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The impact and mechanism of the relaxation of fertility policy on income distribution: Evidence from China's Selective Two Children Policy

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ABSTRACT

Numerous studies have explored the impact of family planning policies on income distribution, but the impact of policy relaxation remains largely unexplored. To address this gap, we investigate the effects of China's selective two-child policy, which was implemented in 2013, using provincial panel data from 2011 to 2016. Specifically, we employ a generalized difference-in-differences model to empirically analyze the impact and mechanism of the policy relaxation on residents' income distribution. Our findings are as follows. Firstly, the selective two-child policy has narrowed the income distribution gap. Secondly, male labor force participation, the urban-rural income gap, and disposable income serve as mechanisms through which the selective two-child policy affects income distribution. Thirdly, the robustness test confirms the robustness of our conclusions. Finally, we observe regional heterogeneity in the impact of the selective two-child policy on residents' income distribution. Specifically, the policy has had significant effects in the western and northeastern regions, but not in other regions. Overall, our results shed light on the impact of childbearing policies on income distribution, providing important insights for optimizing China's childbearing policies and promoting common prosperity.

KEYWORDS

Selective two-child policy; Income distribution; Labor force participation, Income gap; Disposable income

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1. Introduction

One of the goals pursued by the Chinese government is to achieve common prosperity for all people, which encompasses two important dimensions: commonality and affluence. Commonality refers to controlling the income distribution gap among all people within a moderate range, while affluence means ensuring that all residents have a relatively high income level. According to data from the China Statistics Bureau, the Gini coefficient of China has been on the rise since 2003, increasing from 0.479 in 2003 to 0.491 in 2008 (see Figure 1). However, it has been decreasing year by year since 2008, reaching a low of 0.462 in 2015. Although there has been a small increase since 2016, the current value is still lower than that in 2008. Nonetheless, despite the decreasing trend, China's Gini coefficient remains above 0.40, indicating that the income distribution gap in China is still relatively large.

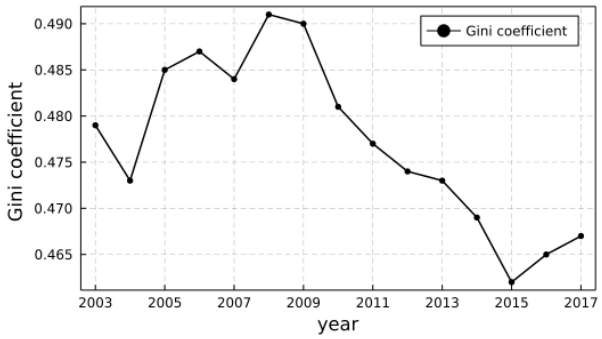

Figure 1. Per capita disposable income's Gini coefficient.

Excessive income distribution gaps can have a significant impact on regional economic growth, social fairness, and justice. Thus, it is essential to analyze the factors and mechanisms that affect residents' income distribution to improve income distribution fairness. While a higher Gini coefficient can bring about economic and social impacts, economic and social factors can also affect the Gini coefficient. Recent literature has explored how various factors affect income distribution. For instance, tourism development has been found to impact income distribution through technological progress generated by human capital (Porto and Espinola, 2019). Demographic factors, such as changes in population size and characteristics, also play a crucial role in income distribution (Morley, 1981; Chevan and Stokes, 2000). Additionally, Lam (1986) found that fertility has a significant impact on income inequality. The fertility policies of different countries and regions can affect residents' fertility levels by influencing their willingness to have children and childbearing costs, thereby affecting income distribution. Therefore, birth policies can also impact income distribution.

China's aging process has been accelerating since it entered an aging society in 1999. As of 2020, the population ratio of individuals aged over 59 accounted for 18.70%, a significant increase from 13.26% in 2015. Furthermore, the population aged 65 and above (65+) has steadily increased from 7.49% in 2002 to an estimated 13.50% in 2021 (see Figure 2). These statistics demonstrate that China's population is progressively aging, with the degree of aging deepening year by year.

To address the challenges of aging, China has gradually relaxed its family planning policy (FPP) since 2013. In 2013, the selective two-child policy (STCP) was introduced, followed by the universal two-child policy (UTCP) in 2015. Previous research has suggested that China's FPP has an impact on income inequality and that it has a negative effect on the urban-rural income gap (URIG) (Jia et al., 2021). We can identify two main characteristics of the existing literature. First, many studies argue that China's FPP affects income inequality, but consistent conclusions have not been reached. Second, the impact mechanism of policy relaxation on the Gini Coefficient, a commonly used measure of income inequality, has not been clearly established. In this study, we focus on the STCP launched in 2013 and explore how the relaxation of FPP affects the Gini Coefficient in China. Our contribution may

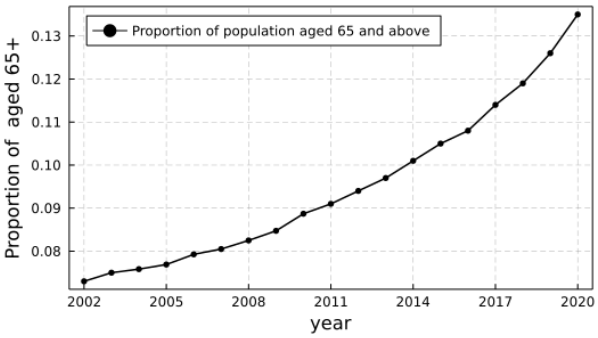

Figure 2. Proportion of population aged 65 and above of China.

be as follows. First, we analyze the impact and mechanism of the STCP on the Gini Coefficient. We find that the STCP has narrowed income distribution, and the mechanism through which it affects the Gini Coefficient is male labor participation. Second, we use a Generalized DID method to analyze the impact of the STCP on income distribution. Our results show that the STCP reduces the Gini index, and the result is robust. Third, we find that the STCP has increased the male labor force participation (LFP) rate, narrowed the URIG, and increased the income of residents. This suggests that a higher male LFP rate and income of residents and a lower urban and income gap lead to a lower Gini coefficient. Finally, we find that the effect of the STCP has regional heterogeneity and is significant in the western and northeastern regions. Our study provides a new perspective for understanding the impact of the relaxation of childbearing policies on income distribution in China. It sheds light on the importance of promoting male labor force participation and reducing urban-rural income gaps to achieve more equitable income distribution.

2. Overview, Literature Review and Research Hypotheses

2.1. An overview of China's fertility policy history

Since 1949, China's birth policy can be roughly divided into three stages: encouraging childbearing, birth control, and relaxation of the birth policy.

Encouraging Childbearing (1949-1952): During this period, Chinese families had a high willingness to have children, and the Chinese government adopted policies to encourage births. The policy encouraging births during this period was closely tied to the prevailing attitudes of the time. People were concerned about how to promote rapid economic growth, but the capital stock and production technology levels were relatively low. Therefore, labor was highly valued as the source of economic growth. The government hoped to promote economic development by encouraging fertility and increasing the size of the labor force. The large population provided China with an abundant labor force, which became one of the key sources of China's economic growth.

Birth Control (1953-2012): The high willingness of Chinese families to have children and the government's policy of encouraging children led to double-digit growth in China's population. The higher population growth raised concerns among the Chinese government and scholars, who realized that excessive population growth could adversely affect economic and social development. Therefore, the Chinese government adopted a policy of birth control. In 1970, the "Wan Xi Shao policy" was introduced, which advocated late marriage and childbearing, longer intervals between births, and fewer children. This policy effectively controlled the number of births. The birth rate dropped rapidly from 33.43‰ in 1970 to 18.21‰ in 1980. In 1980, the Central Committee of the Communist Party of China called for "every couple to have only one child". In 1982, the Chinese government allowed those whose first child was a girl in rural areas to have a second child. After the 1980s, with the strengthening of the Family Planning Policy (FPP), the birth rate in China dropped rapidly. In 1982, the birth rate of the population was 22.28 per thousand. The birth rate continued to decline in the following two years. In 1985, it increased to 21.04 per thousand,

and in 1986, it was 22.43 per thousand. 1986 was the year when the birth rate was the highest after the implementation of the FPP. Since then, the birth rate has declined year by year. While China's population is decreasing, the quality of its population is improving. The number of years of education per capita in China has increased, and the illiteracy rate has decreased. The growth of knowledge and skills of the labor force has matched the transformation of China's economy and promoted the continuous optimization of China's economic structure. China's FPP has effectively controlled population growth and achieved a dynamic balance between population and the economy.

Relaxation of the Birth Policy (2013-): Since 1999, China has been entering the aging process, and the number of elderly people has been increasing while the number of labor force has been decreasing. This has reduced the economic growth rate and increased the government's pension expenditure. In order to actively cope with the aging population, the Chinese government has gradually relaxed the FPP since 2013. The Second-Child-Two-Policy (STCP) was launched in 2013, followed by the Universal Two-Child Policy (UTCP) in 2015, and the Three-Child Policy in 2021. China's birth control policy has entered a new phase of relaxation. China's new birth policy has achieved positive results. In 2014 and 2016, the birth rate was 13.83‰ and 13.57 ‰ respectively. It was the two years with the highest birth rate after the birth policy was relaxed. The STCP improves the birth rate and promotes population growth. However, it will also have an impact on the economy. It will not only affect the economic aggregate and consumption structure but also affect the income and income distribution of residents by affecting the participation of the labor market.

2.2. Literature Review

In 1995, Kuznets argued that economic growth and income inequality have an inverted U-shaped relationship (Kuznets, 1955). In 1973, he incorporated population factors into the inverted U-shaped curve (Kuznets, 1973). Kuznets found that the birth rate and natural growth rate are negatively correlated with economic income levels. Boulier (1975) discovered that the birth rate would affect income distribution, and the increase in the birth rate widened the Gini coefficient. Fertility differences among different income groups affect income inequality. When the fertility rate of low-income groups increases, the Gini coefficient will widen (Chu and Koo, 1990). Docquier and Paddison (2003) argued that differences in fertility and education investment among families with different incomes determine the evolution of inequality and that an increase in social security investment is more effective in reducing inequality than public education investment. Since the fertility rate has an impact on income distribution, scholars are interested in the impact of policies that affect the fertility rate on income distribution.

The conclusions can be divided into three categories. First, the FPP has expanded the unequal income distribution of residents. Zhou and Shi (2022) believe that the fine system for extra births in the FPP hinders the accumulation of physical capital and human capital in rural areas, which in turn widens the URIG. Yang and Huang (2017) found that the difference in the fertility rate and urban-rural human capital level jointly affected and widened the URIG, and the difference in family fertility rate and human capital accumulation determined the income inequality. In addition, the FPP has narrowed the income gap among residents. The FPP can explain the urban-rural and ethnic group's differences in intergenerational mobility (Kumar et al., 2020), and can restrain the expansion of income inequality among offspring. Finally, the FPP has a U-shaped impact on the URIG. The impact on low- and high-income groups is greater, while the contribution to the URIG between middle-income groups is relatively small, in which the number of births allowed by the policy plays an important role (Zhang et al., 2019).

The impact of the childbearing policy on the Gini Coefficient has been relatively fully studied, but there is still room for the following questions. (I) The increasing fertility rate has widened the Gini coefficient, but whether this proposition is true in China still needs to be empirically tested in combination with Chinese data. (II) Although the existing literature believes that the FPP affects the Gini coefficient, the research conclusions are not consistent.

(III)The effect of the relaxation of the FPP on the Gini coefficient remains to be explored. Therefore, based on the existing theoretical and empirical research, we put forward research hypotheses and test the impact of the relaxation of China's birth control policy on Gini Coefficient effects and mechanisms.

2.3. Research Hypotheses

Next, we will analyze the impact of the STCP on the Gini Coefficient, and the research hypotheses include the impact of the STCP on the Gini Coefficient and its mechanism. The increase in family consumption resulting from reproductive behavior affects labor participation and income distribution through the supply and demand of the product and labor market.

As the group affected by the STCP is families with only one child, these families include two types: urban families and rural families with only one boy. Generally, these families have higher income than those with multiple children, which is due to the higher economic cost of raising multiple children. These families were affected by the STCP and had a second child. Therefore, the wife's labor participation in the family was first affected. The wife reduces her time of labor supply due to the birth of children, thus reducing the family income. The income gap has decreased, so the Gini coefficient of all residents has decreased. Therefore, the STCP reduces the Gini coefficient and alleviates income inequality. We propose hypothesis 1: The STCP reduces the Gini coefficient.

The STCP not only directly affects the Gini coefficient but also has other possible channels to affect the Gini coefficient. We propose three channels through which the STCP affects residents' income distribution, namely, male labor participation, URIG, and residents' income level.

The first potential channel is male labor participation behavior. From the perspective of the product market, the increase in household consumption has two impacts. First, from the perspective of households, after household consumption increases, household income should raise accordingly to smooth household consumption (Baker et al., 2022). Since childbearing reduces the LFP of women in the family, to have a higher level of income, the husband goes out and finds job, which increases the LFP of men. Besides, from the perspective of enterprises, the increase in consumption due to childbirth has increased the demand for products, and the it has increased the output of enterprises, and the increase in enterprise output has led to an increase in labor demand for enterprises (Wei et al., 2020). Second, through the scale effect, the demand for labor will increase. The increase in labor demand and supply results in an increase in the number of balanced laborers. Therefore, family reproductive behavior has led to an increase in male labor force participation. Because of the dual labor market in China, there are rural labor forces entering the urban labor market. These workers from rural areas get wages from the labor market, which leads to a relative increase in rural household income. It will reduce the URIG, which will narrow the Gini coefficient (Zheng, 2016). Therefore, male labor market participation is the mechanism through which the STCP affects income distribution. We propose hypothesis 2: Male labor force participation is the mechanism through which the STCP affects the Gini Coefficient.

The second potential channel is the URIG. The first channel is the quantitative channel through which the STCP affects the Gini coefficient. The URIG is the price channel through which the STCP affects the Gini coefficient. The STCP has improved men's labor participation. However, China has a dual labor market in urban and rural areas. Therefore, the effect of the STCP on male LFP will be different. Compared with urban men, rural working men have a higher LFP rate. This is because China's rural labor market plays a role as a reservoir. The increase in labor demand makes more rural men enter the labor market to work. As the labor participation rate of rural men increases, the income level is also high. On the other hand, the labor participation behavior of urban men and the income of urban family will also increase. However, there are good reasons to believe that the increase in income of rural households is greater than that of urban households. On the one hand, the number of depressed workers in rural areas is greater than that in urban areas. On the other hand, due to the influence of industrial structure, the demand for rural labor

in China is greater than that for urban labor (Fleisher and Yang, 2006). Therefore, from the perspective of male labor participation rate, the "Two-child policy" reduces the URIG. From the perspective of women's labor participation rate, the impact of the STCP on women's LFP is also different between urban and rural areas. Compared with rural women in China, the labor participation rate of urban women has decreased more. Therefore, the income of urban households in China has decreased more than that of rural households. Therefore, this has narrowed the URIG in China on the other hand. Therefore, we propose hypothesis 3: the URIG is the mechanism by which the STCP affects the income distribution of residents. That is, the single "Two-child policy" has narrowed the URIG and reduced the Gini coefficient.

The third potential channel is residents' disposable income (DI). This channel is also a price channel for the STCP to affect residents' income distribution. The implementation of the STCP has increased the DI of all residents and thus reduced the Gini coefficient. This is due to the impact of the STCP on the product market and labor market. The policy of two children alone has increased the demand for baby products, thereby increasing the demand for labor (Zeng and Hesketh, 2016). From the perspective of the family behavior of labor supply, the reduction of female labor participation makes men who have not entered the labor market before go to the labor market to find jobs (Wu, 2022). From the macro point of view, the total effect of the increase of male labor participation rate and the decrease of female labor participation rate is the increase of labor participation rate. There are sufficient theories that the increase of supply and demand increases the wage level of the labor market, which is the result of the supply elasticity of labor being less than the demand elasticity of labor. Therefore, in the short term, the policy of two children alone has raised the wage level. The increase in wages has increased the DI of residents. Therefore, we propose hypothesis 4: DI is the mechanism that the STCP affects income distribution.

3. Research Design, Variables, and Data

3.1. Research Design

According the theoretical analysis and previous research (Ren, et al.,2021; Almond et al., 2019), we construct the following conceptual framework.

$$Income\ distribution = F(STCP,\ Other\ Variables) \tag{1}$$

where STCP is the policy, and other variables are the factors that influence the income distribution. We take the STCP, launched in 2013, as a quasi-natural experiment and use Generalized DID method to analyze the impact of the relaxation of the FPP on the income distribution. Since the STCP was implemented nationwide in 2013, all provinces were affected. Therefore, the traditional difference-in-differences method cannot identify the impact of the STCP. We draw on the research of Chen (2017) and other scholars to construct the following double-difference model of intensity.

$$ID_{it} = \beta_0 + \beta_1 dudt + \beta ControlVar + v_t + u_i + \epsilon_{it} \tag{2}$$

where ID_{it} is the income distribution gap, $dudt$ is the STCP, which is the product of du and dt, du is the intensity, and dt is the time dummy variable. $ControlVar$ is a set of control variable vectors, v_t and u_i represent time and individual effect respectively, ϵ_{it} is the error term. β_0 is constant, β_1 measures the impact of the STCP, and β is the coefficient vector corresponding to the control variable. The empirical analysis focuses on the sign and significance of β_1. According to the previous analysis, we expect that the sign of β_1 is significantly negative.

We refer to the mediation effect test method of Baron and Kenny (1986) to test the impact mechanism. In addition to estimating equation (2), we need to estimate the following two equations additionally.

$$Medi_{it} = \alpha_0 + \alpha_1 dudt + \alpha ControlVar + v_{2t} + u_{2i} + \epsilon_{2it} \quad (3)$$

$$ID_{it} = \gamma_0 + \gamma_m Medi_{it} + \gamma_1 dudt + \gamma ControlVar + v_{3t} + u_{3i} + \epsilon_{3it} \quad (4)$$

$Medi_{it}$ in Equations (3) and (4) is a mediator variable for the STCP to affect residents' income distribution.$v_{jt}, u_{ji}, \epsilon_{jit}$ j∈ {2,3}, represent the individual effect, time effect and error term of equation (3) and equation (4), respectively. The rest variables are the same as those in equation (2). α_0 and γ_0 are constant term of equation (3) and (4), respectively, α_1 is the effect of the STCP, and α is the coefficient vector of the control variable. γ_1 is the effect of the STCP, and γ is the coefficient vector of the control variable. If β_1 is significant and α_1 and γ_m are significant, then there is a mechanism by which the STCP affects the Gini Coefficient.

3.2. Variable and Data

3.2.1. Explained Variable

We use Gini coefficient to capture the income distribution gap. We use formula (5) to directly compute Gini coefficients of urban and rural areas, respectively. Then, we use the group weighting method to compute the provincial income Gini coefficients.

$$G = 1 - \frac{1}{PW}\sum_{i=1}^{n}(W_{i-1} + W_i) \times P_i \quad (5)$$

3.2.2. Explanatory Variable

dudt is the product of du and dt. du represents the intensity, measured by the average fertility rate of each province from 2010 to 2012, and dt represents the dummy variable of time. Because the STCP was launched in December 2013, and considering the time lag of the policy, we take 2014 as the year when the policy took effect. The value of dt is 1 in 2014 and later, and the value of dt in 2011 to 2013 is zero. The intersection term dudt means that in each quantile, the provinces whose treatment intensity index is greater than the quantile are the relative treatment groups of the samples to which the quantile belongs.

3.2.3. Explanatory Variable

Economic development (lnavgdp). We use the logarithm of per capita GDP to measure the level of economic development and use the data of each province's GDP divided by the population of each province. These data are from the data-sharing platform of the Central University of Finance and Economics. After calculating the per capita GDP, we take the logarithm and then perform regression analysis. Population aging (lndr). The logarithm of the old-age dependency ratio in each province is used to measure population aging. Population (lnpop). We calculate the population of each province and then take the logarithm. The original data of the population comes from the data-sharing platform of the Central University of Finance and Economics. Industrial structure (lnsr). We use the logarithm of the proportion of the secondary industry to measure the industrial structure. Digital economy development level (dentropy). According to the method of Tao Zhao et al. (2020), we construct an index system to compute the digital economy development level. We use the entropy method to compute the weight of the indicator. The data for calculating these indicators came from the China Statistical Yearbook.

3.2.4. Mechanism Variable

Male labor force participation rate (lpmale). We compute this variable as its definition, which is

$$lpmale = \frac{Male\ labor\ force}{Total\ population\ of\ Male} \tag{6}$$

The data comes from data-sharing platform of the Central University of Finance and Economics. We first compute the male labor force and total population by province. Then, we calculate it according to formula (5). We sort them into panel data for mechanism analysis.

Income gap (urgap). It is the ratio of per capita disposable income of urban residents to that of rural residents.

$$urgap = \frac{per\ capita\ urban\ residents\ disposable\ income}{per\ capita\ rural\ residents\ disposable\ income} \tag{7}$$

Per capita disposable income of residents (lndinc). We compute the logarithm of per capita disposable income of all residents. The basic descriptive statistics of each variable are shown in Table 1.

Table1. Basic descriptive statistics.

Variable	Mean	SD	Median	Min	Max	N
gini	0.4311	0.0472	0.4382	0.3502	0.5097	186
lndr	12.8253	2.7967	12.6000	6.7000	20.0000	186
lnpop	8.1192	0.8462	8.2416	5.7333	9.3850	186
lnavgdp	10.6393	0.4176	10.5571	9.7058	11.7322	186
lnsr	-0.8684	0.2223	-0.8077	-1.7571	-0.4787	186
dentropy	0.2600	0.0969	0.2674	0.0773	0.5863	186
urgap	2.7332	0.4601	2.6576	1.8451	3.9791	186
lndinc	9.7830	0.3808	9.7345	8.9240	10.9024	186

4. Empirical Analysis

4.1. Regression Results

Table 2 shows the regression results of Equation (2). Model 1 does not include any control variables. The coefficient of the STCP in Model 1 is significantly negative, indicating that the STCP narrows the income distribution. Models 2 to 5 added control variables such as aging, population size, economic development level, and industrial structure in turn. After adding these control variables, the coefficients of the STCP in Models 2 to 5 remain significantly negative. Model 6 includes all the control variables, and the coefficient of the STCP is also significant. The STCP significantly reduces the Gini coefficient and narrows the income distribution. The regression results are still robust. According to Table 2, we can conclude that the STCP has significantly reduced the Gini coefficient.

The reason why the STCP has reduced the Gini coefficient is that it has increased household expenditure and reduced income affected by the policy. Due to the inequality in family income and wealth accumulation caused by the previous fertility policy, families with higher income and wealth have higher expenditure. Therefore, this has narrowed the gap within the group to a certain extent, and the narrowing of the gap within the group has reduced the Gini coefficient. Since the conclusion of the effect of STCP on income distribution depends on the same trend, we will conduct a robustness test next.

4.2. Robustness Test

4.2.1. Parallel Trend Test

We use the first year of the sample data as the base period to construct the following model.

Table 2. Basic Regression Result.

Variable	Model1	Model2	Model3	Model4	Model5	Model6
dudt	-0.0043*	-0.0057**	-0.0055**	-0.0062**	-0.0063**	-0.0059*
	(0.0024)	(0.0024)	(0.0025)	(0.0027)	(0.0027)	(0.0033)
lndr		-0.0055	-0.0057	-0.0059	-0.0057	-0.0026
		(0.0041)	(0.0040)	(0.0041)	(0.0042)	(0.0049)
lnpop			-0.0609	-0.0761	-0.1002	0.0696
			(0.1757)	(0.1718)	(0.1658)	(0.2333)
lnavgdp				0.0469	0.0170	-0.0323
				(0.0737)	(0.0822)	(0.0943)
lnsr					0.0684	0.0761
					(0.0727)	(0.0893)
dentropy						0.3882
						(0.6120)
_cons	0.4506***	0.5246***	1.0196	0.6527	1.2220	0.2410
	(0.0113)	(0.0546)	(1.4191)	(1.6021)	(1.6477)	(2.0861)
N	217	217	217	217	217	186

*Note: The cluster robust standard errors are in parentheses, and * ** *** represent the significance levels of 10%, 5% and 1%, respectively. Time and individual effects were controlled for in all equations. The same as Table3 Table4 and Table5.*

$$ID_{it} = \beta_0 + \sum_{2012}^{2016} \beta_t (du * year_i) + \beta ControlVar + v_t + u_i + \epsilon_{it} \quad (8)$$

where, $year_i$ is a dummy variable with a value of 1 for the corresponding year. The meanings of other variables are the same as in Equation (2). The panel of Parallel Test in Table 3 reports the estimated results. We can see that the estimated coefficient of the cross-product term before 2013 is not significant, suggesting that the parallel trend assumption holds. After 2013, the coefficient of the multiplication term is significantly negative, which means that the STCP has a significant and continuous impact on the income distribution of residents. In the previous article, 2014 was taken as the year of policy implementation, and a STCP variable was constructed. The coefficient here in 2013 is significant, indicating that the STCP has formed a certain expected effect.

4.2.2 Placebo Test

We refer to Chetty et al. (2009) and use the method of permutation test to examine whether the setting of equation (2) is appropriate. The specific method is to randomly assign the original outcome variables to individuals and then re-estimate Equation (2). Since the outcome variable is randomly formed, theoretically, the two-child policy alone has no significant impact on the Gini coefficient, otherwise, the setting of Equation (2) is biased. We conducted 500 randomized experiments on the outcome variable, resulting in 500 regression coefficients and a two-sided P value of 0.084 with permutation tests. The results of the permutation tests are shown in Figure 1, indicating that the coefficients of the baseline regression are outside the 90% of the distribution. This shows that the setting of equation (2) is not biased, and the conclusion that the STCP narrows the income distribution is robust.

4.2.3. Change Policy Implementation Year

We change the implementation year to conduct a counterfactual test. We assume that the policy was launched in 2012 or 2015, construct the intersection product of policy variables, and then estimate Equation (2). The 3rd and 4th columns of Table 3 show the results. The coefficients of the policy variable are not significant. We can draw the conclusion that if the policy was launched in 2012 or 2015, there would be no effects on the income distribution. After changing the implementation year of the policy, the assumption that the STCP narrows the income distribution

does not hold. Therefore, the STCP reduces the Gini index.

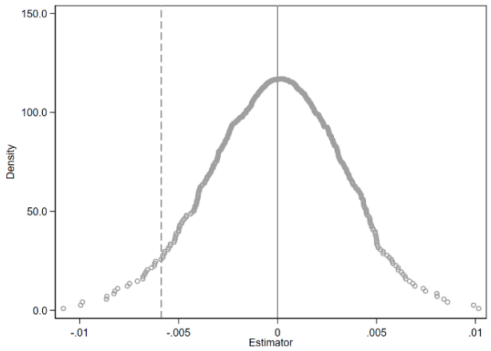

Figure 3. Placebo Test.

4.2.4. Use Different Birth Rate

We re-estimate Equation (2) using different intensity indicators. We use the average fertility rate of each province from 2009 to 2011, 2009 to 2012, and 2010 to 2012 as the intensity indicators. The last three columns of Table 3 tell the results of the estimation, which show that the coefficients are significant. The conclusion that the STCP has reduced the Gini coefficient holds. The estimated results using the average fertility rate from 2009 to 2011 as the intensity indicator are slightly larger than the estimated results of the basic regression of Equation (2), and the estimated results of the other two intensity indicators are slightly smaller than those of Eq (2). The conclusion that the STCP narrows the income distribution is robust.

Table 3. Robustness Check.

Variable	Parallel Test	Policy Year		Alternative Intensity		
		2012	2015	09-11	09-12	10-12
dudt				-0.0060*	-0.0058*	-0.0056*
				(0.0033)	(0.0034)	(0.0030)
dd2012	-0.0030					
	(0.0017)					
dd2013	-0.0058*					
	(0.0029)					
dd2014	-0.0078**					
	(0.0035)					
dd2015	-0.0093**					
	(0.0042)					
dd2016	-0.0084*					
	(0.0046)					
dudt2012		-0.0122				
		(0.0047)				
dudt2015			-0.0007			
			(0.0043)			
N	186	186	186	186	186	186

4.3. Heterogeneity Test

We made an estimate based on the division of the three major regions of the East, Middle and West by the China National Bureau of Statistics. Considering that the Northeast region experienced negative population growth from 2010 to 2020, we also grouped the Northeast region for regression. The 2nd to 5th columns of Table 4 show the regional heterogeneity test results, indicating that the STCP has reduced the Gini coefficient in the eastern, central,

western and northeastern regions, but the effects in the eastern and central regions are not significant. From the perspective of policy influence, the STCP has a greater effect in the Northeast than in the West and greater than the effect on the whole country. The reason for the regional heterogeneity of the STCP on the Gini Coefficient may be that the STCP has a greater impact in areas with a relatively small population, and the western and northeastern regions have relatively small populations.

Table 4. Heterogeneity Test**.**

Variable	Eastern	Middle	Western	Northeastern
dudt	-0.0020	-0.0128	-0.0100**	-0.1151**
	(0.0060)	(0.0083)	(0.0041)	(0.0242)
lndr	0.0018	-0.0100	-0.0036	-0.0101
	(0.0084)	(0.0133)	(0.0063)	(0.0141)
lnpop	0.3299	0.5260	-0.2412	-2.8103**
	(0.6927)	(0.8905)	(0.2553)	(0.5990)
lnavgdp	-0.2401	0.2769	-0.0102	-2.9769*
	(0.2257)	(0.1516)	(0.1001)	(0.9596)
lnsr	0.2238	-0.2354**	0.1816	0.8679*
	(0.1531)	(0.0795)	(0.1175)	(0.2578)
dentropy	0.7712	-3.5406	0.9163	-1.9356
	(0.8166)	(2.0413)	(1.6338)	(3.3916)
_cons	0.2855	-6.1029	2.4545	56.2882**
	(5.7669)	(7.3853)	(2.2297)	(7.4701)
N	66	48	72	18
R^2	0.2958	0.5313	0.2873	0.9109

4.4. Mechanism Analysis

Next, we will verify the mechanism of the STCP's impact on Gini Coefficient. We estimate according to Equations (3) and (4), and the estimated results are shown in Table 5. The STCP in Equation (3) has a significantly positive impact on the Gini Coefficient. It tells us that the STCP has increased the male LFP. The estimated results in Eq (4) indicate that the increase in the male LFP has narrowed the income distribution. The STCP variable in Equation (4) is still significant. Therefore, it can be concluded that the STCP has significantly increased the male LFP, and the increase in the male LFP has significantly narrowed the Gini Coefficient. The STCP has narrowed the income gap by increasing the male LFP rate. Therefore, there is a mechanism by which STCP influences residents' income distribution through LFP. The reason is that the STCP promotes the family reproductive behavior. In order to raise children, more men in the family work in the labor market to obtain higher income.

The estimated results of the second mechanism are listed in the second panel of Table 5. The coefficient of the STCP is significantly negative, which means that the STCP significantly reduces the urban-rural income gap (URIG). The regression results of the Gini coefficient on the URGAP show that the URIG has a significant impact on the Gini coefficient. The increase in URGAP has significantly increased the Gini coefficient. Combining the above two regression results, we can conclude that the STCP has significantly reduced the URIG and thus reduced the Gini coefficient. Therefore, there is a mechanism for the STCP to influence residents' income distribution through URGAP. The reason is that because the impact of the STCP on rural areas is greater than that on urban areas. The income of rural residents has increased, thus reducing the URGAP.

The mechanism test results of residents' disposable income (DI) are shown in the last two columns of Table 5. The results show that the STCP has significantly improved the income level of residents. The regression results of the Gini coefficient on residents' DI indicate that the increase of residents' DI significantly reduces the Gini coefficient. According to the above two regression results, the STCP has significantly increased the DI of residents

and thus reduced the Gini coefficient. Therefore, there is a mechanism that the STCP affects the income distribution of residents through the increase in DI of residents. The reason is that the increase in the income of rural residents has increased the DI of residents. In addition, the income of urban residents affected by the policy has also increased. However, due to the implementation of the previous family planning policy, the impact of STCP on rural residents was greater than that on urban residents, so the increase in DI reduced URGAP. This means that the inter-group gap has narrowed, so the Gini coefficient has narrowed, and the income distribution gap has narrowed.

Table 5. Mechanism Analysis.

Variable	LFP		URGAP		Indispensable Income	
	lpmale	gini	urgap	gini	lndinc	gini
dudt	0.0020***	-0.0056**	-0.0196**	-0.0038*	0.0035***	-0.0040*
	(0.0006)	(0.0021)	(0.0078)	(0.0019)	(0.0009)	(0.0020)
lndr	-0.0025***	-0.0047**	0.0256**	-0.0023	-0.0033***	-0.0014
	(0.0007)	(0.0019)	(0.0121)	(0.0017)	(0.0011)	(0.0019)
lnpop	-0.0606	-0.0013	0.7929	-0.0010	-0.1119	0.0022
	(0.0463)	(0.0060)	(0.6309)	(0.0061)	(0.1128)	(0.0059)
lnavgdp	0.0209	-0.0000	-0.5846**	0.0122	0.1580***	0.0387
	(0.0234)	(0.0240)	(0.2396)	(0.0242)	(0.0241)	(0.0272)
lnsr	-0.0159	-0.0015	-0.1661	-0.0016	-0.0225	0.0058
	(0.0211)	(0.0240)	(0.2609)	(0.0225)	(0.0177)	(0.0258)
dentropy	-0.0382	0.0261	3.4504**	-0.0670	-0.2348*	0.3907
	(0.0846)	(0.1665)	(1.4193)	(0.1555)	(0.1310)	(0.2441)
lpmale		-0.2807**				
		(0.1232)				
urgap				0.0367**		
				(0.0146)		
lndinc						-0.1377***
						(0.0396)
_cons	0.9093**	0.7011**	1.2554	0.2764	9.0756***	1.2919***
	(0.3829)	(0.2812)	(5.4491)	(0.2593)	(0.9104)	(0.3450)
N	186	186	186	186	186	186
R^2	0.9852	0.0670	0.9534	0.0815	0.9995	0.1007

5. Conclusion and Discussion

On the basis of theoretical analysis, we use the provincial panel data from 2011 to 2016 and Generalized DID method to empirically analyze the impact of the STCP on the Gini index and test its impact mechanism. The results show that the STCP has significantly reduced the Gini coefficient.

Subsequently, we conduct robustness checks, including parallel trend tests, permutation tests, and counterfactual analysis by changing the year of policy implementation, and benchmark models with different treatment intensities. The results of the test show that the assumption of parallel trends is satisfied. The results of the permutation test show that there is no missing variable problem. The counterfactual analysis shows that after the changing the implementation year of the policy, the impact on the Gini index is not significant. The results of the intensity test are all significant. Therefore, the conclusions drawn by the generalized difference-in-differences model are robust.

We then conducted a heterogeneity test by region. There is regional heterogeneity in the impact of the STCP on the Gini Coefficient. The STCP in the eastern and central regions has no significant impact on the Gini Coefficient, while the impact in the western and northeastern regions is significant. This may be due to the population of these two regions being relatively small, which in turn makes the policy effect more significant.

Finally, the mechanism of the STCP on the income distribution is tested. (1) The STCP has significantly

increased the male LFP, and the increase in the male LFP has significantly narrowed the income distribution. Therefore, the STCP has narrowed the income distribution by increasing the male LFP, and the male LFP is the mechanism through which the STCP affects the income distribution. (2) The STCP has significantly narrowed the URIG, and the narrowing of the URIG has significantly reduced the Gini Coefficient. Therefore, the STCP narrows the Gini Coefficient by narrowing the URIG. The URIG is the mechanism by which the STCP affects the Gini Coefficient. (3) The STCP has significantly increased the DI of residents, and the increase in residents' DI has significantly reduced the Gini index. Therefore, the STCP reduces the Gini index by increasing residents' DI, which is the mechanism by which the STCP affects residents' income distribution gap.

Although we used the STCP in 2013 as a quasi-natural experiment to explore the impact of the relaxation of the fertility policy on the income distribution and its mechanism, it remains to be discussed whether the UTCP, which is a more relaxed fertility policy, has an impact on the Gini coefficient. Although the paper has this limitation, we provide evidence of the impact of the relaxation of the fertility policy on the income distribution. This has significance for the policy formulation of China's childbirth policy optimization and the promotion of common prosperity.

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Conflict of interest

All the authors claim that the manuscript is completely original. The authors also declare no conflict of interest.

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