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Spousal Bargaining Over Care for Elderly Parents in China: Imbalances in Sex Ratios Influence the Allocation of Support

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Abstract

Using a unique Chinese survey of parents and adult children, this paper examines how married children negotiate with their spouses for time devoted to caring for their own parents. Applying a collective bargaining framework, I show that the sex ratio at marriage shifts household bargaining in favour of the husband's parents when women are less scarce, or against his parents when women are scarcer. Such changing dynamics in the family may potentially reverse the current preference for sons in China, implying that those with sons, rather than daughters, may be increasingly in need of state support.

Keywords

household bargaining; marriage; intergenerational transfers; China; sex ratios; economics of ageing

1. Introduction

Married couples must often decide how much time and resources to devote to ageing parents. Such decisions are particularly pivotal in developing countries such as China, where state support is often limited, and elderly parents must therefore rely on their children for assistance (Bian et al., 1998; Zeng and George, 2000; Yan, 2003; Zimmer and Kwong, 2003; Guo, 2006). In China, decisions regarding parental care have historically been guided by the tradition of sons caring for their parents. Today, such traditional norms are rapidly changing, with women playing a more substantial role in caring for ageing parents (see for example, Yan, 2003).

This article identifies an increase in women's relative bargaining power vis à vis their husbands as a critical factor in such changing norms. Such shifts in bargaining power are due to demographic changes catalysing marriage markets in favour of women. Once married, men facing competitive marriage markets have less bargaining power (see for example, Francis, 2011). Supposing men and women are more invested in caring for their own parents than their in-laws, such changes in bargaining power influence the degree of support couples respectively provide to each of their parents.

These changing family dynamics have important policy implications for developing countries such as China, where the elderly lack publicly provided social support and rely on family for both care and financial help. Policymakers might be encouraged to counter prevailing preferences for sons by providing financial support to those with daughters. This article demonstrates that, alternatively, elderly parents with sons, rather than daughters, may increasingly be in need of support from the state. Such changing dynamics in the family may also reverse the current preference for sons in China.

This article also provides a novel contribution to the literature on family economics, helping to merge the household bargaining literature with work on intergenerational ties. First, unlike related studies that have used income, wealth, age, and education as proxies for shifts in bargaining power (Lee et al., 1994; Lillard and Willis, 1997; Behrman and Rosenzweig, 2006; Ham and Song, 2014), in this case, the sex ratio acts as a shifter of bargaining power. While income, wealth, and education are important factors to consider when selecting one's spouse, such decisions are determined largely endogenously, and cannot be separated from subsequent decisions once married.

Second, this research focuses on time devoted to one's own parents as the bargaining outcome. This differs from most research in the field, with the exception of Lillard and Willis (1997), which examines effects of monetary transfers to parents (Lee et al., 1994; Behrman and Rosenzweig, 2006; Ham and Song, 2014). Shifts in bargaining power may affect time transfers very differently from monetary transfers, given that daughters are typically considered better caretakers (Ham and Song, 2014), while sons are considered providers of financial support.

Lastly, this article also uses a unique survey dataset of ageing parents matched to their adult children, focusing on those sons who live closer to parents than other siblings, and therefore have a comparative advantage in caring for parents (Konrad et al., 2002; Pezzin et al., 2007).

The remainder of this article is organised as follows. Section 2 outlines the theoretical framework. Section 3 describes the empirical strategy. Section 4 describes the dataset. Section 5 summarises empirical results. Section 6 discusses the sensitivity analysis, followed by a conclusion.

2. Theoretical Framework

Economic models for understanding household decisions have been developed to move beyond the unitary household model (Becker, 1991) to a collective (Chiappori, 1988, 1992) or bargaining framework (Manser and Brown, 1980; McElroy and Horney, 1981; Lundberg et al., 1997; Rasul, 2008) in which spouses are individual decision-makers with differing preferences.

In the collective model, household bargaining between two actors takes place over the allocation of household income to both private and public goods. To incorporate care for elderly parents, the utility of one's elderly parent can be included as an additional private, individually consumed good.

Suppose parents receive utility from the amount of time their child spends supporting them, net of any support they provide to their child. Note that this can be positive or negative, despite the fact that parents in China tend to earn significantly lower incomes than their adult children. Nonetheless, they often help their children with other means of support, such as rearing of grandchildren.

If the amount of grandchild care a parent provides is greater than the amount of time the married couple devotes to the parent, then adult children and their spouses would have more time to devote to leisure or work. Therefore, the decision on how much time to spend supporting their parents involves a trade-off between the indirect utility from providing such support and the utility derived from leisure or earning more income.

Adult children determine how much care they provide to parents based on a number of motivations (for example, see Bernheim et al., 1985; Cox, 1987; Altonji et al., 1997). The collective model does not distinguish among these different motivations, as it is generalisable to various forms of utility. Men and women each care more for their own parents rather than their spouse's parents, but no assumptions are made here regarding the reasons for doing so.

The collective model (when extended to include support to parents) implies that as a woman's bargaining power increases, time spent supporting her husband's parents declines, while time spent supporting her own parents rises.² Such bargaining power is a function of distribution factors that influence outcomes through the bargaining process and do not affect individual preferences over various other goods (Blundell et al., 2005). Using the sex ratio as such a distribution factor, it reduces (increases) the likelihood of providing support to the husband's (wife's) parents.

In assuming the wife cares more about her parents than her husband's parents, in equilibrium, the decision to coreside with the husband's parents is a result of the wife's lower bargaining power. This is based on the assumption that time spent supporting the husband's parents is greater when the couple lives with them as opposed to living independently, and that time spent supporting the wife's parents is lower when the couple lives with the husband's parents as opposed to when they live alone. Below, I test whether the sex ratio is positively related to the likelihood of couples living on their own rather than living with the husband's parents.

3. Empirical Framework

3.1 Sex ratios

Sex ratios are estimated using retrospective data on surviving men and women from the 1982 census. As men and women differ in their survival rates, and as these differences may be affected by bargaining power, these differences may bias ratio estimates. However, this bias is mitigated in two ways. First, ratios are estimated using the 1982 census because cohorts that experienced high mortality rates -- those born during or soon after the famine --

²The Online Appendix outlines this extended collective model and related propositions tested here.

had either reached or were close to reaching marriageable age (23 or younger) at this time. Second, those born prior to 1932 were excluded from ratio calculations because they were over 50 years old at the time of the census. Since mortality rates between men and women diverge at this age, using data on cohorts born prior to 1932 would underestimate the number of men in the marriage market.

Sex ratios are constructed using census data on province of residence rather than province of birth, given that 1982 census data does not indicate birth province. Notably, before 1985, households were extremely limited in their ability to migrate, given the limited opportunities for rural workers in the urban labour market (Fan and Huang, 1998; Chan et al., 1999; Chan, 2001; Huang and Zhan, 2005; Chan, 2008). In the 1982 census, 99 per cent of the enumerated population resided in the same location as their registered place of birth. Of the remaining 1 per cent, many did not move across provinces.

Province-level sex ratios are matched to one's birth province. While county-level sex ratios may better reflect one's marriage market conditions, any potential biases specific to one's birth cohort would be more problematic using county-level sex ratios than province-level ratios. For example, one's education opportunities would be more correlated with average education opportunities of others born in one's year and county rather than individuals born in one's year and province.

Urban and rural sex ratios are estimated separately since urban-rural marriage was rare for the study sample (Fan and Huang, 1998). China's *hukou* system gives every person either urban or rural classification, and urban hukou-holders prefer not to marry someone holding a rural hukou, as rural areas are far poorer. As a result, prior to 1990, it was exceedingly difficult to switch hukou.

Sex ratios are estimated by summing across several contiguous cohorts, following conventions used in similar studies (Grossbard-Shechtman, 1993; Angrist, 2002; Chiappori et al., 2002; Stopnitzky, 2012). For men, the numerator of the sex ratio is the sum of the number of men born in one's cohort (year of birth = i) and surrounding eight cohorts, or $[i-4, i+4]$. The denominator is the sum of the number of women born in year $(i-2)$, and the eight cohorts surrounding this cohort, or $[i-6, i+2]$. For example, given a man born in 1960, the numerator of his sex ratio would be the number of men born between 1956 and 1964 and the denominator of his sex ratio would be the number of women born between 1958 and 1966. Thus, a man born in 1960 may marry someone two years older, six years younger, or any age difference in between. This staggering of cohorts across men and women reflects the fact that on average, men tend to marry women two years younger than themselves.³ The average age gap between spouses in this sample is 2.2 years. Ratios are similar for women.

Figure 1A plots the number of urban and rural individuals by birth year, and Figure 1B plots the cohort-specific urban and rural marriage market sex ratio, as defined above.⁴ While sex ratios within single cohorts are not highly imbalanced for this population, “the virtual sex

³While high sex ratios delay age at marriage, particularly for men, age differences between spouses are not significantly affected by sex ratios (Porter, 2014).

⁴Female sex ratios exhibit similar patterns.

ratio – that is, the number of men available and *likely to marry* a given women – can be highly imbalanced” (Angrist, 2002). For example, rural fertility reached its lowest point in 1961, the final year of the Great Famine for most provinces. By 1963, after the famine, China experienced a fertility boom, which persisted in rural areas. As a result, the 1961 and 1962 male cohorts included in the 1965 ratio are the smallest cohorts of this period. In contrast, the female cohorts included in this ratio (birth year after 1963) are the largest cohorts of this period. This combination results in a very low 1965 ratio. In comparison, the 1966 ratio only includes men and women born after the famine, when fertility was at a high point, and results in a ratio closer to one man per woman.

3.2 Empirical Model

The empirical model from the husband's perspective is the following:

$$y_{im,a}^{kp} = b_1(\text{Sex Ratio})_{m,a}^{kp} + b_2X_{m,a}^{kp} + b_3X_{im} + \mu_a + \lambda_p + \nu_k + (\lambda_p * \nu_k) + (\mu_a * \nu_k) + \varepsilon_{im,a}^{kp} \quad (1)$$

where $y_{im,a}^{kp}$ is the outcome for individual couple i of cohort a , the subscript m indicates the variable applies to the husband, k indicates whether the respondent is from a rural or urban area, and p indicates the birth province. Similar regressions are estimated from the wife's perspective, which may differ somewhat given that the particular spouse a man marries may have faced marriage market conditions quite different from his own.

Outcomes include: whether the elderly survey respondent talks most frequently with a son; whether a son and his spouse care for the elderly respondent; and whether the respondent lives with an adult child. An additional outcome is derived from the survey of adult children, specifying whether they or their spouses are primary caregivers for parents and parents-in-law.

A number of control variables are included in regression (1).⁵ Individual-specific variables (X_{im}) include a dummy variable for whether the parent is widowed, as the availability of a spouse reduces the likelihood of a child being a caregiver.⁶ When possible, the gender of the elderly respondent is included as well. Additional covariates specific to one's birth province and rural or urban region ($X_{m,a}^{kp}$) address several possible identification issues.

One potential concern with identifying sex ratio effects is that the degree of competition for a spouse may be correlated with competition for education resources or jobs. As men compete with younger men in labour markets, relatively large adjacent cohorts may lead to larger school class sizes. Such competition for limited resources may limit wage earnings, thereby limiting one's marriage market prospects, and influencing mate selection and subsequent bargaining power. In addition, as women with higher ratios might earn more relative to men, the size of competing cohorts might reflect the relative returns to male or

⁵Results are also presented without a number of these controls.

⁶The likelihood an elderly respondent is widowed is not affected by sex ratios.

female earnings in the labour market. Finally, the more competition one might face in the marriage market, the higher the potential search costs in finding a spouse. To control for such factors, I include same-sex birth cohort size,⁷ as well as the number of competing men (or women) in adjacent cohorts. For men, this is the numerator of the male sex ratio. For women, it is the denominator of the female sex ratio.

As sex ratios are calculated by averaging across multiple cohorts, individuals across these different cohorts may have starkly differing early work experiences and educational opportunities. Such variation in unobservables could introduce potential biases in estimated effects. For example, educational opportunities have changed considerably in recent decades, so that women at the beginning and end of the nine-year window used in estimating sex ratios may have very different initial experiences in the labour market.

Several covariates mitigate such potential biases. For regressions from the husband's (wife's) perspective, I include the average completed education level as of the year 2000 for women (men) who are included in the sex ratio,⁸ as the 2000 census is closest to outcome measures. Additional covariates include the number of women (men) in the youngest and oldest cohorts of the sex ratio.

Finally, I include a measure of exposure to the Great Famine while in-utero - the average death rate based on one's birth year and province (Almond et al., 2010).⁹ This measure is uncorrelated with sex ratios ($\rho = -0.03$ to $\rho = -0.14$). Supposing men who face a higher ratio were slightly less exposed to the famine while in-utero, they would be slightly healthier and better off than those with more famine exposure (Meng and Qian, 2006; Chen and Zhou, 2007; Brandt et al., 2008; Almond et al., 2010). Men with a higher ratio may have parents who are on average better off and more independent. On the other hand, if mortality selection dominates, males who survived the famine might be better off than average (Almond, et al. 2010; Mu and Zhang, 2011; Gørgens et al., 2012). In other words, those who had greater exposure to the famine and survived may be healthier on average than those who had less exposure. Men with a higher sex ratio who also had less exposure to the famine would then be less well-off than average, and would have less healthy parents who require more care from their children. I control for such potential biases to the extent possible by including this measure.

Any remaining unobserved systematic variation across cohorts or birth provinces (for example: education, employment, or other opportunities) is captured by an urban/rural dummy (ν_k), birth province and year fixed effects (λ_p and μ_a), and interaction terms between ν_k and λ_p and between ν_k and μ_a .

⁷There is no evidence of female infanticide among small-sized cohorts, though female infanticide occurs in higher birth parities (Coale, 1984).

⁸This variable is not predicted by sex ratios.

⁹Since death rates were only available for years surrounding the famine, zero values were given for other birth years. Since the birth months of child respondents and spouses were not available, this is a more crude measure of famine exposure than in Almond et al. (2010).

3.3 Clustering Standard Errors

Sex ratios vary by rural or urban area, as well as province and year of birth. Given that there is correlation across years of birth by construction of the sex ratio, standard errors are clustered by urban or rural areas and birth province. Given that only eight provinces were included in the survey of adult children (see below), bias may result from too few clusters. I therefore cluster standard errors of the final specifications using a wild cluster bootstrap-*t* procedure (Cameron et al., 2008).

4. Data

4.1 Surveys of Elderly Respondents and their Children

The Chinese Longitudinal Healthy Longevity Survey (CLHLS) is a national panel survey, comprised of five waves (1998, 2000, 2002, 2005, and 2008-2009). The CLHLS was initially a survey of adults ages 80 and older. However, in 2002, it was expanded to include adults 65 and older. Respondents were asked detailed questions regarding health, ageing, and their relationships with their adult children.¹⁰

In 2002, the Survey of Family Dynamics of the Elderly's Children (SFDC), a supplementary survey targeting children of the 2002 CLHLS respondents was conducted. Of the 22 provinces surveyed in the CLHLS, eight coastal provinces were chosen for the sample pool of the SFDC. The sampling was designed to select an adult child (age 35 to 64) of each CLHLS respondent (age 65 to 106), so long as parents and their adult children lived in these selected provinces. Adult children were sampled in terms of gender, age, and urban-rural status in proportion to the population distribution for each selected province. The 4,478 CLHLS respondents in 2002 resulted in 4,364 parent-child dyads from the additional SFDC survey. To my knowledge, this is the only survey of its kind that attempted to track down adult children of elderly respondents on such a large scale. Further details on the survey design and data quality can be found in Zhang (2004), Zeng et al. (2008), and Zhang et al. (2014).

4.2 Sample Selection

Given that the SFDC was not a random sample of adult children of CLHLS respondents, with 90 per cent of SFDC respondents in their first marriage and only 2.5 per cent having never been married, I restricted the sample to include only couples in their first marriage. Furthermore, given that 70 per cent of respondents were sons, I also restricted the sample to include only male SFDC respondents. Because sons are culturally expected to support their parents in old age, this sample of sons suits the purposes of the analysis here. Since sons were asked about spouses, similar regressions are estimated for their wives.

Those surveyed live closer to their parents than their non-surveyed siblings (see Table 1 below), making them more likely to be the children parents rely on most for help and nonfinancial means of support. While children with a comparative advantage in caring for

¹⁰Summary statistics of regressors and dependent variables are in Online Appendix Tables A1 and A2. For additional details, see the project's website: <http://centerforaging.duke.edu/chinese-longitudinal-healthy-longevity-survey>.

parents live close to their mothers and fathers, those with a comparative advantage in the labour market move further away for better job opportunities (Konrad et al., 2002; Pezzin et al., 2007).

Importantly, average sex ratios are similar across samples of surveyed and non-surveyed sons, and the sex ratio does not influence the likelihood of being sampled in the SFDC (see Online Appendix Table A3). Furthermore, because CLHLS outcomes do not distinguish between support derived from different sons -- for instance: whether the parent talks most frequently to a son, whether a son and his wife are the parent's primary care-providers, or whether the parent lives with an adult child -- regressions are estimated for the sample of all sons of the CLHLS respondent for these outcomes. This is possible because parents provided detailed birth histories of their children, which were then used to derive population-related variables for all sons. Regressions are also estimated separately for the two sub-samples of surveyed and non-surveyed sons. Finally, these results are robust to estimating bivariate probit models that take sample selection into account (available upon request).

5. Results

5.1 Support from Adult Children

Whether the elderly parent talks most frequently with a son, as compared to daughters, spouses, other relatives, or friends is the first dependent variable I examine in Table 2. As this outcome was derived from the CLHLS and does not refer to support received from the specific child surveyed in the SFDC, regressions are estimated for three samples: all sons of CLHLS respondents, all surveyed sons, and all non-surveyed sons. Focusing on Models 3 and 4, coefficient estimates are fairly similar across these different samples. For Model 4, they are statistically significant only for the non-surveyed sons (with wild clustering of standard errors).

Model 4 implies that a unit increase in a son's sex ratio results in a 2.5 per cent decrease in the likelihood that the son's parents talk most with him. A standard deviation increase in a surveyed (non-surveyed) son's sex ratio implies a 31 (38) per cent decline in the likelihood that parents talk most frequently to their sons. The effect of the son's ratio is stronger than that of the daughter-in-law, where a unit increase in her ratio lowers the likelihood that the elderly respondent talks most to a son by one per cent.

In addition to regularly talking to sons, parents rely on children as caretakers when they are ill. In the second set of results in Table 2, the dependent variable equals one when the elderly respondent states that a son or daughter-in-law provides caregiving during illness. As in previous regressions, since the CLHLS respondent does not distinguish between which son provides such care, regressions are estimated for surveyed and non-surveyed sons. Here ratio effects are nearly zero for non-surveyed sons; while in contrast, coefficient magnitudes are significant for surveyed sons and their wives. Wild *p*-values indicate that coefficient estimates are only statistically significant for surveyed sons, indicating that CLHLS respondents are likely referring to the son chosen for the SFDC survey. Wild *p*-values also indicate statistically significant coefficient estimates for the wives of SFDC sons.

A unit increase in the surveyed son's ratio reduces the likelihood that he or his wife cares for his parent by 2.7 per cent. A standard deviation increase in the ratio implies a 39 per cent decline. Similarly, for a wife, this likelihood is lowered by three per cent per unit increase in her ratio.

Elderly parents' ties to daughters are also related to adult children's marriage market conditions. In the SFDC, respondents were asked both whether they help their parents and whether their spouses respectively help their own parents. Interestingly, higher ratios (whether of the husband or wife) similarly increase the likelihood that a wife helps her own father (see Table 3).

A unit increase in either ratio raises the likelihood that a daughter helps her father by three or four per cent -- a substantial increase considering that a standard deviation increase in either ratio implies an overall increase of 43 per cent (wife's ratio) or 68 per cent (husband's ratio). In contrast, a husband's care for his father is not similarly affected in terms of the same indicator.

5.2 Living Arrangements

The parents of sons who face increasing competition for a spouse are less likely to live with an adult child. Table 4 presents results in which the dependent variable is the likelihood that the elderly respondent lives with an adult child. As with previous CLHLS outcomes, since the co-residing son is not distinguished from other sons, regressions are estimated for the sample of all sons of CLHLS respondents. Coefficient estimates are statistically significant for both the pooled sample of sons and non-surveyed sons, with wild clustering. While sons chosen for the SFDC live closer to parents, sex ratios impact living arrangements among sons who tend to live farther from their parents.

Between the two subsamples, magnitudes are greater for the sample of sons not in the SFDC. In Model 4, a unit increase in the sex ratio of non-surveyed sons reduces the likelihood parents live with a child by 3.4 per cent, compared to 1.9 per cent for surveyed sons. A standard deviation increase in the ratio implies a decrease of 46 per cent for non-surveyed sons and 26 per cent for surveyed sons. A daughter-in-law's marriage market conditions also negatively impact the likelihood that elderly parents live with at least one of their adult children, although these estimates are not statistically significant.

6. Sensitivity Analysis

6.1 Additional Outcomes

Individual labour supply is a more conventional outcome measure of household bargaining. Regressions were estimated on the natural logarithm of the number of hours per week devoted to work by SFDC male respondents and their wives. While sex ratios do not affect male labour supply, marriage market conditions in favour of women negatively impact female labour supply. These findings can be explained by women with greater bargaining power consuming greater leisure time or devoting increased time to their parents.

To examine whether such sex ratio effects might reflect exposure to the famine or other negative consequences of being born in smaller or larger cohorts, regressions were estimated on factors typically influenced by birth circumstances -- such as exposure to the Great Famine --that might otherwise not be influenced by marriage market conditions. Sex ratios do not influence outcomes including the likelihood of primary school completion, individual health, and parents' education.

In addition, I constructed four different summative indices of the main outcomes: Index 1 is the sum of three indicators (the elderly respondent living with an adult child, talking most frequently to a son, and a son caring for the respondent); Index 2 is the sum of two indicators (talking most frequently to a son and a son caring for the respondent); Index 3 is the sum of Index 1 and the surveyed son reporting helping his father; and Index 4 is the sum of Index 2 and the surveyed son reporting helping his father. Ordered logit models were estimated for these four outcomes, and results were highly robust across all these outcome measures.¹¹

6.2 Matching and Sibling Control Variables

To determine whether findings result from either changes in bargaining power once married or mate selection, regressions are estimated with controls for differences in age and education between spouses (see Online Appendix Tables A4 and A5).¹² Ratio effects are similar to the main results, indicating that spouse characteristics and mate selection do not explain sex ratio effects.

To determine whether findings may be influenced by marriage market conditions of siblings, regressions are estimated to include the number of older and younger siblings. For SFDC respondents, regressions also include the mean sex ratio of all brothers interacted with a dummy for having at least one brother, and the mean sex ratio of all sisters interacted with a dummy for having at least one sister.

Ratio coefficients are unaffected by such sibling controls (see Online Appendix Tables A4 and A5). While sex ratios of siblings are not significant predictors of outcomes, the number of siblings does play a role, suggesting important dynamics between siblings may influence support of ageing parents. This sibling dynamic would be an interesting area for future research.

6.3 Transfers from Parents to Children and Related Income Variables

While elderly parents in China are usually net recipients of financial support from children, such financial transfers may also be provided in exchange for grandchild care (Secondi, 1997). If such exchange motives influence the relationship between sex ratios and bargaining outcomes, we would expect findings to differ significantly between those with and without young grandchildren (under age 10) needing care. Yet, for the sample of SFDC respondents without young children, ratio effects are robust (see Online Appendix Table A7).

¹¹All results are available upon request.

¹²Results are similar when age and education of each spouse are included (available upon request).

While an elderly parent cannot influence an adult son's bargaining position by providing time for grandchildren, a parent may devote resources to her son to shift bargaining power in his favour. This becomes relevant should an elderly parent choose to buy a house for or give more resources to a son facing high sex ratios, in order to help him find a spouse or improve his bargaining position once married.¹³ Indeed, parents in areas of China with higher sex ratios tend to save more (Wei and Zhang, 2011). If higher sex ratios lead parents to raise their sons' bargaining power and assets at marriage, this would dampen ratio effects. A son might be expected to “repay” his parents once married, perhaps by providing financial transfers.

However, regressions on net financial transfers given by parents, which are negative on average (see Online Appendix Table A2), indicate that sex ratios do not impact monetary transfers to or from parents (available upon request). As sex ratios here affect time transfers, but not monetary transfers, there is no evidence that one type of transfer displaces the other.

Higher income parents may provide more financial support to children (before or after marriage), which may impact either the likelihood of reciprocated nonfinancial support, or an increase in the bargaining power of adult sons with respect to wives (Behrman and Rosenzweig, 2006). Alternatively, women with more marriage market options may be inclined to marry men from higher-income families. Income of ageing parents also controls the extent to which elderly parents require support from children.

Ratio effects are robust to including the log of per capita household income of the elderly respondent, as well as the log of the relative income between husband and wife when first married (see Online Appendix Table A6).¹⁴

In regressions on per capita household income of the adult child, ratio effects are close to zero and not statistically significant. Similarly, regressions on the relative income between spouses at the time of marriage are not statistically significant, with estimates close to zero.

6.4 Additional Sex Ratios

Given that men tend to marry younger women, one would expect inclusion of older women in the denominator of the male sex ratio would yield ratios that do not impact household bargaining. Likewise, because women tend to marry older men, a sex ratio including younger men in the numerator would also not be expected to impact outcome measures. This is indeed the case, with such findings notably not due to different samples (see Appendix Table A7).

Alternatively, one can estimate a more complex “availability ratio” incorporating the degree to which men are interested in marrying women of varying ages (Porter, 2014). Findings are robust to such ratios, as well as to ratios including more or fewer cohorts.

¹³Quisumbing and Maluccio (2003) found this to be the case in several countries. For women, dowries may serve a similar purpose (Zhang and Chan, 1999).

¹⁴Both variables are in natural logarithms, with zeros having been replaced by the first percentile before taking logs.

Finally, regressions are estimated for “placebo” ratios, in which urban sex ratios are applied to the rural population and vice versa, with ratios still matched by birth province and year. These estimates are not statistically different from zero. All results are available upon request.

6.5 Heterogeneous Effects

Findings are generally robust across various subsamples of the population, with a few notable differences. In predicting the likelihood that parents communicate most with sons, ratio effects are similar for rural and urban couples as well as across education and income levels. On the other hand, in predicting the likelihood of a son caring for his parent, effects are stronger for rural, low-educated, and low-income subsamples.

Finally, in predicting the likelihood that a daughter helps her father, results are similar across urban and rural samples. Yet ratio effects are primarily driven by higher income and more educated couples. These results are all available upon request.

7. Conclusion

By demonstrating sex ratios influence the decision-making behaviour of married couples in terms of care provided to elderly parents, this research makes an important step toward merging household bargaining literature with work on intergenerational ties. Furthermore, the emphasis on time allocated to one's own parents underscores what can be considered an individually consumed good, more clearly assignable to individual household members' consumption than individual labour supply and the human capital of young children.

Sex ratio effects can be identified given that one's ratio is determined by the province and timing of one's birth. This identification is limited to the extent that such ratios may be endogenous to individuals, an issue similarly encountered in other studies of sex ratio effects (Grossbard-Shechtman, 1993; Angrist, 2002; Chiappori et al., 2002). Importantly, this research examines the extent to which such biases influence findings and controls for related factors when possible. The sensitivity analysis rules out alternative explanations for the main findings.

Although marital contract terms are continually renegotiated over the course of a marriage (Mazzocco, 2007), empirical evidence has also been found indicating a commitment to future resource allocation at the time of marriage (Iyigun and Walsh, 2007; Lee, 2007; Francis, 2011; Stopnitzky, 2012). This paper points to further evidence of such commitment. Given that sex ratios do not impact the likelihood of being in an arranged marriage (which only account for 14 per cent of all marriages in the data), it is unlikely that parents negotiate for old age support in prenuptial agreements. Yet, because initial marriage market conditions influence premarital endowments through dowries, bride price, and mate characteristics (Brown 2009), spouses continue to control their endowments after marriage. Subsequent allocations may then follow a non-ergodic process resulting from habit formation and high transition costs to altering initial arrangements (Arthur, 1994). For example, if a son communicates less with his mother at the beginning of marriage because his wife demands

more time from him, this could develop into a persistent pattern of devoting less time to his mother, even as his bargaining position with respect to his wife increases with time.

Such path dependence may hold, even as divorce becomes more common. Although reforms in 2001 made divorces in China easier to obtain (and increased women's bargaining power (Sun and Zhao, 2014)), divorce rates remain low, particularly in rural areas. Note that these changes affected all marriages, regardless of whether or not sex ratios were highly imbalanced. Moreover, marriage markets for those who divorce are distinct from marriage markets for those who have never been married (Chiappori et al., 2002; 2008). While this article does not address how bargaining power within the marriage shifts as divorce becomes a more credible outside option, the findings here demonstrate that, even in the face of such changes, spouses commit to many household allocation decisions for a long term period.

In sum, China's dwindling supply of women provides them with more favourable marriage market conditions, increasing women's bargaining power and enabling them to provide greater support for their parents and less support for parents-in-law. These effects remain even when controlling for match quality. While high sex ratios do not significantly alter match quality for those born before the One Child Policy (OCP) (Porter, 2014), more skewed sex ratios, including those faced by individuals born under the OCP, influence mate selection (Anderson and Leo, 2013). Such high sex ratios may imply even greater effects on bargaining power for women once married (Du et al., 2015) and further negative effects for parents pressured to buy housing for their sons (Wei and Zhang, 2011; Wei et al., 2012).¹⁵ Thus, while highly imbalanced sex ratios in the marriage market likely improve conditions of younger women and their parents, they may do so at the expense of their parents-in-law. Such changing dynamics in the family may in fact shift parental preferences towards daughters instead of sons.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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¹⁵In addition, those born under the OCP do not have siblings to help with caring for parents. This may lead to even greater unmet needs of parents of only sons.

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Figure 1.

A. Number of Individuals in Urban and Rural China by Year of Birth

B. Male Marriage Market Sex Ratios in Urban and Rural China (by year of birth)

Table 1
Comparison of Means of Population-Related Variables Across Surveyed and Non-Surveyed Sons in SFDC

Variable	Surveyed Sons			Non-surveyed Sons			p-value
	Obs	Mean	Std.Dev.	Obs	Mean	Std.Dev.	
Sex ratio	1682	104.8	12.3	1979	104.6	11.5	0.6042
Average female education	1683	3.7	0.5	2095	3.7	0.5	0.3273
Number of younger women	1683	261.4	200.5	2089	265.2	196.0	0.5544
Number of older women	1683	209.4	161.1	2095	222.8	171.6	0.0149 **
Size of competing cohorts	1682	144.9	1516.0	1979	2294.4	1589.7	0.0038 ***
Same-sex birth cohort size	1683	241.0	179.2	2095	253.1	187.5	0.0459 *
Degree of famine exposure	1690	2.3	5.6	2107	4.4	5.6	0.0000 ***
Year of birth	1690	1953.7	8.4	2107	1954.4	10.0	0.0125 **
Urban = 1, Rural = 2	1690	1.6	0.5	2107	1.7	0.5	0.0263 **
Highest education level achieved	1690	2.9	1.5	2100	2.8	1.4	0.0599 *
CLHLS respondent is widowed = 1	1690	0.5	0.5	2107	0.5	0.5	0.0070 ***
Male CLHLS respondent=1	1690	1.5	0.5	2107	1.5	0.5	0.5149
Talk most frequently to son = 1	1690	0.3	0.5	2107	0.3	0.4	0.0485 **
Son and daughter-in-law are caregivers = 1	1689	0.6	0.5	2106	0.6	0.5	0.4021
CLHLS respondent lives with adult child	1690	0.6	0.5	2107	0.5	0.5	0.0000 ***
Distance to parent	1690	0.7	0.8	724	1.7	1.3	0.0000 ***
(1= same village., 5=county/city not nearby)							

Notes:

p<0.01,

**
p<0.05,

*

p<0.1. The sample is based on elderly respondents in the 2002 CLHLS and male respondents in the 2002 SFDC, who were matched to one another. The sample is also restricted to those in their first marriages. Population variables were derived from 1982 census data. Average female education for the relevant population was derived from 2000 census data. Degree of famine exposure was derived from data provided by Douglas Almond (see Almond et al. 2010).

Table 2
Sex Ratio Effects on Caring for Parents (as Reported by Elderly Respondent, Logits)

	Model 1	Model 2	Model 3	Model 4	Model 4 Robust P	Model 4 Wild P
<u>Elderly respondent talks most frequently to son</u>						
All sons	0.005 (0.008)	0.001 (0.010)	-0.023 ** (0.011)	-0.025 ** (0.010)	0.01592 **	0.10200
N	3,661	3,661	3,637	3,637		
Surveyed sons	0.009 (0.009)	0.004 (0.010)	-0.025 ** (0.010)	-0.022 (0.014)	0.13484	0.22000
N	1,682	1,682	1,671	1,671		
Non-surveyed sons	0.001 (0.009)	-0.002 (0.011)	-0.023 * (0.013)	-0.028 *** (0.010)	0.00531 ***	0.02800 **
N	1,979	1,979	1,964	1,964		
Wife of surveyed sons	0.006 (0.006)	0.003 (0.007)	-0.017 ** (0.008)	-0.010 (0.010)	0.33256	0.41600
N	1,646	1,646	1,621	1,611		
<u>Elderly Respondent's Son and Daughter-in-law are Primary Care Providers</u>						
All sons	-0.005 (0.006)	-0.002 (0.006)	-0.012 ** (0.005)	-0.015 ** (0.006)	0.01444 **	0.06400 *
N	3,659	3,659	3,647	3,647		
Surveyed sons	-0.009 (0.006)	-0.012 * (0.007)	-0.020 *** (0.007)	-0.027 ** (0.013)	0.04487 **	0.07200 *
N	1,681	1,681	1,674	1,674		
Non-surveyed sons	-0.001 (0.007)	0.007 (0.008)	-0.004 (0.009)	-0.003 (0.008)	0.68840	0.67400
N	1,978	1,978	1,950	1,950		
Wife of surveyed sons	-0.006 (0.005)	-0.006 (0.005)	-0.032 *** (0.009)	-0.031 ** (0.014)	0.02694 **	0.04200 **
N	1,645	1,645	1,612	1,607		
Prov & YOB FE	No	No	Yes	Yes	Yes	Yes
Birth Prov FE * Urban	No	No	Yes	Yes	Yes	Yes
YOB FE * Urban	No	No	No	Yes	Yes	Yes
Other controls	No	Yes	Yes	Yes	Yes	Yes

Notes:

p<0.01,

**
p<0.05,

*
p<0.1. Robust standard errors in parentheses clustered by urban/rural and birth province. Dependent variable is from 2002 CLHS. Samples are restricted to those in their first marriages. All regressions include an urban/rural dummy, whether the elderly respondent is widowed, and the elderly respondent's gender. Other controls include: same-sex birth cohort size, competing cohorts size, mean male or female education, num. younger or older men or women, and famine exposure.

Table 3
Sex Ratio Effects on Caring for Parents (as Reported by Son, Logit)

	Model 1	Model 2	Model 3	Model 4	Model 4 Robust P	Model 4 Wild P
<u>Daughter Helps Her Father</u>						
Husband's Ratio	0.012 [*] (0.007)	0.013 [*] (0.007)	0.033 ^{***} (0.010)	0.042 ^{***} (0.013)	0.00179 ^{***}	0.03000 ^{**}
N	1,673	1,673	1,662	1,634		
Wife's Ratio	0.007 (0.010)	0.012 (0.010)	0.028 [*] (0.015)	0.031 ^{**} (0.015)	0.04031 ^{**}	0.09000 [*]
N	1,638	1,638	1,515	1,512		
<u>Son Helps His Father</u>						
Husband's Ratio	-0.009 ^{**} (0.005)	-0.006 (0.008)	-0.001 (0.014)	0.015 (0.013)	0.26869	0.43000
N	1,682	1,682	1,673	1,673		
Wife's Ratio	-0.003 (0.006)	0.000 (0.007)	-0.004 (0.011)	-0.012 (0.015)	0.42240	0.49200
N	1,646	1,646	1,628	1,624		
Province and year of birth FE	No	No	Yes	Yes	Yes	Yes
Birth Province FE * Urban	No	No	Yes	Yes	Yes	Yes
Year of Birth FE * Urban	No	No	No	Yes	Yes	Yes
Additional covariates	No	Yes	Yes	Yes	Yes	Yes

Notes:

p<0.01,

**
p<0.05,

*
p<0.1. Robust standard errors in parentheses, clustered by urban/rural and province of birth. The dependent variable is based on the 2002 adult child supplementary survey to the CLHLS. The sample is restricted to male respondents in the SFDC who were matched to an elderly parent in the 2002 CLHLS. All regressions are either from the perspective of the son or daughter-in-law as indicated, and samples are restricted to those in their first marriages. All regressions include an urban/rural dummy, whether the elderly respondent is widowed, and the gender of the elderly respondent. Additional covariates include: same-sex birth cohort size, competing cohorts size, mean male or female education, num. younger or older men or women, and famine exposure.

Table 4
Sex Ratio Effects on Living Arrangements (as Reported by Elderly Respondent, Logits)

	Model 1	Model 2	Model 3	Model 4	Model 4 Robust P	Model 4 Wild P
<u>Elderly Respondent Lives with an Adult Child</u>						
All sons	0.004 (0.004)	0.008* (0.005)	-0.021** (0.008)	-0.027*** (0.010)	0.00667***	0.03800**
N	3,661	3,661	3,644	3,644		
Surveyed sons	0.013** (0.005)	0.017*** (0.006)	-0.013 (0.009)	-0.019 (0.012)	0.13168	0.21000
N	1,682	1,682	1,658	1,658		
Non-surveyed sons	-0.002 (0.005)	0.001 (0.005)	-0.029*** (0.010)	-0.033** (0.013)	0.01226**	0.01800**
N	1,979	1,979	1,973	1,973		
Wife of surveyed sons	0.014** (0.006)	0.012* (0.006)	-0.011 (0.010)	-0.021 (0.014)	0.13416	0.21800
N	1,646	1,646	1,623	1,612		
Province and year of birth FE	No	No	Yes	Yes	Yes	Yes
Birth Province FE * Urban	No	No	Yes	Yes	Yes	Yes
Year of birth FE * Urban	No	No	No	Yes	Yes	Yes
Additional covariates	No	Yes	Yes	Yes	Yes	Yes

Notes:

p<0.01,

**
p<0.05,

*
p<0.1. Robust standard errors in parentheses clustered by urban/rural and birth province. Dependent variable from 2002 CLHLS. Samples are restricted to those in their first marriages. All regressions include an urban/rural dummy, whether the elderly respondent is widowed, and the elderly respondent's gender. Additional covariates include: same-sex birth cohort size, competing cohorts size, mean male or female education, num. younger or older men or women, and famine exposure.