *consequences* of skewed sex ratios for familial behaviors and the well-being of young women and men (Dyson 2012; Hesketh and Xing 2006). The research that has been conducted on the consequences of skewed sex ratios has focused predominantly on the ramifications of a marriage squeeze for men's marriage formation behavior, particularly in China (e.g., Guilmoto 2012; Tuljapurkar, Li, and Feldman 1995). Comparatively little research has explored the consequence of imbalanced sex ratios for women, in social contexts other than China, and for outcomes other than marriage timing and prevalence.

With its distinctive cultural practices regarding family formation, India provides a potentially valuable case study for examining how excessively masculine sex ratios might influence the process of mate selection. Unlike Chinese marriages, Indian marriages are most often arranged by parents and other family members, leaving young women and men with little say over when or whom to marry (Desai et al. 2010). Such a cultural context provides the

opportunity to examine how abnormally masculine sex ratios shape not only women's marital timing, but also the amount of agency women exercise in the selection of a spouse. In India, imbalanced sex ratios have the potential to alter women's agency in the mate selection process more so than in other countries that have been witnessing increases in their population sex ratio, such as China, but that lack a tradition of arranged marriage. Further justifying a focus on India is evidence that women's discretion over the choice of husband, as well as other features of the mate selection process, critically influence women's marital quality and overall well-being (e.g., Allendorf and Ghimire 2013).

In this analysis we merge individual-level data from the 2004-05 India Human Development Survey (IHDS) with full-count data from the 1991 and 2001 Indian population censuses to examine how the community sex ratio to which young women were exposed during late adolescence is associated with various dimensions of the mate selection process, including their age at marriage, the age difference between themselves and their husband, the amount of agency they had in choosing a husband, and the amount of time they knew their husband prior to the wedding. We estimate multilevel models that control for a host of individual-level and community-level determinants of the outcome variables and that adjust for the clustering of observations within geographic districts. At a broad level, our findings suggest that a key dimension of social structure—the relative numbers of women and men in the population—helps shape in largely predictable ways these mate selection practices. Moreover, our findings raise important questions about the trajectory of change in women's agency in light of India's ostensibly looming increase in the relative numbers of young men in its population.

BACKGROUND

India's marriage system

To Western observers, and even many inhabitants of developing countries, the process of selecting a mate in India may appear quite distinctive. Marriage is virtually universal and occurs relatively early in life (Das and Dey 1998; Desai and Andrist 2010; Dommaraju 2011). Child marriage is not uncommon, even though actual cohabitation with a spouse may not begin until years after the initiation of the marriage contract (Raj et al. 2009; Singh 2008). Marriages are very often arranged by children's parents or other family members, with young women and men frequently having little or no say in the selection of their spouse (Desai and Andrist 2010; Dommaraju 2011; Singh 2005). Women often marry men much older than themselves (Singh 2008). And, most newlyweds first meet their spouse in person on or about their wedding day (Desai and Andrist 2010). Although currents of modernization and globalization may have eroded these practices slightly, they remain widespread, particularly in rural areas of the country (Desai et al. 2010).

Except for a few regions in south India and among the tribal populations in northeastern India, Indian families are generally patriarchal, patrilineal, and patrilocal (Medora 2007; Sonawat 2001). In modern India, the joint family of the past is the exception rather than the rule, particularly in urban areas (Medora 2007). However, the importance of extended family members endures as the traditional joint family has given way to an adaptive, extended family, or "functionally joint" family (Sonawat 2001:180), in which extended family members do not live under the same roof but continue to provide practical assistance ((D'Cruz and Bharat 2001). In such a system, men remain valued members of the family even after leaving the parental home because they continue the lineage and provide economic support to other family members, especially aging parents. Young women, in contrast, are considered somewhat transient family members whose loyalty will belong to her husband's family when she marries. Young women

are considered outsiders who are socialized by other women into her husband's family upon marriage (D'Cruz and Bharat 2001). Because young men often need financial support from their parents in the early years of marriage, young wives must learn to co-exist with their in-laws during those years. The presence of parents-in-law in the early years of marriage often means that wives are allowed only limited interaction with their husband inside the home (D'Cruz and Bharat 2001; Derné 1994).

India is a collectivistic society that stresses family welfare and cohesiveness over individual well-being (Derné 2005; Medora 2007). The selection of a mate is therefore mostly a matter of family choice rather than individual desire. In spite of the social changes wrought by globalization and urbanization, the vast majority of marriages in India are arranged (Ghimire et al. 2006; Jauregui and McGuinness 2003; Netting 2010), and even a majority of young adults prefer arranged marriages over love marriages (Derné 2005; Sonawat 2001). Love, romance, and courtship are traditionally considered unnecessary in an arranged marriage (D'Cruz and Bharat 2001; Medora 2007). Indeed, love or choice marriages are often regarded with suspicion because of their potential for disrupting the social order (Jauregui and McGuinness 2003; Netting 2010).

Arranged marriages typically tend to be endogamous with parents selecting their children's spouses from the same caste (and sub-caste), social class, and ethnic group. Although still quite rare, marriages across caste, linguistic, and religious boundaries are increasing, primarily among educated professionals (Jauregui and McGuinness 2003; Sonawat 2001). This increase is partly a function of the rise in love marriages among the urban elite. Paralleling the increase in love marriages, many young Indians are engaging in hybrid arranged-love marriages in which already betrothed couples are allowed by their parents to engage in some form of

courtship prior to marriage or in which couples already in love ask their parents to approve and arrange the wedding (Ghimire et al. 2006; Netting 2010).

India's marriage practices are of course deeply embedded in a cultural system in which families' exchanges of daughters and sons through marriage result from, and further solidify, familial, community, and kinship bonds. Arranged marriages typically form alliances between two families that are aimed to enhance family prestige, status, and normative kinship order (Fuller and Narasimhan 2008; Mason 1995). In this paper we ask whether these longstanding and deeply-rooted practices of mate selection are influenced as well by the demographic opportunities available to young people to locate and choose—or to have chosen for them—a marriage partner. Although several studies have explored the influence of social context, broadly construed, on marital dynamics in South Asia (Barber 2004; Yabiku 2004; 2006), the possible influence of the local sex ratio has thus far been ignored.

Study motivation

Our study of the impact of India's imbalanced sex ratio on women's mate selection practices is motivated in large measure by two considerations. First is concern over the social consequences of India's historical—and likely accelerating—numerical surplus of men and attendant deficit of women. India's population has historically displayed an imbalance between the numbers of men and women (Agnihotri 2000; Chakraborty and Kim 2010; Guillot 2002; Griffiths, Matthews, and Hinde 2000; Guilmoto 2008, 2009; Mayer 1999; Sen 1992). The current male-to-female sex ratio of 106.4 indicates women are moderately underrepresented in India's total population. However, the numerical deficit of young girls is a graver concern. Sex ratios at birth (the number of male to female births) normally range between 103 and 107. India's current sex ratio at birth is currently 111 (Haub 2011) and has failed to show significant

improvement over recent years (Ramaiah, Chandrasekarayya, and Murthy 2011). In fact, India's childhood sex ratio has become more masculine over time. The ratio of boys to girls ages 0 to 6 was 102.5 in 1961, rose to 104.0 in 1981 and now stands at 109.4 according to the most recent census of 2011 (Census of India 2011).

India's child sex ratio imbalance is particularly severe in some geographic regions (Arnold, Kishor, and Roy, 2002; Dyson 2001). The sex ratio at birth is over 120 in both Punjab and Haryana, and is nearly as high in several other Indian states (Sharma and Haub 2008). High sex ratios are also recorded for the child population. For example, there are currently 120.5 boys per 100 girls age 0 to 6 in Haryana (Census of India 2011). These sex ratio imbalances at birth and during childhood likely foreshadow a substantial surplus of adult men in India's population, and thus warrant consideration of the consequences of the numerical shortage of Indian women (Bhat and Sharma 2006).

Several factors are thought to contribute to India's numerical deficit of females. A long-standing preference for sons over daughters reflects a patriarchal culture that favors the familial and economic contributions of men over the contributions of women (Clark 2000; Das Gupta 1987; Das Gupta et al. 2003; George 2002; Malhotra et al. 1995; Pande and Astone 2007). This deeply-rooted preference for sons has recently become easier to satisfy because of widespread use of sex-selective abortion (Abrejo et al. 2009; Arnold, Kishor, and Roy 2002; Hvistendahl 2011; Jha et al. 2006). A surplus of boys and attendant deficit of girls is also generated by differential survival rates. Discrimination against girls in immunization (Boorah 2004), nutrition (Pande 2003), and other health care practices (Mishra, Roy, and Retherford 2004) leads to greater female mortality relative to male mortality during early childhood (Oster 2009). As these cohorts age, skewed sex ratios at birth and during childhood lead to sex ratio imbalances among adults.

A second motivation for studying the impact of India's skewed sex ratio on women's mate selection practices derives from an emerging literature linking women's marriage characteristics and circumstances to their autonomy, household power, health, victimization, and other dimensions of well-being. Compared to women who marry later in life, women who marry at very young ages in less developed countries are thought to be particularly vulnerable in marriage and to be at risk for a variety of unfavorable social and health outcomes (Adhikari 2003; Mensch et al. 2005). Women who marry young attain lower levels of education (Adhikari 2003), are less likely to use contraceptives to delay a pregnancy, and are more likely to experience physical and sexual violence within marriage (Sahin et al 2010; Santhya et al. 2010; Speizer and Pearson 2011). The effects of spousal differences in demographic characteristics on women's autonomy have been studied less extensively, but it has been suggested that when the husband is much older than the wife, women's decision-making authority is diminished (Barbieri, Hertrich, and Grieve 2005; Carmichael 2011; National Research Council & Institute of Medicine 2005; Quisumbing and Hallman 2005). A large age difference between spouses has also been linked to increased risk of intimate partner violence (International Center for Research on Women 2000).

And although the findings are somewhat complex, in general women in self-arranged or so-called "love" or "companionate" marriages generally enjoy greater household power and autonomy, enhanced independence and physical mobility, more frequent contact with natal kin, and more satisfying marital communication and interaction than women who had no say in the selection of their spouse (Allendorf and Ghimire 2013; Banerji and Vanneman 2011; Jejeebhoy et al. 2009; Niraula and Morgan 1996). Women who chose their spouse are less likely to experience domestic violence than women who had little or no agency in partner choice (Sahin et

al. 2010). Granted, the associations between age at marriage, spousal age differences, and marriage type, on the one hand, and indicators of women's well-being, on the other, might not be causal in nature; preexisting (but often unobserved) individual and contextual attributes could be driving both sets of behaviors. But these associations nonetheless warrant examination of the social forces that shape women's entry into marriage, including not only when and whom to marry, but also the amount of agency women enjoy in these critical life-course decisions.

HYPOTHESES

Our theoretical point of departure for exploring the impact of India's sex ratio imbalance on mate selection patterns is a perspective variously referred to as "demographic-opportunity theory" (e.g., Trent and South 2011), "macrostructural-opportunity theory" (South et al. 2001), or simply "opportunity" theory (Uecker and Regnerus 2010). Demographic-opportunity theory views the distribution of the population by sex, as well as by other pivotal demographic and social characteristics such as age, race, and social class, as a defining characteristic of social structure (Blau 1977). Indeed, for Blau (1977; 1994), the univariate and joint distributions of the population across these salient individual characteristics *constitute* social structure. A fundamental premise of demographic-opportunity theory is that the likelihood of forming inter-group associations, including cross-sex associations such as marriage, is determined to a substantial degree by the number of available out-group members with whom such associations can be formed. At the broadest level, then, demographic-opportunity theory links an important aspect of the local social structure—the sex ratio—with individual behavior, thereby illustrating one connection between macrostructures and microbehaviors.

One fairly straightforward hypothesis derivable from the demographic-opportunity theory is that a copious supply of potential mates in individuals' local marriage market will hasten the

transition to marriage. Prior applications and tests of demographic-opportunity theory in this context have focused primarily on how the availability of men affects U.S. women's marital timing. Research shows that female marriage rates tend to be higher, and the transition to first marriage sooner, in geographic areas containing more eligible men (e.g., Fossett and Kiecolt 1993; Lichter et al. 1991; 1992; South 1996). Fewer studies have examined the impact of mate availability in developing countries, but Trent and South (2011) find that in China, which like India has also been experiencing a growing surplus of men (Banister 2004; Goodkind 2004), women are more likely to marry at a young age when there are comparatively more men in their local geographic area. In both India and China, projections indicate that the numerical deficit of women will leave many men unable to marry (Guilmoto 2012; Tuljapurkar, Li, and Feldman 1995; Poston and Glover 2005). And in India, a numerical deficit of women in the local geographic area delays men's entry into marriage (South, Trent, and Bose 2012). By the same token, a surfeit of men should increase not only the percentage of women who are able to attract a suitable husband, but also hasten women's entry into marriage.

Young women and their families could respond to a relative surfeit of eligible husbands not only by marrying earlier in life but also by restricting their marital search to men with the most desirable characteristics. Of particular salience in this context is husband's age. We hypothesize that the supply of prospective husbands will be inversely associated with age heterogamy, i.e., the age difference between a woman and her husband. When faced with an ample supply of available mates, women (and their parents) will be easily able to satisfy preferences for a husband who is somewhat but not greatly older than themselves. In contrast, when men are relatively scarce, women (and their parents) are constrained to consider potential husbands outside of the normative age range (Berardo, Appel, and Berardo 1993; Edlund 1999).

For their part, a numerical deficit of women makes it difficult for men to marry women much younger than themselves, who are often preferred as daughters-in-law. Because of strong normative pressures in India against women marrying younger men, and particularly strong pressures against men marrying older women, we expect that the impact of a deficit of men will be felt primarily at the upper end of the age difference distribution, increasing the likelihood that women will marry much older (but not necessarily much younger) men than themselves. This reasoning leads to the hypothesis that the male-to-female sex ratio will be inversely associated with the degree to which husband's age exceeds that of the wife.

An ample supply of available husbands is also likely to impact the amount of agency women have in choosing a marital partner. In India, parents and other adults often choose a mate for their children (Singh 2005), sometimes when their children are very young. When young men are plentiful, parents and other adult family members will find it easier to locate a suitable and attractive husband for the family's daughters, one that is likely to improve the family's social status in the community. Under these circumstances, the selection of a husband for a young woman will reside mainly, if not entirely, in the hands of parents and other adults, leaving daughters with little discretion or agency over whom to marry. In contrast, when men are relatively scarce, parents will find it more difficult to locate a desirable husband for their daughters. In some cases, the selection of a husband may be postponed until daughters are old enough to demand at least some involvement in the selection of a spouse. In other cases, parents may simply forego their role as matchmaker, leaving the mate selection process mostly up to their daughters. In either case, this extension of demographic-opportunity theory leads us to hypothesize that the greater the numerical supply of men in young women's local marriage

market, the more say parents will have, and the less say young women themselves will have, in whom to marry.

For essentially similar reasons, we expect the supply of available men to be related to the amount of time young women knew their husband prior to marrying. When men are abundant and consequently marriages are more likely arranged by parents, young women will have little if any opportunity to interact with their prospective husband prior to the wedding. Having not participated directly in the marital search, and having experienced no prior period of courtship as in the case of "love" marriages, and in a context where most marriages are to persons residing outside of the village or urban neighborhood, young women will have spent little if any time with their betrothed prior to marrying him (Desai and Andrist 2010). But if, as argued above, women are more likely to participate in the selection of a husband when men are numerically scarce, then we would expect that women will be more likely to have known their husband prior to the wedding day in a low-sex-ratio context. Indeed, women's selection of a husband in this context is likely to be partly based on the quality of her encounters with him, even if these encounters are not necessarily components of the traditional Western courtship process. For these reasons we hypothesize that the relative supply of men in the local marriage market will be inversely associated with the length of time women have known their husband prior to marrying him.

DATA AND METHODS

Data for this study come from two sources: the 2004-2005 India Human Development Survey (IHDS) and the 1991 and 2001 India population censuses. The IHDS is a multi-purpose, nationally-representative survey of 41,554 households interviewed in 2004 and 2005 (Desai et al. 2009). Surveyed households are distributed across 382 of India's 602 districts. The administration of the IHDS consisted of two one-hour interviews in each household, with

separate questionnaire modules administered to the household head and to an ever-married woman between the ages of 15 to 49 (N = 33,510). Questionnaire items cover issues related to marriage, fertility, gender relations, health, education, and employment, among other topics. The IHDS was organized by researchers at the University of Maryland and the National Council of Applied Economic Research in India.

From the 1991 and 2001 full-count Indian census files, we extract district-level population counts by sex and single years of age. Using the IHDS district codes, we then attach these age/sex distributions to the household records of the IHDS. India population censuses are considered to be of high quality; net undercount rates estimated via post-enumeration survey are quite low. More importantly for the accurate computation of sex ratios, the sex difference in undercount appears negligible (Census of India 2008).

Districts have long been used to study the causes (e.g., Agnihotri 2000) and consequences (e.g., Dreze and Khera 2000) of variation in India's sex ratio. India's districts are both administrative and statistical units that are thought to circumscribe the relevant social contexts for a wide range of demographic outcomes and behaviors (Desai and Wu 2010; Kishor 1993; Murthi, Guio, and Dreze 1995), including specifically mate selection practices (Desai and Andrist 2010; Malhotra et al. 1995). Indian districts are comparable in size to large U.S. metropolitan or labor market areas, which have been used to examine the impact of sex ratios and other marriage market characteristics on marriage propensities (e.g., Lichter et al. 1992). Most of India practices village exogamy, so geographic units much smaller than districts—towns and villages, for example—would likely do a poor job of circumscribing the spatial boundaries of the typical marital search process.

Because we are interested in estimating the sex ratio to which the IHDS women were exposed to when these women were reaching marriageable age, we generate estimates of the sex ratio these women were exposed to at age 18, which is approximately the mean age at marriage for women, as well as the legal (if often violated) age for marriage. We use standard demographic techniques of linear interpolation and cohort reverse and forward extrapolation to estimate district-level, sex-specific, single-year-of-age population counts for each calendar year from 1984 to 2005. As described below, we then use these population counts to construct a male-to-female sex ratio based on the typical ages of husbands and wives. We limit our sample to women who were between the ages of 18 and 39 at the time of the survey. We exclude women younger than 18 because we cannot observe the sex ratio to which they will be exposed to when they turn age 18. We exclude women older than 39 because estimating the sex ratio to which these women were exposed at age 18 would necessitate backward extrapolation from the 1991 census beyond what we feel is a reasonable time span (e.g., women age 49 at the time of the survey turned age 18 in 1974, well before the 1991 census).[1] Our maximum sample size consists of 24,029 ever-married women ages 18 to 39; the sample size varies across specific outcomes because of small but varying amounts of missing data on the dependent variables and because of the need to restrict the age at first marriage analysis to women older than 25 (see below).

Dependent Variables: Our analysis includes four dependent variables. Age at first marriage is measured in years. Because the IHDS only surveys married women, those who marry at a young age may be a select group of all young women. Accordingly, following the recommendations of Desai and Angrist (2010), we limit the sample for this outcome to women older than age 25 (and, as noted above, younger than 40). According to the 2001 Indian census, over 95% of Indian women have married by age 25, thus minimizing problems incurred by the overrepresentation of

early marriers in the IHDS.[2] The age difference between spouses is measured by the signed difference between husband's age and wife's age.[3]

Following the work of Banerji and Vanneman (2011), the amount of say women have in the choice of a partner is captured by a four-category polytomous variable. In the IHDS, women were asked "Who chose your husband?" The possible response categories included "respondent herself"; "respondent and parents/other relatives together"; and "parents or other relatives alone."[4] Women who responded "parents or other relatives alone" were further asked: "Did you have any say in choosing him?" with possible response categories of "yes" or "no," thereby permitting a subdivision of this category. The four categories of marriage type are thus: "self-arranged"; "jointly arranged with parents"; "parent-arranged with consent of respondent;" and "parent-arranged with no consent of respondent." In the multinomial regression models to follow, the latter group serves as the base, or reference, category.

To measure the length of time the IHDS women knew their husband prior to marrying him, we construct another four-category variable. The IHDS women were asked: "How long had you known your husband before marrying him?" Response categories included: "on wedding/*gauna* day only"; "less than one month"; more than one month but less than one year"; "more than one year"; and "since childhood." To simplify the analysis, and because relatively few observations fell into the latter two categories, we combine these categories and label it "more than one year." In the multinomial regression models, meeting the husband for the first time on the wedding (or *gauna*) day serves as the reference category.

Not surprisingly, the amount of say women have in choosing their husband and the length of time they knew their husband prior to marrying him are related to each other. For example, 85% of women who had no say in the selection of their husband met him for the first time on the

wedding day, compared to 30% of women in self-arranged marriages. And almost half of women in self-arranged marriages knew their husband for more than a year before marrying, compared to less than 6% of women whose husband was selected entirely by their parents or other adults. But the association is far from perfect (Gamma = .40, $p < .001$), suggesting that these two outcomes are tapping somewhat different dimensions of the mate selection process.

Independent Variables: Our focal independent variable is a district-level, single-year cohort-specific sex ratio, expressed here as the number of men per 100 women.[5] The relevant pool of men available to serve as marriage partners for women is minimally circumscribed both by geography and by age. As noted above, to circumscribe marriage markets geographically, we compute the sex ratio at the district level. To circumscribe the relevant pool of eligible men by age, and to take into account the fact that women's marriages may have occurred years before the administration of the IHDS, we assign to each woman respondent a seven-year sex ratio with a four-year staggering of the numerator (number of males) and denominator (number of females) when the respondent was age 18. This four-year staggering corresponds roughly to the age difference between spouses in India.[6] More specifically, then, the sex ratio is defined as the district-level number of men ages 19 to 25 divided by the number of women ages 15 to 21, estimated for when the respondent was age 18.[7] To limit the influence of extreme values of the sex ratio, we bottom-code values below 50 to that value, and we top-code values above 150 to that value.

Ideally, we might wish the sex ratio to be limited to unmarried persons, and perhaps also to be specific for the IHDS respondents' caste, religion, or social class, given that these factors play a role in assortative mating in India, as elsewhere. Unfortunately, India census data do not allow us to implement these refinements. Research in the U.S. suggests that little is gained by

restricting the sex ratio to unmarried persons (Fossett and Kiecolt 1991), though whether this also holds true for India is open to question. Problems incurred by the inability to construct sex ratios specific for demographic characteristics are perhaps somewhat moderated by noting that the Indian population sex ratio tends to be high among virtually all castes, religions, and social classes. The clustering of particular demographic groups within districts means that the sex ratio for the total district population may proxy reasonably well for the observed group-specific sex ratio.

Inferring a causal effect of the sex ratio on mate selection practices is challenging in part because both variables may be related to causally prior characteristics. The gender-biased parental interventions, such as son preference and gender discrimination, that help to create a surplus of boys and a deficit of girls are also likely to reflect a patriarchal system that may limit women's agency in marriage decision-making. Accordingly, our models include numerous control variables at both the individual (or household) level and the district level.

Women's educational attainment, shown in prior studies to be a potent predictor of marital choice in South Asia (Ghimire et al. 2006; Hoelter, Axinn, and Ghimire 2004), is measured by years of schooling. Secular changes in the outcome variables are captured by dummy variables for decadal birth cohort, contrasting women born in the 1980s (and who were thus ages 18-24 at the time of the IHDS administration) with women born in the 1970s (ages 25-34 at the time of the IHDS) and women born in the 1960s (ages 35-39 at the time of the IHDS), with the latter group serving as the reference category. To capture possible religious differences in mate selection practices, we include separate dummy variables for Hindus and Muslims, with all other religious categories serving as the reference. To capture possible caste differences in the outcomes, we include separate dummy variables for members of scheduled castes, scheduled

tribes, and other backward castes (OBCs), with other castes serving as the reference category. A dummy variable distinguishes residents of urban areas from residents of rural areas.

India's marriage practices, patriarchal structures, and kinship organization exhibit sharp regional variation (Dyson and Moore 1983; Malhotra et al. 1995). Along with the other covariates, controlling for the IHDS respondents' geographic region of residence is likely to go some distance toward removing the influence of confounding factors from the observed associations between the sex ratio and the dimensions of mate selection that serve as dependent variables. The regression models contrast residents of Northern states (Chhattisgarh, Delhi, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Madhya Pradesh, Punjab, Rajasthan, Uttaranchal, Uttar Pradesh), Southern states (Andhra Pradesh, Goa, Karnataka, Kerala, Maharashtra, Tamil Nadu), Eastern states (Bihar, Jharkhand, Orissa, West Bengal), and Northeastern states (Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura), with the Northeastern region serving as the reference category.

To capture further inter-area variation in contextual characteristics that might be related to both the sex ratio and the mate selection process, we create indicators of areal average educational attainment and women's empowerment by aggregating the responses of all IHDS sample members to the district level. District educational attainment is measured by the mean of the most highly educated adult household member. To more directly control for the possible influence of a patriarchal culture, we include two indicators developed by Desai and Andrist (2010) of arguably patriarchy's opposite—women's empowerment. As an indicator of women's control over family resources, we include the district-level proportion of women who have their names on the home title or rental papers. And as an indicator of participation in household decisions, we use the district-level mean of the number of the following five areas in which

women say they have at least some say: 1) what to cook on a daily basis; 2) whether to buy an expensive item such as a television of refrigerator; 3) how many children to have; 4) what to do if a child is sick; and 5) whom children should marry.[8]

Analytic Strategy: To examine the possible influence of the cohort- and district-specific sex ratio on the four dimensions of women's mate selection, we estimate multivariate regression models. Worth noting is that our focal independent variable—the sex ratio—is not entirely a characteristic of districts because it varies among women in the same district depending on the calendar year they turned age 18. Yet, not surprisingly, it varies substantially across districts; the intraclass correlation is .56. Moreover, several of our control variables, including the two measures of women's empowerment, are characteristics of districts. Accordingly, the regression models need to attend to the clustering of observations in districts. For the two continuous outcomes—age at marriage and the age difference between spouses—we estimate random intercept linear regression models (Raudenbush and Bryk 2002). However, because of difficulties encountered attempting to estimate random intercept multinomial logistic regression models, for the two polytomous outcomes—women's say in partner choice (marriage type) and the length of time women knew their husband before marrying him—we adjust for the clustering of observations within districts by computing robust standard errors of the regression coefficients (Wooldridge 2002).[9] Models are estimated using STATA's xtreg and mlogit procedures (StataCorp 2005).

RESULTS

Table 1 presents descriptive statistics for all variables used in the analysis. The mean age at marriage (among respondents age 25 and older) is 17.36. On average, wives are about five years younger than their husbands.

Table 1 about here

As indicated by the frequency distribution for marriage type, Indian women often have little say in the choice of their husband. Only 5% of marriages are self-arranged by women with no input from parents or other adults. Thirty-seven percent of marriages are jointly arranged with parents, and in 24% of marriages parents make the decision but with the consent of their daughter. For a full third of the women in the sample, however, the choice of husband is entirely the prerogative of parents, with women having no say in the matter.

Given women's lack of agency in the selection of a spouse, it is perhaps not surprising that most women in the sample knew their husband only a short while prior to the initiation of the marriage. Indeed, over 65% of women first met their husband on the day of the wedding, and another 10% had known him for less than a month. About 13% of respondents knew their husband for more than a month but for less than a year, and only 12% of respondents knew him for longer than a year.

Turning to the independent variables, the mean number of men ages 19 to 25 per 100 women ages 15 to 21, estimated at the district level for when these respondents were age 18, is 101.06, indicating a close to even gender distribution. This near parity in the numbers of women and men may appear surprising in light of concerns noted earlier about India's historically masculine sex ratio. This figure is somewhat misleading, however, because of the age staggering of numerator (number of men) and denominator (number of women). Because the 15 to 21 year age group is large relative to older age groups (as is typical of developing countries with high fertility), and because only females in this age group figure into the computation of the age-staggered sex ratio, the ratio of men ages 19 to 25 to women ages 15 to 21 is deflated. The male-to-female sex ratio computed using the age range of 15 to 21 for both numerator and

denominator has a mean of 109, indicating at least a moderate surplus of young men relative to young women.

The standard deviation of the sex ratio (14.47) indicates considerable variability in the relative number of men in the IHDS women's marriage markets. Such variation is likely driven not only by skewed sex ratios at birth and the subsequent aging of these cohorts, but also by sex differentials in mortality and migration, perhaps especially rural-to-urban migration.

The respondents average slightly fewer than five years of schooling. Twenty-seven percent were born in the 1960s, 51% were born in the 1970s, and 22% were born in the 1980s. A little more than a third of respondents resided in an urban area at the time of the survey. The bulk of respondents—over 80%--are Hindu, with Muslims (11%) and members of other religions (7%) comprising the remainder. Members of scheduled castes, scheduled tribes, and other backward castes (OBCs) constitute 21%, 8%, and 40% of the sample, respectively. Almost half of respondents reside in Northern India and one-third resides in the South, with smaller representations from the Eastern (15%) and Northeast (5%) regions.

In the typical district, only 16% of women have their names on house documents. On average, women have a say in four of five common household decisions. The mean years of schooling of the most educated household member is 7.5 years.

Multivariate Models

Table 2 presents the results of the linear regression models for age at marriage (Model 1) and the age difference between spouses (Model 2). As shown in Model 1, contrary to the hypothesis advanced above, the sex ratio is not significantly associated with the age at which women marry. The coefficient is, as expected, negative in sign, but it falls far from attaining statistical significance.

Table 2 about here

Most of the other independent variables are significantly associated with women's age at marriage. Higher levels of educational attainment strongly delay marriage, with each year of schooling postponing marriage by about three months. Residents of urban areas marry significantly later than their rural counterparts. Hindu and Muslim women marry significantly younger than women of other faiths, and members of scheduled castes and other backward castes marry younger than members of other castes (excluding scheduled tribes). Inhabitants of the Northern, Southern, and Eastern regions all tend to marry younger than residents of the Northeast region. Women residing in districts in which women have more say in household decision-making and women in districts with comparatively high levels of education tend to marry later in life than other women.

The results presented in Model 2 of Table 2 may provide a clue for why the sex ratio does not appear to affect the age at which women marry. As hypothesized, the coefficient for the sex ratio in this model is negative and statistically significant, indicating that when young women are exposed to a relative surplus of men in their local marriage market, they tend to marry somewhat younger men than they ordinarily would have.[10] Put another way, when women are faced with a numerical dearth of men, they expand their pool of eligible husbands to include much older men. Admittedly, this effect is by no means overwhelming in magnitude. Comparing the extremes of the observed (and recoded) sex ratio, women of a given age marrying in a market with 150 men per 100 women would on average marry a man who is six months younger than the husbands of otherwise comparable women marrying in a market with only 50 men per 100 women [6 = (-.005)(150-50)(12)]. And comparing women two standard deviations below the mean sex ratio with women two standard deviations above the mean sex ratio yields a predicted difference in

husband's, relative to wife's, age of only about three and a half months [3.5 = (-.005)(130-72)(12)]. Yet, while modest in absolute terms, this effect of the sex ratio on the age difference between spouses is comparable to that of some other predictors, including time trends (i.e., birth cohort), urban residence, being Muslim, and belonging to a scheduled caste.

The coefficients for the cohort dummy variables indicate a diminution over time in the extent to which husband's age exceeds that of the wife, although the trend appears to have leveled off from the 1970s to the 1980s. Net of the effects of the other predictors, women residents of urban areas tend to marry older men compared to rural women. Hindu and Muslim women tend to marry older men than women of other religions, and members of scheduled castes and tribes tend to marry somewhat younger men than other (non-OBC) women. Pronounced regional differences are again evident, with the age difference between husband and wife significantly larger in the Northeast than in the other three regions.

Table 3 presents the multinomial logistic regression model of marriage type, contrasting women whose husband was chosen entirely by their parents without women's consent with 1) women in self-arranged marriages; 2) women who chose their husband jointly with their parents; and 3) women whose parents chose her husband but in which the woman could consent. As shown in the first contrast, the sex ratio is negatively and significantly related to the odds that women will select their husband entirely by themselves rather than having no say at all in the matter. The effect is at least moderate in strength. For example, the odds of having selected one's own husband among women exposed to a sex ratio two standard deviations above the mean (130) are only 28% of the corresponding odds for women exposed to a sex ratio two standard deviations below the mean (72) [$.28 = e^{(-.022)\,(130-72)}$]. While expectedly negative, the coefficient for the sex ratio is not significant at conventional levels for the contrasts between

having no consent in husband choice and either selecting a husband jointly (contrast 2) with parents or being able to consent to the parents' choice (contrast 3), although the coefficient for the latter contrast comes very close to reaching significance ($z = -1.90$, $p = .057$). In any event, the main ramification of being exposed to a relative surplus of men in the local marriage market is a marked reduction in the likelihood that women will choose their own husband and an attendant increase in the likelihood that parents will make this decision entirely without their daughter's input or approval.

Table 3 about here

Other independent variables are also significantly associated with women's say in the choice of a husband. Educational attainment is strongly related to women's agency in this matter, with more educated women significantly more likely to have at least some say in choosing a husband. The coefficients for the cohort dummy variables indicate secular increases in the proportion of self-arranged marriages and marriages arranged by parents but in which women have some say, both relative to marriages arranged by parents without women's consent. Relative to women of other religions, Hindu and Muslim women are less likely to choose their own husband or have the option of consenting (and presumably vetoing) their parents' choice. Members of scheduled tribes are especially likely to select their own husband or to do so jointly with parents, while members of scheduled castes and other backward castes (OBCs) are especially unlikely to have the opportunity to consent to their parents' decision. Compared to residents of the Northeast, residents of other regions are significantly less likely to be solely responsible for choosing their husband. Although the effects are not consistent across all contrasts, for the most part women living in districts in which women are more empowered (as indicated by having their names on house papers and participating in key household decisions)

and in districts with higher levels of educational attainment tend to have greater agency in husband choice.

Table 4 presents a largely parallel analysis of the length of time women knew their husband prior to marrying him, contrasting women who first met their husband on the wedding day with 1) women who knew their husband for less than one month; 2) women who knew their husband for more than a month but less than one year; and 3) women who knew their husband for at least a year.

Table 4 about here

For two of these three contrasts, the coefficient for the sex ratio is, as hypothesized, negative and statistically significant. The more men in their local marriage market, the less likely women are to have known their husband for at least a month prior to marrying him. Put another way, when young women are exposed to a numerical surfeit of men, they are more likely to have first met their husband on their wedding day than to have known him for more than a month. The effect appears moderately strong. The odds of having known their husband for more than a month but less than one year, relative to meeting on the wedding day, among women exposed to a sex ratio two standard deviations above the mean are less than half the corresponding odds for women exposed to a sex ratio two standard deviations below the mean [$.44 = e^{(-.014)\,(130-72)}$]. And the odds of having known their husband for more than a year, relative to having met on the wedding day, among women exposed to a sex ratio two standard deviations above the mean are slightly more than half the corresponding odds for women exposed to a sex ratio two standard deviations below the mean [$.56 = e^{(-.010)\,(130-72)}$]. Thus, a "favorable" marriage market for young women serves to eliminate a period of courtship between wife and husband, perhaps partly

because, as observed in Table 3, a numerical surfeit of men reduces women's participation in the selection of a husband.

Other individual and contextual characteristics are also important predictors of the length of time women knew their husband prior to the marriage. Higher levels of education significantly increase the likelihood that women will have known their husband prior to the wedding day. Longer courtships (or at least familiarity with one's husband-to-be), particularly ones lasting more than a year, are more common among younger birth cohorts. Urban women are more likely than their rural counterparts to have known their husband for more than a year rather than to have first met him on the wedding day. Hindu women are significantly less likely than (non-Muslim) women of other religions to have known their husband for between one month and a year, and Muslim women are more likely than (non-Hindu) women of other religions to have known their husband for more than a year. Women belonging to scheduled tribes and other backward castes (OBCs) are generally more likely than women of other castes and tribes to have known their husband prior to the wedding day. Residents of the Northern and Eastern regions, but not the South, are less likely than residents of the Northeast to have known their husband prior to the wedding. District-level educational attainment is positively associated with women's likelihood of having known their husband for between one month and one year, relative to meeting for the first time on the day of the wedding.

Differences by educational attainment

The analyses presented thus far tacitly assume that the effects of the sex ratio on women's mate selection practices do not vary by women's sociodemographic characteristics. Such an assumption is open to question, however. For example, women with higher status or greater intra-family power may be more capable than other women of resisting pressures to marry when

men are plentiful. We explored this possibility by adding to the regression models shown in Tables 2-4 product terms capturing the interaction between women's educational attainment and the sex ratio. For the models of the two continuous outcomes, age at marriage and spouse age difference, the coefficient for the product term was statistically significant, and the inclusion of the interaction significantly improved the model fit for the two polytomous outcomes, marriage type and length of time knew husband prior to marriage.[11] However, the pattern of results is more complex than anticipated. The effect of the sex ratio on age at marriage and the length of time women knew their husband prior to marriage actually grows significantly stronger as women's educational attainment increases, while the effect of the sex ratio on spouse age difference and marriage type declines with increasing education.

Table 5 about here

To show these differences more clearly, we divided the sample into women with eight or fewer years of education and women with nine or more years of education, and re-estimated the models. To simplify the presentation, we show in Table 5 only the coefficients for the sex ratio.[12] Among less educated women (Panel A), the sex ratio is not significantly associated with age at marriage, but among more educated women (Panel B) the effect is negative, as hypothesized, and statistically significant. Conversely, the effect of the sex ratio on the age difference between spouses is significant (and negative) among less educated women but not among more educated women.

For marriage type, the coefficient for the sex ratio is significant for two of the three contrasts for less educated women, but it fails to attain significance for any of the contrasts among more educated women. Among less educated women, the sex ratio is significant and inversely associated with the odds that women self-arrange their marriage or approve of their

parents' choice of groom, relative to parents selecting the husband with no input from their daughter. Although among less educated women the coefficient for the sex ratio is statistically significant in two of the three contrasts involving the length of time that women knew their husband prior to the wedding, the parallel coefficient is always at least as large (if not always significant) among more educated women. The difference between the education groups in the inverse effect of the sex ratio on the odds of knowing their husband for less than one month versus meeting him on the wedding day is (-.017 vs. -.006) is particularly noteworthy.

The stronger effect of the sex ratio on women's agency in marriage choice among less educated than more educated women is consistent with the idea that more educated women are better able to resist parents' attempts to control the marriage selection process when men are plentiful. It is more difficult to explain why the sex ratio might have a stronger effect on age at marriage among more educated than less educated women. Perhaps the age at marriage among less educated women is already so low (see Table 6) that even a surfeit of eligible men in the local area cannot drive it much lower. In contrast, age at marriage among more educated women is substantially higher, and thus can respond more easily to the local supply of potential husbands. Moreover, all else equal, marrying at a younger age will tend to increase the age difference between wife and husband and reduce the amount of time available for courtship, thus increasing the likelihood that women will meet their husband for the first time on the wedding day.

To illustrate the strength of the association between the number of potential husbands available to women and mate selection practices, Table 6 presents predicted values of the outcome variables for selected values of the sex ratio, separately for less educated (Panel A) and

more educated (Panel B) women. These predicted values are derived from the education-specific regression models, holding all other covariates constant at their sample means.

Table 6 about here

Given the nonsignificant effect of the sex ratio on women's age at marriage among less educated women (Table 5, Panel A), it is not surprising that the conditional mean age at marriage varies little across the values of the sex ratio for this group (Table 6, Panel A). Somewhat more variation in mean age at marriage is observed for the more educated women (Table 6, Panel B). At a sex ratio of 80, which is 1.5 standard deviations below the mean (about the sixth percentile), the predicted mean age at marriage is 20.2 years. The mean age at marriage drops to 19.7 years under a sex ratio of 120, which is about one and one-third standard deviations above the mean (about the 90^{th} percentile). Thus, although being exposed to a relative surfeit of men tends to lead women to marry at a younger age than they ordinarily would, the effect is not very large.

Among less educated women, the mean age difference between husband and wife also varies modestly across values of the sex ratio (Table 6, Panel B). At a sex ratio of 80, husbands are on average 5.2 years older than their wives. This difference drops to 4.8 years—a reduction of about 5 months—at a sex ratio of 120. Among more educated women, the age difference between spouses varies negligibly across sex ratio values.

With regard to marriage type, less educated women who are exposed to 80 men per 100 women in their local marriage market are over twice as likely as women exposed to 120 men per 100 women to choose their husband entirely by themselves (.064 vs. .030). This difference is more than counterbalanced by a six point difference in the percentage of women whose marriage is arranged entirely by their parents (37.1% vs. 43.0%). Variation in women's marital agency across sex ratio conditions is weaker among more educated women.

For both education groups, the length of time women knew their husband prior to the wedding varies at least moderately by values of the sex ratio, and the differences are particularly pronounced among more educated women. Among this latter group, over 60% of women exposed to a male-to-female sex ratio of 120 are predicted to have met their husband for the first time on their wedding day, compared to 48% of women exposed to a sex ratio of 80. This difference is counterbalanced mainly by an almost five percentage point difference in the likelihood of having known their husband for less than one month (12.3% vs. 17.1%) and a six percentage point difference in the likelihood of having known their husband for between one month and one year (15.1% vs. 21.2%). The analogous differences among less educated women (Panel A) are weaker but also nontrivial. Among this group, over 72% of women exposed to a sex ratio of 120 are predicted to have meet their husband for the first time on the wedding day, compared to 66% of women exposed to a sex ratio of 80.

Admittedly, these predicted differences in mate selection practices across sex ratio values are not overwhelming in magnitude, and whether they are large enough to materially influence women's autonomy and household power is a matter for future research. Contextual effects of this type are rarely very strong (Liska 1990). But the findings are generally consistent with our expectation that the process by which Indian women "choose" a spouse is shaped to some degree by the availability of potential husbands in the local marriage market.

DISCUSSION AND CONCLUSION

Motivated in part by the impending masculinization of India's already skewed adult population sex ratio, in this paper we ask whether the distinctive cultural practices surrounding mate selection in India are influenced by availability of men to serve as partners for women. Our meta-theoretical framework adopts a Blauian conceptualization of social structure, in which the

distribution of the population along salient sociodemographic characteristics such as biological sex is posited to facilitate and constrain the opportunity to form intergroup associations (Blau 1977). Coupled with more specific knowledge of family exchange strategies in India, we derive hypotheses linking the sex ratio to which women were exposed during their marriage-forming years to several dimensions of the mate selection process. We then test these hypotheses by merging district-level census data with individual-level marital history data among women respondents to the India Human Development Survey. The results of linear and categorical regression models that adjust for the clustering of observations within geographic areas reveal that, among more educated women, exposure to an oversupply of eligible husbands reduces the age at which women marry. And, when less educated women are exposed to a relatively copious supply of men in their local marriage market, they tend to marry men somewhat younger than these women otherwise would have. Moreover, and perhaps more importantly, exposure to a relative surplus of potential mates is associated with a greater likelihood that women will have little or no say in the selection of their husband (particularly among less educated women) and an increased probability that women will meet their husband for the first time on their wedding day. Thus, even longstanding and ingrained cultural practices involving mate selection are affected, if only moderately, by a simple and fundamental characteristic of social structure—the relative numbers of women and men in the population.

Our results portend generally adverse effects of India's ostensible looming surplus of men on women's marital power, autonomy, and overall well-being. An increase in the supply of potential husbands is likely to retard or temper trends toward older ages at marriage, greater agency in women's choice of a husband, and longer periods of women knowing their fiancé prior to marrying him. This impact of an increasingly masculine sex ratio is likely to prove

problematic for women given evidence that early marriage, a lack of say in husband choice, and an abbreviated or nonexistent courtship period are associated with diminished autonomy, power, and marital quality among married women. These findings complement recent research on China showing that when women there are exposed to excess men in their local marriage market, they not only tend to marry earlier in life, but they are more likely to be victims of sexual violence and to harbor a sexually-transmitted infection (Trent and South 2011; 2012). Our analysis extends these findings to show that, in an arranged marriage society, a surplus of men also constrains women's agency in the mate selection process. Highly masculine sex ratios at birth and during childhood are often taken as prima facie evidence of discrimination against girls (Sen 1992). Our findings imply that such sex ratio imbalances also have negative impacts for women later in their lives.

However, the implications of masculine sex ratios for Indian women's marital quality may not be entirely deleterious. We also find that an abundant supply of potential husbands is associated with a smaller age difference between husband and wife, at least among less educated women. Consequently, an increase in the male-to-female sex ratio is likely to accelerate the ongoing trend toward age homogamy. Given evidence that a smaller age difference between wife and husband is associated with enhanced autonomy and household power among married women, this manifestation of an increasingly masculine sex ratio may help to improve Indian women's well-being.

We acknowledge several important limitations to our analysis. Paramount, of course, is the problem of causal inference. Our hypotheses posit effects of the sex ratio on mate selection practices, but imbalances in the numbers of women and men may be driven at least in part by behaviors and group characteristics that also influence how women and men form marital

relationships. A patriarchal culture, for example, might generate a masculine sex ratio via high levels of son preference, sex-selective abortion, and discrimination against girls, while simultaneously restricting women's agency regarding when and whom they marry. Our models attempt to isolate a causal effect of the sex ratio that women are exposed to during late adolescence by controlling for a host of individual-level sociodemographic characteristics, such as religion and caste, and areal characteristics, such as urban residence, geographic region, and women's empowerment. Yet, the extent to which the observed associations between the sex ratio and the mate selection outcomes have been fully purged of confounding influences remains uncertain.

We also acknowledge that our measure of the focal independent variable—the sex ratio—is rather crude. Although the measure is sensitive to the age range from which women typically choose their husbands and to geographic constraints on mate selection, because of data limitations it does not impose other restrictions on partner choice, such as caste, religion, or social class, even though most Indian marriages are homogamous on these traits. Presumably, however, a more refined measure of mate availability that incorporates spousal matching along these dimensions of partner choice would yield stronger, rather than weaker, observed associations between the sex ratio and mate selection practices. Future research might profit by attempting to develop such measures.

Future research might also benefit from exploring a broader range of possible responses to imbalanced sex ratios, not only in India but also in other countries whose population is characterized by an overabundance of males. For example, a numerical surplus (or deficit) of men might affect not only patterns of assortative mating by age, but also by other characteristics, such as caste and social class. Like the age difference between spouses, heterogamy along these

other characteristics may have implications for women's status, power, and well-being. Exposure to a surfeit of men may also have implications for women's sexual health, reproductive behavior, and exposure to violence. For example, a numerical deficit of women may lead husbands to guard their wives especially closely in order to restrict their potential social interactions with other men; such restrictions may manifest themselves in the form of intimate partner violence. Sex ratio imbalances might also modify dowry and bride price (Bhat and Halli 1999) and encourage cross-region and inter-caste marriage (Kaur 2004), with potential ramifications for women's marital quality and well-being. And of course, a comprehensive accounting of the impact of skewed sex ratios will require attention to the implications of a numerical deficit of women for men's marital behavior and well-being. Future research might attempt to determine how young men's agency in the marital selection process responds to a numerical deficit of marriageable women. Our study, along with related work by others (e.g., Dyson 2012), suggests that a rather simple facet of social structure—the relative numbers of women and men in a population—may have far-reaching implications for individuals' well-being and, as such, represent a fundamental way in which macrostructure shapes microbehavior.

NOTES

[1] Unfortunately, the 1971 and 1981 India censuses are not available in usable form. The 2011 India census was not yet available at the time of our analysis.

[2] However, using the full sample of women ages 18 to 39 generated very similar effects of the sex ratio. In supplemental analyses we also examined the age at which women first started living with their husband (had *gauna*). Again, similar effects of the sex ratio were observed.

[3] Because women could adapt to a numerical deficit of men by marrying either older or younger men than they ordinarily would, in supplemental analyses we also used as a dependent variable the absolute value of the difference between the spousal age difference and the mean spousal age difference. However, the effect of the sex ratio on this outcome was considerably weaker than the analogous effect on the signed difference between husband's and wife's age, implying that wives respond to a dearth of men by marrying men older than they ordinarily would have, but not men younger than they ordinarily would have.

[4] The very few respondents who replied "other" are excluded from the analysis.

[5] In Indian demography the sex ratio is traditionally expressed as the number of females per males. Unless otherwise noted, we adopt the convention used most elsewhere in the world of measuring the sex ratio as the number of males per females.

[6] We use a four-year rather than a five-year staggering of the numerator and denominator to eliminate problems created by high levels of age heaping (or digit preference) on even-numbered ages. An odd staggering number would mean that the numerator has a different number of even digits than the denominator (four in some years, three in others), and that this varies as a function of women's age (or, alternatively, the calendar year that they turn age 18). Using an even number to stagger numerator and denominator solves this problem because both values will always be based on the same number of even and odd ages.

[7] We acknowledge that the sex ratio at age 18 provides only a snapshot of the number of men women are exposed to during the period when marital decisions are being made. For some women, the decision about whom they will marry may be made by their parents soon after their daughter's birth. We assume that the sex ratio measured at age 18 is a reasonable proxy for the unobserved sex ratio at other points in childhood and early adulthood. In the absence of sex differences in mortality and migration, the sex ratio will of course be constant across a cohort's lifecourse.

[8] Following Desai and Andrist (2010), we do not attempt to combine the two measures of women's empowerment into a single scale.

[9] Binomial logistic random effects models yield similar results to the multinomial models. We do not estimate ordered logistic models in order to allow for possible nonmonotonic effects of the sex ratio and other predictors on the outcomes.

[10] Limiting this analysis to women age 25 and older, as in Model 1, yields a slightly stronger and still significant effect of the sex ratio ($b = -.006$, $p < .01$).

[11] We also estimated models that included interactions between the sex ratio and type of residence (urban versus rural), but found no evidence of differential effects.

[12] Results for the full models are available from the authors upon request.

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Table 1. Descriptive Statistics for Variables Used in Analysis of Mate Selection: Ever-married Women in the India Human Development Survey

Dependent Variables	Mean/ %	SD	N
Age at Marriage[a]	17.37	3.58	18,829
Spouse Age Difference (Husband Age – Wife Age)	5.18	3.46	22,544
Marriage Type:			
Self-arranged	5.25%		1,258
Joint with parents	37.03		8,867
Parents with R's consent	24.33		5,826
Parents no consent	33.39		7,996
Length of Time Knew Husband:			
Met on wedding day	65.33%		15,698
Less than one month	10.00		2,404
One month to one year	12.72		3,057
More than one year	11.94		2,870
Independent Variables			
Sex Ratio[b]	101.06	14.47	24,029
Education (years of schooling)	4.92	4.84	24,029
Birth Cohort:			
1960s	26.61%		6,394
1970s	51.45		12,364
1980s	21.94		5,271
Type of Residence:			
Rural	64.60%		15,523
Urban	35.40		8,506
Religion:			
Hindu	81.42%		19,564
Muslim	11.27		2,708
Other	7.31		1,757
Caste/Tribe:			
Scheduled caste	21.31%		5,121
Scheduled tribe	8.13		1,954
Other backward caste (OBC)	39.88		9,583
Other caste/tribe	30.68		7,371
Region:			
North	47.45%		12,628
South	33.12		7,959
East	14.87		3,573
Northeast	4.56		1,096

District-Level Characteristics:			
Proportion of women with names on house papers	.16	.17	24,029
Women's participation in household decisions	4.16	.84	24,029
Education of most-educated household member	7.49	2.08	24,029

[a] Women ages 25 to 39. All other statistics for women ages 18 to 39.

[b] Estimated number of men ages 19 to 25 per 100 women ages 15 to 21 in respondent's district when she was age 18.

Table 2. Linear Regression Models of Age at Marriage and Spouse Age Difference: Ever-married Women in the India Human Development Survey

	Model 1: Age at Marriage[a]		Model 2: Spouse Age Difference[b]	
Independent Variables	b	se	b	se
Sex Ratio[c]	-.001	.002	-.005*	.002
Education	.275***	.005	-.009	.005
Birth Cohort				
1960s	reference		reference	
1970s	.035	.045	-.174**	.052
1980s	NI		-.184**	.063
Urban residence	.217**	.064	.250***	.064
Religion				
Hindu	-.557***	.096	.505***	.099
Muslim	-.866***	.119	.388**	.123
Other	reference		reference	
Caste/Tribe				
Scheduled caste	-.444***	.064	-.247***	.066
Scheduled tribe	-.091	.010	-.467***	.100
Other backward caste (OBC)	-.267***	.055	-.097	.057
Other caste/tribe	reference		reference	
Region				
North	-1.585***	.284	-3.085***	.237
South	-1.255***	.290	-1.043***	.242
East	-1.222***	.316	-1.044***	.263
Northeast	reference		reference	
District-level Characteristics				
Proportion of women with names on house papers	.231	.388	-.140	.318
Women's participation in household decisions	.251***	.072	.052	.059
Education of most-educated household member	.264***	.031	.047	.026
Constant	15.000***		6.809***	
N	18,829		22,544	
R^2	.306		.113	

Notes: Models include a random intercept for district (n=377 in Model 1, n=381 in Model 2).
NI = Not included.

[a] women ages 25 to 39.

[b] women ages 15 to 39.

[c] Estimated number of men ages 19 to 25 per 100 women ages 15 to 21 in respondent's district when she was age 18.

* p < .05 ** p < .01 *** p < .001

Table 3. Multinomial Logistic Regression Model of Marriage Type: Ever-married Women Ages 18 to 39 in the India Human Development Survey

	Self-arranged vs. Parents, no consent			Joint with parents vs. Parents, no consent			Parents with R's consent vs. Parents, no consent		
Independent Variables	b	se	e^x	b	se	e^x	b	se	e^x
Sex Ratio[a]	-.022**	.007	.978	-.003	.004	.997	-.009	.005	.991
Education	.113***	.010	1.120	.089***	.007	1.093	.115***	.007	1.122
Birth Cohort									
1960s		reference			reference			reference	
1970s	.277**	.083	1.319	.062	.048	1.064	.165*	.065	1.179
1980s	.443***	.115	1.557	.052	.059	1.053	.343***	.072	1.409
Urban residence	.304	.172	1.355	-.033	.136	.968	.244	.131	1.276
Religion									
Hindu	-.609*	.262	.544	.022	.194	1.022	-.369*	.142	.691
Muslim	-.822**	.314	.440	.132	.229	1.141	-.423*	.177	.655
Other		reference			reference			reference	
Caste/Tribe									
Scheduled caste	.133	.132	1.142	-.072	.086	.931	-.254**	.086	.776
Scheduled tribe	.821**	.247	2.273	.380*	.177	1.462	-.156	.170	.856
Other backward caste (OBC)	-.098	.151	.907	-.102	.093	.903	-.578***	.095	.561
Other caste/tribe		reference			reference			reference	
Region									
North	-2.861***	.485	.057	-.985	.599	.373	-1.598***	.383	.202
South	-1.450**	.510	.235	.385	.582	1.470	.193	.406	1.213
East	-1.933***	.490	.145	-1.372*	.588	.254	-1.013*	.435	.363
Northeast		reference			reference			reference	
District-level Characteristics									
Proportion of women with names on house papers	2.707***	.718	14.984	1.671*	.696	5.317	1.363*	.549	3.908
Women's participation in household decisions	.090	.131	1.094	.306**	.100	1.358	-.130	.091	.878

Education of most-educated household member	.107	.061	1.113	.090*	.042	1.094	.101*	.048	1.106
Constant		.508			-1.555			.964	
N					23,947				
Pseudo R^2					.115				

Note: Standard errors adjusted for the clustering of observations within districts (n=381).

[a] Estimated number of men ages 19 to 25 per 100 women ages 15 to 21 in respondent's district when she was age 18.

* p < .05 ** p < .01 *** p < .001

Table 4. Multinomial Logistic Regression Model of Length of Time Knew Husband Prior to Marriage: Ever-married Women Ages 18 to 39 in the India Human Development Survey

	Less than one month vs. Wedding Day			One month to one year vs. Wedding Day			More than one year vs. Wedding Day		
Independent Variables	b	se	e^x	b	se	e^x	b	se	e^x
Sex Ratio[a]	-.010	.006	.990	-.014*	.007	.986	-.010*	.004	.990
Education	.048***	.008	1.049	.044***	.008	1.045	.021**	.007	1.021
Birth Cohort									
1960s		reference			reference			reference	
1970s	.126*	.062	1.134	.111	.062	1.117	.152*	.061	1.164
1980s	.051	.086	1.052	.132	.082	1.141	.253**	.077	1.288
Urban residence	.000	.159	1.000	.281	.174	1.324	.410**	.126	1.507
Religion									
Hindu	-.249	.198	.780	-.439*	.171	.645	-.281	.160	.755
Muslim	.208	.218	1.231	-.076	.229	.927	.451*	.198	1.570
Other		reference			reference			reference	
Caste/Tribe									
Scheduled caste	-.044	.121	.957	.058	.123	1.060	.164	.099	1.178
Scheduled tribe	.500*	.227	1.649	1.015***	.202	2.759	.711***	.173	2.036
Other backward caste (OBC)	.176	.108	1.192	.315**	.109	1.370	.192*	.097	1.212
Other caste/tribe		reference			reference			reference	
Region									
North	-2.217***	.492	.109	-2.102***	.461	.122	-1.933***	.389	.145
South	-.459	.505	.632	-.320	.470	.726	-.220	.399	.803
East	-2.697***	.541	.067	-2.307***	.512	.100	-1.734***	.404	.177
Northeast		reference			reference			reference	
District-level Characteristics									
Proportion of women with names on house papers	.011	.750	1.011	.731	.846	2.077	-.084	.683	.919

Women's participation in household decisions	.134	.108	1.143	-.116	.109	.890	-.007	.089	.993
Education of most-educated household member	.147**	.046	1.158	.114*	.050	1.121	-.056	.039	.946
Constant		-1.432			.218			.610	
N					24,029				
Pseudo R^2					.122				

Note: Standard errors adjusted for the clustering of observations within districts (n=381).

[a] Estimated number of men ages 19 to 25 per 100 women ages 15 to 21 in respondent's district when she was age 18.

* p < .05 ** p < .01 *** p < .001

Table 5. Coefficients for the Sex Ratio from Regression Models of Women's Mate Selection Variables, by Education Level: Ever-married Women in the India Human Development Survey

Panel A: Women with 0-8 Years of Education

Age at Marriage (N=13,714)		**Spouse Age Difference** (N=16,222)	
b	se	b	se
.001	.002	-.010***	.002

Marriage Type (N=17,270)

Self-arranged vs. Parents, no consent			Joint with parents vs. Parents, no consent			Parents with R's consent vs. Parents, no consent		
b	se	e^x	b	se	e^x	b	se	e^x
-.026***	.007	.974	-.003	.004	.997	-.011*	.005	.989

Length of Time Knew Husband Prior to Marriage (N=17,327)

Less than one month vs. Wedding day			One month to one year vs. Wedding day			More than one year vs. Wedding day		
b	se	e^x	b	se	e^x	b	se	e^x
-.006	.006	.994	-.012*	.005	.988	-.011**	.004	.989

Panel B: Women with 9 or More Years of Education

Age at Marriage (N=5,115)		**Spouse Age Difference** (N=6,322)	
b	se	b	se
-.014**	.004	-.002	.004

Marriage Type (N=6,677)

Self-arranged vs. Parents, no consent			Joint with parents vs. Parents, no consent			Parents with R's consent vs. Parents, no consent		
b	se	e^x	b	se	e^x	b	se	e^x
-.014	.009	.986	-.002	.005	.998	-.005	.006	.995

Length of Time Knew Husband Prior to Marriage (N=6,702)

Less than one month vs. Wedding day			One month to one year vs. Wedding day			More than one year vs. Wedding day		
b	se	e^x	b	se	e^x	b	se	e^x
-.017*	.008	.983	-.017	.010	.983	-.011	.006	.989

Notes: Models include all independent variables listed in Tables 2-4 (coefficients not shown). Sex ratio is the estimated number of men ages 19 to 25 per 100 women ages 15 to 21 in respondent's district when she was age 18.

*p < .05 ** p < .01 *** p < .001

Table 6. Predicted Values of Mate Selection Variables at Selected Values of the Sex Ratio, by Education Level: Ever-married Women in the India Human Development Survey

Panel A: Women with 0-8 Years of Education

Variable	Sex Ratio[a]: 80	90	100	110	120
Age at Marriage	16.383	16.392	16.401	16.410	16.419
Spouse Age Difference	5.227	5.132	5.036	4.940	4.844
Marriage Type:					
Self-arranged	.064	.053	.044	.036	.030
Joint with parents	.340	.346	.352	.356	.359
Parents with consent	.224	.214	.203	.192	.181
Parents no consent	.371	.386	.402	.416	.430
Length of Time Knew Husband:					
Met on wedding day	.660	.677	.694	.711	.723
Less than one month	.084	.084	.083	.082	.081
One month to one year	.123	.114	.106	.098	.091
More than one year	.132	.124	.116	.108	.101

Panel B: Women with 9 or More Years of Education

Variable	Sex Ratio[a]: 80	90	100	110	120
Age at Marriage	20.222	20.082	19.943	19.803	19.663
Spouse Age Difference	5.496	5.477	5.457	5.438	5.418
Marriage Type:					
Self-arranged	.087	.080	.073	.066	.060
Joint with parents	.407	.415	.422	.430	.437
Parents with consent	.361	.355	.350	.344	.338
Parents no consent	.145	.150	.155	.160	.165
Length of Time Knew Husband:					
Met on wedding day	.482	.514	.545	.576	.607
Less than one month	.171	.158	.146	.134	.123
One month to one year	.212	.196	.181	.166	.151
More than one year	.135	.132	.128	.124	.119

Note: Predicted values derived from regression models in Table 5, holding all other variables constant at the sample mean.

[a] Estimated number of men ages 19 to 25 per 100 women ages 15 to 21 in respondent's district when she was age 18.