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Estimating the Effect on the Sex Ratio of the Two-Child Policy: Evidence from China

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Abstract: The 2015 two-child policy impacts gender ratios in China, as traditional son preference drives the desire for males. This article examines rural and urban boy ratios before and after the two-child policy and its reasons. Therefore, the sample included 1,985 children aged under 6 years, 10,126 parents of children who participated in the China General Social Survey (CGSS) ques-tionnaire in 2018, and 9,034 parents in 2012. My study used Difference-in-Difference (DID) and linear regression methods. After the two-child policy was implemented, urban boys' ratio (boys/overall) outnumbered rural boys by 11.45% and reached above 50% and there was an increase in the number of desired sons. The research results show that the two-child policy does not reduce gender imbalance among Chinese children and even worsens it in metropolitan areas. This is due in part to the fact that having a son is still a goal for many families.

Keywords: sex ratio, two-child policy, policy effect

1. Introduction

According to Banister [1] and Hesketh & Xing [2], early scholars believed the one-child policy contributed to the gender imbalance in Chinese children. Li et al. [3] found that the one-child policy caused 54% of the 2001–2005 increase in boys compared to girls. The regulation isn't the main cause of gender inequality; the population's traditional views are. Even with a severe ban on foetal sex screening in India, Nandi & Deolalikar [4] found that the ratio of males to girls increased by 14-26% [5]. Thus, even if China implements a two-child policy in 2015, which may reduce the amount to which parents verify their foetuses' sex, China's gender imbalance will not alter soon.

There is now a large literature on the changing sex ratios resulting from China's two-child policy [6] [7]. Since Chinese parents prefer boys, these researches found that the two-child policy will not improve the sex ratio of Chinese children quickly. These studies employ prediction models to estimate future developments. These forward-looking models lack statistical modelling and testing of real sex ratio changes. Also, some studies include the whole China, hence there is lack of research on regional trends.

The 2018 China General Social Survey (CGSS) questionnaire was used to compare the ratio of boys to girls and son expectations in urban and rural China before and after the two-child policy. Difference-in-Difference (DID) and linear regression were my key study methodologies. To improve DID outcomes, I included parents' education degree in variable selection. I found through econometric calculations that the two-child policy has not addressed gender inequality in China, with

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boys outnumbering girls in both urban and rural regions. Urban regions preferred sons much more than rural areas. After the two-child limit was implemented, both urban and rural residents still wanted at least one boy.

2. Literature Review

China has an ageing population issue due to a dropping birth rate. In 2015, China ended its one-child policy and fully implemented its two-child programme. China's sex ratio dropped from 105.02 in 2015 to 104.46 in 2019, but it climbed again in 2020 to 104.88 in 2021. The two-child policy did improve the gender ratio briefly, but the population's sex ratio is not typical of new-borns', and the growing sex ratio is still imbalanced [8]. Son preference contributes to China's gender imbalance. Chinese prefers sons because of Confucian tradition, according to Chung and Gupta [9]. Confucians value familial continuity. The absence of men in a home is a major offence since only boys can pass on the family lineage [10]. China prefers males over daughters due of elderly age. Sons traditionally help elderly people, and the oldest son supports his parents most. This technique replaces pensions in nations with inadequate pension systems. Rosenzweig and Zhang [11] observed that many elderly persons in rural China depend on their sons for housing and financial support.

China's two-child policy contributes to gender inequality, early one-child policy affected gender ratios. According to Li et al. [3], the one-child policy caused 54% of China's 2001–2005 gender ratio gains. The two-child policy allows individuals to skip gender selection a second time. However, the outcome may differ. The two-child policy may encourage gender selection for those who want a boy but not as much. They'll let nature select their first child's sex and control their second if they don't have a son [6]. Ebenstein's model [12] suggests that some families with a daughter would manipulate sex to conceive a second boy.

Rural and urban China have different gender imbalances owing to son preference. In 2013, China Household Income Project and Hu et al. found 0.428 years of gender inequality in schooling in urban areas and 1.121 years in rural areas [13]. Rural areas are less educated than cities. Zeng [14] found that urban regions have a substantial negative coefficient, hence the likelihood of finding a statistically significant gender disparity in educational attainment is 41% lower than in rural places. These studies show that rural households prefer boys over girls and offer them more schooling because they feel their sons would always be with them while their daughters will marry other families [15]. After the two-child policy, rural families may want boys less than urban ones. Rural communities had fewer birthing restrictions than cities before the two-child limit. Rural boys may have a second daughter. Thus, this thesis addresses gender ratios in rural and urban areas to better understand the two-child policy's impact across China.

In this paper, I argue that the two-child policy has indeed had an impact on the sex ratio in China and has resulted in a greater proportion of male births in China. The gender imbalance before the policy was more severe in rural areas than in urban areas due to the lower education rates and more traditional attitudes of rural residents. However, after the two-child policy, things will be different. Although many studies have been conducted to demonstrate the impact of the two-child policy on sex ratios, the reasons behind the impact are still worth exploring. This paper will therefore provide further insight into the causal relationship between people’s subjective preference for sons and the imbalance in the sex ratio.

3. Methodology

3.1. Empirical Strategy

I first examined how the two-child policy affected the sex ratio (male/the whole), notably in rural and urban regions. DID is a reliable econometric method for comparing rural-urban sex ratios before and

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after the two-child policy. This innovative method may be utilised for panel data and repeated cross-sections in a variety of fields and eliminates unexpected human elements to assess policy effect [16]. In family planning documents and the Law of Regional Ethnic Autonomy, the Chinese government employs DID demo-graphic research [17]. Thus, I used the DID method to analyse the two-child policy in different places, correcting for macro-social factors. Hukou classifies registrants as agricultural or non-agricultural. My research included agricultural and non-agricultural Hukou proprietors. Rural dwellings are controlled, and urban families treated. Thus, I created a model to evaluate the two-child policy across regions:

$$S_i=\alpha_0+\alpha_1 L_i+\alpha_2 T_i+\alpha_3 L_i*T_i+\alpha_4 X_i+\varepsilon_i \quad (1)$$

In this DID estimate model, S_i is the child's sex, 1 if male and 0 if female. L=1 for rural children and L=0 for urban youngsters. The two-child policy was implemented in 2015, therefore I sampled 5-year-olds and under in 2012 and 2018. If T=1, the infant was born after 2015; else, T=0. The equation's constant term is α_0 and the model's random or error term is ε_i. $\alpha 1$ is the geographical effect that is not related to the two-child policy, while α_2 is the control units' 2012–2018 male percentage variations (rural area). My DID estimator, α_3, is the interaction term coefficient. It examines whether the two-child policy has affected boy birth rates by location. X_i indicates parents' education degree, while α_4 is its coefficient.

DID study demonstrates boys' sex ratios before and after the two-child policy in urban and rural areas. I used simple linear regression to examine the number of boys individuals would expect without policy limits before and after the two-child policy in urban and rural locations to find the origins of these discrepancies. Traditional Chinese culture and the pension system make people favour sons, which may raise son birth rates. The desired quantity of boys indicates son preference. I compared predicted son numbers without policy limits between 2012 and 2018 using the mean. Two simple linear regression models using 2012 and 2018 data compare geographical area:

$$N=\beta_1+\beta_2*L_i \quad (2)$$

$$N=\beta_3+\beta_4*L_i \quad (3)$$

I used simple linear regression to only focus on geographical region, the two regressions are comparable, N is the number of boys one would anticipate if there were no policy limitations, and L is the child's geographical area: L=1 for rural children and L=0 for urban children. β_1 and β_3 are intercepts and β_2 and β_4 are coefficients. If there are no governmental limitations in rural and urban regions, the coefficient variables modify the number of anticipated sons as L_i varies.

3.2. Data Inputs/Sources

The 2018 China General Social Survey (CGSS) with a sample size of 1,985 covers the children's gender across the nation, age in the year of the survey, type of household registration, and other details for the DID research of gender ratio changes before and after the two-child policy. The simple linear regression analysis employed household data from CGSS's 2012 and 2018 surveys of expected boys' numbers before and after the policy. I examined respondents' Hukou and expected son numbers without policy limits, with the sample size of 9,034 in 2012 and 10,126 in 2018. CGSS authorised data usage.

I conducted an econometric analysis based on descriptive and inferential data, and all model building and variable estimation were performed using STATA 14. To obtain specific DID values, I used the 'diff' command in STATA for this purpose.

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4. Results

4.1. Data Description

My DID analysis included 12,787 2018 CGSS questionnaire responses. Adults and children over 6 years old that were not born between 2012 and 2018 were excluded. Our sample size was 1,985.

Table 1 shows all research factors and descriptive data and illustrates parents' educational level-related characteristics. Gender, Rural, and Policy dummies indicate the child's sex, household registration, and age cohort. A boy born after 2015 with an agricultural household registration type has these 3 criteria as 1.

Table 1: Variable definition and summary statistics.

	Definitions	N	Mean	Std Dev.
Gender	1=male; 0=female	1985	0.53	0.5
Birth Cohort	1=born after 2015; 0=otherwise	1985	0.52	0.5
Rural	1=agricultural Hukou type; 0=non-agricultural Hukou type	1985	0.37	0.48
Primary	1=highest education level is primary school; 0=otherwise	1985	0.22	0.41
Junior	1=highest education level is junior middle school; 0=otherwise	1985	0.31	0.46
Senior	1=highest education level is senior middle school; 0=otherwise	1985	0.17	0.38
Higher Education	1=highly educated; 0=otherwise	1985	0.17	0.38

For the linear regressions, my data came from the CGSS questionnaire results in 2012 and 2018, respectively. There were 11,765 and 12,787 observation samples, respectively, and I ended up with 9,034 samples from 2012 and 10,126 samples from 2018 after excluding those individuals who refused to answer.

Tables 2 and 3 summarise the descriptive statistics for the variables used in 2012 and 2018 respectively. Where Rural is a dummy variable and Rural=1 indicates that the sample is from rural areas and Rural=0 indicates that the sample is from urban areas.

Table 2: Summary statistics for simple linear regression in 2012.

	N	Mean	Std Dev.
Rural (2012)	9034	0.41	0.49
Estimated son numbers (2012)	9034	1.1	0.62

Table 3: Summary statistics for simple linear regression in 2018.

	N	Mean	Std Dev.
Rural (2018)	10126	0.3	0.46
Estimated son numbers (2018)	10126	1.07	0.67

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4.2. DID Results

Table 4 presents DID data on rural and urban sex ratios after the two-child policy, including two scenarios that adjust for parental education. Geographically, the policy strongly impacts sex ratio. If male, the ratio is 1; if female, 0. First, rural sex ratios are 0.1149 ($p<0.05$) lower than urban after the two-child policy. Before the policy, rural sex ratio was 0.5525 and urban was 0.4868. After the policy, 0.5079 and 0.5571.

Second, columns 2-5 showed the most parental education from elementary to university. Column 5 after correcting for parental higher education. Rural sex ratio remains 0.1145 lower than urban after the two-child policy ($p<0.05$). Before the policy, rural sex ratio was 0.5518 and urban 0.481, after the policy 0.506 and 0.5502. Rural and urban boys had more births than girls before and after the approach, controlling for parental education. The policy raised urban and decreased rural sex ratios. The first and fifth columns illustrate that increasing parental education reduces the birth sex ratio.

Table 4: Difference-in-Difference estimates of the effect of the two-child policy on the probability of being a boy (born between 2012 and 2018).

	(1)	(2)	(3)	(4)	(5)
Birth Cohort	0.0703**	0.0707**	0.0696**	0.0709**	0.0692**
	(0.0282)	(0.0282)	(0.0282)	(0.0282)	(0.0283)
Rural	0.0657**	0.0604*	0.067**	0.0687**	0.0708**
	(0.0334)	(0.034)	(0.0334)	(0.0336)	(0.0341)
Birth Cohort*Rural	-0.1149**	-0.1133**	-0.1132**	-0.1158**	-0.1145**
	(0.0464)	(0.0465)	(0.0463)	(0.0465)	(0.0464)
Primary		0.0241			
		(0.0279)			
Junior			-0.0765***		
			(0.0243)		
Senior				0.239	
				(0.0298)	
Higher Education					0.0233
					(0.0309)
Constant	0.4868***	0.483***	0.5097***	0.4814***	0.4813***
	(0.0203)	(0.0208)	(0.0215)	(0.0214)	(0.0215)
Observations	1985	1985	1985	1985	1985
R-Squared	0.0039	0.0043	0.0089	0.0042	0.0042

Standard errors are in parentheses
***p<.01, **p<.05, *p<.1

4.3. Linear Regression Results

Table 5 displays linear regression findings. The first column shows respondents' planned number of boys and household registration in 2012, before the two-child ban. Rural regions wanted 1.1886 sons ($p<0.01$). After the two-child policy, rural regions sought 1.2094 boys ($p<0.01$). Both rural and urban communities had sons before and after the strategy. Despite the decrease in the sex ratio after the two-child policy, rural communities projected a high number of boys. This shows that other factors caused the sex ratio shift.

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Table 5: Results of linear regressions of area on the expected sons' numbers in 2012 and 2018.

	(1) Estimated number of sons (2012)	(2) Estimated number of sons (2018)
Rural (2012)	0.1475*** (0.0132)	
Rural (2018)		0.1939*** (0.0144)
Constant	1.0411*** (0.0085)	1.0155*** (0.0079)
Observations	9034	10126
R-squared	0.0136	0.0177

Standard errors are in parentheses
***p<.01, **p<.05, *p<.1

4.4. Robust Analysis

To avoid social influences on the DID model, placebo tests were performed. I examined the sex ratio after the 2015 two-child policy in the preceding section. This policy may have been planned. To rule out this possibility, I analysed the sex ratio results using the same sample data assuming the two-child policy was introduced in 2013 or 2014. Table 6 shows that both robustness tests are statistically negligible (p>0.1). This supports my DID analysis and the findings section.

Table 6: Placebo test of the effect of a two-child policy enacted in 2013/2014 on the sex ratio.

	(1) Policy in 2014	(2) Policy in 2013
Birth Cohort (2014)	-0.0113 (0.0398)	
Rural	-0.0235 (0.0413)	-0.0375 (0.0577)
Birth Cohort (2014)*Rural	0.0255 (0.05)	
Birth Cohort (2013)		-0.0155 (0.0502)
Birth Cohort (2013)*Rural		0.0375 (0.063)
Constant	0.5371*** (0.033)	0.5424*** (0.046)
Observations	1985	1985
R-squared	0.0002	0.0003

Standard errors are in parentheses
***p<.01, **p<.05, *p<.1

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5. Discussion

5.1. Key Findings and Impacts

This paper uses DID and linear regression methods to explore the impact of the two-child policy on the male-to-female ratio and the number of sons expected in urban and rural areas. These research methods exclude unobservable effects, and the main results are reflected in the following two areas.

Rural areas had 0.115 lower sex ratios than urban areas after the two-child policy. After the two-child requirement, rural and urban areas had sex ratios greater than 0.5, showing a preference for boys. The two-child policy skewed gender ratios in cities. In Xu's study [6], the two-child policy did not reduce gender inequality. Yet they ignored regional policy implications. Post-policy factors reduced rural sex ratios. Rural households with daughters might have two children before the two-child policy. This suggests that the strategy may not have increased boys' births since many rural residents already had sons. This finding may be due to the number of rural and urban youngsters. Zhang & Zheng [18] found that rural regions expect more children than urban locations. After the two-child restriction was enacted, urbanites were more likely to pick the sex of their children carefully to avoid financial strain. Both researches support my findings.

My second regression analysis shows that urban and rural individuals prefer a son before and after the two-child mandate. The two-child policy even increased rural son desires. These findings may suggest that parents favour sons, contributing to the gender imbalance. The sex ratio balance is affected by the anticipation of having a son. Wang. T et al.'s study [19] on women's reproductive goals following the two-child policy found that wanting a son is one of the main factors. Their findings match this article and are connected to traditional Chinese culture.

Overall, I found the two-child policy has not improved the sex ratio. Thus, the government might improve social security to lessen parents' reliance on their sons for retirement or provide a fairer employment climate for women. This might reduce gender inequality under the two-child policy by encouraging girls to have children.

5.2. Limitations

Several limitations are worth discussing. My analysis used CGSS questionnaire data rather than census data, which may limit generalizability. However, the survey's 29 provinces span a wide range of respondents' homes, making the sample data diverse and generalizable.

This questionnaire may also cause missing variables or variable bias. Bias may result from inhabitants' urban-rural classification. After adjusting for parents' education, my results remain solid. This implies that these problems are minor.

6. Conclusion

This study examined how the two-child policy influenced urban and rural child sex ratios using 2012 and 2018 CGSS survey data. DID and linear regression showed that the 1985 two-child policy did not reduce gender inequality. Urban lads outnumbered rural ones. A linear regression analysis shows that the two-child policy did not alter the predicted number of sons. Urban and rural residents want a son. People in both urban and rural regions desire at least one son.

The gender imbalance persists because traditional culture and policies impact parental preference for sons. This report suggests ways to evaluate China's two-child policy and address the imbalance. This finding may lead to pension benefits system changes and job parity for women. To evaluate the long-term effects of the two-child policy explored here, this study needs additional updated data.

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