

Out of 'Male-land': Imbalanced Sex Ratios and Local Exodus

ZHANG, Chongjiu¹

¹Beijing Normal University

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Motivation and question

- The massive and ever-growing scale of internal migration in China -
 - What drives such huge scale of migrants?
- The far-reaching aftermaths of male-biased sex ratio imbalance -
 - How may local people react?
- What is the relationship between sex ratio imbalance and internal migration in China? Is it possible that the former leads to the latter?

Idea of this paper

- “Voting with one’s feet”: “Push” factors in migration decisions
 - Just as a region’s strengths may attract migrants, its disadvantages can push locals away (Bogue 1969; Lee 1966).
- An imbalanced sex ratio has negative repercussions, and people react to such adverse circumstances.
- The notion of a homeostatic and self-balancing population system (as posited by Xiong (2022)).

What I do and find

- Aggregate level -
 - Data sourced from China's population census in 2010 and 2020, counties matched.
 - Analysis based on counties, change in local population from 2010-2020 regressed on sex ratio in 2010.
 - Counties with higher sex ratios in 2010 experienced lower population growth between 2010 and 2020.
- Individual level -
 - Data sourced from China's population census in 2010, individual matched with regions.
 - Sex ratios calculated based on hukou registration, and instrumented for with the implementation of the One Child Policy (OCP).
 - Analysis based on individuals, a dummy indicating migrant or not regressed on local sex ratio.
 - Locals in regions with higher sex ratios are more likely to leave.

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Internal migration in China

- From 1982 to 2010, the amount of migrants in China grew from 6.57 mil. to 221 mil., and its share of total population from 0.65% to 16.53%.
- According to the 2020 population census, there are 375.8 mil. migrants nationwide, an increase of 69.73% compared to that in 2010.
- Restriction of the Hukou system and other institutional barriers of migration are further loosening.
- Growing body of literature on what drives such **HUGE** scale of migration and its implications (e.g. Du et al. 2005; Liang 1997, 2001, 2016; Ma and Tang 2020; Mullan et al. 2011; Su et al. 2018).

Internal migration in China

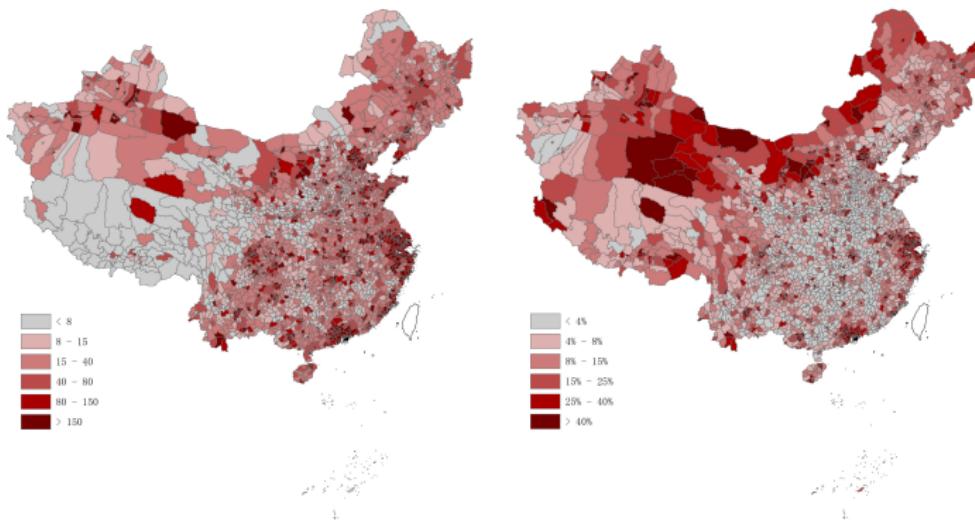


Figure: Number (k) and share (%) of migrants for counties in China, 2020

Factors determining whether to migrate

- Migration decisions modelled as tradeoffs between the payoff flows associated with different locations and the cost of moving.
 - Components of a classic migration model: wage, employment rate, cost of moving, etc. (Kennan and Walker 2011).
- Abundant studies on what regional characteristics may attract people to come (see, e.g. Borjas 1995; Borjas and Bronars 1991; Card 2001; Hanson 2009; Kennan and Walker 2010), relatively little evidence on what might push people to leave.
 - Studies on China have mainly delved into the role of economic development and government policies.
 - A nascent literature on how air pollution leads to internal migration in China (Chen et al. 2020; Chen et al. 2022; Lai et al. 2021).

Sex ratio imbalance

- Male-skewed sex ratio imbalance (henceforth, imbalanced sex ratios or ISR) prevailing in many Asian populations (Miller 1981; Coale and Banister 1994).
 - Abramitzky et al. (2011) and Brainerd (2017) provide discussion of female-skewed sex ratio imbalance.
- Cause: male preference, sex selection (Sen 1990; Edlund 1999; Hesketh and Xing 2006) and other unique institutional context (see, e.g. Chen et al. 2013; Li and Zhang 2019).
- Counterback: rise of female earnings (Qian 2008; Xue 2018).

ISR in China

- Extremely male-skewed sex ratio (NBS 2010, 2020) or a large deficit of “missing women” (Qian 2008; Sen 1990, 1992).
 - 2000 and 2010 population census count a total sex ratio of 106.74 and 105.20, respectively.
 - 2020 population census count a male population of 721 mil., a female population of 688 mil., and a total sex ratio of 104.8.
 - Sex ratio at birth is 111.3-though falling-still much higher than a normal value of 104-107 (Visaria 1967).
 - Imbalance is most severe among youngsters (119.1 for 10-14 year olds and 118.4 for 15-19 year olds) - suggesting it to continue as these generations age.

ISR in China

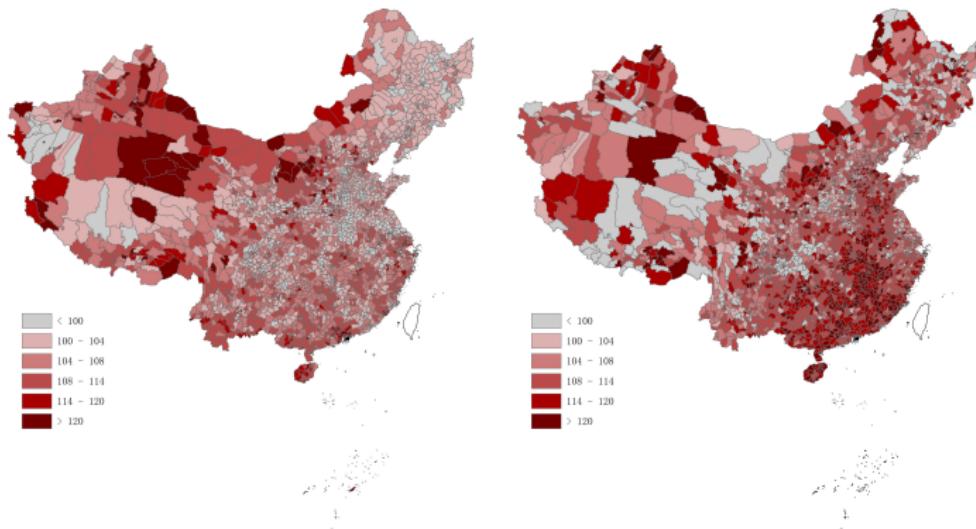


Figure: Sex ratio total and at birth for counties in China, 2020

Repercussions of the ISR

- For males:

- intense competition and a squeeze in the marriage market (Guilmoto 2010; Jiang et al. 2014);
- labor market behavior and outcomes (Angrist 2002; Chang and Zhang 2015);
- educational investments (Lafortune 2013);
- mental health and a range of abnormal sex behaviors (Jin et al. 2013).
- More harmful for those of a lower socio-economic background.

- For females:

- persistent patriarchy vs. increased well-being and status (Edlund 1999; Lin et al. 2014);
- labor force participation and labor market outcomes (Angrist 2002; Grosjean and Khattar 2019);
- bride price and education attainment (Francis 2011; Jiang and Sánchez-Barricarte 2012; Ashraf et al. 2020);
- human trafficking of / violence against women (Xiong 2022).

Repercussions of the ISR

- For parents and families:
 - savings, consumption and investment patterns (Wei and Zhang 2011B; Li et al. 2022);
 - labor market behavior (Wei and Zhang 2011A);
 - pension and old-age support (Ebenstein and Leung 2010).
- Macroscopic:
 - crime and public security (Edlund et al. 2013; Cameron et al. 2019);
 - fertility (Anukriti 2018);
 - social welfare and economic development (Bandiera and Natraj 2013; Bhaskar 2011; Eggleston et al. 2013).
 - bride importation and human trafficking for neighboring countries.
- To sum up: a range of economic and social consequences that are mostly harmful - will they push locals to leave?

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Empirical strategy

- Data

- Tabulation by county from 2010 & 2020 China Population Census
- The China Statistical Yearbook for Regional Economy (CSYRE) and the China County Statistical Yearbook (CCSY).

- Regression specification:

$$\begin{aligned} &Population_{c,h,2020} - Population_{c,h,2010} = \\ &\alpha_0 + \alpha_1 \times Sex_Ratio_{c,h,2010} + X \times \beta + \epsilon_{c,h} \end{aligned} \tag{1}$$

where

$$Sex_Ratio_{c,h} = \frac{Male_Population_{c,h}}{Female_Population_{c,h}} * 100 \tag{2}$$

Aggregate level: Sex ratios in 2010 and change in local population 2010-2020

VARIABLES	Population in 2020 - Population in 2010			
	(1)	(2)	(3)	(4)
Sex ratio total in 2010	-1,993.96*** (-3.18)	-1,446.96* (-1.89)		
Sex ratio of never married in 2010			-352.15*** (-3.01)	-279.95* (-1.69)
Observations	2,211	2,200	2,211	2,200
R-squared	0.284	0.445	0.281	0.444
# Prefectures		316		316
Controls	Yes	Yes	Yes	Yes
Prefec. FE	No	Yes	No	Yes

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Empirical strategy

- Data: 2010 China Population Census micro-dataset
- Regression specification:

$$Migrant_{i,c,h} = \alpha_0 + \alpha_1 \times Sex_Ratio_{c,h} + Z \times \beta + \epsilon_{i,c,h} \quad (3)$$

- Threat to identification: sex ratios as the consequence of migration.
 - I calculate sex ratios based on where hukou is registered instead of residence through the 2010 census micro-data.

An instrumental variable approach

- Implementation of OCP and the introduction of ultrasound led to a surge in sex ratios (Chu 2001; Yang and Chen 2004; Das Gupta 2005; Chen et al. 2013) while -
- The execution of this policy is widely heterogeneous (Gu et al. 2007; Li et al. 2011).
- I instrument for sex ratios with (1) the average number of live-born children for local women of childbearing age, (2) the proportion of local ethnic minorities and (3) an interaction between the two.

Descriptive statistics of regional characteristics

VARIABLE	Obs	Mean	Std. Dev.	Min	Max
Panel A. All counties					
Sex ratio	2,869	105.80	13.43	72.77	722.22
Sex ratio at birth	2,868	115.33	11.01	76.47	176.74
Total Population	2,869	464317	388954.5	444	8220207
Share of urban hukou	2,869	29.52	23.56	1.58	99.4
Average year of education	2,869	8.71	1.47	2	13.14
Per capita GDP (w/o proxied)	2,048	20554.35	20778.46	2172	241034
Per capita GDP (w/ proxied)	2,790	25151.63	22909.41	2172	241034
Share of migrants	2,869	10.08	13.21	0.04	89.89
Panel B. Home counties					
Sex ratio (of hukou registration)	2,873	105.19	28.61	0	600
Total Population	2,865	465,954	388540.7	444	8220207
Share of urban hukou	2,865	29.66	23.62	2.02	99.4
Average year of education	2,865	9	1.45	2	13.14
Per capita GDP (w/o proxied)	2,040	20,352	19845.46	2172	241034
Per capita GDP (w/ proxied)	2,786	25027.06	22327.83	2172	241034
Share of migrants	2,865	10.04	13.12	0.04	89.89
Panel C. Residence counties					
Sex ratio (of hukou registration)	2,625	104.17	11.00	47.62	300
Total Population	2,608	484792.1	397520.8	444	8220207
Share of urban hukou	2,608	29.83	23.92	2.02	99.4
Average year of education	2,608	8.76	1.45	2	13.14
Per capita GDP (w/o proxied)	1,813	20799.71	19651.48	2172	241034
Per capita GDP (w/ proxied)	2,534	25620.82	22254.85	2172	241034
Share of migrants	2,608	10.16	13.35	0.04	89.89

Individual level: Results from OLS

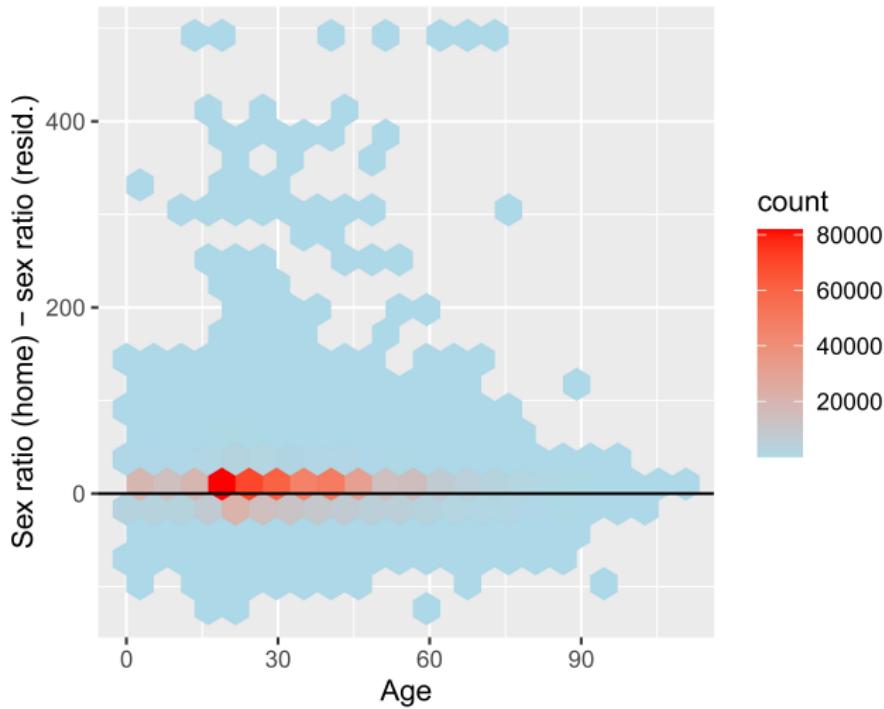
VARIABLES	Migrant	Migrant across prefec.	Migrant across provinces
	(1)	(2)	(3)
Sex ratio (home)	0.0017*** (3.770)	0.0007*** (3.137)	0.0002 (1.466)
Sex ratio (resid.)	-0.0017*** (-3.089)	-0.0005* (-1.884)	-0.0001 (-0.465)
Observations	4,084,406	4,084,406	4,084,406
R-squared	0.606	0.702	0.710
# Home counties	2,761	2,761	2,761
# Home prefec.	335	335	335
# Resid. prefec.	295	295	295
Controls	Yes	Yes	Yes
Home prefec. FE	Yes	Yes	Yes
Resid. prefec. FE	Yes	Yes	Yes

Individual level: Results from IVs

VARIABLES	Migrant	Migrant across prefect.	Migrant across provinces
	(1)	(2)	(3)
Sex ratio (home)	0.0066*** (3.198)	0.0036*** (3.267)	0.0008 (1.100)
Sex ratio (resid.)	-0.0047*** (-3.581)	-0.0022*** (-3.237)	-0.0004 (-0.936)
Observations	4,079,227	4,079,227	4,079,227
R-squared	0.217	0.108	0.024
# Home counties	2,758	2,758	2,758
# Home prefec.	335	335	335
# Resid. prefec.	295	295	295
Controls	Yes	Yes	Yes
Home prefec. FE	Yes	Yes	Yes
Resid. prefec. FE	Yes	Yes	Yes

Where did the migrants go?

Changes in regional sex ratios for migrants



Robustness checks

- Different treatment of the explanatory variables
 - Winsorized (at different cutoffs), standardized, divided into percentiles...
 - Sex ratio of marriable age, of never married, ...
- Alternative samples
 - 2015 China 1% Population Sample Survey
 - Excluding long-term migrants (5/10 years or more)
 - Cross-prefecture migrants
- More set of controls: natural growth rate, sex ratio at birth...

Heterogeneity by personal characteristics

VARIABLES	Female	Migrant Rural hukou	Education
	(1)	(2)	(3)
Sex ratio (home)	0.0016*** (3.582)	0.0010** (1.999)	0.0053*** (10.383)
Sex ratio (resid.)	-0.0017*** (-3.090)	-0.0018*** (-3.126)	-0.0019*** (-3.313)
VAR	-0.0131*** (-3.114)	-0.1006*** (-4.169)	0.1441*** (18.091)
Sex ratio (home) \times VAR	0.0002*** (3.949)	0.0010*** (4.359)	-0.0012*** (-15.459)
Observations	4,084,406	4,084,406	4,084,406
R-squared	0.606	0.607	0.607
Controls	Yes	Yes	Yes
Home prefec. FE	Yes	Yes	Yes
Resid. prefec. FE	Yes	Yes	Yes

VAR denotes the variable interacted with sex ratios, at the head of each column.

Heterogeneity by regional characteristics of home county

VARIABLES	Migrant		
	% of urb. hukou (1)	Ave. year of educ. (2)	Per capita GDP (3)
Sex ratio (home)	0.0027*** (5.603)	0.0070*** (5.209)	0.0065** (2.565)
Sex ratio (resid.)	-0.0018*** (-3.174)	-0.0018*** (-3.127)	-0.0018*** (-3.114)
<i>VAR</i>	0.0029*** (2.617)	0.0253 (1.080)	-0.1123*** (-3.263)
Sex ratio (home) × <i>VAR</i>	-0.0000*** (-4.158)	-0.0006*** (-3.982)	-0.0005* (-1.862)
Observations	4,084,406	4,084,406	4,084,406
R-squared	0.607	0.607	0.606
Controls	Yes	Yes	Yes
Home prefec. FE	Yes	Yes	Yes
Resid. prefec. FE	Yes	Yes	Yes

VAR denotes the variable interacted with sex ratios, at the head of each column.

Implications for family relocation

- Data: 2017 China Migrants Dynamic Survey, migrants matched with regional characteristics based on hukou registration.
- Findings: Migrants coming from areas with highly ISR are more likely to bring their kids along when moving, and this effect is more significant for girls and families with low socioeconomic status.
- Robustness checks along the same lines.

Possible mechanisms

- Marriage squeeze
 - Replace the explanatory variables with sex ratios of the right age or sex ratios of never-married.
 - Results remain robust, and that the effect of marriage squeeze on local exodus is more pronounced for male instead of female - possibly owing to gender differences in marriage prospects, as suggested by Xiong (2023).
- Disruption of social order
 - The relationship between sex ratios and crime on the prefecture level, the dependent variable being 2015 crime rate of each prefecture, defined as the number of arrests and prosecutions per 10,000 people, as reported in the 2015 annual reports of local procuratorates.
 - Both the total sex ratio and the sex ratio of the unmarried are positively correlated with crime rates.

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Conclusion

- The two significant phenomena in China's demographics, namely large-scale internal migration and severe sex ratio imbalance, are likely to be interconnected.
- Counties with higher sex ratios in 2010 experienced lower population growth in the following decade.
- ISR within a region can compel people into moving away, with a more noticeable impact observed among women, those with lower education levels, agricultural hukou holders, and individuals residing in less developed areas.
- Migrants from ISR regions are also more inclined to relocate with their children along, displaying similar levels of heterogeneity.

Thank you!

E-mail: emisrogan@outlook.com