

Sex ratio imbalance and trends on returns to education

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Motivation and question

- Male-skewed sex ratio imbalance and its impact in the labor market -
 - Different people bear its consequences differently.
- Do people benefit more from education under high sex ratios, or do they benefit less?
 - How does this effect differ by gender or different educational levels?
How does it occur?

What I do

- Data sourced from China's 2005 1% Population Sample Survey.
- An extended Mincerian approach to estimate the earning returns to education.
- Examine both the overall returns to education, and the differences in returns associated with different levels of education.

What I find

- Both males and females have lower average returns to education under high sex ratios.
 - The *loss* is bigger for males than for females.
- Females with a junior or senior high degree experience the most significant decrease in income, while males with a college degree experience the most loss.
- Females benefit from significantly higher rates of return to higher education under high sex ratios. Males do not.

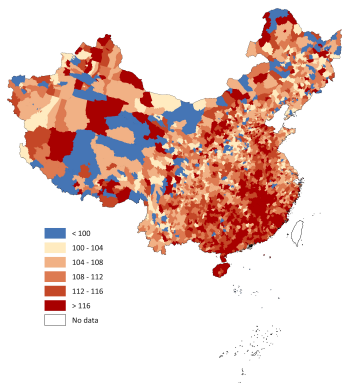
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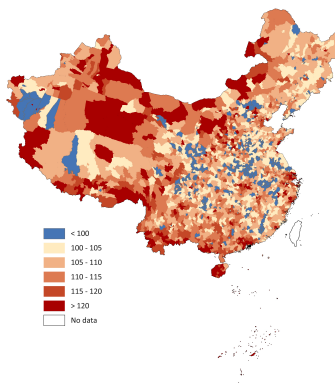
Sex ratios in China

- Extremely male-skewed sex ratio (NBS 2010, 2020) or a large deficit of “missing women” (Qian 2008; Sen 1990, 1992).
 - 2000, 2010, and 2020 Census count a total sex ratio of 106.74, 105.20, and 104.8, respectively.
 - In 2020, sex ratio at birth is 111.3. Imbalance is most severe among youngsters (119.1 for 10-14 year olds and 118.4 for 15-19 year olds).
- 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).

Sex ratios in China



(a) Sex ratio at birth



(b) Sex ratio of 15-60

Figure: Sex ratios for Chinese counties, 2020

Repercussions of sex ratio imbalance

- For males: intense competition and a squeeze in the marriage market (Guilmoto 2010; Jiang et al. 2014)
 - More harmful for those of a lower socio-economic background.
 - Males might therefore resort to different ways to enhance their competitiveness.
- For females: persistent patriarchy vs. increased well-being and status (Edlund 1999; Lin et al. 2014);
- At large: crime and public security (Edlund et al. 2013; Cameron et al. 2019); social welfare and economic development (Bandiera and Natraj 2013; Bhaskar 2011; Eggleston et al. 2013); ...

Returns to education in China

- Various studies have yielded different results.
 - 1980s: 2%-3% (Bryon and Manaloto 1990; Meng and Kidd 1997)
 - 1990s-2010s: 8%-20% (Chen and Hamori 2009; Chen et al. 2020; Mishra and Smyth 2015; Zhang et al. 2005; Zhang et al. 2007)
- A consensus: China's overall returns to education experienced a surge in the 1990s, but has become relatively stable in recent years (Chen and Hu 2013; Fleisher and Wang 2005; Li 2003; Zhang et al. 2005).
- Another consensus: large disparities exist between different subgroups.
 - i.e., men and women, urban and rural populations, cities in the western, eastern, and middle regions of China...

Educational investments, attainments, and returns under high sex ratios

- Males: various strategies - invest more in education, work harder, engage in riskier job opportunities (Lafortune 2013; Wang 2018; Weiang Zhang 2011) - to enhance their competitiveness, and earn more (Angrist 2002).
- Females: less labor force participation and engage less in high-ranking occupations (Angrist 2002; Grosjean and Khattar 2019).

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Data and variables

- A random sample of China's 2005 1% Population Sample Survey, merged with China City Statistical Yearbook 2005.
- Dependent variable: hourly wage (log).
- Years of education: recoded according to one's educational level and completion.
- Sex ratio of one's current residence or hukou registration:

$$Sex_Ratio_r = \frac{Male_Population_r}{Female_Population_r} \times 100 \quad (1)$$

Regression specification

- An extended Mincerian approach:

$$Wage_{i,r,p} = \alpha_0 + \alpha_1 \times Year_of_edu_i + X \times \beta + \epsilon_{i,r,p} \quad (2)$$

- Sex ratio and the overall returns to education:

$$\begin{aligned} Wage_{i,r,p} = & \alpha_0 + \alpha_1 \times Year_of_edu_i + \alpha_2 \times Sex_ratio_r \\ & + \alpha_3 \times Year_of_edu_i \times Sex_ratio_r \\ & + X \times \beta + \epsilon_{i,r,p} \end{aligned} \quad (3)$$

Summary of personal characteristics

	Full sample (N=1595102)		Females (N=791332)		Males (N=803770)	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Hourly wage (log)	0.923	0.964	0.768	0.916	1.079	0.987
Years of education	7.865	3.924	7.271	4.151	8.467	3.579
College educated	0.027	0.161	0.022	0.146	0.031	0.175
Agricultural hukou	0.704	0.457	0.711	0.453	0.696	0.46
Han ethnic	0.899	0.302	0.9	0.301	0.897	0.303
Working experience	27.091	18.822	27.542	19.395	26.633	18.211

Summary of regional characteristics

	Obs	Mean	Std. dev.	Min	Max
Sex ratio	278	101.207	5.732	79.543	121.126
Total population	278	393.701	227.944	16.76	1094.37
Natural growth rate	278	5.150	3.541	-2.52	29.08
Per capita GDP (log)	278	9.272	0.669	7.662	11.184
Total GDP (log)	278	5.839	0.894	3.580	8.323
GDP growth rate	276	14.434	3.573	7.2	37.69
% Industry I	278	18.382	10.236	0.37	44.79
% Industry II	278	47.177	11.906	2.66	87.49
% Industry III	278	34.355	7.023	12.14	59.95

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Baseline regressions

Dep. Var.	Wage					
	(1)	(2)	(3)	(4)	(5)	(6)
Model:	Classic Mincerian			Extended Mincerian		
Sample:	All	Female	Male	All	Female	Male
Years of education	0.0431*** (13.89)	0.0377*** (14.02)	0.0478*** (12.61)	0.0438*** (158.11)	0.0454*** (117.76)	0.0417*** (103.67)
Female	-0.2363*** (-24.26)			-0.2470*** (-175.31)		
Experience	0.0318*** (23.44)	0.0208*** (12.06)	0.0454*** (39.58)	0.0342*** (295.12)	0.0237*** (149.65)	0.0474*** (278.04)
Experience ²	-0.0006*** (-34.21)	-0.0004*** (-20.08)	-0.0008*** (-41.92)	-0.0006*** (-338.48)	-0.0004*** (-183.55)	-0.0008*** (-306.16)
Obs.	2,061,320	1,038,313	1,023,007	1,595,102	803,770	791,332
Adj. R-squared	0.151	0.108	0.162	0.174	0.127	0.195
Mean dep. var.	0.923	0.768	1.079	0.924	0.765	1.085
S.d. dep. var.	0.964	0.916	0.987	0.958	0.911	0.977
Controls	No	No	No	Yes	Yes	Yes
Prov. FE	No	No	No	Yes	Yes	Yes

Sex ratio and the overall returns to education

<i>Dep. Var.</i>	Wage			
	(1)	(2)	(3)	(4)
<i>Sex ratio</i>	<i>SR of residence</i>		<i>SR of home</i>	
<i>Sample</i>	<i>Female</i>	<i>Male</i>	<i>Female</i>	<i>Male</i>
Years of education \times Sex ratio	-0.0003*** (-6.32)	-0.0006*** (-11.70)	-0.0002*** (-4.16)	-0.0005*** (-8.78)
Years of education	0.0734*** (16.45)	0.1045*** (19.40)	0.0647*** (13.93)	0.0905*** (16.27)
Sex ratio	-0.0017*** (-4.22)	0.0048*** (9.45)	0.0028*** (6.71)	0.0080*** (15.04)
Obs.	803,770	791,332	803,770	791,332
Adj. R-squared	0.127	0.195	0.127	0.195
Mean dep. var.	0.765	1.085	0.765	1.085
S.d. dep. var.	0.911	0.977	0.911	0.977
Controls	Yes	Yes	Yes	Yes
Prov. FE	Yes	Yes	Yes	Yes

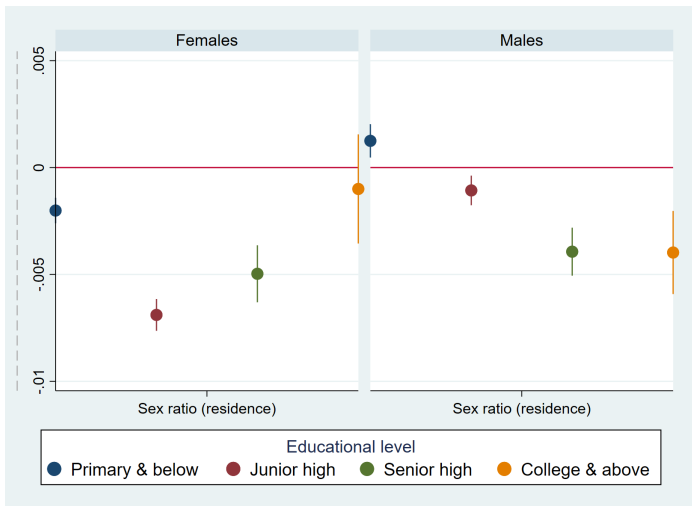
Sex ratio and the overall returns to education

- Higher sex ratios are associated with lower returns to education and lower educational-income gaps.
- How does it happen? - it might be that:
 - the income effects of sex ratio vary in *opposite* directions for individuals with different educational levels; or
 - the income effects of sex ratio vary in the *same* direction for individuals with different educational levels, but differ in their magnitudes.
- I divide the sample by gender and educational levels, and regress sex ratio of residence on individual's wages.

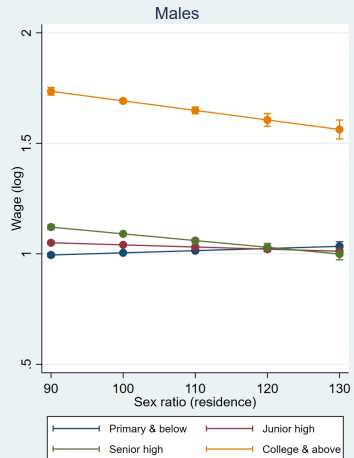
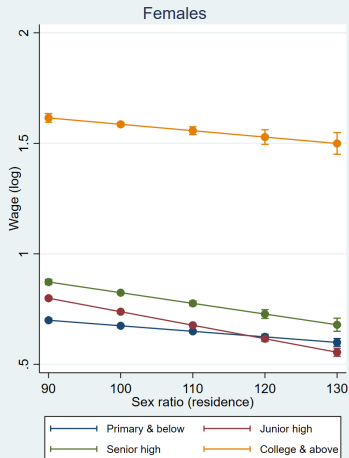
Sex ratio and wage: by gender and educational level

<i>Dep. Var.</i>	<i>Wage</i>			
	(1)	(2)	(3)	(4)
Panel A: Females				
<i>Educational level:</i>	<i>Primary & below</i>	<i>Junior high</i>	<i>Senior high</i>	<i>College & above</i>
Sex ratio (residence)	-0.0020*** (-6.63)	-0.0069*** (-18.16)	-0.0050*** (-7.30)	-0.0010 (-0.77)
Obs.	350,335	305,379	103,484	44,572
Mean dep. var.	0.614	0.828	0.787	1.475
S.d. dep. var.	0.801	0.912	0.970	1.151
Panel B: Males				
<i>Educational level:</i>	<i>Primary & below</i>	<i>Junior high</i>	<i>Senior high</i>	<i>College & above</i>
Sex ratio (residence)	0.0012*** (3.14)	-0.0011*** (-3.03)	-0.0039*** (-6.87)	-0.0040*** (-4.01)
Obs.	241,754	356,247	135,291	58,040
Mean dep. var.	0.862	1.142	1.089	1.656
S.d. dep. var.	0.891	0.940	1.030	1.123

Sex ratio and wage: by gender and educational level



Linear prediction of wage



Sex ratio and the returns to higher education

<i>Dep. Var.</i>	<i>Wage</i>			
	(1)	(2)	(3)	(4)
<i>Sex ratio</i>	<i>SR of residence</i>		<i>SR of home</i>	
<i>Sample</i>	<i>Female</i>	<i>Male</i>	<i>Female</i>	<i>Male</i>
College educated \times Sex ratio	0.0056*** (3.57)	-0.0043*** (-3.35)	0.0058*** (3.69)	-0.0015 (-1.16)
College educated	0.2487 (1.57)	1.0847*** (8.46)	0.2526 (1.60)	0.8193*** (6.39)
Sex ratio	-0.0043*** (-18.09)	-0.0010*** (-3.95)	-0.0022*** (-8.85)	0.0003 (1.31)
Obs.	803,770	791,332	795,876	783,292
Adj. R-squared	0.125	0.194	0.129	0.198
Mean dep. var.	0.765	1.085	0.762	1.081
S.d. dep. var.	0.911	0.977	0.911	0.978

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Basic findings

- People exposed to high sex ratios exhibit lower overall returns to education, indicating that sex ratio imbalance is associated with lower educational-income gaps.
- For women under high sex ratios, those with junior and senior high school degrees experience the most significant income decline, whereas those with a college degree are relatively unaffected.
- For men under high sex ratios, those with the least education observe an increase in income; others, decrease. The magnitude of income loss increases with the level of education.
- Women under high sex ratios witness remarkably high returns for pursuing higher education.

Some notes and concerns

- NOT a causal study...
- What about those not in the labor force?
- How exactly are these results generated and why?

Thank you!

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