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WOMEN'S EDUCATIONAL EMPOWERMENT AND REPLACEMENT-LEVEL FERTILITY IN CHINA: A COHORT ANALYSIS

This study examines how the relationship between women's education and the likelihood of having a second child has evolved among three birth cohorts in China (1961–1970, 1971–1980 and 1981–1990). Using six waves of the China Family Panel Studies (2010–2020), the analysis applied logistic regression models to focus on second-birth progression as an indicator of replacement-level fertility. The findings show that the traditional negative correlation between higher education and second births has persisted but has altered in form across generations. Among women with the lowest level of education, this association has weakened over time. In contrast, among those with a senior high education in the youngest cohort, it has become stronger. These shifts suggest that educational expansion has not eliminated fertility differences, but rather has narrowed and deepened them, redistributing them across educational groups. The study also highlights that educational empowerment does not necessarily lead to higher fertility rates. Rising labour-market returns to education, combined with limited family-support infrastructure, create significant opportunity costs for a second birth, especially for educated women in urban settings. Simply removing birth restrictions is insufficient to reverse fertility decline; more comprehensive childcare, employment and anti-discrimination policies are required to support women in combining work and family life.

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A long-standing assumption in demographic research is that women's education suppresses fertility (Martin 1995; Kim 2023). However, evidence from China complicates this conventional view. Although reforms to compulsory schooling substantially increased women's educational attainment, this shift did not lead to a consistent reduction in fertility. The 2010 Chinese census shows that extended compulsory education is associated with reduced fertility (Chen, Guo 2022). However, other studies have found that the rapid expansion of higher education is linked to an increased likelihood of second births (Chen 2022). These seemingly divergent findings suggest that education does not influence fertility uniformly. Its effects depend not only on years of schooling, but also on the broader economic, institutional and life-course conditions in which reproductive decisions are made. To account for this complexity, the author adopts the concept of educational empowerment, which is understood as the bundle of resources and capabilities that education generates.

China offers a compelling setting for investigating these dynamics. Over the past thirty years, the country has transitioned from a strict one-child policy to a pro-natalist policy permitting two (and now three) children (Zhu 2024). During this period, women's participation in higher education rose from marginal levels to account for over half of all entrants (Mu 2021; Si 2022). Yet the total fertility rate remained close to 1.0 in 2023. This juxtaposition raises a central question: how can highly educated women, who face expanding opportunities but also rising opportunity costs, reach replacement-level fertility and navigate the decision to have a second child? Under what conditions does a second birth become feasible?

The author focuses on women born between 1961 and 1990 who took part in six rounds of the China Family Panel Studies (CFPS) between 2010 and 2020. These cohorts have experienced different stages of China's fertility-policy evolution at different points of their reproductive lives, ranging from strict anti-natalism to the gradual relaxation of restrictions and, eventually, the introduction of the universal two-child policy. During this time, they also witnessed the country's transition from underdevelopment to widespread higher education. This combination of historical changes enables the examination of how educational empowerment shapes the likelihood of having a second child within rapidly evolving opportunity structures. Through cohort analysis and logistic regression, the author explores the circumstances in which women with higher levels of education, a relatively higher income and greater autono-

my in their life choices are able to have a second child, thereby reaching a fertility rate that is crucial for long-term demographic stability.

Literature Review

Several studies have documented a consistent negative correlation between the educational attainment of Chinese women and their fertility (Huang, Zhu 2020; Niu, Qi 2020; Zhang, Zhao 2023). However, this relationship does not operate uniformly across contexts. In many models, education functions as a background factor whose influence depends on the surrounding policy environment. Recent research by Chen (2022) offers a more nuanced perspective, suggesting that the expansion of higher education can constrain and support women's reproductive choices simultaneously. Therefore, it remains unclear whether education directly contributes to reducing fertility, particularly in a country where birth rates have remained below the replacement level (<2.1) since the early 1990s (Gao, Wang 2025). Building on this literature, the present study identifies three pathways through which education shapes reproductive decisions: income, autonomy and life-course timing. These factors together influence women's likelihood of having a second child.

China's demographic transition has unfolded differently from what is typically described as the Second Demographic Transition (Yu, Xie 2022; Zheng 2024). Before 1979, elements of Confucian pronatalism, the stigma surrounding non-marital childbearing and the demands of industrialisation coexisted with strict anti-natalist legislation (Zhu 2024). After 2015, however, the country shifted towards a pro-natalist policies framework, drawing renewed attention to how gender norms and educational trajectories shape reproductive behaviour.

Although women now outnumber men in higher education (Lei et al. 2016), patterns of parental investment remain unequal. In families with multiple children, educational and financial resources tend to be allocated preferentially to sons, leaving daughters with fewer opportunities. In one-daughter families, however, a compensatory dynamic often emerges whereby parents invest heavily in their daughter's education, including in more prestigious and traditionally non-feminine fields of study. Cohort and family-structure differences in fertility preferences are the result of these divergent educational trajectories.

Income path. Higher levels of education increase women's human capital, improving their labour-market prospects and making their employment more stable. This strengthens their bargaining position within the household (Huang et al., 2022; Liu et al., 2024). These advantages can help offset the financial and time costs of childbearing, enabling women with stable careers to achieve their desired family size. Women with higher and more predictable earnings are more likely to plan a second birth (Yang et al. 2023). Meta-analytic evidence from urban China shows an inverted U-shaped relationship between education and fertility: moderate levels of education tend to reduce fertility,

whereas expanded access to higher education, through higher and more secure lifetime earnings, may support a modest fertility rebound under pro-natalist conditions (Hazan, Zoabi 2014; Liu, Hu 2018).

Autonomy path. Education strengthens women's non-material resources, such as self-efficacy, egalitarian attitudes, and the capacity to make autonomous reproductive decisions. Highly educated women tend to have greater control over contraception and the timing of marriage, and are less exposed to normative pressure to pro-natalism (Cygan-Rehm, Maeder 2013; Pazol et al. 2015). Education is also associated with greater marital stability, making reproductive trajectories more predictable and manageable within desired partnerships (Boertien, Härkönen 2018; Heaton 1990). Education does not exert a straightforward 'suppressing' effect on fertility; rather, it complicates and diversifies reproductive strategies. While it enables women to make more autonomous decisions, these remain shaped by structural constraints that continue to play a significant role.

Life-course timing path. Education extends the period spent in schooling and postpones family formation. This process is often described in the literature as the 'incarceration hypothesis' (DeCicca, Krashinsky 2019). Evidence from China following the compulsory schooling reform of 1986 shows that additional years of education substantially delay early childbearing (Chen, Guo 2022; Zhang, Zhao 2023). However, further increases in education beyond the basic level have a weaker effect on the timing of fertility. Similar patterns have been observed in studies from Taiwan and Greece, where the marginal effect of additional education on postponement diminishes beyond the compulsory level, and limited labour-market opportunities reduce the incentives to postpone family formation in response to further increases in educational attainment (Kan, Lee 2017; Kountouris 2020).

In summary, these three factors: income, autonomy, and life-course timing — show that education shapes reproductive behaviour through several interconnected pathways. Rather than assuming a simple 'more education, fewer births' pattern, the proposed model places women's fertility decisions within a broader context of economic opportunities, decision-making autonomy and life-course trajectories within China's evolving political and cultural landscape. Together, these pathways operationalise what this research terms 'educational empowerment.'

If educational empowerment is possibly assumed to support higher fertility among highly educated women, why does China's total fertility rate remain below 1.0? To address this contradiction, the author rephrases the research question as follows: have the opportunity costs of childbearing been offset by income gains and increased bargaining power associated with higher education to the extent that tertiary-educated women now consider having a second child? Or does the negative education gradient in reaching replacement-level fertility still persist among the cohorts that experienced different stages of China's policy reversal (1961–1990)?

Methods

Data

This study draws on secondary data from the China Family Panel Studies (CFPS), a longitudinal survey of a nationally representative sample of households conducted by Peking University's Institute of Social Science Survey. The CFPS collects detailed information on family structure, economic activity, education, and health. Six waves from 2010 to 2020 were used, covering a period of rapid socioeconomic change and major policy shifts, including the relaxation of the One-Child Policy and the expansion of higher education. The survey includes nearly 15,000 households across 25 provinces, cities, and autonomous regions, providing broad geographic coverage.

To examine generational differences in exposure to policy and educational change, the analysis focuses on women born between 1961 and 1990. These respondents experienced family-planning regulations and institutional reforms during their reproductive years. Three cohorts were constructed: those born between 1961 and 1970 reached reproductive age under the strict one-child regime; those born between 1971 and 1980 experienced early economic reforms and initial policy relaxation; and those born between 1981 and 1990 entered adulthood during rapid economic growth and the mass expansion of education and employment opportunities.

The analytical sample includes women aged 20–49 at the time of each survey wave. Respondents with missing information on the key variables used in the main analyses, including educational attainment, fertility outcomes, income, employment status, and the timing of the first birth, were excluded using listwise deletion. Most missing data occurred in income and childbirth-timing variables; descriptive statistics on missing data by wave are reported in Appendix A.

To minimise issues of reverse causality, the sample was restricted to women with 0–5 live births. Cases involving more than five births account for less than 1 % of the sample and have been excluded in order to maintain focus on parity transitions that are relevant to replacement-level fertility (see Appendix B). Following all selection and imputation procedures, the final sample comprises N = 34,098 women.

Variables

(1) Dependent Variable: Replacement-level fertility. Fertility is calculated as the total number of live births reported by each respondent prior to the survey. 'Replacement-level fertility' is defined as having two or more children. The author selected this threshold (≥2 children) because it reflects the level required for long-term population replacement and is central to current demographic debates in China. To capture the transition of interest — moving from a first to a second birth — the fertility measure is coded as a binary variable:

1 for women who have had two or more children and 0 for those who have not. Although China's overall fertility rate remains below the replacement level, achieving replacement-level fertility among subgroups such as highly educated women could contribute towards a more balanced demographic outlook.

(2) Independent Variable(s): Pathways of Women's Educational Empowerment. Rather than measuring a single unified construct; this research conceptualises educational empowerment as an analytical framework through which education influences fertility behaviour via three distinct yet interconnected pathways: educational attainment, labor-market returns (income and employment), and life-course timing. In the empirical section, these dimensions are treated as distinct variables to elucidate the mechanisms connecting education to the outcome variable.

(2.1) Highest Level of Education Achieved. This measure captures women's formal educational qualifications and is categorised as follows: primary (primary school or below); junior high; senior high; and college or higher (associate, bachelor's, and postgraduate degrees). These categories reflect key educational milestones and the stratification of labour-market opportunities in China.

H1: Across birth cohorts, the negative effect of women's educational attainment on the likelihood of having a second child decreases. Among the 1981–1990 cohort, who were exposed to pro-natalist policies, the difference in second-birth likelihood between tertiary-educated and primary-educated women is expected to be statistically insignificant.

(2.2) Returns to Education. This dimension captures the economic rewards associated with education and is measured using two CFPS indicators. The first is employment status (0 = unemployed, 1 = employed). The second is each respondent's relative income position within her birth cohort, which ranks women according to their position in the income distribution within their cohort, thereby adjusting for macroeconomic variation across survey years.

H2: Labor-market returns moderate the relationship between education and fertility. Higher returns are expected to strengthen the positive effect of education on the likelihood of having a second child, helping highly educated women offset the opportunity costs of childbearing.

(2.3) Life-course Timing. Ideally, the interval between the year of highest educational attainment and the year of the first birth would reflect women's ability to balance education and family formation. However, substantial missing data on graduation year meant that the author had to use life-course timing windows instead. Respondents are grouped into three categories: early childbearing (<22 years), regular-window (22–30 years), and delayed childbearing (>30 years) (see Appendix C).

H3: Reproductive timing mediates the link between educational empowerment pathways and replacement-level fertility. Women with a tertiary education who gave birth for the first time within the expected timeframe are more likely to have a second child than similarly educated women who delay childbearing.

(3) Control Variables

Control variables include: (i) hukou status (urban vs. rural), capturing institutional differences in childcare access, labour-market segmentation and the historical enforcement of family-planning policy (Mu 2021); (ii) age and age squared to model non-linear exposure to fertility risk throughout life; (iii) age at first birth, mechanically constraining the spacing and timing of subsequent births. These controls reflect established demographic factors that are known to influence parity progression beyond educational factors.

Results

The negative association between women's education and the likelihood of having a second child has weakened over time. This change is mainly driven by the increased probability of a second birth among highly educated women, while it has remained almost unchanged among women with lower levels of education. The age at which most women have their first child (22–30) does not clearly indicate the most favourable stage of the life course is for having two children, as this varies across different groups. At the same time, employment and adequate income play an important role. Highly educated women typically have lower fertility because the financial and career-related costs of childbearing are higher for them. However, when a woman has stable employment and sufficient earnings, these costs become more manageable, making a second birth more feasible. This also contributes to the weakening of the previously negative relationship between education and second births.

Descriptive analysis

The sample comprised 34 098 observations from three birth cohorts (1961–1970, 1971–1980, and 1981–1990). The majority of respondents (73.8 %) held rural hukou status, while 26.2 % were registered as urban residents. As access to education expanded rapidly over time, there were substantial differences in educational attainment across cohorts. Among the oldest cohort (1961–1970), 56.5 % of women had completed only primary school or less, while just 1.1 % held a university degree. By contrast, in the 1981–1990 cohort, the proportion of women with tertiary education had risen to 8.9 %, while the proportion with only primary schooling had declined to 24.6 %. The mean age at interview increased from 30.17 to 48.47 years, reflecting the inherent age structure of a cohort design and confirming balanced sampling for women and men alike (see Table 1 and Table 2 in the electronic appendix).

Fertility patterns by education and cohort. The data reveal an overarching pattern: the higher a woman's level of education, the less likely she is to have two or more children, and this relationship is evident across all birth cohorts. Within this general trend, however, several nuances stand out. In the 1971–1980 cohort, replacement-level fertility (>2 children) was only exceeded

by 70% among women with primary education or less. Women with lower and upper secondary education show relatively stable patterns across cohorts, with little variation in the likelihood of having a second child. Women with tertiary education consistently have a lower chance of having a second child than women in any other groups. However, in the youngest cohort (1981–1990), this difference is smaller than it was among women born between 1961 and 1970. As educational attainment has increased, the decline in achieving replacement-level fertility has become less steep (see Figure 1 in the electronic appendix). In short, higher education continues to be associated with lower second-birth rates, but the educational gap has narrowed over time and the decline in second births among highly educated women has slowed. Fertility patterns by life-course timing and cohort. When women are grouped by the age at which they have their first child — early (<22), typical (22–30), and delayed (>30) — a clear pattern emerges. Those who begin childbearing earlier ultimately have more children and are more likely to reach replacement-level fertility. In contrast, postponing the first birth is consistently associated with having fewer children and a higher likelihood of remaining childless. Among the 1961–1970 cohort, 60.8% of women who had their first child before the age of 22 went on to have two or more children. This figure was slightly higher in the two subsequent cohorts, at 70.5% and 62.6%, respectively. By comparison, among women in the same first cohort who delayed their first birth beyond the age of 30, only 42.4% reached replacement-level fertility (see Figure 2 in the electronic appendix).

Taken together, these patterns point to a significant demographic challenge: as women's educational attainment increases and the transition to motherhood occurs later, the likelihood of having a second child decreases. Neither educational expansion nor delayed entry into motherhood currently supports replacement-level fertility in contemporary China. Among women born between 1961 and 1980, the pattern is consistent: the later the first birth occurs, the lower the probability of having a second child. In the youngest cohort (1981–1990), however, the picture is less uniform. Women who postpone their first birth show more varied trajectories, but on average, their chances of progressing to a second birth remain lower than those of women who become mothers earlier or within the typical age range.

Multivariate analysis of having two or more children

This section presents the results of two logistic regression models that predict the likelihood of having two or more children by the time of the interview (coded as 1 = two or more children, 0 = one or no children). Model 1 examines the initial relationships between education, the timing of the first birth, employment, income and hukou status. Model 2 adds interaction terms between education and birth cohort to test whether the relationship between education and fertility has changed across generations. Full estimates are provided in Tables 3 and 4 of the electronic appendix.

Model 1: Baseline associations. The results from Model 1 show a clear, albeit non-linear association between women's educational attainment and the probability of having a second child or subsequent child. Women with primary education had substantially lower odds of having a second child than women with junior-high education (B = –0.85, SE = 0.06, OR = 0.43, 95% CI [0.38, 0.48], p < .001), reflecting a 57% reduction in odds. Conversely, women with senior high education had slightly higher odds of progressing to a second birth than those n with only primary education (B = 0.12, SE = 0.04, OR = 1.12, 95% CI [1.04, 1.22], p = .005). A similar, modestly positive difference was observed for women with tertiary education compared to those with only primary education (B = 0.08, SE = 0.03, OR = 1.08, 95% CI [1.02, 1.14], p = .008). These results suggest that the relationship between education and second births is not straightforwardly linear.

The timing of the first birth was not significantly related to the likelihood of a second birth. Women who became mothers before the age of 22 or after the age of 30 did not differ from those whose first births occurred between the ages of 22 and 30 (early timing: B = –0.01, p = .881; delayed timing: B = –0.03, p = .635).

Employment status itself did not influence the likelihood of a second birth (B = 0.02, OR = 1.02, p = .568). However, a woman's relative income rank within their cohort did have an effect: higher-income women were less likely to reach replacement-level fertility (B = –0.19, SE = 0.01, OR = 0.83, 95% CI [0.81, 0.85], p < .001). Age at first birth also exhibited a negative association (B = –0.14, p = .001). The squared age term was statistically significant, but substantively very small (B = 0.00, p = .024), indicating only a slight nonlinearity in the association.

The hukou system was strongly related to fertility: women with rural hukou were much more likely to have a second child than those with urban hukou (B = –1.08, OR = 0.34, 95% CI [0.32, 0.36], p < .001).

A significant interaction was found between employment status and income rank (B = 0.22, SE = 0.05, OR = 1.25, 95% CI [1.12, 1.38], p < .001), indicating that the negative effect of income rank was weaker among employed women. This suggests that labor-market participation may reduce the opportunity costs associated with a second birth.

The baseline model suggests a non-linear education gradient, but does not reveal whether this gradient is stable across generations. As Chinese women born in the 1960s, 1970s and 1980s experienced different policy regimes and educational opportunities, it is possible that education influences second-birth behavior differently across cohorts. To examine these generational shifts directly, Model 2 includes interaction terms between educational attainment and birth cohort. These interactions reveal whether the effect of education strengthens, weakens, or reverses among younger women.

Model 2: Education–cohort interactions. Model 2 reveals substantial differences across birth cohorts. Compared to women who completed primary school, those with junior-high education had significantly lower odds of having two or more children (B = –1.34, SE = 0.11, OR = 0.26, 95% CI [0.21, 0.32], p < .001), as

did those with senior high education (B = –0.21, SE = 0.08, OR = 0.81, 95% CI [0.67, 0.94], p = .011). No statistical difference was observed between those with primary and tertiary education (B = –0.05, SE = 0.04, p = .244).

Birth cohorts themselves differed in fertility levels. Compared to the 1961–1970 cohort, women born between 1971 and 1980 were more likely to reach replacement-level fertility (B = 0.28, SE = 0.09, OR = 1.32, 95% CI [1.12, 1.61], p = .002). Conversely, women born between 1981 and 1990 had significantly lower odds than the reference cohort (B = –0.23, SE = 0.06, OR = 0.79, 95% CI [0.70, 0.88], p < .001).

The interaction terms demonstrate that the relationship between education and fertility shifted across generations. Among women born between 1971 and 1980, the disadvantage associated with low education was considerably weaker than in the reference cohort (primary × 1971–1980: B = 1.05, SE = 0.22, OR = 2.85, 95% CI [1.94–4.71], p < .001). By contrast, in the 1981–1990 cohort, senior-high education was associated with a greater fertility penalty (B = –0.33, SE = 0.12, OR = 0.72, 95% CI [0.56, 0.90], p = .005). These patterns show that education does not have a uniform effect on different birth cohorts; older and younger generations respond differently to similar levels of education.

Life-course timing did not significantly predict second-birth outcomes in the interaction models, with all p-values exceeding .05. As expected, control variables behaved as follows: later age at first birth reduced the likelihood of a second birth (B = –0.15, SE = 0.04, OR = 0.86, p < .001), while urban hukou holders consistently had lower odds than rural women (B = –1.15, SE = 0.03, OR = 0.32, p < .001).

Discussion

In this study, the author examined how the relationship between women's education and the likelihood of having a second child has evolved across birth cohorts. The results show that the familiar pattern of higher education being associated with lower fertility has not disappeared, but now manifests differently. The differences between educational groups have not narrowed, but rather shifted. Among women born between 1971and 1980, the lowest level of education no longer reduced the likelihood of having a second child as much as it once did. Conversely, among the youngest cohort (1981–1990), completing senior high school has become a more significant barrier to having a second child. In other words, the expansion of education in China has not eliminated differences in fertility; it has merely reshaped them.

These findings also suggest that greater education and labour-market opportunities do not automatically lead to higher-order fertility. For many women, the opportunity costs of having a second child remain high, particularly in the absence of institutional family support. Higher education in China has increased women's income, autonomy, and control over reproductive choices, and has reduced their exposure to rigid workplace norms to some extent. However, these gains coexist

with the persistent structural pressures that make combining full-time employment with raising two children challenging. Conversely, women with lower levels of education may have higher fertility because they rely more on extended family support and perceive the economic cost of a second child as less prohibitive.

Differences in the education-fertility relationship across cohorts reflect deeper structural and normative changes. The economic returns on education have increased, which has led to a greater perceived trade-off between career advancement and childbirth. While a delayed first birth continues to lower overall fertility, the magnitude of this penalty varies: some highly educated women have shortened the interval between births, while others face greater constraints. The end of the one-child policy also did not ease pressures uniformly either. Pro-natalist messages now coexist with strong gendered expectations of intensive motherhood, which have the greatest impact on highly educated women. This situation aligns with what Zhang's (2025) description of a 'policy-thin' fertility regime: although birth quotas have been removed, the infrastructure that would genuinely support families, such as affordable childcare, flexible employment arrangements, and effective anti-discrimination policies, remains limited (Zhou 2018). In contrast, Japan and South Korea have implemented modest work-family reconciliation policies that have partially mitigated the impact of educational inequalities on fertility (Takao 2024; Kohara, Maity 2021). Without substantial structural changes, low fertility is likely to persist regardless of women's individual autonomy or educational gains.

Several limitations should be acknowledged. First, women in the youngest cohort have not yet completed their reproductive years. Some of them will go on to have a second child, meaning that current estimates for this group are incomplete and likely to underestimate their eventual fertility. Second, the measure of 'returns to education,' which is calculated based on current income, may be affected by factors that were not considered in the survey, such as family resources, childhood circumstances or initial advantages. Consequently, it does not always capture the effect of education itself. Third, as the analysis focuses on women of Han ethnicity, the findings may not fully apply to ethnic minority women living in different cultural and policy environments. Finally, the lack of direct data on childcare availability and employment practices makes it difficult to determine the specific mechanisms through which education influences fertility.

Overall, the findings demonstrate that relaxing fertility restrictions alone cannot reverse China's fertility decline. Without substantial reductions in the opportunity costs of motherhood, women's increasing educational empowerment will continue to coexist with persistently low fertility levels.

Conclusion

This study examined how the relationship between women's education and the likelihood of having a second child has changed across three birth

cohorts, using six waves of the China Family Panel Studies. The results show that, while the relationship between education and second births has not disappeared, it has shifted across cohorts. Among women born between 1971 and 1980, the link between having a low level of education and being more likely to have a second child weakened — this group was no longer as distinct from others as before. Conversely, among women born between 1981 and 1990, the negative correlation between senior-high education and having a second child became stronger. This means that this educational group increasingly stood out for having lower second-birth rates. Thus, educational expansion has narrowed but also deepened reproductive inequality, redistributing fertility differences across educational groups rather than eliminating them.

This study also highlights the broader point that while higher education provides women with more resources and greater autonomy, it does not automatically lead to higher fertility rates. As the benefits of education in the labor market increase, the influence of institutions and norms on fertility becomes more significant. Simply removing birth limits is not enough to raise fertility. If China is to benefit from the demographic potential of its increasingly educated female population, stronger family support systems are needed, including affordable, high-quality childcare, more flexible employment arrangements, effective anti-discrimination measures and expanded opportunities for fathers to take leave. Such policies would enable women to participate fully in the labour market without having to postpone or forgo their family plans.

Future studies can use causal-identification designs, such as analysing the impact of childcare or parental leave policy discontinuities to identify the effects of family-support interventions. Analyses that take into account hukou status, local policy stringency and gender norms could help shed light on the institutional mechanisms of fertility under China's post-one-child policy.

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