SCIENTIFIC CULTURE

www.sci-cult.com

SCIENTIFIC CULTURE, Vol. 12, No. 2, (2026), pp. 74-85
Open Access. Online & Print

DOI: 10.5281/zenodo.1222607

THE UNINTENDED CONSEQUENCE OF THE ONE-CHILD POLICY: GENDER EQUALITY IN EDUCATION IN CHINA

Bailin Wu[1]

[1]Dyson School of Applied Economics and Management, Cornell University, NY, US, 14853, wuvictor863@gmail.com

Received: 01/12/2025
Accepted: 02/01/2026

Corresponding Author: Bailin Wu (wuvictor863@gmail.com)

ABSTRACT

This study examines how family size affects gender inequality in education under China's One-Child Policy (OCP). Using the establishment of family planning organizations and policy-related fines as instrumental variables, the analysis shows that each additional child increases the gender gap in schooling by 0.2-0.6 years. The results confirm that reducing the number of children significantly narrows gender disparities in education. Moreover, the effect is much stronger in rural areas, where son preference remains deeply rooted, than in urban areas. These findings demonstrate that the OCP, by limiting family size, unintentionally enhanced gender equality in education. The evidence supports the quality-quantity trade-off and son-preference theories, revealing that smaller families enable more equitable parental investment in children's education.

KEYWORDS: Gender Inequality In Education; One-Child Policy; Women's Empowerment; Son Preference Theory; Quality-Quantity Trade-Off Theory.

1. INTRODUCTION

Gender gaps among developing countries are an important factor in hindering the women's empowerment movement and women's emancipation. Due to social interventions and women's empowerment movements, gender gaps in education have been greatly reduced in developing countries (Gran and Behrman, 2010). As one of the largest developing countries in the world, China has made significant progress in reducing the gender gap in education over the last several decades (Wang, 2005; Guo, Hu, and Ding, 2021). Recent individual survey data show that girls' education in urban areas is even higher than boys' in urban areas among those born after 1979 (Guo, Hu, and Ding, 2021). The decline in the gender gap in education has coincided with China's one-child policy, which quickly reduced the number of children per family (Nancy, 2009). It is interesting to explore whether there is a causal relationship between the number of children and the decline in the gender gap in education. Thus, the question I aim to address in this study is: Is the number of children related to the gender gap in education? What is the role of the one-child policy (OCP) in reducing the gender gap in education in China?

Based on son preference theory, parents tend to invest more resources in boys than in girls (Das Gupta et al., 2003; Jayachandran and Kuziemko, 2011; Guo, Hu, and Ding, 2021). Since boys are perceived to have higher productivity and to bring higher returns on investment as they grow up, parents under rational choice are likely to invest more in boys' education. Another phenomenon related to gender discrimination in resource allocation stems from gender norms and patrilineal family structures (Das Gupta et al., 2003; Jayachandran, 2015). In traditional patrilineal families, men play a dominant role in society, and parents desire a son to continue the family lineage. Both factors lead parents to prefer sons over daughters, allocating more family resources to boys. Consequently, the gender gap in education tends to increase with the number of children in a family. However, since family size is endogenous, depending on family resources and parental ideals for family size, OLS regression will yield biased estimates.

The OCP provides a quasi-experimental setting to address this endogeneity problem because its implementation represented a sudden, externally imposed fertility restriction that varied across provinces and over time. The policy's enforcement intensity, determined by local family planning organizations and related fines, created exogenous variation in family size that was unrelated to individual households' socioeconomic choices. Thus, it offers a unique opportunity to identify the causal effect of the number of children on gender inequality in education in China.

Using the establishment of family planning organizations to implement the OCP policy, along with its associated fines and bonuses, as valid instrumental variables, I have examined the impact of the number of children on the gender gap in education in China. OLS estimation shows that the number of children has a mild impact on gender inequality in education, with one additional child leading to boys gaining an additional 0.21 years of schooling compared to girls. However, using IV methods, the results reveal that the gender gap in education increases by 0.60–0.70 years of schooling with the birth of one more child in a family. This indicates that the implementation of the one-child policy in China, which reduced the average number of children from 3 in the late 1960s to about 1.5 in the early 1980s, has decreased the gender gap in education between boys and girls by approximately one year, on average, during this period.

Moreover, I have investigated the heterogeneous impact of the OCP on gender equality in education. Traditional perspectives suggest that gender attitudes and son preference are more pronounced in rural areas than in urban regions. Therefore, family size may have a greater impact on gender equality in education in rural areas compared to urban regions. By running separate regressions based on samples from rural and urban regions, I find that having one fewer child improves gender equality in education by approximately 0.84 years of schooling in rural areas compared to 0.46 years of schooling in urban areas. These findings confirm that the phenomenon of son preference is more severe in rural areas than in urban regions.

The paper is organized as follows: Section 2 provides a literature review, summarizing the OCP in China and its historical development. Section 3 introduces empirical strategies and instrumental variables for family size. Section 4 describes the data and sample used in the paper. Section 5 presents the empirical findings, including the regression results, robustness checks, and the mechanisms underlying the main findings. The final section concludes the paper.

2. LITERATURE

China's demographic and population control policies can be traced back to the 1960s when

Chairman Mao made two announcements regarding birth control and reducing population growth (Whyte, Feng, and Cai, 2015). In 1964, China established the Birth Planning Commission to regulate population and family planning policies, promoting contraceptive use in both urban and rural areas. Subsequently, the establishment of the "Family Planning Leadership Group" by China's State Council promoted the "Later, Longer, Fewer" policy. Local governments formed provincial leadership groups to independently implement this policy.

The one-child policy (OCP) was formally introduced in 1979 to reduce the fertility rate (Zhang, 2017). Under this policy, the government used fines and bonuses to enforce birth quotas and control population growth. Provinces established formal organizations, such as provincial Family Planning Committees, to meet targets set by the central government and regulate the number of children per family. Notably, population and family planning policies in China which were initially introduced in the early 1970s as voluntary measures encouraging couples to have just one child were implemented as one mandatory policy across the nation. The slogan during this period, "Later, Longer, Fewer," promoted marrying later, delaying childbirth, and having fewer children.

Additionally, after Deng Xiaoping came to power, China began enforcing stricter birth control measures, as Deng favored controlling population growth (Zhang, 2017). As a result, fertility rates in China quickly declined. Local governments employed coercive enforcement techniques, including abortion and sterilization, resulting in about 10 million abortions annually during the 1980s (Whyte, Feng, and Cai, 2015; Ebenstein, 2010). Another consequence of the OCP was a sharp drop in the total fertility rate (TFR), which decreased from 2.6 in 1989 to 1.5 in 2010 (Cai, 2013). However, this policy also led to an imbalanced sex ratio, rising to 120 men for every 100 women in 2010. These unintended consequences prompted widespread criticism from scholars and ultimately led the central government to abandon the OCP in 2016 (Ebenstein, 2010; Cai, 2013; Feng, Gu, and Cai, 2016).

One significant consequence of the OCP is the unbalanced sex ratio and the phenomenon of missing girls due to sex-selective abortion and related technologies. Li, Yi, and Zhang (2011) examine this issue using a difference-in-differences approach. Since the birth control policy applied only to Han Chinese and not to ethnic minorities, they compared the sex ratios between these groups to estimate the policy's impact. Their analysis shows that the OCP increased the sex ratio among Han Chinese by 4.4% per 1,000 women, accounting for about one-third of the rising sex ratio during this period. Ebenstein (2010) uses an instrumental variable approach to estimate the number of missing women due to the OCP. He finds that stricter OCP enforcement, measured through fines and bonuses, led to lower fertility rates and higher sex ratios at the provincial level.

This paper contributes to the study of gender inequality by examining how family size influences the gender gap in educational attainment, particularly under the OCP. The son preference theory suggests that parents disproportionately allocate resources to sons over daughters, a pattern widely documented in prior research. For example, Jayachandran and Kuziemko (2011) find that Indian parents shorten breastfeeding durations for daughters to prepare for future pregnancies aimed at producing sons. In China, Guo, Hu, and Ding (2021) show that parental discrimination favors boys in educational investments, particularly in multi-child households. Although previous studies highlight the relationship between family size and gender disparities, many fail to account for the endogeneity of family size. This paper addresses this limitation by leveraging exogenous variations in family size introduced by the OCP, providing robust evidence on how shrinking family size has reduced gender inequality in education.

The study also contributes to the literature on the quantity-quality trade-off, a theory proposed by Becker, which posits that reductions in family size enable parents to focus more resources on the quality, rather than the quantity, of their children. Previous research provides mixed evidence on this trade-off due to methodological challenges. For instance, Angrist, Lavy, and Schlosser (2010) demonstrate a trade-off in OLS models but not in instrumental variable analyses, while Rosenzweig and Zhang (2009) find that larger families negatively impact children's education and health outcomes in China. Nancy (2009), however, suggests that relaxing the OCP increases school enrollment, highlighting potential benefits of larger families under certain conditions. By using robust instruments derived from the OCP's enforcement, this paper provides new evidence on the trade-off's mechanisms, illustrating how family size reductions drive improvements in children's education while influencing gender equity outcomes.

3. MODEL AND IDENTIFICATION STRATEGY

To examine the impact of family size on gender equality, I incorporate an interaction term, $Male \times Number\ of\ children$, to estimate its effect. Educational attainment is measured in years of schooling, and the following regression model is employed:

(1) $$EDU_{irs} = \beta 0 + \beta 1\ Male_{irs} + \beta 2\ Children_{irs} + \beta 3\ (Male_{irs} * Children_{irs}) + X'\theta + e_{irs}$$

Here:

- EDU_{is}: Years of schooling for individual i in region r from survey s.
- $Male_{irs}$: A gender dummy variable (1 for male, 0 for female).
- $Children_{irs}$: Family size, calculated as the number of siblings plus one, based on the counts of individual's brothers and sisters.
- $Male_{irs} * Children_{irs}$: The interaction term, capturing the impact of family size on gender inequality, potentially driven by son preference or differential returns to education between sons and daughters.
- X: A vector of covariates, including age, rural dummy, parental education (father's and mother's highest degrees), provincial fixed effects, and survey fixed effects.

Parental education is categorized into five levels: no education, primary, secondary, high school, and college or above. Based on son preference theory, parents are assumed to invest more resources in sons than daughters as family size increases. Consequently, I expect β3>0β3>0, indicating that larger family sizes exacerbate gender inequality in education due to resource allocation biases favoring sons.

After Becker introduced economic theory to analyze family behavior and highlighted the quality-quantity trade-off in parental investment in children's human capital (Becker and Lewis, 1973; Becker and Tomes, 1976), scholars have empirically tested these theories using data from both developing and developed countries (Angrist, Lavy, and Schlosser, 2010; Caceres-Delpiano, 2006; Rosenzweig and Wolpin, 1980; Rosenzweig and Zhang, 2009). To address endogeneity issues between family size and parental investment, prior research has often relied on within-family variations, such as those driven by sex composition or twin births.

In this paper, we leverage exogenous variation in the strictness of implementing the one-child policy (OCP) across provinces in China. Ebenstein (2010)[1] confirmed that OCP-related fines and bonuses significantly influenced fertility rates and family size across provinces. As fines and bonuses were only introduced by local family planning committees after 1979, we incorporate two additional variables to measure the strictness of population control and family planning implementation in different provinces: the establishment of Family Planning Leadership Groups and Family Planning Committees.

As Peng (1997) noted, China shifted its population policy from "the more, the better" to "family planning" with voluntary birth control in the early 1970s, prompting the establishment of Family Planning Leadership Groups at both the state and provincial levels. After the OCP was officially introduced in 1979, local governments successively established Family Planning Committees to enforce the policy. To capture this, we use two dummy variables indicating whether a province had established a Family Planning Leadership Group or Family Planning Committee during these periods.

Thus, the first stage regression of our IV method can be written as,

3.1. First Stage Regression

$$Children_{irt} = \alpha 0 + \alpha 1 * Fines_{rt} + \alpha 2\ Bonus_{rt} + \alpha 3\ Leadership\ Group_{rt} + \alpha 3\ Committee_{rt} + u_{irt}$$

Here, $Children_{irt}$ represents the number of children in the family of individual i in region r and birth year t. *Leadership Group* and *Committee* indicate whether region r had established a Family Planning Leadership Group or a Family Planning Committee after year t. Fines are measured in multiples of the local average monthly salary, while bonuses are measured in RMB[2].

3.2. Second Stage Regression

(2) $$EDU_{irs} = \beta 0 + \beta 1\ Male_{irs} + \beta 2\ \widehat{Children}_{irs} + \beta 3\ \left(Male_{irs} * \widehat{Children}_{irs}\right) + X'\theta + e_{irs}$$

Appendix Table B demonstrates that the instruments effectively explain cross-province variation in family size. Since fines and bonuses were introduced only after the implementation of the OCP in 1979, the two dummies related to Family Planning organizations prove more robust when including

[1] Ebenstein (2010) utilized fines and bonuses to measure variations in the strictness of one-child policy enforcement across regions, demonstrating that these measures are linked to provincial or prefectural officials' incentives to implement the OCP based on local demographic and social conditions.

[2] Data on fines and bonuses are generously provided by Ebenstein (2010), while the dummy variables for the establishment of Family Planning Leadership Groups and Family Planning Committees are manually compiled from official documents (Peng, 1997).

individuals born before 1978.

4. DATA AND SAMPLE SELECTION

This paper uses data from the China General Social Survey (CGSS) and the 2005 China Census. The CGSS is a biennial survey launched in 2003, but only the 2006, 2008, and 2017 waves include data on the number of siblings, allowing the definition of family size as siblings plus one. CGSS data also provide information on parental education, and we can categorize their education into five levels: no education, elementary, secondary, high school, and college or above. For analysis, the category of higher educational levels include parents with college certificate, bachelor degree or post-graduate degrees as parents with bachelor degree or post-graduate degrees are rare in the sample[3].

The CGSS surveys include 10,000–11,000 randomly selected participants from 30 provinces in China. This study focuses on individuals born between 1970–1995 who were at least 21 years old at the time of the survey, ensuring they had likely completed their highest degree during the survey. Family planning policies began in the early 1970s, so individuals born earlier are excluded. Educational attainment is converted to years of schooling based on China's system: 0 for illiteracy, 3 years for some education, 6 for elementary, 9 for secondary, 12 for high school, 14 for some college, 16 for a bachelor's degree, and 18 for postgraduate education.

As shown in table 1, valid sample for final empirical analysis includes 9550 individuals aged from 23 to 47 from 30 provinces[4]. Most of them are younger than 38, and only those from the 2017 CGSS survey have individuals aged over 39. Thus, our sample focus on individuals aged from 20 to 40 in China. The maximum of number of children is 21, reflecting that large family size is not rare among individuals born in the 1970s. The statistics of birth year indicates that our sample evenly distributed before and after the OCP as the mean of birth year is around 1979 in the sample.

Table 1: Data Summary and Basic Statistics.

Variable	Obs	Mean	Std. dev.	Min	Max
Years of schooling	9,539	10.71	3.911	0	18
Kids	9.550	2.38	1.675	1	21
Age	9.550	33.26	6.533	23	47
Birth Year	9.550	1978.55	6.396	1970	1994
Male	9.550	0.46	0.498	0	1
Parental Degree					
-Father	8,067	1.50	1.115	0	4
-Mother	8,107	1.08	1.068	0	4
Rural	9,530	0.48	0.499	0	1
Fines (Manitude of monthly wage)	4,377	1.22	0.766	0.1	5
Bonus (RMB)	4,377	794.2	178.2	407.3	2253.9
Leadership Group	9,550	0.46	0.498	0	1
Family Planing Committee	9,550	0.28	0.448	0	1

Note: 1) Parental Educational Attainment Is Divided into Five Categories 0 - No Education, 1 - Primary, 2 -Secondary, 3 -High School, 4 -College or Above.
2) Data Are Based on the 2006,2008, And 2017 OGSS Surveys, With A Sample of Individuals Born Between 1970 And 1990, Aged 21 Or Older.
3) Leadership And Committee Are Dummy Variables Indicating Whether A Local Province Had Established These Organizations at the Time the Individuals Were Born.
4) Fines Are Measured in Muitiples of Monthly Wages, While Bonuses Are Measured In RMB
5) Years Of Schooling Are Generated Based on Highest Degree, 0 (No Education), 3(Some Edu.)6 (Primary), 9 (Secondary), 12 (High School), 14 (College), 16 (Bachelor Degree), End 18 (Post-Graduate Degree)

We also use the 2005 Census data for robustness checks. However, since the 2005 Census does not include information on respondents' parental background, we cannot control for parental educational attainment in the final regressions. Additionally, the Census only collects data on the number of siblings for individuals born after 1974, limiting the valid sample to individuals born between 1974 and 1984. This results in a final sample of 360,920 observations from 31 provinces in China[5].

5. EMPIRICAL RESULTS AND DISCUSSION

We use an interaction term, the gender dummy multiplied by the number of children, to examine the

[3] The sample in this paper focuses on individuals born between 1970 and 1995, meaning their parents were typically born between 1940 and 1970—a period when access to higher education, particularly college, was very limited.

[4] There are 31 provinces or metropolitans in China, and the CGSS sample does not include residents from Tibet province.

[5] A summary of the 2005 Census data is available upon request.

impact of family size on gender equality in education. Both OLS and 2SLS regressions, based on equations (1) and (2), are reported. Since gender inequality in education reflects parents' differing investment in sons versus daughters' human capital, its patterns may vary significantly between rural and urban regions due to returns to human capital or cultural norms (Das Gupta et al., 2003). Consequently, the third part of this section explores this heterogeneous effect in detail by running regression based on rural and urban sample, separately.

5.1. OLS Regression

The regression results based on equation (1) are presented in Table 2. The baseline regression, which does not include fixed effects, reveals that boys in one-child families have 0.48 more years of schooling on average compared to girls. Additionally, as family size increases, gender inequality widens: each additional child is associated with a 0.19-year reduction in girls' schooling relative to boys.

Column (2) controls for regional fixed effects, and column (3) includes both regional and survey fixed effects. The results demonstrate that the impact of family size on gender inequality remains consistent across specifications, with each additional sibling reducing girls' schooling by approximately 0.2 years relative to boys.

The model includes four categorical variables to capture the impact of parental education on children's schooling: primary, secondary, high school, and college or above, with the reference group being illiterate parents. Unlike traditional findings (e.g., Holmlund et al., 2011), our results indicate that fathers' education exerts a stronger influence on children's educational attainment compared to mothers' education. This pattern likely reflects traditional gender and household structures in China during the study period, where fathers were the primary earners and decision-makers regarding educational investment. Higher paternal education often translated into greater income stability and stronger aspirations for children's academic success, particularly for sons. Meanwhile, mothers' educational influence may have been constrained by lower labor-force participation and limited autonomy in family decision-making. This divergence may therefore be attributed to both socio-cultural norms and parental role differentiation in intergenerational education transmission.

Unlike Holmlund et al. (2011), we do not control for family income in our regression due to data limitations in the survey, which could partially explain differences in the observed impact of parental education. Despite these constraints, the findings underscore the persistence of gender disparities in education within larger families and emphasize the critical role of parental education in shaping children's educational outcomes. Table 2 summarizes these OLS results, showing that boys gain schooling advantages while larger family size exacerbates girls' disadvantages.

Table 2: OLS Regression.

OLS	(1)	(2)	(3)
Male	0.29* (0.12)	0.28** (0.11)	0.24** (0.11)
Number of Kids	-0.41*** (0.026)	-0.36*** (0.026)	-0.17*** (0.028)
Male * Kids	0.19*** (0.042)	0.19*** (0.041)	0.21*** (0.040)
Age	-0.070*** (0.0054)	-0.074*** (0.0054)	-0.11*** (0.0059)
Rural	-2.62*** (0.074)	-2.46*** (0.074)	-2.77*** (0.076)
Parental education			
– Dad primary	0.95*** (0.11)	0.87*** (0.10)	0.84*** (0.10)
– Dad secondary	1.73*** (0.12)	1.58*** (0.12)	1.51*** (0.12)
– Dad high	2.11*** (0.14)	1.92*** (0.14)	1.82*** (0.14)
– Dad college+	2.85*** (0.21)	2.67*** (0.21)	2.64*** (0.21)
– Mom primary	0.87*** (0.093)	0.75*** (0.092)	0.73*** (0.091)
– Mom secondary	1.43*** (0.12)	1.20*** (0.12)	1.12*** (0.12)
– Mom high	2.01*** (0.16)	1.63*** (0.16)	1.50*** (0.15)
– Mom college+	2.72*** (0.26)	2.27*** (0.26)	2.03*** (0.25)
Constant	12.9*** (0.24)	14.0*** (0.28)	14.5*** (0.28)
Province FE	No	Yes	Yes
Survey FE	No	No	Yes
N	7884	7884	7884
R^2	0.44	0.47	0.48

Note:1. All Regressions Are Based on the 2006, 2008 And 2017 CGSS Survey Data with Individuals Born Between 1970 And 1990, Aged 21 Or Above During the Survey.

2. Standard Errors in Parentheses. * P<0.10, ** P<0.05, *** P<0.01

5.2. Using Exogenous Variation of The OCP As Instruments

As Angrist, Lavy, and Schlosser (2010) highlight, a key challenge in identifying the quality-quantity trade-off is omitted variable bias, which can distort estimates of the impact of family size on children's outcomes. To address this issue, researchers have used instrumental variables to introduce exogenous variation in family size. For instance, twin births (Rosenzweig and Wolpin, 1980; Rosenzweig and Zhang, 2009) and same-sex siblings (Caceres-Delpiano, 2006) have been utilized as natural experiments to identify causal effects. Similarly, this study employs variables reflecting the strictness of One-Child Policy (OCP) enforcement as instruments to mitigate endogeneity concerns and isolate the causal relationship between family size and children's outcomes.

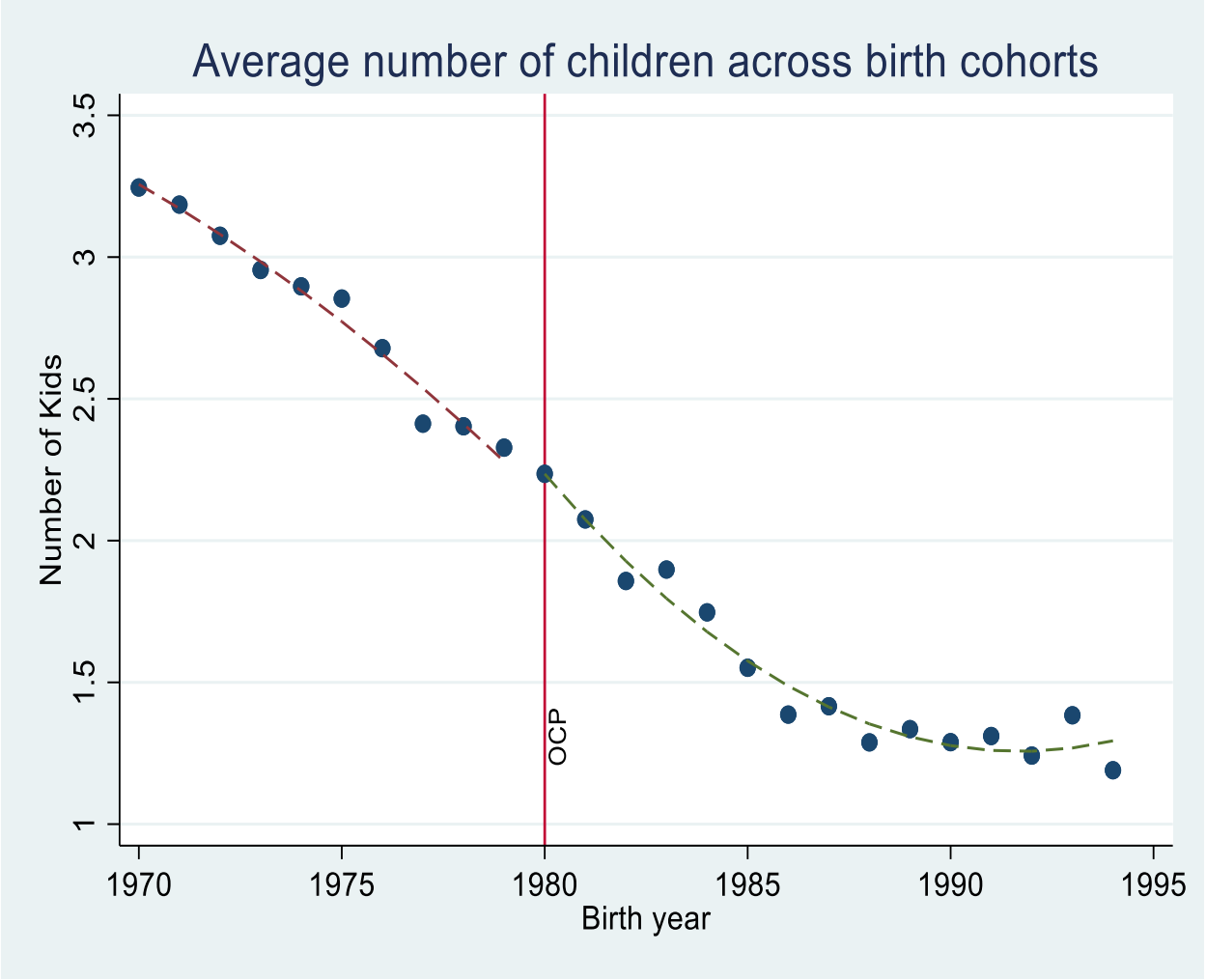

Figure 1: Average Number of Kids from 1970 to 1990.

As illustrated in Figure 1, the average family size in China declined sharply during the 1970s, dropping from approximately 3.5 children per family in 1970 to about 1.5 children per family by 1985. This significant reduction reflects the impact of policies and organizational efforts to implement the One-Child Policy (OCP) and enforce family planning measures[6]. As shown in Appendix Table B, we employ two sets of instruments to capture regional variation in family size during the 1970–1990 period. The first set consists of two variables reflecting the strictness of implementing the One-Child Policy (OCP) after 1979, while the second set captures the timing of establishing family planning organizations across regions. All instruments are robust and statistically significant across various model specifications,

[6] Qin et al. (2017) used a regression discontinuity (RD) design to study the effects of the OCP on child outcomes. However, given the characteristics of our data, the RD method is not applicable. Instead, an instrumental variable (IV) approach is more suitable for identifying the causal impact of family size on child outcomes in this context。

demonstrating that regional differences in family size are exogenous and not influenced by parental or family characteristics. These results support the validity of the instruments for addressing potential endogeneity concerns.

Table 3: IV Regression.

IV method	(1)	(2)	(3)
Male	-0.61** (0.27)	-0.74*** (0.26)	-0.77*** (0.26)
Predicted Kids Number	-1.49*** (0.088)	-1.32*** (0.088)	0.081 (0.14)
Male * predicted Kids	0.57* (0.11)	0.63* (0.11)	0.64* (0.11)
Age	0.0072 (0.0068)	-0.0085 (0.0069)	-0.15*** (0.012)
Rural	-2.78*** (0.075)	-2.60*** (0.075)	-2.79*** (0.076)
Parental education			
– Dad primary	1.00*** (0.11)	0.91*** (0.10)	0.86*** (0.10)
– Dad secondary	1.78*** (0.12)	1.62*** (0.12)	1.54*** (0.12)
– Dad high	2.09*** (0.14)	1.91*** (0.14)	1.84*** (0.14)
– Dad college+	2.94*** (0.21)	2.77*** (0.21)	2.66*** (0.21)
– Mom primary	0.92*** (0.092)	0.78*** (0.092)	0.74*** (0.091)
– Mom secondary	1.47*** (0.12)	1.22*** (0.12)	1.15*** (0.12)
– Mom high	1.99*** (0.16)	1.61*** (0.16)	1.55*** (0.15)
– Mom college+	2.70*** (0.26)	2.26*** (0.26)	2.07*** (0.25)
Constant	12.9*** (0.26)	14.2*** (0.29)	14.7*** (0.30)
Province FE	No	Yes	Yes
Survey FE	No	No	Yes
N	7884	7884	7884
R^2	0.44	0.47	0.48

Notes: 1. All Regressions Are Based on the 2006, 2008, And 2017 CGSS Survey Data, With Individuals Born Between 1970 And 1990, Aged 21 Or Older at The Time of The Survey.
2. Standard Errors in Parentheses, * P<0.10, ** P<0.05, *** P<0.01
3. The Ivs for The First-Stage Regression Include Fines for Exceeding the Birth Limit, Bonuses for Having One Child, And Indicators for The Establishment of Leadership Groups and Family Planning Committees, With F-Statistics Equal To 360.28.

Using the predicted number of children as an explanatory variable, we employ the two-stage least squares (2SLS) method to estimate the effect of family size on gender equality in education. The results, detailed in Table 3, demonstrate a stronger causal relationship between family size and the gender gap in education compared to the ordinary least squares (OLS) estimates. Specifically, the 2SLS results suggest that OLS underestimates the impact of family size on widening gender inequality (Bhalotra and Clarke, 2019).

The analysis reveals that, on average, boys receive 0.10 fewer years of education compared to girls in cohorts born between 1970 and 1990, a trend likely driven by the reversal of gender inequality observed in urban areas after 1985. Furthermore, for each additional child in the family, the gender gap narrows by 0.60 years of schooling, reflecting a shift in traditional educational disparities. Consistent with the OLS findings, fathers' education continues to have a more substantial impact on children's educational attainment than mothers' education. These findings underscore the importance of addressing endogeneity in analyses and provide valuable insights into evolving gender dynamics in education over time.

5.3. Heterogenous Effect Between Rural and Urban Areas

As Das Gupta et al. (2003) highlight, parental preferences for investing in children's human capital often reflect cultural norms, such as son preference or adherence to patrilineal systems. In regions where son preference is more pronounced, parents disproportionately allocate resources to sons over daughters. Zhang (2017) underscores how urbanization has contributed to narrowing the gender gap in education, while Fong (2002) attributes improvements in urban women's opportunities to demographic shifts associated with the one-child policy (OCP). However, few studies explicitly compare gender inequality in educational investment between rural and urban areas, even though the phenomenon of son preference remains persistent and deeply rooted in rural China.

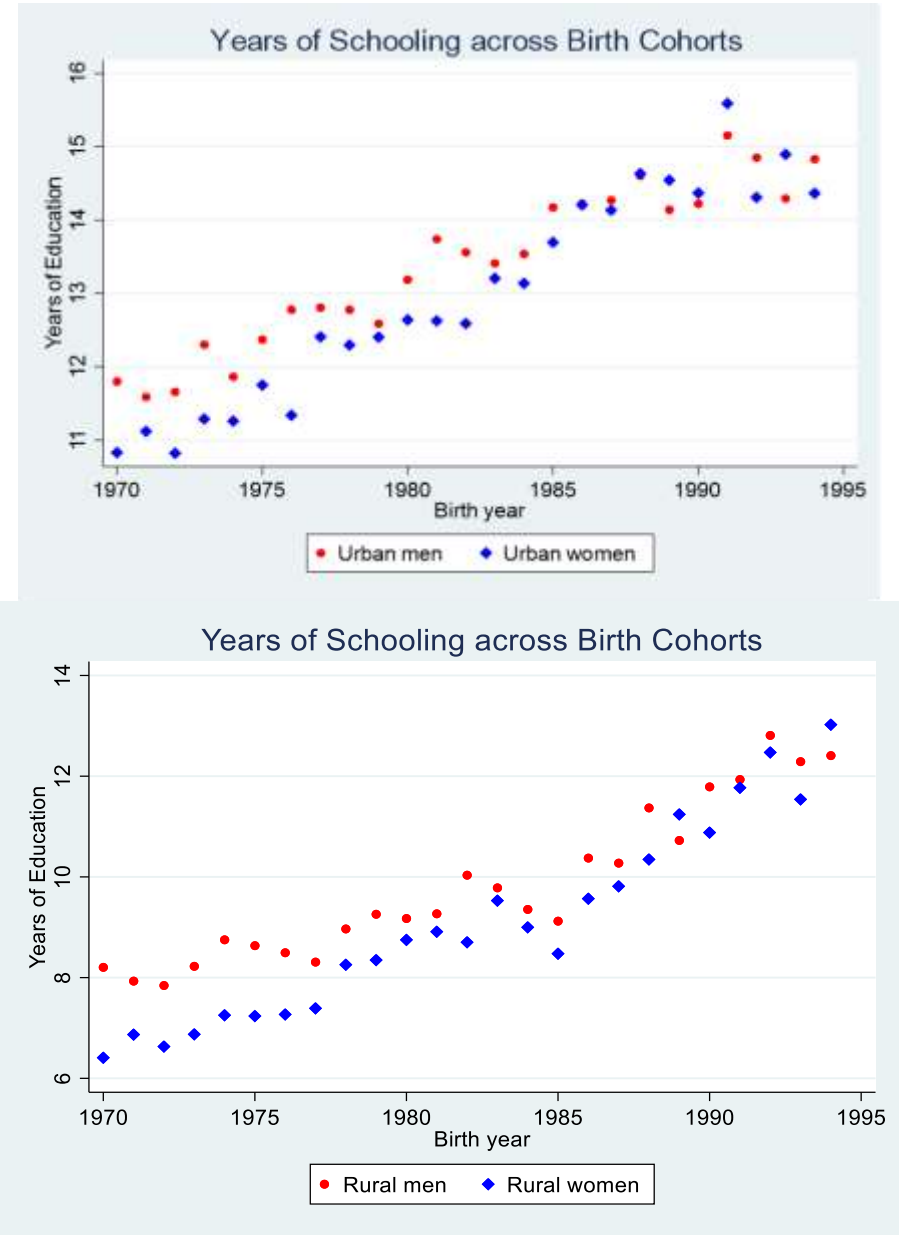

Figure 2: Gender Gap In Education in Rural and Urban Areas.

To address this gap, this study examines the differential impact of family size reduction on gender inequality in rural and urban contexts. By analyzing these samples separately, it investigates how socio-economic and cultural factors shape the dynamics of parental investment. Figure 2 illustrates that, on average, urban girls surpassed urban boys in years of schooling after 1985, while the reversal of the gender gap in rural areas occurred only after 1990. These trends reveal distinct patterns in the evolution of gender inequality in education across rural and urban regions following the implementation of the One-Child Policy (OCP).

Table 4 presents the empirical results derived from equations (1) and (2). The OLS estimates suggest that the reduction in family size has contributed to faster improvements in gender equality in urban areas compared to rural areas. However, as discussed earlier, OLS estimates are subject to bias. Using the instrumental variable (IV) method to account for endogeneity, the analysis confirms that daughters in rural regions benefit more from smaller family sizes than sons. These findings align with the hypothesis of son preference (Das Gupta et al., 2003), highlighting that in rural areas, parents are more likely to prioritize sons for their role in providing elder care and maintaining the patrilineal system. This underscores the persistent cultural influence of son preference in shaping educational outcomes for rural girls and boys. The

results also support Zhang (2017)'s argument that the process of urbanization is good for improving women empowerment and reducing gender inequality in China.

Table 4: Heterogenous Effect.

	OLS Regression		IV	
	Urban (1)	Rural (2)	Urban (3)	Rural (4)
Male	-0.024 (0.15)	0.56*** (0.16)	-0.55 (0.35)	-1.03*** (0.37)
Number of Kids	-0.29*** (0.043)	-0.11*** (0.038)	-0.068 (0.18)	0.16 (0.21)
Male * Kids	0.24* (0.060)	0.16* (0.055)	0.46* (0.14)	0.84* (0.15)
N	4136	3748	4136	3748
R^2	0.33	0.34	0.32	0.34

Notes:1. All Regressions Are Based on the 2006, 2008, And 2017 CGSS Survey Data, With Individuals Born Between 1970 And 1990, Aged 21 Or Older at The Time of The Survey.
2. Standard Errors in Parentheses, * P<0.10, ** P<0.05, *** P<0.01
3. All Regressions Are Full Set of Controls, Including Age, Mother and Father's Education, Province and Survey Fixed Effects.
4. The Ivs for The First-Stage Regression Include Fines for Exceeding the Birth Limit, Bonuses for Having One Child, And Indicators for the Establishment of Family Planning Leadership Groups and Family Planning Committees.
5. IV Regression Kids Denotes the Predicted Number of Kids Based on First-Stage Regression.

5.4. Robustness Check with the 2005 Census Data

To ensure the robustness of the findings in this paper, we also conduct a robustness check using data from the 2005 Census. A notable advantage of the 2005 Census is that its questionnaire includes information on the number of brothers and sisters for each respondent, enabling us to calculate family size based on sibling data. However, this survey collects sibling information only for individuals born after 1974, restricting our analysis to those born between 1974 and 1984. This subset provides a sample of 360,920 observations spanning 31 provinces in China, offering an additional dataset to validate the study's conclusions.

Table 5 presents the results based on the 2005 Census data, encompassing both OLS estimates from equation (1) and IV estimates from equation (2). The F-statistic from the first-stage regression confirms that the four instrumental variables are robust and significantly explain the variation in family size across provinces and over time. The first three columns report OLS results, suggesting that daughters benefit more from smaller family sizes in urban areas compared to rural areas. However, this may reflect biased estimation due to the stricter implementation of the OCP in urban regions. Using IV estimation to account for endogeneity confirms that women, particularly in rural areas, gain significantly from smaller family sizes, where deep-rooted son-preference culture plays a critical role. The results from IV methods show that the gender gap in education has narrowed by 0.40 years in rural areas compared to 0.20 years in urban areas. This suggests that, under the OCP, financially constrained parents in rural regions were able to allocate more resources to their daughters, thereby reducing gender disparities in education.

Table 5: Robustness Check with the 2005 Census Data.

	OLS (1)	OLS: Rural (2)	OLS: Urban (3)	IV (4)	IV: Rural (5)	IV: Urban (6)
Male	-0.0073 (0.017)	0.22*** (0.021)	-0.23*** (0.031)	-0.62*** (0.042)	-0.58*** (0.051)	-0.40*** (0.077)
Number of Kids	-0.29*** (0.0040)	-0.23*** (0.0045)	-0.42*** (0.0089)	-0.098 (0.063)	-0.23*** (0.072)	0.21* (0.12)
Male * Kids	0.13* (0.0055)	0.091* (0.0063)	0.13* (0.013)	0.36* (0.015)	0.39* (0.018)	0.19* (0.029)
Age	-0.080*** (0.0014)	-0.090*** (0.0015)	-0.048*** (0.0028)	-0.097*** (0.0034)	-0.097*** (0.0038)	-0.091*** (0.0067)
Rural	-3.43*** (0.0092)			-3.60*** (0.0090)		
Constant	16.3*** (0.044)	12.6*** (0.056)	15.9*** (0.079)	16.4*** (0.069)	12.8*** (0.084)	15.9*** (0.13)
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
N	360920	252833	108087	360920	252833	108087
R^2	0.43	0.20	0.10	0.42	0.19	0.08

Notes: 1. All Regressions Are Based on the 2005 Census Data with Individuals Born Between 1974 And 1984, Aged 21 Or Above During the Survey.
2. Standard Errors in Parentheses, * P<0.10, ** P<0.05, *** P<0.01
3. The Ivs for the First-Stage Regression Include Fines for Exceeding the Birth Limit, Bonuses for Having One Child, And Indicators for the Establishment of Leadership Groups and Family Planning Committees, With F (34, 360885) = 1694.883 And Adjusted R^2 = 0.14

6. CONCLUSION

This paper explores the relationship between family size and gender inequality in education through the lens of son preference theory, a phenomenon deeply rooted in many Asian cultures. Using the OCP and its associated fines as instrumental variables, the study assesses how the

number of children affects the gender gap in education in China. The results indicate that having fewer children significantly reduces gender disparities in years of schooling. On average, one additional child per family widens the gender gap in education by 0.6 year, representing approximately 6% of the average years of schooling in China. This finding underscores the persistent son-preference culture, as parents tend to invest more in boys' education with the rising of family size. Further analysis reveals that the impact of family size on gender disparity is more pronounced in rural areas, highlighting the deeper entrenchment of son preference in these regions compared to urban areas.

The empirical findings suggest that the recent strides in women's empowerment in China are closely linked to the OCP. By limiting the number of children per family, the policy inadvertently enabled parents to allocate more educational resources to their daughters, thereby improving women's educational attainment and social status (Fong, 2002; Zhang, 2017). However, with the relaxation of fertility control policies, from the One-Child Policy to the Two-Child Policy (2016) and later the Three-Child Policy (2021), the demographic and cultural environment surrounding gender equality is undergoing rapid transformation. The revival of larger families may reintroduce gender-biased investment behaviors, particularly in regions where son preference remains pronounced.

To prevent such regressions, policymakers should integrate gender-equality objectives into the design of pro-natalist measures. This includes offering targeted scholarships, conditional cash transfers, and rural education subsidies for girls, as well as promoting public campaigns that challenge patriarchal norms. Expanding parental leave for both fathers and mothers and encouraging equal participation in childcare can also help redistribute household responsibilities and promote gender equity. Moreover, continued investment in rural education infrastructure and public childcare services would reduce opportunity costs for parents and create a more equitable environment for female education under flexible fertility policies.

The evidence presented reinforces the notion that smaller family sizes contribute to reduced gender inequality in education. Nonetheless, the challenge of balancing gender equality with the government's objective of increasing total fertility rates (TFR) requires nuanced policy coordination. Future fertility policies should adopt a dual-goal framework, encourage childbirth while safeguard equal opportunities for boys and girls. This approach not only supports sustainable population growth but also ensures that gender equality remains a central pillar of China's human capital strategy.

Future research could build on these findings by leveraging regression discontinuity design (RDD) to identify the short-term effects of the OCP on gender inequality, particularly for individuals born around 1979 when the policy was implemented[7]. Additionally, incorporating variables that directly capture son preference could provide a quantitative evaluation of its influence on gender inequality in education and evaluate its mechanism in enlarging gender disparities in education. This extended analysis would offer further insights into the complex interplay between family size, cultural norms, and educational outcomes in China.

REFERENCES

Angrist, Joshua, Victor Lavy, and Analia Schlosser. 2010. "Multiple Experiments for the Causal Link between the Quantity and Quality of Children." *Journal of Labor Economics* 28 (4): 773-824.

Becker, Gary S, and H. Gregg Lewis. 1973. "On the Interaction between the Quantity and Quality of Children." *Journal of Political Economy* 81 (2, Part 2): S279-288.

Becker, Gary S, and Nigel Tomes. 1976. "Child Endowments and the Quantity and Quality of Children." *Journal of Political Economy* 84 (4, Part 2): S143-162.

Bhalotra, Sonia and Damian Clarke. 2019. "The Twin Instrument: Fertility and Human Capital Investment." *Journal of the European Economic Association* 18 (6): 3090-3139.

Caceres-Delpiano, Julio. 2006. "The Impacts of Family Size on Investment in Child Quality." *The Journal of Human Resources* XLI (4): 738–54.

Cai, Yong. 2013. "China's New Demographic Reality: Learning from the 2010 Census." *Population and Development Review* 39 (3): 371-396.

Das Gupta, Monica, Jiang Zhenghua, Li Bohua, Xie Zhenming, Woojin Chung, and Bae Hwa-Ok. 2003. "Why is

[7] Qin et al. (2017) has applied the regression discontinuity method to identify the improvement of child quality due to the OCP.

Son Preference so Persistent in East and South Asia? a Cross-Country Study of China, India and the Republic of Korea." *The Journal of Development Studies* 40 (2): 153-187.

Ebenstein, Avraham. 2010. "The "Missing Girls" of China and the Unintended Consequences of the One Child Policy." *The Journal of Human Resources* 45 (1): 87-115.

Fong, Vanessa L. 2002. "China's One-Child Policy and the Empowerment of Urban Daughters." *American Anthropologist* 104 (4): 1098–1109.

Grant, Monica J and Jere R Behrman. 2010. Gender Gaps in Educational Attainment in Less Developed Countries," *Population and Development Review*, 36 (1), 71-89.

Guo, Hao, Chenxu Hu and Xiaozhou Ding. 2021. Son Preference, Intrahousehold Discrimination, and the Gender Gap in Education in China. Working paper.

Holmlund, Helena, Mikael Lindahl, and Erik Plug. "The Causal Effect of Parents' Schooling on Children's Schooling: A Comparison of Estimation Methods." *Journal of Economic Literature* 49, no. 3 (2011): 615–51.

Jayachandran, Seema and Ilyana Kuziemko. 2011. "Why do Mothers Breastfeed Girls Less than Boys? Evidence and Implications for Child Health in India." *The Quarterly Journal of Economics* 126 (3): 1485-1538.

Jayachandran, Seema. 2015. "The Roots of Gender Inequality in Developing Countries." *Annual Review of Economics* 7 (1): 63–88.

Li, Hongbin, Junjian Yi, and Junsen Zhang. 2011. "Estimating the Effect of the One-Child Policy on the Sex Ratio Imbalance in China: Identification Based on the Difference-in-Differences." *Demography* 48 (4): 1535-1557.

Qian, Nancy, Research, 2009. *Quantity-Quality and the One Child Policy: The Only-Child Disadvantage in School Enrollment in Rural China* National Bureau of Economic Research, No. 14973.

Qin, Xuezheng, Castiel Chen Zhuang, and Rudai Yang. 2017. "Does the One-Child Policy Improve Children's Human Capital in Urban China? A Regression Discontinuity Design." *Journal of Comparative Economics* 45 (2): 287–303.

Rosenzweig, Mark R, and Kenneth Wolpin. 1980. "Testing the Quantity-Quality Fertility Model: The Use of Twins as a Natural Experiment." Econometrica 48 (1): 227–40.

Rosenzweig, Mark R. and Junsen Zhang. 2009. "Do Population Control Policies Induce More Human Capital Investment? Twins, Birth Weight and China's "One-Child" Policy." *The Review of Economic Studies* 76 (3): 1149-1174.

Wang, Wendy. 2005. "Son Preference and Educational Opportunities of Children in China—'I Wish You were a Boy!'." *Gender Issues* 22 (2): 3-30.

Whyte, Martin King, Wang Feng, and Yong Cai. 2015. "Challenging Myths about China's One-Child Policy." *The China Journal (Canberra, A.C.T.)* 74 (1): 144-159.

Zhang, Junsen. 2017. "The Evolution of China's One-Child Policy and its Effects on Family Outcomes." *The Journal of Economic Perspectives* 31 (1): 141-159.

APPENDIX

Appendix A: Year Of Establishment of Family Planning Organizations by Province in China.

Province	Province in Chinese	Family Planning Leadership Group	Family Planning Committee
Beijing	北京市	1973	1981
Tianjin	天津市	1969	1982
Hebei	河北省	1972	1983
Shanxi	山西省	1971	1983
Inner Mongolia	内蒙古	1979	1983
Liaoning	辽宁省	1972	1983
Jilin	吉林省	1971	1983
Heilongjiang	黑龙江省	1972	1982
Shanghai	上海市	1973	1982
Jiangsu	江苏省	1973	1981
Zhejiang	浙江省	1971	1983
Anhui	安徽省	1972	1982
Fujian	福建省	1972	1983
Jiangxi	江西省	1972	1983
Shandong	山东省	1970	1983
Henan	河南省	1971	1983

Hubei	湖北省	1971	1983
Hunan	湖南省	1971	1983
Guangdong	广东省	1969	1983
Guangxi	广西	1972	1984
Hainan	海南	1969	1989
Chongqing	重庆市	1971	1983
Sichuan	四川省	1971	1983
Guizhou	贵州省	1975	1983
Yunnan	云南省	1972	1983
Tibet	西藏	1975	1975
Shaanxi	陕西省	1971	1983
Gansu	甘肃省	1971	1983
Qinghai	青海省	1974	1981
Ningxia	宁夏	1972	1983
Xinjiang	新疆	1975	1983

Notes: 1. In 1973, China's State Council Established "The Family Planning Leadership Group", Promoting The "Later, Longer, Fewer" Policy, With Provincial Leadership Groups Operating Independently Within the Ministry of Health.
2. On September 25, 1980, The Central Committee of The Communist Party Issued an Open Letter on Controlling Population Growth in China, leading to the Establishment of Provincial Family Planning Committees to Enforce Its Stricter Policies.

Appendix B: First-Stage OLS For IV Method.

	(1)	(2)	(3)
Fine	-0.13*** (0.031)	-0.057* (0.031)	-0.097*** (0.031)
Bonus	-0.0011*** (0.000059)	-0.000064 (0.00013)	-0.00015 (0.00015)
Leadership group		-0.60*** (0.11)	-0.52*** (0.12)
Family Planning Committee		-0.67*** (0.049)	-0.49*** (0.048)
Constant	2.87*** (0.022)	2.90*** (0.022)	2.35*** (0.065)
Province FE	No	No	Yes
N	9550	9550	9550
R^2	0.11	0.13	0.18
F-statistic	584.22	360.28	64.39